

B.Sc.(Horticulture)

Syllabus

I Year I Semester

Sl. No.	Course Number	Course Title	Credit Hours
1.	FSC 101	Fundamentals of Horticulture	2 + 1
2.	VSC 101	Botany of Horticultural crops	1 + 1
3.	SAC 101	Principles of Analytical Chemistry	1 + 1
4.	AGM 101	Agricultural Microbiology	2 + 1
5.	MAT 111	Applied Mathematics	1 + 1
6.	COM 111	Fundamentals of Information Technology	1 + 1
7.	ENG 101	English for Effective Communication	0 + 1
8.	PED 101	Physical Education	0 + 1
9.	NSS 101	National Service Scheme	0 + 1
Total			8+9=17

FSC 101 FUNDAMENTALS OF HORTICULTURE 2 + 1

Aim

- ❖ To teach the basic and fundamental aspects of horticulture

Theory

Unit I Basic concepts of horticulture

Scope and importance - Global scenario of horticultural crops- Divisions of horticulture - area and production - export and import - classification of horticultural crops - Nutritive value of horticultural crops - horticultural therapy - Horticulture Zones of India and Tamil Nadu - Horticultural developmental agencies

Unit II Soil and climatic factors on crop production

Influence of soil - physical and chemical properties and climatic factors - light, temperature, photoperiod, relative humidity, rainfall, micro climate, pollution - influence of biotic and abiotic stresses on crop production

Unit III Nursery techniques and cropping systems

Nursery techniques - vegetable garden - Nutrition garden, kitchen garden and other types of gardens - planting systems - planning, layout and management of an orchard- wind breaks - after-cultural practices - clonal orchards- use of growth regulators - water management - drip and fertigation - weed management - nutrient management - soil fertility management - cropping systems - intercropping - multi-tier cropping

Unit IV Growth and development

Important phases of growth and development - bearing habits - Principles and methods of pruning and training of horticultural crops- rejuvenation of old and senile orchards- factors influencing fruitfulness and unfruitfulness - special horticultural practices

Unit V Protected cultivation and post harvest handling

Protected cultivation - principles of organic horticulture - hydroponics - harvesting and post harvest handling - processing, value addition, storage and marketing of horticultural produce.

Practical

Features of orchard - planning and layout of orchard - Tools and implements - layout of nutrition garden - preparation of nursery beds - sowing vegetable seeds - digging pits for fruit plants and planting - layout of irrigation systems - preparation and application of fertilizer mixtures - preparation and application of growth regulators - identification and management of nutritional disorder in fruits and vegetables - assessment of bearing habits - practice in training and pruning of fruit crops- structures for protected cultivation - study of maturity standards - harvesting, grading, packing and storage of horticultural crops.

Lecture schedule

1. Scope, importance and divisions of Horticulture
2. Global and national scenario of area, production, export and import of horticultural crops
3. Classification and Nutritive value of horticultural crops
4. Horticultural therapy
5. Horticulture zones of India and TamilNadu
6. National and state level agencies involved in Horticultural development
7. Role of soil - physical and chemical properties in horticultural crop production
8. Role of climatic factors in horticultural crop production
9. Biotic stress and management in horticultural crops
10. Abiotic stress and management in horticultural crops
11. Nursery techniques and production of healthy planting materials
12. Vegetable gardens - nutrition garden, kitchen garden and other types of gardens
13. Planning, layout and management of an orchard

14. Planting systems and planting
15. After cultural practices and clonal orchards
16. Growth regulators and their role in horticulture crops
17. Mid semester examination
18. Water management including drip irrigation and fertigation system in horticultural crops
19. Weed management in horticultural crops
20. Nutrient management and fertigation in horticultural crops
21. Soil fertility management and fertigation in horticultural crops
22. Cropping systems - intercropping and multi-tier cropping and mulching
23. Growth and development including bearing habits of horticultural crops
24. Principles and methods of training in horticultural crops
25. Principles and methods of pruning in horticultural crops
26. Factors influencing fruitfulness and unfruitfulness in major horticultural crops
27. Rejuvenation of old, unproductive orchards
28. Special horticultural practices
29. Protected cultivation in horticultural crops
30. Organic horticulture
31. Hydroponics in horticultural crops
32. Harvesting and post harvest handling of horticultural crops
33. Processing and value addition of horticultural crops
34. Marketing and storage of horticultural crops

Practical schedule

1. Study of different features of an orchard
2. Planning and layout of orchard
3. Planning and layout of orchard - Advanced
4. Tools and implements used in cultivation
5. Layout of nutrition garden
6. Preparation of nursery bed and sowing of vegetable seeds

7. Preparation of pits and planting of fruit plants
8. Layout of different irrigation systems and irrigation methods
9. Preparation of fertilizer mixtures and method of application
10. Preparation and application of growth regulators
11. Identification and correction of nutritional and physiological disorders
12. Study of bearing habits in horticultural crops
13. Methods of training and pruning in horticultural crops
14. Observation of structures used in protected cultivation and storage structures
15. Study of maturity standards, harvesting, grading, packing and storage of horticultural crops
16. Visit to private orchards and cold storage unit
17. Practical Examination

Outcome

After completion of this course, the students will acquire basic knowledge about the fundamental aspects of horticulture. The students in turn will find it easier to undergo other horticultural courses in the following semesters.

Text Books

1. Adams, C.R. and M. P. Early. 2004. Principles of horticulture. Butterworth – Heinemann, Oxford University Press.
2. Bansil. P.C. 2008. Horticulture in India. CBS Publishers and Distributors, New Delhi.
3. Kumar, N.1997. Introduction to Horticulture, Rajalakshmi Publication, Nagercoil.

Further reading

1. Bhattacharjee.S.K. 2006. Amenity Horticulture, Biotechnology and Post harvest technology. Pointer publishers. Jaipur
2. Chadha, K.L. 2001, Handbook of Horticulture, ICAR, New Delhi.
3. Chandra, R. and M. Mishra. 2003. Micropropagation of horticultural crops. International Book Distributing Co., Lucknow.

4. Chattopadhyaya, P.K.2001. A text book on Pomology (Fundamentals of fruit growing) Kalyani Publication, New Delhi
5. Christopher, E.P. 2001. Introductory Horticulture, Biotech Books, New Delhi
6. Edmond, J.B. T.L.Senn, F.S. Andrews and P.G.Halfacre, 1975. Fundamentals of Horticulture, Tata MC. Graw Hill Publishing Co.New Delhi
7. George Acquaaah, 2002, Horticulture-principles and practices. Prentice-Hall of India pvt. Ltd., New Delhi.
8. Hartman, H.T. and Kester, D.E. 1986. Plant propagation - Principles and Practices - Prentice Hall of India Ltd., New Delhi.
9. Jacob John. P. 2008. A hand book of post harvest management of fruits and vegetables. Daya publishers.
10. Jitendra Singh. 2006. Basic Horticulture. Kalyani Publishers, New Delhi.
11. Rajan, S. and B.L. Markose. 2007. Propagation of horticultural crops. New India Publishing, New Delhi.
12. Shanmugavelu, K.G., N. Kumar and K.V. Peter. 2005. Production technology of spices and plantation crops. Agrobios, Jodhpur.
13. Singh, D.K. 2008. Hi-tech horticulture. Agrotech publishers, Udaipur
14. Singh, N.P. 2005. Basic concepts of fruit science. International Book Distributing Co., Lucknow.
15. Surendra Prasad and U. Kumar. 1999. Principles of horticulture, Agro-botanica, Bikaner, India.
16. Sureshkumar, P. Sagar and Manish Kanwat. 2009. Post harvest physiology and quality management of fruits and vegetables. Agrotech publishers, Udaipur
17. Utpal Banerjee. 2008. Horticulture. Mangal Deep publishers
18. Vijaikumar UmRao. 2008. Horticulture terms - Definitions and Terminology. IBD publishers, Dehradun

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- <http://aggie-horticulture.tamu.edu/propagation/propagation.html>
- <http://www.britannica.com/>
- <http://www.horticulture.com.au/export/hmac.asp>

- <http://www.horticultureworld.net/hort-india.htm>
- <http://www.fao.org/>

Journals

- Indian Horticulture
- Acta Horticulture
- Indian Journal of Horticulturae
- Scientia Horticulturae
- Journal of Horticulture Sciences and Biotechnology

VSC 101 BOTANY OF HORTICULTURAL CROPS 1+1

Aim

- ❖ To teach basic and fundamental aspects on botany of the horticultural crops.

Theory

Unit I

Systematic botany- terminology, morphological description and classification - root, stem, leaf, inflorescence, flower and fruit - flowering mechanism - modes of pollination - asexual/vegetative reproduction - floral biology - fertilization and fruit set. Principles involved in nomenclature, ICBN rules and recommendations with special reference to names of hybrids and names of cultivated plants.

Unit II

Botany, floral biology, pollination, fruit set and economic part in the families Anacardiaceae (mango, cashew), Rutaceae (acid lime, sweet orange and mandarin), Musaceae, Moraceae, Vitaceae, Caricaceae, Euphorbiaceae (aonla, cassava, rubber), Myrtaceae (guava, clove), Sapotaceae, Bromeliaceae, Punicaceae, Annonaceae (custard apple), Rhamnaceae and Rosaceae (apple, pear, plum, rose).

Unit III

Botany, floral biology, pollination, fruit set and economic part in the families Solanaceae (tomato, brinjal, chilli, potato), Malvaceae, Cucurbitaceae (pumpkin, watermelon, muskmelon, ridge gourd, bitter gourd, cucumber), Moringaceae, Fabaceae (peas, French beans), Alliaceae (onion, garlic), Brassicaceae (cabbage, cauliflower, radish), Chenopodiaceae, Amaranthaceae, Convolvulaceae (sweetpotato), Araceae (elephant foot yam, colocasia), Dioscoreaceae (yam, medicinal dioscorea).

Unit IV

Botany, floral biology, pollination, fruit set and economic part in the families Piperaceae (pepper, betelvine) Zingiberaceae (cardamom, turmeric, ginger), Orchidaceae (Vanilla, Dendrobium orchid), Apiaceae (Umbelliferae) (coriander), Myristicaceae, Lauraceae, Leguminosae, Caesalpiniaceae, Camelliaceae, Rubiaceae, Arecaceae(Palmae) (coconut, arecanut, palmyrah, oil palm), Sterculiaceae(Cocoa).

Unit V

Botany, floral biology, pollination, fruit set and economic part in the families Oleaceae (malligai, mullai, jathimalli), Asteraceae (chrysanthemum, marigold, marikolundu, gerbera, golden rod, aster, pyrethrum), Amaryllidaceae, Acanthaceae, Caryophyllaceae, Iridaceae, Apocynaceae, Poaceae (Graminae), (lemongrass, citrononella, palmarosa, vetiver), Geraniaceae, Lamiaceae (Labiatae) (coleus, patchouli, mint, maruvu), Scrophulariaceae.

Practical

Observation and recording the morphology of root, stem, leaf, flower and fruit. Study of taxonomy and morphology of crops in the above families - herbarium (minimum 50 - covering not less than 25 families) collection of the crops mentioned in theory.

Lecture schedule

1. Systematic botany-principles involved in nomenclature.
2. Terminology, morphological description and classification based on root, stem, leaf, inflorescence, flower and fruit.
3. Flowering mechanism - modes of pollination - asexual/vegetative reproduction - floral biology - fertilization and fruit set. Botany, floral biology, pollination, fruit set and economic part in the families- ICBN rules and recommendations - special reference to names of hybrids and cultivated plants
4. Anacardiaceae (mango, cashew), Rutaceae (acid lime, sweet orange and mandarin) and Musaceae.

5. Moraceae, Vitaceae, Caricaceae, Euphorbiaceae (aonla, cassava, rubber), Myrtaceae (guava, clove) and Sapotaceae.
6. Bromeliaceae, Punicaceae, Annonaceae (custard apple), Rhamnaceae and Rosaceae (apple, pear, plum, rose).
7. Solanaceae (tomato, brinjal, chilli, potato) and Malvaceae.
8. Cucurbitaceae (pumpkin, watermelon, muskmelon, ridge gourd, bitter gourd, cucumber).
9. Mid-semester examination.
10. Moringaceae and Fabaceae (peas, French beans) and Alliaceae (onion, garlic).
11. Brassicaceae (cabbage, cauliflower, radish), Chenopodiaceae and Amaranthaceae.
12. Convolvulaceae, Umbelliferae, Araceae (elephant foot yam, colocasia) and Dioscoreaceae (yam, medicinal dioscorea).
13. Piperaceae (pepper, betelvine) Zingiberaceae (cardamom, turmeric, ginger), Orchidaceae (vanilla, dendrobium orchid) and Apiaceae (coriander).
14. Myristicaceae, Lauraceae, Leguminosae and Caesalpiniaceae.
15. Camelliaceae, Rubiaceae, Palmae (coconut, arecanut, palmyrah, oil palm), Sterculiaceae.
16. Oleaceae (malligai, mullai, jathimalli), Asteraceae (chrysanthemum, marigold, marikolundu, gerbera, golden rod, aster, pyrethrum), Amaryllidaceae and Acanthaceae.
17. Caryophyllaceae, Iradiaceae, Apocynaceae, Graminae, (lemongrass, citrononella, palmarosa, vetiver), Geraniaceae, Labiatae (coleus, patchouli, mint, maruvu) and Scrophulariaceae.

Practical schedule

Observation and description of the taxonomy and morphological characters of the crops in the families

1. Anacardiaceae (mango, cashew), Rutaceae (acid lime, sweet orange and mandarin) and Musaceae.

2. Moraceae, Vitaceae and Caricaceae.
3. Euphorbiaceae (aonla, cassava, rubber), Myrtaceae (guava, clove) and Sapotaceae.
4. Bromeliaceae, Punicaceae, Annonaceae (custard apple), Rhamnaceae and Rosaceae (apple, pear, plum, rose).
5. Solanaceae (tomato, brinjal, chilli, potato) and Malvaceae.
6. Cucurbitaceae (pumpkin, watermelon, muskmelon, ridge gourd, bitter gourd, cucumber).
7. Moringaceae and Fabaceae (peas, French beans) and Alliaceae (onion, garlic).
8. Brassicaceae (cabbage, cauliflower, radish), Chenopodiaceae and Amaranthaceae.
9. Convolvulaceae, Umbelliferae, Araceae (elephant foot yam, colocasia) and Dioscoreaceae (yam, medicinal dioscorea).
10. Piperaceae (pepper, betelvine) Zingiberaceae (cardamom, turmeric, ginger), Orchidaceae (vanilla, dendrobium orchid) and Apiaceae (coriander).
11. Myristicaceae, Lauraceae, Leguminosae and Caesalpiniaceae.
12. Camelliaceae, Rubiaceae, Palmae (coconut, arecanut, palmyrah, oil palm) and Sterculiaceae.
13. Oleaceae (malligai, mullai, jathimalli), Amaryllidaceae and Acanthaceae.
14. Asteraceae (chrysanthemum, marigold, marikolundu, gerbera, golden rod, aster, pyrethrum)
15. Caryophyllaceae, Iradiaceae, Apocynaceae and Geraniaceae
16. Graminae (lemongrass, citrononella, palmarosa, vetiver), Labiatae (coleus, patchouli, mint, maruvu) and Scrophulariaceae
17. Practical examination.

Outcome

The students will learn the basics of botany and the botanical terms in relation to horticultural crops. This fundamental course will help students to understand the course on breeding of horticultural crops.

This course will help students to understand the course on morphology and diagnostic characters of plants/families and in turn, it will help to undertake the breeding of the horticultural crops.

Text books

1. Mauseth, J.D. 2009. Botany: an introduction to plant biology. Jones and Bartlett Publishers, MA.
2. Spichiger, R., Savolainen, V., Figeat, M., Jeanmond, D. 2004. Systematic Botany of flowering plants. Science Publishers Inc., USA.
3. Jansi Rani, P. Subramanian, S., Veeraragavathatham and S. Thamburaj, 1997. Botany of vegetable crops. KRS Screen Printers, Lawley Road, Coimbatore.
4. Gangulee, Das and Datta. 1997. College Botany Vol. I. New Central Book Agency (P) Ltd., 8/1, Chintamani Daslane, Calcutta - 700 009.
5. Genin, A. 1994. Application of Botany in Horticulture. Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi.
6. Kochhar, S.L. 1992. Economic Botany in the tropics. Macmillan India Ltd., Madras, 600 041.
7. Madhu Arora, 1991. Dictionary of Botany. Anmol Publications Pvt. Ltd., New Delhi.
8. Joseph Y. Bergen, 1990. Fundamentals of Botany. Arihant Publishers, Jaipur (India)
9. Subhash Chandra Datt, 1989. Systematic Botany - Willey Eastern Ltd., New Delhi.
10. Bahadur and Achari. 1989. A manual of Botany. Anmol Publications, New Delhi.
11. Sambamurthy and Subrahmanyam. 1989. Text Book of Economic Botany. Wiley Eastern Ltd., New Delhi.
12. Simpson, B.B. and Ogorzaly, M.C. 1986. Economic Botany. Mc Graw-Hill Book Company, New York.

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- http://www.emc.maricopa.edu/faculty/farabee/BIOBK/BioBookDiversity_6.html
- <http://waynesword.palomar.edu/index.htm>

SAC 101 PRINCIPLES OF ANALYTICAL CHEMISTRY 1 +1

Aim

- ❖ This course aims to introduce concepts and principles of analytical techniques among under graduate students. It also provides opportunity to develop skill of students in various analytical techniques.

Theory

Unit I

General principles of analytical chemistry – common analytical methods – qualitative and quantitative analysis – accuracy and precision of analytical results- Preparation of laboratory reagents.

Unit II

Volumetric analysis – preparation of primary and secondary standards – standardization. Theory of indicators and buffers – acidimetry, alkalimetry, oxidimetry, complexometry and thio-cyanometry.

Unit III

Gravimetric analysis – principles of precipitation reactions- solubility product – common ion effect – conditions of precipitation – – choice of filters -washing solutions.

Unit IV

Instrumental analysis – principles and practices of potentiometry, conductometry, colorimetry, spectrophotometry, absorption and emission spectroscopy and chromatography – choice of analytical methods.

Unit V

Radiation chemistry – radio activity – radiation decay, detection and measurements - radiological safety – stable isotopes – mass spectroscopy- use of radio active and stable isotopes in agriculture.

Practical

Analytical techniques and concepts – Gravimetry – Volumetry- Acidimetry - Alkalimetry- Permanganimetry – Dichrometry - Iodimetry, Complexometry -

Potentiometry - Conductometry -Colorimetry - Spectrophotometry -Turbidimetry -
Flame Photometry - Atomic absorption spectrophotometry- Radioactivity.

Lecture schedule

1. General principles in analytical chemistry - common analytical methods - quantitative and qualitative analysis -Accuracy and precision of analytical results.
2. Preparation of laboratory reagents - digestion and distillation techniques.
3. Volumetric analysis - preparation of primary standard solutions.
4. Volumetric analysis - preparation of primary and secondary standard solutions - standardization.
5. Theory of indicators and buffers. Preparation of indicator and buffer solutions.
6. Theory of acidimetry , alkalimetry, oxidometry, complexometry and thiocyanometry - titration curve.
7. Gravimetric analysis - Principles - techniques.
8. Precipitation - solubility product - common ion effect - conditions of precipitation.
9. Mid semester examination
10. Filtration and choice of filters - washing - washing solutions and washing technique.
11. Instrumental methods of analysis- Principles and practices of potentiometry, conductometry, colorimetry & spectrophotometry.
12. Principles and practices of absorption and emission spectroscopy
13. Principles and practices of chromatography - Paper chromatography, Gas Chromatography, TLC ,HPLC and HPTLC.
14. Radiation chemistry - radio activity.
15. Radiation - detection and measurement of radio activity - radiological safety.
16. Stable isotopes - Mass spectroscopic measurements and their application in agricultural research.
17. Use of radioactive and stable isotopes in analytical applications.

Practical schedule

1. Study of common laboratory glassware and apparatus - do's and don'ts in the laboratory- Part - I
2. Study of common laboratory glassware and apparatus - do's and don'ts in the laboratory- Part - II
3. Principles of Gravimetry and Moisture estimation.
4. Volumetric analysis - Preparation of primary, secondary standards and indicators
5. Acidimetry - Standardization of bases
6. Alkalimetry - Standardization of acids
7. Permanganometry - Standardization of KMnO_4
8. Dichrometry- Standardization of Ferrous Sulphate
9. Iodimetry - Estimation of Copper
10. Complexometry- Estimation of Calcium and Magnesium
11. Potentiometry and Conductometry - Determination of pH and EC
12. Spectrophotometry- Determination of phosphorus in matrices
13. Turbidimetry -Estimation of Sulphur
14. Flame Photometry - Estimation of Potassium
15. Absorption spectrophotometry -Estimation of Fe / Zn / Mn / Cu
16. Detection and measurement of radioactivity using Geiger Muller (GM) Counter
17. Practical Examination

Outcome

The students will gain knowledge on concepts and principles of analytical techniques. They will also acquire skills in various analytical techniques. Further, the knowledge gained will form as building block for many research works.

Text books

1. Hesse, P.R. 1971. A Text book of Soil Chemical Analysis. John Murray (Publishers) Ltd. London.
2. Jackson, M.L. 1973. Soil Chemical Analysis. Prentice Hall Pvt. Ltd
3. Piper, C.S. 1942. Soil and plant analysis: Interscience Publishers, New York.
4. Gupta A.K. and Varshney M.L., 1989. Practical manual for Agricultural Chemistry - Kalyani Publishers, New Delhi.
5. Hamilton I.F. and Simpson G.S.G., 1964. Quantitative Chemical Analysis - The Mc Millan Co., New York.
6. Keith A. Smith, 1983. Soil Analysis - Instrumental Techniques and Related Procedures, New York.
7. Kreshkov A.P. and Yaroslavtsev, 1977. Course of Analytical Chemistry Vol.II. Quantitative Analysis - Mir Publishers, Moscow.
8. Sankaram, A. 1966. A Laboratory Manual for Agricultural Chemistry - Asia Publishing House, Bombay.

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- http://en.wikipedia.org/wiki/Analytical_chemistry
- <http://www.scribd.com/doc/30296831/Instant-Notes-in-Analytical-Chemistry>
- http://sndt.digitaluniversity.ac/downloads/syllabus_M.Sc.pdf
- http://www-pub.iaea.org/MTCD/publications/PDF/TCS-18_web.pdf
- <http://nzic.org.nz/ChemProcesses/analysis/15B.pdf>
- <http://www.tutornext.com/ws/rock-type-chart>

Aim

- ❖ To acquaint students with the basic laboratory techniques and tools of microbiology.
- ❖ To introduce the fundamental characteristics of various microorganisms.
- ❖ To enable better understanding of students about the microscopic world around them.
- ❖ To enlighten the students with the knowledge of microbial diversity in soils.
- ❖ To highlight the role of soil microorganisms in soil fertility and plant growth promotion.
- ❖ To develop experimental skills in soil microbiology which, include isolation of beneficial microorganisms from soil and plant and their mass production.

Theory

Unit I History and scope of microbiology and bacterial cell structure

Definition and scope -Spontaneous generation theory. Contributions of Anton Von Leeuwenhoek, Louis Pasteur, John Tyndall, Robert Koch, Edward Jenner, Joseph Lister, Beijerinck, Winogradsky and Waksman; Position of microorganisms in living world; Prokaryotes Vs Eukaryotes; Groups of microorganisms; Bacterial size, shape and arrangement and morphology; functional anatomy of bacteria; structure and organization of a bacterial cell: Invariant and variant components structure and organization of microbial cell. Morphology of fungi and algae- economic importance

Unit II Microbiological techniques

Microscopy - principles and types; staining of microorganisms-principles; sterilization and disinfection techniques; principles and methods of sterilization - physical methods - heat, filters, and radiation; chemical methods; isolation of pure culture techniques - enrichment culturing, dilution-plating, streak plate, spread plate methods; preservation of microbial cultures.

Unit III Microbial physiology and metabolism

Bacterial growth, reproduction and factors influencing bacterial growth - Growth curve: environmental condition for growth- nutritional types and metabolic diversity of bacteria; principles of energy generation and carbon metabolism; fermentation-respiration in bacteria- Metabolic diversity in bacteria-overview, outline classification of bacteria - bergey's manual of systematic bacteriology Edn-II

Unit IV Soil Microbiology

Overview of soil microbiology, definitions- Concepts and scope, discovery, distribution and importance of soil microorganisms in soil fertility - factors affecting the activities of soil microorganisms; Rhizosphere microorganisms and importance; Phyllosphere microorganisms - plant-microbe and microbe-microbe interactions in soil.

Unit V Microbial transformation of nutrients in soil

Microbial transformation of nutrients in soil - carbon, phosphorous and sulphur cycle; nitrogen cycle, biological nitrogen fixation - symbiotic and non-symbiotic microorganisms, Process of nodulation and nitrogen fixation; Silicate and zinc solubilising bacteria - types and importance of biofertilizers in agriculture; mass production and quality control of biofertilizers.

Practical

Microscopy - light microscopes; staining techniques - simple and differential staining; Sterilization - equipment and apparatus used for sterilization; media preparation; isolation and enumeration of soil microorganisms; purification and preservation of microorganisms; morphological and biochemical characters of bacteria.

Qualitative analyses of soil microbial profile - organic matter decomposition - measurement of CO₂ evolution; Isolation of N₂ fixing and phosphate solubilizing microorganisms; infection by Arbuscular mycorrhizae; Winogradsky column - mass production of bacterial biofertilizers - mass production of algal and fungal biofertilizers; demonstration of antibiosis.

Lecture schedule

1. Definition and scope of microbiology - Spontaneous generation theory.
2. Contributions of Anton Van Leeuwenhoek, Louis Pasteur, John Tyndall, Robert Koch, Edward Jenner, Joseph Lister, Beijerinck, Winogradsky and Waksman - Germ theory of fermentation and disease.
3. Position of microorganisms in living world; Prokaryotes Vs Eukaryotes.
4. Bacterial morphology - arrangement of cells, structures.
5. Functional anatomy and reproduction in bacteria.
6. Morphology of fungi and their economic importance.
7. Morphology of algae and their economic importance
8. Microscopy: principles - different types of microscopy.
9. Microbial staining - principle - simple staining and differential staining.
10. Sterilization - principle - physical and chemical methods.
11. Bacterial growth - Growth curve - generation time and growth rate.
12. Environmental conditions for growth - Temperature - psychrophiles, mesophiles and thermophiles; air - aerobic and anaerobic; pH- acidic and alkali; salt.
13. Nutritional types of bacteria - autotrophs, heterotrophs, phototrophs and chemolithotrophs.
14. Microbial metabolism - principles of energy generation - Phosphorylation.
15. Respiration - fermentation.
16. Metabolic diversity in bacteria - overview.
17. Mid semester examination
18. Outline classification of bacteria - Bergey's Manual of Systematic Bacteriology Edn.II
19. Overview of soil microbiology - Definition, concepts and scope of soil microbiology - Discoveries in soil microbiology.
20. Diversity of soil microorganisms-bacteria, actinomycetes, fungi and algae- factors influencing the microbial diversity.
21. Diversity of uncultivable microorganisms - metagenomic approach.
22. Factors affecting the activities of soil microorganisms.
23. Rhizosphere microorganisms- R: S ratio and importance.
24. Plant growth promoting rhizobacteria; Phyllosphere microbiology and Methylophs.
25. Microbial interactions in soil - neutralism, positive and negative interactions.
26. Microbial transformation of nutrients in soil - Carbon cycle.
27. Organic matter decomposition- aerobic and anaerobic - Importance of C: N ratio in

soil fertility - humus formation.

28. Microbial transformation of nutrients in soil – Nitrogen
29. Biological nitrogen fixation - symbiotic and non-symbiotic microorganisms.
30. Process and genetics of nodulation and nitrogen fixation.
31. Microbial transformation of nutrients in soil - Phosphorous & Sulphur.
32. Silicate and Zinc solubilizing microorganisms; Mycorrhizae.
33. Types of biofertilizers and importance in agriculture.
34. Production and quality control of biofertilizers and methods of application of biofertilizers.

Practical schedule

1. Microscopes- handling light microscope.
2. Staining techniques-Simple and Differential staining
3. Sterilization-equipment and apparatus used for sterilization
4. Media preparation for bacteria, fungi and actinomycetes
5. Enumeration of soil microorganisms- serial dilution plate technique (bacteria, fungi, and actinomycetes)
6. Purification and preservation of bacteria & fungi
7. Growth of bacteria - turbidimetric method.
8. Morphological and biochemical characters of bacteria.
9. Conn's direct microscopic count and Burried slide technique.
10. Organic matter decomposition - measurement of CO₂ evolution.
11. Demostration of antibiosis – crowded plate assay
12. Isolation of symbiotic N₂ fixing microorganism – Rhizobium
13. Isolation of associative and non symbiotic N₂ fixer: *Azospirillum* and *Azotobacter*
14. Isolation of phosphate solubilizing microorganisms and demonstration of Winogradsky column.
15. Assessment of AM fungi colonization in crop plants
16. Mass production of biofertilizers
17. Practical examination

Outcome

- ❖ Skill development in the safe handling, culturing, and staining of microorganisms.
- ❖ Learning the laboratory procedures needed to identify a bacterial culture.
- ❖ Acquiring knowledge about the factors that influence microbial growth and how it can be controlled.
- ❖ Gaining of knowledge of microorganisms in soil by students.
- ❖ Learning the contribution of soil microorganisms in soil fertility and plant growth promotion.
- ❖ Acquiring experimental skills in Soil microbiology which includes isolation of beneficial microorganisms from soil and plant and their mass production.

Text books

1. Black, J.G. 2005. Microbiology: Principles and Explorations, John Wiley, USA.
2. Michael Madigan, John Martinko and Jack Parker. 2006. Brock Biology of Microorganisms. 11th Edition. Benjamin Cummings. England.
3. Prescott, M.J., Harley, J.P. and Klein, D.A. 2002. Microbiology. 5th Edition, WCB Mc GrawHill, New York.
4. Singh, T. Purohit, S. S. and Parihar, P. Soil Microbiology. 2010. Mrs. Saraswati Purohit. India.
5. Subba Rao, N.S. 2006. Soil Microbiology (4th Edition of Soil Microbiology and Plant Growth). Oxford & IBH, New Delhi.

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MAT 111 APPLIED MATHEMATICS 1 + 1

Aim

- ❖ To understand and apply fundamental concepts of mathematics applicable in biology and to acquire about theoretical concepts of algebra, geometry, calculus and mathematical modelling.

Theory

Unit I Algebra

Permutation and combination -meaning of nPr and nCr and simple problems. Progressions - arithmetic, geometric and harmonic progressions. Matrices: types - algebra of matrices - Determinants - expansion- inverse of a matrix by adjoint method- solving system of equations by Cramer's rule and matrix inverse method.

Unit II Analytical geometry

Review of various forms of equations of a straight line. Circles - standard and general forms of equation of a circle - Conic sections - parabola, ellipse and hyperbola in standard forms (without proof).

Unit III Differential calculus

Definition - methods of differentiation. Geometrical and physical meaning of the derivative - higher order derivatives- applications of differentiation. partial differentiation -Homogeneous functions and Euler's Theorem (without proof). Increasing and decreasing function-maxima and minima of single and several variables without constraints- physical and economic optima- applications in agriculture.

Unit IV Integral calculus

Definition of integration-indefinite and definite integrals-formulae-methods of integration - substitution, method of partial fractions-integration by parts -Simple applications in finding the area and volume by integration.

Unit V Mathematical modelling in agriculture

Mathematical models – system – types of models and their uses in agriculture – fitting of linear, quadratic, exponential and logistic models to data from agricultural field experiments.

Practical

Problems in permutation and combination . Problems in A.P, G.P, and H.P. in biology. Problems in forming price and quantity matrix and estimation of revenue matrix. Formation and solution (using matrix inverse and Cramer’s rule) of simultaneous equations from problems in agriculture. Problems in straight line, circle and conic sections.

Problems in differentiation- maxima and minima of single and several variables without constraints - physical and economic optima-finding the fertilizer dosage for maximum yield and maximum profit. Simple problems in methods of integration computation of area, volume using definite integrals. Problems in fitting linear, quadratic, exponential and logistic models to data from agricultural experiments.

Lecture schedule

1. Permutation and combination-meaning of nPr and nCr -simple problems
2. Arithmetic, Geometric and Harmonic progression.
3. Matrix Algebra and evaluation of determinants.
4. Inverse of a matrix by adjoint method.
5. Solution of simultaneous equations by Cramer’s rule & inverse method.
6. Various forms of equation of a straight line, general forms of the equation of a circle.
7. Equations of conic (parabola, ellipse and hyperbola) in standard forms(without proof)
8. Differentiation – definition – methods of differentiation.
9. Mid semester examination.
10. Partial differentiation –Homogeneous functions and Euler’s Theorem (without proof).

11. Increasing and decreasing function- Maxima and minima of single variables- Physical and Economic optimum -Applications in agriculture- finding the fertilizer dosage for maximum yield and maximum profit.
12. Maxima and minima of several variables without constraints.
13. Integration - methods of integration and definite integrals
14. Integration by parts -Application of integration in area and volume.
15. Mathematical models - Types of models and their uses in Agriculture
16. Linear and Quadratic models-their applications in agriculture.
17. Exponential and Logistic models - their applications in agriculture.

Practical schedule

1. Simple problems in permutation and combination and its applications.
2. Problems Arithmetic, Geometric and Harmonic progression
3. Problems in Matrix Algebra and determinants.
4. Inverse of a matrix by adjoint method
5. Solution of simultaneous equations by Cramer's rule & Inverse method.
6. Problems in equation of a straight line and finding the center and radius of a circle
7. Simple problems in parabola, ellipse and hyperbola.
8. Problems in Differentiation - methods of differentiation.
9. Problems in Partial differentiation -Homogeneous functions and Euler's Theorem
10. Problems in Increasing and decreasing function- Maxima and minima of single variables.
11. Physical and Economic optimum-Finding the fertilizer dosage for maximum yield and maximum profit.
12. Problems in Maxima and minima of several variables without constraints.
13. Simple problems in methods of integration and applications of definite integrals
14. Problems in integration by parts -Application of integration in area and volume.
15. Problems in fitting linear and quadratic models to data from agricultural experiments

16. Problems in fitting Exponential and Logistic models to data from agricultural experiments
17. Final practical examination

Outcome

Students will acquire knowledge in basic techniques that are applicable to agricultural sciences. Further the course will provide them good introduction to various mathematical models used in biological sciences.

Text Books

1. Manickavasagam Pillai, T. K and Natarajan, T. 2003. Calculus, Viswanathan Publications, Madras.
2. James Stewart and Barbara Frank, Calculus, 2008, International Thomson Publishers, Singapore

References

1. Duraipandian, 2007, Calculus and Analytical Geometry, Emerald Publishers, Chennai.
2. Suyambulingom, C and Kailasam, C. 1990. Mathematics for Plant Sciences, Sakthi Publications, Coimbatore.
3. Mehta, B. C. and G. M. K. Madhani.2006, Mathematics for Economists, Latest edition, Sultan Chand & Sons, New Delhi.
4. Veerarajan, T, 2004. Engineering Mathematics, Tata McGraw-Hill Publishing Company Limited, New Delhi.
5. Ranganathan.C.R. 2006, A First Course in Mathematical Models of Population Growth (with MATLAB programs), Associated publishing company, New Delhi

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e Journals

- <http://www.math.neu.edu/~Suciu/journals.html>

COM 111 FUNDAMENTALS OF INFORMATION TECHNOLOGY 1 + 1

Aim

- ❖ To understand the building blocks of computer system (hardware and software) and its functions, networking basics, internet and web utilities and acquire the skill of programming using C programming language.

Theory

Unit I Introduction to computers and operating systems

Computer system - hardware: input devices, output devices - Software : system software - application Software - utility Software - Virus: types of virus - virus preventive and corrective measures - operating system: Building blocks of a generic operating system - Types of operating system - disk operating System (MS-DOS 8.0) - Windows 7 operating system.

Unit II Computer networks

Introduction to computer network - Types of Network - LAN, MAN, WAN, WLAN - Basic networking devices: hub, switch, router, Wi-Fi Hotspot - IP Address: Class A, B, C and D - Protocols: TCP/IP, HTTP, FTP - Network port: 80.

Unit III Internet and web utilities

Internet Vs Intranet - Browser - Universal Resource Locator (URL) - World Wide Web (WWW) - Search Engine - e-Mail Servers - e-Mail services: Create, Forward, Reply, Attachment, Carbon Copy (CC), Blind Carbon Copy (BCC) - Introduction to Agricultural websites.

Unit IV Office automation

Introduction to office automation - Microsoft Office Suite 2010 - Word processor software - Microsoft Word 2010: create, edit, format, print a document - Document conversion : PDF to Word - Word to PDF - Spreadsheet software - Microsoft Excel 2010 - Worksheet manipulation: insert, delete, copy and hide worksheet - cell manipulation: copy, edit and format cell data - charts - create bar and pie charts - Presentation software - Microsoft PowerPoint 2010 - views - slide layout - slide design - create presentation - slide show - animation - database management system (DBMS) - table - row - Column - structured query language (SQL) - ANSI SQL vs MS Access SQL -

CREATE, INSERT, SELECT, UPDATE and DELETE statements – Microsoft Access 2010
- Query Wizard – Query Design - Open Source office automation software –
Introduction to Open Office 3.x.

Unit V Programming in C

Programming in C - C Compiler - compilation and execution - structure of a C program - data types - constants and variables - Operators: arithmetic operators, relational operators, logical operators, increment and decrement operators - input and output statements - decision making and branching statements: If, If...else and switch - looping statements: While, do...while and for.

Practical

Computer innards: CPU, RAM, ROM, hard disk drive, display, keyboard and mouse - Operating system: MS-DOS 8.0 and Windows 7 working environments - virus troubleshooting - Word processor software – Microsoft Word 2010 - document creation – formatting a document - document conversion : PDF to Word - Word to PDF. Spreadsheet software - Microsoft Excel 2010 - Creation of worksheets, insertion of worksheets, rows and columns - Creating bar and pie charts - Presentation software – Microsoft PowerPoint 2010 - creating presentation – slide show and animation – DBMS – Microsoft Access 2010 : create database, create table, insert rows into a table, select rows from a table, update data in a table, delete rows in a table - search engines : simple and advanced searching - e-mail server – creation of e-mail : create, reply, forward, attachment and download options - C program to print the formatted text – C program to perform basic arithmetic operations.

Lecture schedule

1. Computer System, Hardware: Input devices, Output devices - Software: System Software - Application Software - Utility Software.
2. Viruses: Types of viruses – virus preventive and corrective measures.

3. Operating System: Building blocks of a generic Operating System – Types of Operating System - Disk Operating System (MS-DOS 8.0) - Windows 7 Operating System.
4. Introduction to Computer Network – Types of Network – LAN, MAN, WAN, WLAN - Basic networking devices: Hub, Switch, Router, Wi-Fi Hotspot
5. IP Address: Class A, B, C and D – Protocols: TCP/IP, HTTP, FTP – Network Port: 80.
6. Internet Vs Intranet – Browser – Universal Resource Locator (URL) - World Wide Web (WWW) – Search Engine.
7. e-Mail Servers – e-Mail services: Create, Forward, Reply, Attachment, Carbon Copy (CC), Blind Carbon Copy (BCC) - Introduction to Agricultural websites.
8. Introduction to Office automation - Microsoft Office Suite 2010 - Word Processor Software - Microsoft Word 2010: create, edit, format, print a document – Document conversion : PDF to Word - Word to PDF
9. Mid Semester Examination
10. Spreadsheet Software - Microsoft Excel 2010 - Worksheet manipulation: insert, delete, copy & hide worksheet – cell manipulation: copy, edit and format cell data – Charts - Create Bar and Pie charts
11. Presentation Software - Microsoft PowerPoint 2010 - Views - Slide Layout - Slide Design – Create presentation – Slide show – Animation
12. Database Management System (DBMS) – Table – Row - Column – Structured Query Language (SQL) – ANSI SQL Vs MS Access SQL – CREATE, INSERT, SELECT, UPDATE and DELETE statements
13. Microsoft Access 2010 - Query Wizard – Query Design - Open Source office automation software – Introduction to Open Office 3.x.
14. Programming in C - C Compiler - Compilation and Execution - Structure of a C program - Data types – Constants and variables
15. Operators: Arithmetic operators, Relational operators, Logical operators, Increment & Decrement operators

16. Input and Output statements - Decision making and branching statements: If, If...Else and Switch
17. Looping statements: While, Do...While and For.

Practical schedule

1. Keying practice using online/offline keyboard tutor software
2. Familiarizing working environment of MS DOS 8.0
3. Familiarizing working environment of Windows 7 Operating System
4. Troubleshooting computer viruses by using an Anti-virus software
5. Creating a document using Microsoft Word 2010.
6. Document conversion using Word to PDF and PDF to Word softwares
7. Spreadsheet creation and manipulation using Microsoft Excel 2010.
8. Creating Bar and Pie charts using Microsoft Excel 2010
9. Creating presentation using Microsoft PowerPoint 2010.
10. Working with animation and slideshow using Microsoft PowerPoint 2010
11. Creation and manipulation databases and tables in Microsoft Access 2010
12. Updating and Deleting a row in a Table using Microsoft Access 2010
13. Simple and Advanced searching of web and retrieving articles from open access agricultural journals
14. Creating e-Mails : Create, Reply, Forward, Attachment, CC and BCC and Download options
15. Write a C program to print a formatted text.
16. Write a C program to perform basic arithmetic operations.
17. Final practical examination.

Outcome

After completing this course, the student must demonstrate the knowledge and ability to

1. Understand and identify the integral components of a computer system.
2. Familiarize the working environment and applied knowledge of Windows Operating System 7.

3. Understand the basic computer security and gain applied knowledge of troubleshooting computer viruses.
4. Understand the basics of computer networks and gain applied knowledge of working with wired and wireless network environments.
5. Gain applied knowledge of internet, email and web access utilization.
6. Familiarize the working environment of office automation softwares and gain applied knowledge of working with Microsoft Office 2010.
7. Familiarize the fundamental programming constructs and gain applied knowledge of coding using C programming language.

Text books

1. Sanjay Saxena, A First Course in Computers, 2004 Edition, Vikas Publishing House Private Limited.
2. Wallace Wang, Office 2010 for Dummies, 2010, Wiley Publishing Inc.,
3. Balagurusamy, E., Programming in ANSI C, Fourth Edition, 2008, Tata McGraw Hill.

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1. Guy, Hart-Davis, Beginning Microsoft Office 2010, 2010, APress
2. Brian W. Kerighan and Dennis M. Ritchie, C Programming Language, Prentice Hall of India, New Delhi.
3. Rajaraman, V, Computer Programming In C, PHI Learning, Easter Economy Editions

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- <http://linux.org>
- <http://www.doaj.org>

ENG 101 ENGLISH FOR EFFECTIVE COMMUNICATION 0 + 1

Aim

- ❖ To impart proficiency in English language skills *viz.*,

Listening: To impart different kinds of listening and process of listening - interactive listening - listening cloze

Speaking: To enable learners to learn English phonemes - stress and intonation- speaking skill - dialogue and monologue

Reading: To facilitate learners to internalize reading strategies and skills pertaining to technical texts

Writing: To impart the mechanics of writing skills - types of writing - exercise science writing

Practical

Unit I Listening skill

Introduction to listening, - kinds of listening, process of listening, - listening mechanism listening TOEFL, IELTS, BEC

Unit II Reading skill

Reading: skimming, scanning, SQ3R, intensive reading, extensive reading, critical reading, Cloze texts for integrated grammar and vocabulary, including subtle differences between synonyms, reading comprehension texts for civil service exams, Bank P.O. exams, IELTS, TOEFL and GRE

Unit III Speaking skill

English phonemes - stress, intonation and rhythm - genres of speaking, techniques of speaking - public speaking (welcome address, vote of thanks, extempore talk)

Unit IV Writing skill

Mechanics of writing, writing genres, five types of writing, précis paragraph writing, essay writing- issue- based writing and argument based writing

Unit V Integrated skills

Note-taking, note- making, summarizing, brainstorming and simulation

Practical schedule

1. Introduction to listening - kinds of listening and process of listening
2. English phonemes
3. Stress , intonation and rhythm
4. Introduction to speaking skill - dialogue and monologue
5. Reading strategies – skimming and scanning -Critical reading
6. Introduction to writing – basic grammar in writing
7. genre - mechanics of writing
8. Welcome address, vote of thanks, and extempore talk
9. Mid-semester examination
10. Listening comprehension and reading comprehension – (five levels of comprehension viz., factual , inferential, referential , global and attitudinal)
11. Cloze texts - grammar and vocabulary in discourse
12. Listening cloze & Reading cloze
13. Brainstorming, simulation for integrated skills
14. paragraph writing and essay writing
15. Précis writing and summarizing and Integrated skills: SQ3R, factual writing and summarizing note taking, note making
16. Orientation to TOEFL. IELTS & BEC.
17. Practical exam

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1. Peter Roach(2009): English phonetics and phonology, A practical Course: (Fourth edition).CUP. U.K
2. Steven Brown&Dorokyn Smith (2006)-Active Listening: CUP U.K
3. Christian Evans Carter (2010)Mindscapes: Critical Reading Skills: Wadsworth publishing company. Belmont, Calif. USA

4. Kory Floid(2008) Interpersonal Communication: the Whole Story Tata McGraw Hill Publishers.
5. John Langan(2007):College Writing Skills with Readings Tata McGraw Hill Pub. USA
6. Hariharan.S,(2003)English for Agriculture and Allied Sciences: Orient Longman, Hyderabad)
7. Interactive software on Effective Communication. Learning to Communicate. TOEFL Books published by Orient Longman and Cambridge University Press

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- www.teachingenglish.org.uk
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PED 101 PHYSICAL EDUCATION 0 + 1

Practical

(17 practical classes - 2 hours-each class-17 classes will be converted into 40 practical hours and 2 hours for evaluation)

I Semester (20 hours)

Exercise for strength, agility, co-ordination, flexibility, cooperation, vital capacity endurance, speed and for various systems of our body and team spirit

Exercise for good posture conditioning and calisthenics for various athletic activities, i.e. (a) Before start-arm stretch, hand stretch and cat stretch (b) loosening up jogging, bending and twisting (c) standing-lateral arc, triangle and hands to feet post (d) sitting-camel kneel, spinal twist and supine knee bend (e) relaxation-the corpse pose, quick and deep relaxation

Basic gymnastic exercises-participation of athletic events-running, throwing and jumping events

Skill development in anyone of the following games

Warming up, suitable exercise, lead up games, advance skill for all the games

- Basket ball** : Dribbling, pass, two or three men pass, pivot, lay up shot, shooting, pass break, hook pass, screening, positional play, defence and offence tactics
- Volley ball** : Fingering, under arm, pass, over head pass, setting, spiking, back pass, jump pass, stunts, elementary dive, flying dive, roll, blocking and various types of services
- Ball badminton** : Grip, service, foot work, fore hand stroke, back hand stroke, lob, smash, volley, wall practice, spin service and defence tactics
- Foot ball** : Dribbling, passing, dodging, kicking, heading, screening, chest pass, throwing, dragging, goal kick, defence and offence tactics
- Hockey** : Grip, bully, dribbling, hitting, drive, push strokes, scoop, flick,

stopping, various types of passes, dodging, defence and offence tactics

- Kho-Kho** : Quadra Ped, Bi-Ped, How to give Kho, taking a direction, recede, parallel toe method, bullet toe method, distal method, foot out, dive, ring game, chains and persue and defence skills
- Chess** : Moves, move of king, move of pawns, move of rooks, move of bishops, move of queen, move of knights, en passant, castling, check and notation
- Kabaddi** : Raid, touch, cant, catch, struggle, various types of defence and offence tactics
- Cricket** : Grip, bowling, spin, leg spin, off spin, medium, batting, dive, sweep, mode of delivery, fielding, rolling etc.
- Tennis** : Grip, Forehand Drive, back hand drive, stroke, backhand ground stroke, service, volley, smash, wall practice, foot work, defence and offence tactics
- Table tennis** : Grip, tossing and serving, spin serve, rally, smash, flick, defence and offence tactics
- Shuttle badminton** : Grip, foot work, service, setting, smash, volley, forehand and back hand stroke, back hand serve and defence
- Gymnastics** : Balanced walk, execution, floor exercise, Tumbling I aerobatics, grip, release, swinging, Parallel Bar exercise, 'Horizontal Bar Exercise, Flic-flack-walk and pyramids

Athletics

- Sprint** : Medium start, long start, bunch start, set, pick up, finish, upsweep, downsweep, placement, receiving and exchanging
- Jumps** : Western roll, belly roll, eastern cut off, Foss Ferry Flop, approach, Take off, Straddle Hitch-kick, hanging, clearance, landing, strides etc.
- Throws** : Grip, momentum, pre shift, sub phase, the wind up, foot work, entry to the turn, shift, angle of release, follow throw, delivery, front cross step, rear cross step, hop step, fuck method Pary obraine, Discoput, rotation, carry and glide
- Hurdles:** : Finding lead leg, use of lead leg and trial leg, flight, cleaning, finish. Lead up games, advance skills, and game for anyone of the above games

II Semester (20 + 2 ½ hours)

- ❖ Rules and regulations of anyone of the games and athletic events.
- ❖ Aims and objectives of Yoga-Asanas: i.e. Padmasana, Pujankasana, Sarvangasana, Chakrasana, Dhanurasana, Halasana, Mayurasana and Savasana. Asanas for ailments, back pain, arthritis, abdominal problems, stress, fatigue, insomnia, obesity, circulation, hypertension, varicose veins, respiration, heart, digestion, head aches, depression, addiction and eye problems.
- ❖ Mental Balance and Importance-Development of concentration Suriyanamaskar- Advance skills of anyone of the games which were taught in the I Semester.

NSS 101 NATIONAL SERVICE SCHEME 0 + 1

Practical

I Year

Orientation - NSS origin - motto - symbol - NSS administration at different levels - programme planning - rural projects - urban projects - government schemes - career guidance - self help groups - environment protection - use of natural energy - conventional energy resources - soil and water conservation - community health programmes - women and child welfare - education for all- national days - commemorative days- NSS thematic programmes - literacy and computer awareness campaigns.

II Year

Popularization of agro techniques - self employment opportunities - animal health, dairy and poultry farming - road safety - training on first aid and emergency cell. Popularization of small savings - communal harmony and national integration - care of senior citizens - personality development - meditation, yoga art of living - activities on the preservation of national monuments, cultural heritage and folklore - special camp activities- national days - commemorative days- NSS thematic programmes - literacy and computer awareness campaigns.

Practical Schedule

I Semester

1. Orientation of NSS volunteers and programme coordinator and programme officers.
2. Origin of NSS in India and its development.
3. NSS motto, symbol and NSS awards.
4. Organizational set up of NSS at Central, State University and college levels.
5. Programme planning - Theme of the year - planning implementation at PC, PO and NSS volunteer level.

6. Visit to selected village - gathering basic data on socio economic status.
7. Participatory rural appraisal – studying the needs of the target group.
8. Visit of urban slum and gathering data on socio economic status.
9. Self involvement and methods of creating rapport with the target group.
10. Awareness campaign on welfare schemes of the central and state government.
11. Formation career guidance group with NSS volunteers and students welfare unit.
12. Cycle rally on environmental protection.
13. Campus development activities – clean environment campaign, formation of plastic free zones.
- 14 – 16. Campus development, tree planting maintenance and greening the campus cleaning.
17. Practical examination.

II Semester

1. - 3. Motivation of rural and urban youth for formation of SHG (Self Help Groups)
in collaboration with Government machinaries and NGOs.
4. Campaign on ill effects of plastics in the adjoining campus areas – Villages / urban areas.
5. Campaign on *Parthenium* eradication.
6. Cycle rally on air pollution – Vehicle exhaust and other means.
7. Popularization of biogas and smokeless chula.
8. Demonstration on the use of wind energy and solar energy.
9. Demonstration of water harvesting techniques.
10. Demonstration on soil conservation techniques wherever possible.
11. Campaign on Community health programmes of central and state Government – involving Health department officials.

12. AIDS awareness campaign ; campaign on diabetes and healthy food habits and drug abuse
13. Planing formation of blood donors club - involving NGOs.
14. Campaign on gender equality and women empowerment.
15. Campaign on child health care - immunization, food habits and child labour abolition.

III Semester

1. Conducting field days with KVK to popularize improved agro techniques.
2. Conducng seminar / workshop in a nearby village to motivate the youth on agribusiness (involving DEE, KVK, NGO and local agro- entrepreneurs
3. -5 Campaign on self employment opportunities like Apiculture, mushroom cultivation, Food processing and value addition, production of biocontrol agents and biofertilizers, nursery techniques, seed production, tissue culture, vermicompost, manufacture of small gadgets and agricultural implements as per local needs and feasibility.
6. Animal health care campaign - Dairy and poultry farming - Forage production techniques and silage making.
7. Training the NSS volunteers on road safety measures in involving traffic wardens and RTO.
8. Training NSS volunteers on First AID and emergency call involving NGOs and organizations like St. John's Ambulance, Red Cross, etc.,
9. Organizing Road safety rally.
10. Motivating NSS Volunteers on small savings concept and conveying the message to the public through them.
12. Observation of National integration and communal harmony.
- 14-16. Campus development and greening activities.
17. Practical examination.

IV Semester

- 01-03. Visit to orphanages and old age homes to look after their needs.
04. Personality development programmes – Building up self confidence in youth.
- 05-07. Teaching NSS volunteers on mediation Yoga and art of healthy living with trained teachers.
- 08-09. Visit of nearby National Monument / Places of tourist importance and campaign on cleanliness and preservation.
- 10-11. Exploration of hidden talents of village youth and public on folklore, traditional art, sports, martial arts and cultural heritage.
- 12-13. Campus improvement activities
- 14-16. Visit to special camp village and pre camp planning.
17. Practical examination.
1. Besides the above, NSS volunteers will attend work during important occasions like Convocation, Farmers' day, Sports meet and other University / College functions. NSS Volunteers will attend one special camp in the selected village for a duration of 10 days and undertake various activities based on the need of that village people.
 2. For all out door regular activities villages / slums nearby the campus may be selected to avoid transport cost (Cyclable distance).
 3. Special camp activity may be carried out in a village situated within a radius of 15 – 20 KM.

EVALUATION

A. Regular activities

60 marks	=	I Semester	15 marks
		II Semester	15 marks
		III Semester	15 marks
		IV Semester	15 marks

(Written test 10 marks – participation in programmes and behaviour - 5 marks)

80% attendance is mandatory for attending special camp

1. Special camping activities
: 40 marks
2. Participation in daily activities : 30 marks
3. Special camp activity report : 5 marks
4. Viva voce on the 10th day : 5 marks
of the special camp -----
40 marks

NCC 101 NATIONAL CADET CORPS 0 + 1

Practical

I Year

General-military history-introduction to NCC-aims of NCC-Principles of NCC. NCC organization. Duties of good citizen-system of NCC training-foot drill-arms drill-Guard of Honour-ceremonial drill-weapon training-first aid-rifle and light machine gun-map reading-civil defence-leadership.

II Year

Drill-weapon drill - weapon training and firing-introduction to national integration-historical - geographical - religions background of India - health and sanitation - aid to civil authorities - civil defence - ecology / nature awareness - map reading - social service-adventure activities - leadership qualities.

I Semester

1. NCC Song-Aims and Motto of NCC-Motivation of cadets.
2. History of NCC and organization of NCC.
3. Foot drill-General and word of command.
4. Human Resource development-Motivation-Duties of Good citizen.
5. National Integration-Indian history and culture.
6. Health and Hygiene-Structure and function of a human body, hygiene and sanitation.
7. Social service-weaker sections of our society and their needs.
8. Self defence-Theory and Practice, prevention of untoward incidence.
9. Map reading-Introduction to map and lay out of map.
10. Disaster Management Civil defence organization and its duties.
11. Communication-Different types-media.
12. Signals-introduction to radio, telephony procedures.
13. Field engineering-principles and applications, camouflage and concealment.
14. Adventure training introduction, different types.
15. First Aid-Methods and practices.

16. Environment and Ecology-conservation.

17. Practical examination.

II Semester

1. Drill-Weapon drill-Word of Commands.

2. National integration-utility in diversity.

3. Guard of Honour and ceremonial drill.

4. Types of weapon, parts stripping and assessment of light gun.

5. Rifle firing and follow up activities.

6. Camps, types of camps, preparation and participation.

7. Awards, different types, ranks of officers and cadets.

8. Map reading-judging distance, conventional signs and uses of compass.

9. Leadership traits, types, perception.

10. Fire fighting, role of NCC during natural hazards.

11. Field Engineering-section formation.

12. Obstacle training.

13. Health and sanitation-preventable diseases, fractures and types of treatments.

14. Environment and Ecology-Pollution and its control.

15. Social service-Contribution of youth towards social welfare.

16. First Aid-Snake bite and other common medical emergencies.

17. Practical examination.

III Semester

1. Drill- individual word of command.

2. Weapon training - parts of heavy weapons.

3. Stripping and assembling of heavy weapons.

4. Importance of team work, values, code of ethics.

5. Disaster management during earthquake.

6. Evaluation of causalities.

7. Map reading - Camposs and Service Protractor.

8. Aids to civil authority.

9. Section and platoon formation.

10. Social service, NGO's and their contribution to the society.
11. Roll of NCC cadets in civil administration.
12. Traffic rules and road signs.
13. Mines and types of mine fields.
14. Dressing of wounds, physical and mental health.
15. Field signals.
16. Air raid warning, fire fighting.
17. Practical examination.

IV Semester

1. Drill - Foot drill.
2. Formation of squad and squad drill.
3. Man management, morale.
4. Time Management, stress management.
5. Ecology and Environment- wild life conservation.
6. Adventure Activities, Trekking camp.
7. Map reading - field to map - map to field - grids and scale systems.
8. Communication systems - internet - faxi mail - satellites.
9. Collection and distribution of aid material.
10. Field Engineering - mines, anti tanks, explosives.
11. Opportunities for NCC cadets in Army and other services.
12. Social service, family planning.
13. Section battle drill.
14. Roll of NCC cadets in national programmes.
15. Visit to Wellington, Ooty.
16. Self defence mechanisms.
17. Practical examination.

Evaluation

		Semester				Total
		I	II	III	IV	
A.	Regular activities and behaviour	10	10	10	10	40
B.	Participation in camps and special assignments	5	5	5	5	20
C.	Written test and viva voce	10	10	10	10	40
	Total	25	25	25	25	100

I Year II Semester

Sl. No.	Course Number	Course Title	Credit Hours
1.	FSC 102	Propagation of Horticultural Crops	2 + 1
2.	FSC 103	Production Technology of Tropical and Arid Zone Fruit Crops	2 + 1
3	VSC 102	Production Technology of Tropical Vegetable Crops	2 + 1
4	AGR 102	Fundamentals of Agricultural Meteorology	1 + 1
5	PBG 102	Principles of Genetics and Cytogenetics	2 + 1
6	CRP 101	Crop Physiology	2 + 1
7	BIC 101	Fundamentals of Biochemistry	2 + 1
8.	AEC 101	Principles of Agricultural Economics	1 + 1
Total			14+8=22

FSC 102 Propagation of Horticultural Crops 2 + 1

Aim

- ❖ To impart skill oriented knowledge on media preparation, propagation method and maintenance and after care of propagated plants.

Theory

Unit I Basics of plant propagation

Scope and importance - different methods - definitions - sexual propagation - importance, advantages and disadvantages - asexual propagation - importance, advantages and disadvantages - agencies involved in the nursery development - government schemes for development of nurseries - establishment of nursery - site selection - tools and implements - mist chamber - phytotron - humidifiers - greenhouse - glasshouse - polyhouse - shade net - cold frames - hot beds - pit nursery - ball and bur lapped culture - media and containers - soil sterilization - manures and manuring - liquid manures.

Unit II Sexual propagation

Micro and megasporogenesis - apomixis - mono and polyembryony - seeds - quality - nursery bed - protray culture - sowing - seed viability - longevity - germination - dormancy - types of dormancy - seed treatments - seed invigoration - seedling vigour.

Unit III Asexual propagation - cutting and layering

Genetic variations - chimeras and types - methods of vegetative propagation - identification of plus trees - mother block - raising clonal nursery - types of cuttings - factors influencing rooting of cuttings - use of growth regulators - layering - advantages and disadvantages - methods of layering - anatomical and physiological basis of rooting

Unit IV Asexual propagation - grafting, budding and propagation through special organs

Grafting and budding - methods - advantages and disadvantages - rootstocks - scion bank - factors for successful graft union - selection, pre-curing and collection of scion - bud wood selection - bud wood certification - anatomical and physiological basis of graft / bud union - stock-scion relationship - root stock influences - after care and hardening - techniques of propagation through specialized organs - tubers - bulbs -

corms - runners - suckers - crown - slips - rhizome - offshoots - top working - quality management and nursery certification - display, packing, transport and marketing.

Unit V Techniques of Micro propagation

Micro propagation - definitions - different methods - protocol of micropropagation - Stage I establishment and sterilization - Stage II shoot multiplication - Stage III root formation - Stage IV acclimatization and hardening - specific protocol for aseptic culture - explants - sterilization techniques - types of media - composition - media preparations - meristem tip culture - micro grafting - *in vitro* clonal propagation of important horticultural crops - constraints and problems in micropropagation - after care - packing, transport and marketing - infrastructure requirements - establishment of commercial tissue culture units - visit to commercial TC units- status of micropropagation in India.

Practical

Propagation structures - tools and implements - propagation media - containers - preparation of nursery beds - seed treatment - sowing - plug transplants / seedling production - potting, depotting and repotting of plants - methods of asexual propagation through cuttings, layering, grafting and budding - scion bank - techniques of cuttings - leaf and leaf bud cuttings - stem cuttings - single nodal cuttings and root cuttings - techniques of layering - potting of layers and hardening - grafting methods - separation of grafts - potting and maintenance of grafted plants - budding and maintenance of budded plants - mist chamber - structures - maintenance - use of mist chamber for seed and vegetative propagation - hardening and maintenance - shade structure - nutrition and plant protection - application of growth regulators - standardization of formulations - growth regulators for seed and vegetative propagation - project preparation for commercial nurseries - visit to commercial nurseries and tissue culture units.

Lecture schedule

1. Scope and importance of plant propagation, different methods, principles and definitions

2. Agencies involved in the development of nursery, government schemes and economics
3. Propagation structures, mist chamber, shade net, phytotron, humidifiers, green house, poly house, hot beds and pit nursery
4. Tools and implements, preparation of growing media, rooting media ratio, soil sterilization, organic manure, coco peat, rooting media pH and containers
5. Sexual and asexual propagation, advantages and disadvantages, factors influencing different methods of propagation
6. Seed propagation, dormancy, viability, germination, longevity, seedling vigour
7. Seed treatments in sexually propagated crops, formation of nursery bed and pro tray culture
8. Micro and megasporogenesis, apomixes, mono embryony, poly embryony, chimeras and principles
9. Different methods of cutting and layering
10. Anatomical and physiological basis for rooting
11. Grafting methods and techniques
12. Raising rootstocks and maintenance of scion bank
13. Budding methods and techniques
14. Bud wood collection and maintenance
15. Factors influencing the stock - scion relationship
16. Anatomical and physiological basis of bud and graft union
17. Mid semester examination
18. Vegetative propagation, clonal orchard establishment and maintenance and scion bank
19. Bud wood selection and bud wood certification.
20. Propagation through specialized organs *viz.*, tubers, bulbs, corms, bulbils, rhizome, runner, off shoot, crown, slip and sucker.
21. Propagation through specialized organs *viz.*, runner, off shoot, crown, slip and sucker.
22. Hardening of plants in nurseries and maintenance

23. Quality management and quality standards
24. Nursery act
25. Packing, transport and marketing of nursery plants
26. Scope and importance of micro propagation
27. Plant tissue culture, definitions, totipotency, cell division, cell cycle,
28. Media preparation, shoot multiplication, growing and rooting media
29. Concepts and commercial production of tissue culture plants
30. Micro propagation - commercially important fruit crops
31. Micro propagation - of commercially important spices, medicinal and aromatic crops
32. Micro propagation of commercially important foliage plants, indoor ornamental plants and cut flowers
33. Production of disease free planting materials through micro propagation.
34. Constraints and problems associated with micro propagation - after core, packing, transport and marketing, Infrastructure requirements, Establishment of commercial tissue culture units.

Practical schedule

1. Media and containers for macro propagation, tools and implements -
2. Propagation structures *viz.*, mist chamber, poly house, shade net house, cold frames and hot beds and their maintenance
3. Sexual propagation of acid lime, papaya and raising rootstocks in mango - Preparation of nursery beds and sowing
4. Potting, repotting, handling and maintenance of seedling and rootstocks
5. Preparation of growth regulators and standardization of formulations for seed and vegetative propagation.
6. Techniques of propagation through leaf cuttings
7. Techniques of propagation through stem cutting
8. Techniques and methods of layering
9. Techniques and methods of layering
10. Techniques and methods of propagation through grafting

11. Techniques and methods of propagation through grafting
12. Propagation techniques through budding
13. Propagation techniques through budding
14. Propagation through specialized organs
15. Project preparation for commercial nurseries
16. Visit to private nurseries and commercial tissue culture units
17. Final practical examination.

Out come

Students will be benefited with hands on training in media preparation, mother plant selection, propagation techniques and maintenance and after care of propagated plants.

Text books

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2. Bose, T.K., S.K. Mitra, M. K. Sadhu and B. Mitra. 1991. Propagation of Tropical and Subtropical Horticultural Crops. Naya Prakash 206, Bidhan Sarani, Calcutta. Six. India
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4. Razdon, M.K. 1993. An introduction to plant tissue culture plant tissue culture. Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi.

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- <http://www.biotech / tissue culture techniques.com>
- <http://www.Agriculture-Horticulture / biotechnology.com>
- <http://www.Biotech / Horticultural crops.com>

Journals

- Journal of Horticulture Sciences and Biotechnology
- Acta Horticulture
- Plant Cell Reporter
- Indian Journal of Horticulture

FSC 103 Production Technology of Tropical and Arid Zone Fruit Crops 2 + 1

Aim

- ❖ To impart knowledge on the principles and cultivation of tropical and arid zone fruit crops.

Theory

Unit I Principles and cultivation of tropical fruits - mango and banana

Scope and importance of tropical fruits cultivation – overview: global, national and regional levels – area, production and export potential– horticultural zones of India and Tamil Nadu with emphasis on tropical fruits- GAP. organic production - composition and uses – origin and distribution – species and cultivars - climate and soil requirements - species and varieties - cropping systems- propagation techniques - planting systems and planting density - after care – training and pruning - water management, macro and micronutrient management, weed management - special horticultural techniques - use of plant growth regulators - production constraints - physiological disorders – post harvest handling - economics of production.

Unit II Tropical fruits - papaya, sapota and guava

Composition and uses – origin and distribution – species and cultivars - climate and soil requirements, cropping systems- varieties - propagation techniques - planting systems and planting density - after care – training and pruning - water management, macro and micronutrient management, weed management – GAP - organic production - special horticultural techniques – sex forms and pollination - use of plant growth regulators - production constraints - physiological disorders - pre and post harvest handling - economics of production.

Unit III Tropical fruits - acid lime, sweet orange and jack fruit

Composition and uses – origin and distribution – species and cultivars - climate and soil requirements, cropping systems- varieties - production constraints - propagation techniques - planting systems and planting density - after care – training and pruning - water management, macro and micronutrient management, weed management - GAP - organic production - special horticultural techniques - use of plant

growth regulators - physiological disorders - pre and post harvest handling - economics of production.

Unit IV Arid zone fruits - aonla, ber, pomegranate and date palm

Dryland horticulture - importance and scope in India and Tamil Nadu- distribution of arid and semi-arid zones in India and Tamil Nadu. Composition and uses - origin and distribution - species and cultivars - climate and soil requirements - varieties -cropping systems and intercropping - crops suitable for dry land system - spacing and planting patterns for rainfed horticultural crops- *in situ* grafting and budding techniques - alternative land use systems - mulching - soil and moisture conservation methods - chemical application - anti-transpirants - management of nutrients, water, weeds and problem soils - training and pruning methods - physiology of flowering - regulation of cropping - top working and rejuvenation - use of plant growth regulators - post harvest handling - economics of production.

Unit V Arid zone fruits - custard apple, jamun, bael, wood apple and manila tamarind

Composition and uses - origin and distribution - species and cultivars - climate and soil requirements - varieties - cropping systems and intercropping - crops suitable for dry land system - spacing and planting patterns for rain fed horticultural crops- *in situ* grafting and budding techniques - alternative land use systems - mulching - soil and moisture conservation methods - chemical application - anti-transpirants - management of nutrients, water, weeds and problem soils - training and pruning methods - physiology of flowering - crop regulation - top working and rejuvenation - use of plant growth regulators - post harvest handling - economics of production.

Practical

Description and identification of cultivars/varieties - nursery management - nursery preparation, seed sowing and raising seedlings / rootstocks, practising propagation techniques of mango, banana, papaya, sapota, guava, acid lime, sweet orange, aonla, ber, pomegranate, date palm, custard apple, jamun, bael, wood apple and manila tamarind. Banana scoring techniques. Selection and pre-treatment of banana suckers - desuckering in banana -planting systems- manures, fertilizers and biofertilizers application in mango, banana, papaya, sapota, guava, acid lime, sweet orange and aonla - application of growth regulators - sex forms in papaya - sibmating and seed production in papaya - latex extraction and preparation of crude papain - training and pruning in mango, sapota, guava, acid lime and sweet orange, aonla, ber, pomegranate and date palm - practising harvesting methods - ripening of fruits - grading and packaging - visit to commercial orchards - project preparation on production economics for fruits.

Lecture Schedule

1. Fruits cultivation - overview: global, national and regional level. Area, production, and export potential, past and present status of fruits in India
2. General appraisal of fruit growing regions / zones in India and Tamil Nadu - special features of tropical and arid zone fruits - GAP- organic production.
3. Mango - area, production, productivity, species and varieties - varietal classification - specific purpose and exportable varieties. Climate and soil requirements- effect of weather factors on growth, flowering and productivity
4. Propagation techniques - planting - Nutrition-nutrient deficiency and management -after care-alley cropping -weed and water management.
5. Flowering, fruit set, bearing problems - special horticultural techniques - Production constraints - physiological disorders - rejuvenation of old orchards
6. Harvesting techniques - postharvesthandling & post harvest treatments - ripening of fruits - storage and processing.

7. Banana - climate and soil requirements - varieties. Genome classification - production constraints - selection of planting material- planting systems - high density planting - inter-cropping.
8. Manuring - nutrient deficiency and management - irrigation and weed management - special horticultural techniques
9. Physiological disorders - production constraints - harvesting - post harvest handling - ripening of fruits - storage and processing
10. Papaya - climate and soil requirements - sex forms - varieties - propagation - planting requirements, manures and manuring - nutrient deficiency and management -weed and water management
11. Thinning -use of growth regulators - production constraints - harvesting - latex extraction - postharvesthandling - storage - processing.
12. Sapota - climate and soil requirements - varieties - propagation - planting requirements - manures and manuring.
13. Nutrient deficiency and management - weed and water management - irrigation -use of growth regulators - production constraints - harvesting - postharvest handling -storage - processing.
14. Guava - climate and soil requirements - varieties - propagation - planting requirements manures and manuring - nutrient deficiency and management - weed and water management.
15. Use of growth regulators - bending - bahar treatments - production constraints - harvesting - postharvest handling - storage - processing
16. Acid lime - climate and soil requirements - varieties - propagation - planting requirements - training and pruning - manures and manuring - nutrient deficiency and management. weed and water management - use of growth regulators - production constraints - harvesting - postharvest handling .
17. Mid semester examination
18. Sweet orange - climate and soil requirements - varieties - propagation - planting requirements - training and pruning - manures and manuring.- nutrient deficiency and management - weed and water management - use of

- growth regulators - production constraints - harvesting - postharvest handling - storage - processing.
19. Jackfruit - climate and soil requirements - varieties - propagation - planting requirements- training and pruning - manures and manuring.- nutrient deficiency and management - weed and water management
 20. Use of growth regulators - production constraints - harvesting - postharvest handling.
 21. Dryland horticulture - importance and scope in India and Tamil Nadu- distribution of arid and semi-arid zones in India and Tamil Nadu.
 22. Cropping systems and intercropping - crops suitable for dry land system - spacing and planting patterns for rainfed horticultural crops
 23. Special practices - mulching - Soil and moisture conservation methods - chemical application - anti-transpirants for cultivation of arid zone fruits
 24. Aonla - climate and soil requirements - varieties - production constraints - propagation - planting method -planting density - pollination - nutrient, weed and water management - training and pruning - use of growth regulators - harvest - grading - postharvest handling.
 25. Ber - climate and soil requirements - varieties- propagation - planting density - nutrient, weed and water management - training and pruning - use of growth regulators - production constraints and harvest - grading - postharvest handling.
 26. Pomegranate - climate and soil requirements - varieties - propagation - planting density - nutrient, weed and water management training and pruning
 27. Growth regulation by chemical regulators and harvest - grading - postharvest handling.
 28. Custard apple - climate and soil requirements - varieties - propagation - planting density - nutrient, weed and water management - training and pruning - crop regulation - use of growth regulators - harvest - grading - postharvest handling & processing.

29. Date palm - climate and soil requirements - varieties - production constraints - propagation - planting density - nutrient, weed and water management training and pruning, growth regulation by chemical regulators and harvest - grading - postharvest handling.
30. Jamun - climate and soil requirements - varieties - propagation - planting density - nutrient, weed and water management - training and pruning - use of growth regulators - harvest - grading - postharvest handling
31. Wood apple - climate and soil requirements - varieties - production constraints - propagation - planting density - nutrient, weed and water management - training and pruning, growth regulators - harvest - grading - postharvest handling
32. Bael - climate and soil requirements - varieties - propagation - planting density - nutrient, weed and water management
33. Training and pruning - use of growth regulators - harvest - grading - postharvest handling.
34. Manila tamarind - climate and soil requirements - varieties - propagation - planting density - nutrient, weed and water management training and pruning - use of growth regulators - harvest - grading - postharvest handling

Practical

1. Study of mango varieties
2. Practices in propagation, planting and growth regulation in mango.
3. Study of banana varieties and their genome classification and scoring techniques.
4. Practices in propagation, planting, growth regulation treatments and special practices in banana.
5. Study of grapes varieties, training and pruning practices
6. Visit to mango, banana and grapes orchards in Cumbum valley
7. Study of sapota varieties, propagation and planting
8. Study of papaya varieties, propagation and thinning of plants
9. Papain extraction and its cost economics
10. Study of guava propagation techniques and varieties.
11. Acid lime, lemon and sweet orange varieties, suitable root stocks and their propagation
12. Aonla, pomegranate custard apple, Jamun, bael and manila tamarind propagation and varieties
13. Visit to RRS, Aruppukottai
14. Assessment of maturity standards for tropical and arid zone fruits.
15. Practices in harvesting and postharvest handling
16. Working out the economics of production of tropical fruits and project preparation.
17. Practical examination.

Outcome

1. Practical knowledge on specialized production techniques of tropical and arid zone fruits.
2. Understanding the production constraints through various field visits.

Text Books

1. Bose, T. K., S. K. Mitra and D.Sanyal, 2001. Fruits: Tropical and subtropical. Volume I. Naya Udyog, Calcutta.
2. Chattopadhyay, T. K. 1994. A text book of Pomology (Vol 1-3). Kalyani Publishers, New Delhi.
3. Shanmugavelu, K. G. 1987. Production technology of fruit crops. SBA Publications, Calcutta.
4. Singh, S. P. 1995. Commercial Fruits, Kalyan Publishers, Ludhiyana.
5. Veeraraghavathatham, D., M. Jawaharlal, S. Jeeva and S. Rabindran 1996. Scientific Fruit culture, Suri Associates, Coimbatore.

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VSC 102 Production Technology of Tropical Vegetable Crops 2 + 1

Aim

- ❖ To teach the students about the scenario of vegetable cultivation advanced production techniques and production constraints.

Theory

Unit I Overview of vegetable cultivation

Area, production, world scenario, industrial importance, export potential of tropical vegetable crops - institutions involved in vegetable crops research - Classification of vegetable crops - Effect of climate, soil, water and nutrients on vegetable crop production and their management- cropping systems.

Vegetable production in nutrition garden, kitchen garden, truck garden, market garden, roof garden, floating garden - types of vegetable farming and contract farming- rice fallow cultivation, river bed cultivation, rain fed cultivation, organic farming - GAP in vegetable production - export standards of vegetables.

Unit II Solanaceous vegetables and bhendi

Composition and uses - area and production- climate and soil requirements - season-varieties and hybrids - seed rate- nursery practices-containerized transplant production and transplanting -preparation of field-spacing-planting systems-planting- water and weed management-nutrient requirement-fertigation-nutrient deficiencies- physiological disorders- use of chemicals and growth regulators-cropping systems-constraints in production-harvest-yield crops: Tomato, brinjal, chilli and bhendi.

Unit III Bulbous and Cucurbitaceous vegetable crops

Composition and uses- area and production- climate and soil requirements - season - varieties and hybrids -seed rate - nursery practices - containerized transplant production and transplanting- preparation of field - spacing - planting systems - planting

- water and weed management - nutrient requirement - fertigation - nutrient deficiencies
- physiological disorders - sex expression - use of chemicals and growth regulators -
cropping systems - constraints in production - harvest - yield

Onion, ash gourd, pumpkin, bitter gourd, snake gourd, ribbed gourd, bottle gourd, watermelon, musk melon, coccinia, cucumber and gherkin.

Unit IV Fabaceous vegetable crops and greens

Composition and uses- origin and distribution- area and production- climate and soil requirements - season - varieties and hybrids - seed rate -preparation of field - spacing - planting systems - planting - water and weed management - nutrient requirement - fertigation - nutrient deficiencies - physiological disorders- use of chemicals and growth regulators - cropping systems - constraints in production- harvest - yield.

Cluster beans, cowpea, lab-lab, moringa, chekurmanis, palak, basella and amaranth.

Unit V Tuber crops

Composition and uses- origin and distribution- area and production- climate and soil requirements - season - varieties and hybrids - seed rate -preparation of field - nursery practices and transplanting - spacing - planting systems - planting - water and weed management - nutrient requirement - fertigation - nutrient deficiencies - physiological disorders- use of chemicals and growth regulators - cropping systems - - constraints in production -virus elimination in cassava- harvest - yield

Cassava, sweetpotato, colocasia, vegetable coleus, amorphophallus, edible dioscorea, and yam bean

Practical

Identification and description of tropical vegetable crops -nursery practices and transplanting for transplanted vegetable crops- preparation of field and sowing /planting for direct sown/ transplanted vegetable crops, kitchen garden- herbicide use in vegetable culture - top dressing of fertilizers and inter-culture - use of growth regulators - identification of nutrient deficiencies - physiological disorders- harvest

indices and maturity standards - post harvest handling and storage - marketing - seed extraction- working out cost of cultivation for tropical vegetable crops - project preparation for commercial cultivation. Visit to commercial vegetable growing areas, market and processing centre.

Lecture schedule

1. Area, production, world scenario, industrial importance, export potential of tropical vegetable crops and institutions involved in vegetable crops research.
2. Classification of vegetable crops.
3. Effect of climate, soil, water and nutrients on vegetable crop production and their management.
4. Cropping systems in vegetable crops.
5. Vegetable production in nutrition garden, kitchen garden, truck garden, market garden, roof garden, floating garden, vegetable farming, contract farming, rice fallow cultivation, river bed cultivation, rainfed cultivation.
6. Organic farming - GAP in vegetable production
7. Export standards of vegetables
8. Tomato: Composition and uses- area and production- climate and soil requirements - season - varieties and hybrids -seed rate - nursery practices - containerized transplant production - and transplanting- preparation of field - spacing - planting systems - planting - water and weed management - nutrient requirement.
9. Tomato: Nutrient requirement - fertigation - nutrient deficiencies - .physiological disorders use of chemical and growth regulators - cropping system - constraints in production - harvest - yield
10. Brinjal: Composition and uses- area and production- climate and soil requirements - season - varieties and hybrids -seed rate - nursery practices - containerized transplant production - and transplanting- preparation of field - spacing - planting systems - planting - water and weed management.

11. Brinjal: nutrient requirement – fertigation – nutrient deficiencies – physiological disorders – use of chemical and growth regulators – cropping system – constraints in production – harvest – yield
12. Chilli : Composition and uses- origin and distribution- area and production- climate and soil requirements – season - varieties and hybrids -seed rate – nursery practices – containerized transplant production – and transplanting- preparation of field – spacing – planting systems – planting – water and weed management
13. Chilli: Nutrient deficiencies – fertigation – physiological disorders – use of chemical and growth regulators – cropping system – constraints in production – harvest – yield
14. Bhendi : Composition and uses – area and production- climate and soil requirements – season – varieties and hybrids -seed rate – preparation of field – spacing – sowing – water and weed management – nutrient requirement – fertigation- nutrient deficiencies – physiological disorders – use of chemical and growth regulators – cropping system – constraints in production – harvest – yield
15. Onion (Aggregatum and Common): Composition and uses- origin and distribution- area and production- climate and soil requirements – season – varieties and hybrids -seed rate – nursery practices – containerized transplant production and transplanting- preparation of field – spacing – planting systems – planting – water and weed management
16. Onion (Aggregatum and common): Nutrient requirement – fertigation- nutrient deficiencies – physiological disorders – use of chemical and growth regulators – cropping system – constraints in production – harvest – yield – seed production
17. Mid semester examination
18. Bitter gourd : Composition and uses- area and production- climate and soil requirements – season – varieties and hybrids -seed rate – nursery practices – containerized transplant production and transplanting- preparation of field- spacing – planting systems – planting – water and weed management – nutrient requirement – fertigation – nutrient deficiencies – physiological disorders – sex

expression - use of chemical and growth regulators - cropping system - constraints in production - harvest - yield

19. Snake gourd and ribbed gourd : Composition and uses - area and production- climate and soil requirements - season - varieties and hybrids -seed rate - nursery practices - containerized transplant production and transplanting- preparation of field - spacing - planting systems - planting - water and weed management - nutrient requirement - fertigation - nutrient deficiencies - physiological disorders - sex expression - use of chemical and growth regulators - cropping system - constraints in production - harvest - yield
20. Ash gourd and pumpkin : Composition and uses - area and production- climate and soil requirements - season - varieties and hybrids -seed rate - nursery practices - containerized transplant production and transplanting- preparation of field - spacing - planting systems - planting - water and weed management - nutrient requirement - fertigation - nutrient deficiencies - physiological disorders - sex expression - use of chemical and growth regulators - cropping system - constraints in production - harvest - yield
21. Bottle gourd and coccinea : Composition and uses - area and production- climate and soil requirements - season - varieties and hybrids -seed rate - nursery practices - containerized transplant production and transplanting- preparation of field - spacing - planting systems - planting - water and weed management - nutrient requirement - fertigation - nutrient deficiencies - physiological disorders - sex expression - use of chemical and growth regulators - cropping system - constraints in production - harvest - yield
22. Cucumber and gherkin : Composition and uses - area and production- climate and soil requirements - season - varieties and hybrids -seed rate - nursery practices - containerized transplant production and transplanting- preparation of field - spacing - planting systems - planting - water and weed management - nutrient requirement - fertigation - nutrient deficiencies - physiological disorders - sex expression - use of chemical and growth regulators - cropping system - constraints in production - harvest - yield

23. Water melon and Musk melon: Composition and uses - area and production- climate and soil requirements - season - varieties and hybrids -seed rate - nursery practices - containerized transplant production and transplanting- preparation of field - spacing - planting systems - planting - water and weed management - nutrient requirement - fertigation - nutrient deficiencies - physiological disorders - sex expression - use of chemical and growth regulators - cropping system - constraints in production - harvest - yield
24. Cluster beans: Composition and uses - area and production- climate and soil requirements - season - varieties and hybrids - seed rate -preparation of field - spacing - planting systems - planting - water and weed management - nutrient requirement - fertigation - nutrient deficiencies - physiological disorders- use of chemical and growth regulators - cropping system - - constraints in production - harvest - yield
25. Vegetable Cowpea and Lab lab: Composition and uses - area and production- climate and soil requirements - season - varieties and hybrids - seed rate - preparation of field - spacing - planting systems - planting - water and weed management - nutrient requirement - fertigation - nutrient deficiencies - physiological disorders- use of chemical and growth regulators - cropping system - - constraints in production - harvest - yield
26. Moringa: Composition and uses - area and production- climate and soil requirements - season - varieties and hybrids - seed rate -preparation of field - spacing - planting systems - planting - water and weed management - nutrient requirement - fertigation - nutrient deficiencies - physiological disorders- use of chemical and growth regulators - cropping system - - constraints in production - harvest - yield- value addition.
27. Amaranth: Composition and uses - area and production- climate and soil requirements - season - varieties and hybrids - seed rate -preparation of field - spacing - planting systems - planting - water and weed management - nutrient requirement - fertigation - nutrient deficiencies - physiological disorders- use of

chemical and growth regulators - cropping system - - constraints in production - harvest - yield

28. Palak, basella and chekkurmanis: Composition and uses - area and production- climate and soil requirements - season - varieties and hybrids - seed rate - preparation of field - spacing - planting systems - planting - water and weed management - nutrient requirement - fertigation - nutrient deficiencies - physiological disorders- use of chemical and growth regulators - cropping system - - constraints in production - harvest - yield
29. Cassava : Composition and uses - area and production- climate and soil requirements - season - varieties and hybrids - seed rate -preparation of field - spacing - planting systems - planting - water and weed management
30. Cassava : Nutrient requirement - fertigation - nutrient deficiencies - physiological disorders- use of chemical and growth regulators - cropping system - - constraints in production -virus elimination- harvest - yield
31. Sweet potato: Composition and uses - area and production- climate and soil requirements - season - varieties and hybrids - seed rate -vegetative propagation - preparation of field - spacing - planting systems - planting - water and weed management - nutrient requirement - fertigation - nutrient deficiencies - physiological disorders- use of chemical and growth regulators - cropping system - - constraints in production - harvest - yield
32. Colocasia and Vegetable coleus: Composition and uses - area and production- climate and soil requirements - season - varieties and hybrids - seed rate - vegetative propagation - preparation of field - spacing - planting systems - planting - water and weed management - nutrient requirement - fertigation - nutrient deficiencies - physiological disorders- use of chemical and growth regulators - cropping system - - constraints in production - harvest - yield
33. Amorphophallus: Composition and uses - area and production- climate and soil requirements - season - varieties and hybrids - seed rate -vegetative propagation - preparation of field - spacing - planting systems - planting - water and weed management - nutrient requirement - fertigation - nutrient deficiencies -

physiological disorders- use of chemical and growth regulators - cropping system -
- constraints in production - harvest - yield

34. Dioscorea and xanthosoma: Composition and uses - area and production- climate and soil requirements - season - varieties and hybrids - seed rate -vegetative propagation - preparation of field - spacing - planting systems - planting - water and weed management - nutrient requirement - fertigation - nutrient deficiencies - physiological disorders- use of chemical and growth regulators - cropping system -
- constraints in production - harvest - yield

Practical schedule

1. Preparation of nursery, containerized transplant production and sowing of seeds for solanaceous vegetable crops.
2. Preparation of field and sowing of direct sown vegetable crops.
3. Preparation of field, sowing of cucurbitaceous, perennial and leafy vegetable crops and tuber crops.
4. Identification and description of species and varieties of tomato, brinjal and chilli. Working out cost- benefit ratio.
5. Identification and description of species and varieties of bhendi, amaranth, cluster beans, vegetable cowpea and lab-lab. Working out cost- benefit ratio.
6. Identification and description of species and varieties of cucurbits, onion, moringa, chekkurmanis and determination of sex ratio in cucurbits. Working out cost- benefit ratio.
7. Identification and description of cultivars and wild relatives of tuber crops. Working out cost -benefit ratio.
8. Planning and lay out of kitchen/ nutrition garden.
9. Study of rainfed cultivation practices in vegetable crops
10. Study of drip and fertigation, basal dressing, top dressing and foliar spray of fertilizers for vegetable crops.
11. Identification of weeds, preparation of herbicide spray fluids and their usage in the field. Working with the economics of weed management

12. Preparation of growth regulator spray solution- their usage in tropical vegetable crops
13. Identification of nutrient deficiencies, physiological disorders and corrective measures in vegetable crops.
14. Maturity indices, harvesting and seed extraction
15. Visit to commercial vegetable growing area / markets
16. Project preparation for commercial cultivation of tropical vegetable crops.
17. Practical Examination.

Outcome

1. Hands on experience of vegetable cultivation
2. Knowledge about quality requirement and production and techniques for export
3. Managing skill for solving field problems

Text Books

1. Pranab Hazra, A. Chattopadhyay, K. Karmakar and S. Dutta. 2010. "Modern technology in vegetable production" New India Publishing Agency, New Delhi.
2. Uma Shankar Singh, 2008. "Indian vegetables", Anmol publications Pvt., Ltd., New Delhi.
3. Gopalakrishnan, T.R., 2007. "Vegetable Crops" New India publishing agency, New Delhi.
4. James S. Shoemaker and Thomas Smith., 2006. "Culture of Veg., Growing" Asiatic.

Further Reading

1. Vishnu Swarup, 2006. Vegetable science and technology in India. Kalyani publishers, New Delhi.
2. Neeraj Pratap Singh . 2005. "Basic concepts of vegetable science", International Book distributing co., New Delhi.

3. Rai, N. and D.S. Yadav, 2005. *Advances in Vegetable Production: Research co Book Centre, New Delhi.*
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5. Bishwajit Choudhury . 2003. "Vegetables", International Book Trust, New Delhi.
6. Bose, T. K, Kabir, J., Maity T. K., Parthasarathy V. A., and Som M. G., 2002. *Vegetable Crops Vol. I, II & III Naya Prokash, Kolkata.*
7. Veeraraghavathatham. D., M Jawaharlal and Seemanthini Ramdas. 1991. *A guide on vegetable culture. A. E. Publication Coimbatore.*
8. Hazra, P. and M. G., Som. 1999. *Technology for vegetable production and improvement, Naya Prokash, Calcutta.*
9. Bailey, L. H 1999. *Principles of Vegetable cultivation. Discovery Publishing House, New Delhi.*

Journals

1. Indian Journal of Horticulture
2. Indian Journal of Vegetable sciences
3. Indian Horticulture
4. International Journal of Vegetable Science
5. Scientia Horticulture
6. Green farming

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- <http://www.ces.ncsu.edu/depts/hort/hil/hil-32-a.html>
- <http://attra.ncat.org/attra-pub/manures.html>
- <http://ucanr.org/freepubs/docs/8129.pdf>
- <http://www.agnet.org/library/eb/545/>
- <http://www.sus-veg-thai.de/>
- <http://www.amazon.co.uk/Vegetable-Alliums-Production-Science-Horticulture/dp/0851987532>

AGR 102 Fundamentals of Agricultural Meteorology 1 + 1

Theory

Unit I Introduction

Meteorology - agricultural meteorology - scope in crop production. Coordinates of India and Tamil Nadu - atmosphere - composition and vertical layers of atmosphere (stratification) - climate - weather - factors affecting climate and weather - climatic types

Unit II Basics of weather parameters and their influence on crop production- Solar radiation, light, temperature, RH, wind

Solar radiation - light intensity, quality, direction and duration - air and soil temperature - Diurnal variation - importance in crop production. Heat unit and its importance in agriculture. Relative humidity and its importance - wind and its effect on crops.

Unit III Atmospheric circulation-clouds, cloud seeding, evapotranspiration

Atmospheric pressure - pressure systems - cyclones, anticyclones, tornado, hurricane and storms - wind systems of the world - inter tropical convergence zone. Clouds - types and their classification. Precipitation - forms - monsoon - - Seasons of India- rainfall variability- drought, flood and their effect - cloud seeding - Evapotranspiration

Unit IV Weather analysis-forecast and impact of climate

Agroclimatic zones - agroclimatic normals - weather forecasting - synoptic chart - crop weather calendar - remote sensing and crop weather modeling - Impact of climate and weather on crop production and pest and diseases.

Unit V Introduction to climate change

Climate change- climate variability - definition and causes of climate change - Impact of climate change on agriculture, forestry, hydrology, marine and coastal ecosystem

Practical

Agromet Observatory - site selection and layout. Acquiring skill in use of pyranometers - sunshine recorder - maximum, minimum, gross minimum and soil thermometers - thermograph, dry and wet bulb thermometers - hygrograph - psychrometers - Fortein's barometer - Barograph - altimeter; wind vane, anemometer - Rain gauge - ordinary and self-recording; automatic weather station - evaporimeters - lysimeters, dew gauge. Preparation of synoptic charts and crop weather calendars. Rainfall probability analysis. Mapping of agroclimatic zones.

Lecture schedule

1. Meteorology - Agricultural Meteorology - Definition, their importance and scope in crop production.
2. Coordinates of India and Tamil Nadu. Atmosphere - Composition of atmosphere - Vertical layers of atmosphere based on temperature difference / lapse rate.
3. Climate and weather - Factors affecting climate and weather. Macroclimate - Meso climate - Microclimate - Definition and their importance - Different climates of India and Tamil Nadu and their characterization.
4. Solar radiation - Radiation balance - Wave length characteristics and their effect on crop production - Light - effect of intensity, quality, direction and duration on crop production
5. Air temperature - Factors affecting temperature. Diurnal and seasonal variation in air temperature - Isotherm, Heat unit and its use - Heat and cold injuries
6. Role of temperature in crop production. Soil temperature - Importance in crop production. Factors affecting soil temperature, diurnal and seasonal variation in soil temperature.
7. Humidity - Types - Dew point temperature - Vapour pressure deficit - Diurnal variation in Relative humidity and its effect on crop production - Wind and its role on crop production

8. Atmospheric pressure, diurnal and seasonal variation - Pressure systems of the world - causes for variation - Isobar - Low, depression, anticyclone, Tornado, hurricane
9. Mid Semester Examination
10. Wind systems of the world - Inter Tropical Convergence Zones (ITCZ), wind speed in different seasons -. Clouds and their classification - Concepts of cloud seeding - present status.
11. Precipitation - Forms of precipitation - Isohyte - Monsoon - Different monsoons of India - Rainfall variability - Drought and flood - Impact on crop production
12. Evaporation - Transpiration, evapotranspiration - Potential evapotranspiration - Definition and their importance in agricultural production. Agroclimatic zones of Tamil Nadu - Agroclimatic normals for field crops.
13. Weather forecasting - Types, importance, Agro Advisory Services - Synoptic chart - Crop weather calendar
14. Remote sensing and its application in agriculture - Crop weather modeling and its application in agriculture - list of models available
15. Effect of weather and climate on crop production, soil fertility and incidence of pest and diseases
16. Climate change, climate variability - definition and causes of climate change including ENSO
17. Impact of climate change on Agriculture, Forestry, Hydrology, marine and coastal ecosystem

Practical schedule

1. Site selection and layout for Agromet Observatory - Calculation of local time - Time of observation of different weather elements - Reviewing agromet registers.
2. Measurements of solar radiation (pyranometers), sunshine hours (sunshine recorder) - working out weekly and monthly mean for graphical representation
3. Measurement of air and soil temperature and grass minimum thermometers and thermographs - drawing isolines
4. Humidity measurements - use of wet and dry bulb thermometers - Psychrometers - Hygrograph - Measurement of wind direction and wind speed and conversion (KMPH, KNOT, and M/Sec.) - Beaufort's scale.
5. Measurement of atmospheric pressure - barograph - Fortein-s barometer - Isobars based on past data for different seasons.
6. Measurement of rainfall - Ordinary and self-recording rain gauges - Measurement of Dew - dew gauge- study of Automatic weather station.
7. Measurement of Evaporation - Open pan evaporimeter- application of evaporation data-Measurement of Evapotranspiration- Lysimeter.
8. Heat Unit concept- GDD, HTU, PTU for fixing time of sowing.
9. Probability analysis of rainfall for crop planning
10. Drawing Synoptic charts for understanding weather.
11. Preparation of crop weather calendars and forecast based agro advisories
12. Preparation pest weather calendar and pest forewarning
13. Estimation of length of growing periods using weekly rainfall data.
14. Water balance studies
15. Identification of efficient cropping zone- RYI, RSI
16. Mapping of agro climatic Zones of India and Tamil Nadu and its characterization.
17. Practical Examination.

References

1. Gopaldaswamy, N. 1994. Agricultural Meteorology, Rawat publications, Jaipur.

2. IPCC Fourth Assessment report, 2007 (<http://www.ipcc.ch>)
3. Kakde, J.R., 1985. Agricultural climatology, Metropolitan Book Co. Pvt. Ltd., New Delhi.
4. Lenka, D. 2000. Climate, Weather and Crops in India, Kalyani Publishers, Ludhiana.
5. Mavi, H.S., 1996. Introduction to Agrometeorology, oxford and IBH Publishing Co., New Delhi.
6. Murthy, V.R.K. 1995. Practical manual on Agricultural Meteorology, Kalyani Publishers, Ludhiana.
7. Prasad, Rao, G.S.L.H.V. 2005. Agricultural Meteorology. Kerala Agricultural University, Press, Thrissur.
8. Radhakrishna Murthy, V. 2002. Basic Principles of Agricultural Meteorology. BS Publications Hyderabad.
9. Venkataraman, S., Krishnan, A. 1992. Crops and Weather. Indian Council of Agricultural Research, Pusa, New Delhi.
10. Yellamanda Reddy, T. and G.H. Sankara Reddi, 2004. Principles of Agronomy, Kalyani Publishers, Ludhiana.

PBG 102 Principles of Genetics and Cytogenetics 2 + 1

Aim

- ❖ The fundamental concepts of genetics and cytogenetics will be exposed to the students quoting classical examples

Theory

Unit I Cell theory and chromosome morphology

Cell and cell organelles- differences between prokaryotes and eukaryotes. Cell theory - cell cycle - cell division - mitosis, meiosis and their significance. Chromosome structure - types of chromosomes- karyotype, ideogram -special chromosomes. Chromosomal aberration: variation in chromosome structure - deletion, duplication, inversion and translocation - genetic and cytological implications. Chromosomal aberration: Variation in chromosome number - euploid, aneuploid, types of aneuploids and their origin. Polyploid - auto and allopolyploids, their characters; evolution of wheat, triticale, cotton, tobacco, brassicas.

Unit II Mendelian laws of inheritance

Earlier concepts of heredity - vapour and fluid theory, magnetic power theory, preformation theory, Lamarck's theory, Darwin's theory, germplasm theory and mutation theory. Mendel's work- laws of heredity. Chromosomal theory of inheritance. Allelic interactions - dominance vs. recessive, complete dominance, codominance, incomplete dominance, over dominance. Gene interactions - Non-allelic interactions. Lethal genes, pleiotrophy, penetrance and expressivity, phenocopy. multiple alleles, blood group in humans, coat colour in rabbits, self incompatibility in plants; pseudo alleles, isoalleles. Quantitative inheritance - Multiple factor hypothesis - Nilsson Ehle experiment on wheat kernel colour. Polygenes - transgressive segregation, comparison of quantitatively and qualitatively inherited characters.

Unit III Linkage and crossing over

Linkage - coupling and repulsion; experiment on Bateson and Punnett - Chromosomal theory of linkage of Morgan - complete and incomplete linkage, linkage group.

Crossing over - significance of crossing over; cytological proof for crossing over - Stern's experiment; factors controlling crossing over. Strength of linkage and recombination; Two point and three point test cross. Double cross over, interference and coincidence; genetic map, physical map.

Unit IV Sex determination and sex linkage

Sex determination - chromosomal mechanism of sex determination and its types - autosomes and sex chromosomes - homogametic and heterogametic sexes; genic balance theory of sex determination of bridges. Sex linked inheritance - criss cross inheritance - reciprocal difference; holandric genes; sex influenced and sex limited inheritance. Sex determination in plants - Melandrium, papaya, maize. Cytoplasmic inheritance and maternal effects - features of cytoplasmic inheritance, chloroplast, mitochondrial, plasmid and episomic inheritance.

Unit V Modern concepts of genetics

DNA, the genetic material - Griffith's experiment, experiment of Avery, McCleod and McCarthy - confirmation by Hershey and Chase; RNA as genetic material - Frankel, Conrat and Singer experiment. Structure of DNA - Watson and Crick model. Proof for semi conservative method of DNA replication; Models of DNA replication; steps involved in DNA replication. RNA types - mRNA, tRNA, rRNA; genetic code. Transcription - central dogma of life. Gene expression - translation - protein synthesis. Regulation of gene expression - operon model of Jacob and Monod; Structural genes and regulator genes. -exons and introns. Modern concept of gene- cistron, muton and recon; complementation test; mobile genetic elements. Mutation - characteristics of mutation micro and macro mutation - CIB technique - molecular basis of mutation; major physical and chemical mutagens.

Practical

Study of cell and cell organelles – preparation of fixatives and stains – pre-treatment of materials for mitosis and meiosis – study of mitosis and meiosis. Study of genetic ratios of – monohybrid, dihybrid- incomplete dominance. Gene interaction - multiple alleles and multiple factors. Study of linkage, estimation of strength of linkage and recombination frequency in two point and three point test cross data and F₂ data – Drawing of genetic map – interference and coincidence.

Lecture schedule

1. Definition of genetics, heredity, inheritance, cytogenetics; Brief history of developments in genetics and cytogenetics
2. Physical basis of heredity: Structure and function of cell and cell organelles – Differences between Prokaryotes and Eukaryotes.
3. Cell division – mitosis, meiosis and their significance, cell cycle.
4. Chromosome structure, chemical composition, nucleosome, centromere, telomere, NOR, satellite chromosome, karyotype, ideogram, Types of chromosomes based on position of centromere. .
5. Special chromosomes – polytene, lampbrush, B, ring and isochromosomes.
6. Chromosomal aberration: Variation in chromosome structure – deletion, duplication, inversion and translocation – genetic and cytological implications.
7. Chromosomal aberration: Variation in chromosome number – euploid, aneuploid, types of aneuploids and their origin.
8. Polyploid - auto and allopolyploids, their characters; meaning of genome; evolution of wheat, Triticale, cotton, tobacco, Brassicas,
9. Pre-Mendelian ideas about heredity – Vapour and fluid theory, Magnetic power theory, Preformation theory, Lamarck's theory, Darwin's theory, Germplasm theory and Mutation theory.
10. Work of Mendel – Characters studied reasons for Mendel's success, Law of dominance, Law of segregation and Law of independent assortment. Rediscovery of Mendel's work

11. Chromosomal theory of inheritance. Allelic interactions – Dominance vs. recessive, complete dominance, codominance, incomplete dominance, over dominance.
12. Terminologies: gene, allele, locus, homozygous, heterozygous, hemizygous, genotype, phenotype, monohybrid, dihybrid, polyhybrid.
13. Deviation from Mendelian inheritance – Non allelic interaction without modification in Mendelian ratio – Bateson and Punnett's experiment on fowl comb shape. Non allelic interaction with modification in Mendelian ratio – i.) Dominant epistasis (12:3:1)
14. ii.) Recessive epistasis(9:3:4) iii.) Duplicate and additive epistasis((9:6:1). iv.) Duplicate dominant epistasis(15:1)
15. v) Duplicate recessive epistasis (9:7) vi.) Dominant and recessive epistasis(13:3); Summary of epistatic ratios (i)to (vi).
16. Lethal genes, Pleiotrophy, penetrance and expressivity, phenocopy: Multiple alleles, blood group in humans, coat colour in rabbits, self incompatibility in plants; pseudo alleles, isoalleles.
17. Mid semester examination
18. Quantitative inheritance – Multiple factor hypothesis – Nilsson Ehle, his experiment on wheat kernel colour.
19. Polygenes – transgressive segregation, comparison of quantitatively and qualitatively inherited characters; modifiers.
20. Linkage - coupling and repulsion; Experiment on Bateson and Punnett – Chromosomal theory of linkage of Morgan – Complete and incomplete linkage, Linkage group.
21. Crossing over – significance of crossing over; cytological proof for crossing over - Stern's experiment; Factors controlling crossing over.
22. Strength of linkage and recombination; Two point and three point test cross.
23. Double cross over, interference and coincidence; genetic map, physical map.

24. Sex determination - chromosomal mechanism of sex determination and its types - autosomes and sex chromosomes - homogametic and heterogametic sexes; genic balance theory of sex determination of Bridges.
25. Sex linked inheritance - criss cross inheritance - reciprocal difference; holandric genes; sex influenced and sex limited inheritance.
26. Sex determination in plants - Melandrium, papaya, maize.
27. Cytoplasmic inheritance and maternal effects - features of cytoplasmic inheritance, chloroplast, mitochondrial, plasmid and episomic inheritance.
28. DNA, the genetic material - Griffith's experiment, experiment of Avery, McCleod and McCarthy - confirmation by Hershey and Chase; RNA as genetic material - Frankel, Conrat and Singer experiment.
29. Structure of DNA - Watson and Crick model
30. Proof for semi conservative method of DNA replication; Models of DNA replication; steps involved in DNA replication.
31. RNA types - mRNA, tRNA, rRNA; genetic code, transcription - central dogma of life.
32. Gene expression - translation - protein synthesis.
33. Regulation of gene expression - operon model of Jacob and Monod; Structural genes and regulator genes; exons and introns. Modern concept of gene - cistron, muton and recon; complementation test; mobile genetic elements.
34. Mutation - characteristics of mutation - micro and macro mutation - CIB technique - molecular basis of mutation; major physical and chemical mutagens.

Practical schedule

1. Use of microscopes and study of cell shapes and cell organelles of active mitotic and meiotic tissues.
2. Principles of killing and fixing; preparation of stains and preservatives.
3. Study of the mitotic phases in root tips of onion / *Aloe sp.*
4. Study of behaviour of chromosomes in mitosis.
5. Procedure for fixing and observing different meiotic phases in the inflorescence of maize.

6. Procedure for fixing and observing different meiotic phases in the inflorescence in pearl millet/sorghum.
7. Induction of polyploidy using colchicine
8. Repetition of meiotic studies in maize/sorghum/pearl millet and making temporary and permanent slides.
9. Principles of dominance, recessive, back cross, test cross, incomplete dominance, codominance and lethal factor; Chi square test; Monohybrid genetic ratio with dominance, with incomplete dominance and test cross;
10. Dihybrid ratio with dominance, with incomplete dominance and test cross
11. Simple interaction of genes-comb character in fowls; Dominant epistasis.
12. Recessive epistasis, Duplicate and additive epistasis.
13. Duplicate dominant epistasis, Duplicate recessive epistasis, Dominant and recessive epistasis.
14. Multiple alleles and polygenic inheritance
15. Estimation of linkage with F₂ and test cross data; Coupling and repulsion.
16. Problems on two point test cross and three point test cross; Working out interference, coincidence and drawing genetic maps.
17. Practical examination.

Text books

1. Gupta P.K., 1997. Cytogenetics, Rastogi Publications, Meerut
2. Strickberger. M.W., 1996. Genetics, Prentice-Hall of India Pvt. Ltd. New Delhi.
3. Singh, B.D. 2004. Fundamentals of genetics, Kalyani Publishers, Chennai.

Further reading

1. Daniel Sundararaj, G. Thulasidas and M.Stephen Dorairaj, 1997. Introduction to Cytogenetics and Plant Breeding. Popular Book Depot, Chennai -15.
2. Benjamin Lewin 2005 Genes IX Oxford University Press, Oxford.
3. Gupta P.K., 1993. Genetics, Rastogi publications, Meerut.
4. Reddi, O.S., 1992. Understanding Genetics. Sunil Sachdev Publishers, New Delhi - 64.

e references

➤ www.nmsu.edu
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CRP 101 Crop Physiology 2 + 1

Aim

- ❖ To expose the students to the basic concepts and underlying applications of crop physiology

Theory

Unit I Plant water relations

Importance of crop physiology in agriculture, role of water -water potential and components -Definitions - field capacity, water holding capacity of soil and permanent wilting point, absorption and translocation of water and solutes, transpiration - significance- antitranspirants.

Unit II Nutrio physiology

Mineral nutrition -mobility and mechanism of uptake - physiological role of nutrients, physiological disorders - nutritional disorders (deficiencies and toxicities) - difference between physiological and nutritional disorders - diagnosis, identification of disorders - foliar, tissue testing. Management techniques- foliar feeding, root feeding, trunk feeding and fertigation.

Unit III Carbon fixation

Photosynthesis - light reaction and photosynthetic pathways - C₃, C₄ and CAM, differences between C₃, C₄ and CAM pathways - Factors affecting photosynthesis, photorespiration and significance phloem and xylem loading- source sink relationship.

Unit IV Growth physiology

Growth - growth analysis - LAI, LAD, SLW, SLA, LAR, NAR, RGR and CGR in relation to crop productivity,- Photoperiodism - role of phytochrome in flowering and regulation of flowering. Vernalisation - devernalisation- plant growth regulators and commercial applications - physiological role of auxins and GA, physiological role of cytokinin, ethylene and ABA - novel growth regulators and retardants - their uses in

crop productivity, post harvest physiology - physiology of seed germination, seed and bud dormancy and breaking methods, parthenocarpy - physiology of fruit ripening - climacteric and non-climacteric fruits- - factors affecting ripening and storage, abscission - senescence, shelf life and quality changes - use of PGRs and nutrients.

Unit V Stress physiology

Environmental stresses - water stress - physiological changes - adaptation to drought and its amelioration, temperature stress - physiological changes - low and high temperature - chilling injury - tolerance - alleviation, low light and UV radiation stresses - salt stress - physiological changes and alleviation, Global warming - Carbon sequestration - physiological effects on crop productivity.

Lecture schedule

1. Importance of Crop Physiology in Agriculture.
2. Role of water - process and significance
3. Definition - field capacity, water holding capacity of soil and permanent wilting point.
4. Translocation of water and solutes - phloem and xylem transport.
5. Transpiration - mechanism - significance - guttation - antitranspirants.
6. Mineral nutrition - macro, secondary and micronutrients - sand, hydroponics and aeroponic culture.
7. Mechanism of uptake - physiological role of nutrients.
8. Foliar diagnosis - nutritional and physiological disorders
9. Foliar nutrition- root feeding, trunk feeding and fertigation
10. Photosynthesis - light reaction
11. Photosynthetic pathways - C₃, C₄ and CAM
12. Differences between C₃, C₄ and CAM pathways - Factors affecting photosynthesis.
13. Photorespiration - photorespiration process and significance of photorespiration.
14. Source sink relationship and their manipulations
15. Photoperiodism - short day, long day and day neutral plants

16. Phytochrome. Role of phytochrome in flowering and regulation of flowering.
17. Mid semester examination
18. Vernalisation - mechanism of vernalisation and its significance - devernalisation.
19. Growth analysis - LAI, LAD, SLW, SLA, LAR, NAR, RGR and CGR in relation to crop productivity.
20. Plant growth regulators - Physiological role of Auxins and GA.
21. Physiological role of Cytokinin, and ABA
22. Physiological role of Ethylene
23. Novel growth regulators and retardants and their uses in crop productivity.
24. Seed germination - physiological changes ,seed and bud dormancy, breaking methods
25. Abscission - senescence
26. Physiology of ripening- climatic non climatic and factors affecting ripening and storage
27. Role of PGRS and nutrients in shelf life and quality changes
28. Environmental stresses - water stress - physiological changes - adaptation and amelioration.
29. Temperature stress - Physiological changes - low and high temperature - adaptation and amelioration
30. Chilling injury - tolerance - alleviation.
31. Low light and UV radiation stresses – physiological changes - adaptation and amelioration.
32. Salt stress - physiological changes- adaptation and alleviation
33. Global warming – physiological effects of green house gases-
34. Carbon Sequestration - physiological effects on crop productivity

Practical schedule

1. Preparation of solutions
2. Measurement of plant water status by different methods.
3. Estimation of stomatal index and stomatal frequency.

4. Measurement of leaf area by different methods.
5. Physiological and Nutritional disorders in crops plants
6. Rapid Tissue Tests for:
7. Estimation of chlorophyll Stability Index
8. Estimation of RWC
9. Determination of photosynthetic efficiency in crop plants.
10. Estimation of Nitrate reductase activity
11. Growth Analysis - Determination of LAI, LAD, SLA, SLW, LAR, NAR, RGR, CGR and HI.
12. Bioassay of cytokinin
13. Bioassay of GA
14. Estimation of proline accumulation to assess the water stress in crop plants.
15. Demonstration of crop response to growth regulators.
16. Field visit for foliar diagnosis.
17. Practical examination

Outcome

The students will know about the principles, basic and application of crop physiology in agriculture.

References

1. Jain, J.K. 2007. Fundamentals of plant physiology, S.Chand & Company Ltd., New Delhi.
2. Pandey, S. N. and B. K.Sinha, 2006. Plant Physiology. Vikas Publishing House Private Limited, New Delhi.
3. Purohit, S.S, 2005. Plant physiology, Student edition, Jodhpur.
4. Ray Noggle, G. and Fritz, G. J., 1991. Introductory Plant Physiology. Prentice Hall of India Pvt. Ltd., New Delhi.
5. Taiz. L. and Zeiger. E., 2006. Plant Physiology. Publishers: Sinauer Associates, Inc., Massachusetts, USA.

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- <http://www.plantphys.org>
- [http://www. Biologie. Uni-hamburg. de/b-online](http://www.Biologie.Uni-hamburg.de/b-online)
- <http://4e.plantphys.net>

- <http://3e.plantphys.net>
- <http://www.botany.org>

BIC 101 Fundamentals of Biochemistry 2 + 1

Theory

Unit I Carbohydrates

Carbohydrates - occurrence and classification. Structure of monosaccharides, disaccharides and polysaccharides. Physical and chemical properties of carbohydrates - optical isomerism, optical activity, reducing property, reaction with acids and alkalis. Industrial uses.

Unit II Lipids

Lipids - occurrence and classification. Important fatty acids and triacyl glycerol. Essential fatty acids . Physical and chemical constants of oils. Rancidity of oils. Waxes and phospholipids - types and importance. Plant pigments - structure and function of chlorophyll and carotenoids. Sterols - basic structure and their importance. Industrial applications of lipids.

Unit III Proteins and enzymes

Amino acids - classification and structure. Essential amino acids, properties of amino acids - colour reactions, amphoteric nature and isomerism. Classification of proteins based on functions and solubility. Structure of proteins - primary, secondary, tertiary and quaternary. Properties and reactions of proteins. Enzymes - classification and nomenclature. Mechanism of enzyme action. Factors affecting enzyme action. Competitive, non-competitive and uncompetitive inhibitors. Cofactors and coenzymes. Vitamins and minerals as coenzymes / cofactors. Isozymes. Industrial applications of enzymes.

Unit IV Metabolism

Carbohydrate metabolism - breakdown of starch by amylases, glycolysis and TCA cycle Pentose phosphate pathway. Respiration -electron transport chain and oxidative phosphorylation. Bioenergetics of glucose. Metabolism of lipids - lipases and phospholipases. Fatty acid oxidation and bioenergetics. Biosynthesis of fatty acids and triacyl glycerol. General catabolic pathway for amino acids -transamination,

deamination and decarboxylation. Ammonia assimilating enzymes. Metabolic inter-relationship.

Unit V Secondary metabolites

Secondary metabolites - occurrence, classification and functions of phenolics, terpenes and alkaloids. Applications of secondary metabolites in food and pharma industries.

Practical

Qualitative tests for carbohydrates, estimation of reducing sugar, total sugar, starch and amylose. Qualitative tests for amino acids and proteins. Estimation of protein and amino acids. Estimation of free fatty acid and determination of iodine number. Estimation of ascorbic acid. Estimation of phenol. Assay of an enzyme - amylase. Chromatography of amino acids/sugars.

Lecture schedule

1. Introduction to biochemistry, Carbohydrates-importance and classification.
2. Occurrence and structures of monosaccharides.
3. Structures of disaccharides and polysaccharides.
4. Mutarotation, optical activity and physical properties of sugars.
5. Chemical reactions of carbohydrates, Optical isomerism, Industrial uses
6. Lipids-introduction, importance and classification.
7. Structures of fatty acids and triacyl glycerol, essential fatty acids.
8. Phospholipids and their importance.
9. Waxes, plant pigments, sterols and industrial applications of lipids.
10. Physical constants and rancidity of oils.
11. Amino acids -classification and properties, essential amino acids.
12. Proteins- importance and classification.
13. Colour reactions of proteins, hydrogen bond and hydrophobic interactions.
14. Structure of proteins.
15. Enzymes - classification.

16. Mechanism of enzyme action-active site.
17. Mid semester examination.
18. Factors affecting enzyme action and competitive, non-competitive and Uncompetitive inhibition.
19. Cofactors and coenzymes, Isozymes, industrial applications of enzymes.
20. Breakdown of starch.
21. Glycolysis and its energetics.
22. TCA cycle and its energetics.
23. Pentose phosphate pathway.
24. Electron transport chain and oxidative phosphorylation.
25. Bioenergetics of glucose.
26. Lipases and phospholipases.
27. β -oxidation of fatty acids and energetics of β -oxidation.
28. Fatty acid and triacyl glycerol biosynthesis.
29. Transamination, deamination and decarboxylation.
30. Ammonia assimilating enzymes, GDH, GS and GOGAT.
31. Metabolic interrelationship.
32. Secondary metabolites - occurrence, classification and functions of phenolics.
33. Occurrence, classification and functions of terpenes.
34. Occurrence, classification and functions of alkaloids ; Applications of secondary metabolites in food and pharma industries.

Practical schedule

1. Qualitative tests for carbohydrates.
2. Estimation of total sugars.
3. Determination of reducing sugars
4. Amylose estimation.
5. Estimation of starch
6. Colour reactions of amino acid and proteins.
7. Estimation of proteins. by Biuret method
8. Sorenson's formal titration of amino acids.
9. Estimation of total free amino acids by Ninhydrin method.
10. Estimation of free fatty acids of an oil.
11. Determination of iodine number of an oil.
12. Estimation of ascorbic acid.
13. Estimation of total phenol.
14. Assay of amylase
15. Separation of amino acids through PC.
16. Separation of sugars through TLC.
17. Final practical examination.

Text books

1. Rastogi S.D., 2010, *Biochemistry*, 3rd edn, Tata McGraw-Hill, Delhi
2. Murray,R.K., Granner,D.K., Mayes,P.A.. and Rodwell,V.W., 2003.26th edn, Tata McGraw-Hill, New Delhi
3. Nelson DL, Cox MM. 2004. *Lehninger Principles of Biochemistry Fourth (Indian edition)* Macmillian, Worth Publishers.
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5. Thayumanavan, B, Krishnaveni, S and Parvathi, K. 2004. *Biochemistry for Agricultural Science*, Galgotia Publications Pvt Ltd., New Delhi

6. Sadasivam S and Manickam, A. Biochemical Methods, 2009, 3rd edn, New Age International
7. Wilson, K. and Walker, J.M. 2000. Principles and techniques of Practical Biochemistry, 5th edn. – Cambridge University Press.

Further reading

1. Conn, E.E. and Stumpf, P.K.1996. Outlines of Biochemistry – Wiley Eastern Ltd., Fifth Edition.
2. Stryer L, Berg T, Tymoczko, J, Biochemistry., 2009 5th Ed. Wiley Eastern Ltd, New Delhi
3. Chesworth, JM., Stuchbury, T. and Scaife, JR. 1998. An Introduction to Agricultural Biochemistry. Chapman and Hall.
4. Goodwin, T.W. and Mercer, E.I. 1991. Introduction to Plant Biochemistry. Pergamon Press.

e Reference

- www.faculty.virginia.edu/mcgarveylab/Carbsyn/Carblast/html/disacch.html
 - www.messiah.edu/departments/chemistry/molscilab/organic/disaccharides.htm
- www.ncbi.nlm.nih.gov

AEC 101 Principles of Agricultural Economics 1 + 1

Theory

Unit 1 Nature and scope of economics

Nature and scope of economics: Importance – subject matter, science vs. art, positive vs. normative science - deductive and inductive methods - Different economic systems: merits and demerits - definitions of economics: wealth, welfare, scarcity and growth definitions - divisions of economics – micro and macro economics - agricultural economics: definition and scope - basic concepts: goods, service, value, cost, price, wealth, welfare - wants: characteristics and classification.

Unit II Theory of consumption

Utility: definition, measurement - cardinal and ordinal utility - marginal utility - Law of diminishing marginal utility and Law of equi-marginal utility: definition – assumptions - limitations and applications - Demand: definition - kinds of demand, demand schedule, demand curve, law of demand, determinants of demand - extension and contraction vs increase and decrease in demand - Elasticity of demand: types, degrees of price, elasticity of demand, methods of measuring elasticity, factors influencing elasticity of demand - importance of elasticity of demand - Engel's law of family expenditure - Consumers surplus: definition – importance.

Unit III Theory of production

Concept of production – factors of production – land and its characteristics - Labour – division of labour - Malthusian theory and modern theory of population - Capital – characteristics of capital - capital formation – entrepreneur, characteristics and functions of entrepreneur - supply definition – law of supply – factors influencing supply - elasticity of supply.

Unit IV Theory of distribution

Pricing of factors of production – rent and Ricardian theory of rent – quasi rent - wage – real wage and money wage – marginal productivity theory of wage - Interest – liquidity preference theory – profit – Risk bearing theory of profit.

Unit 5 Macroeconomic concepts

National income: Concepts - GNP, GDP, NNP, disposable income and per capita income- measurement of national income - public finance: meaning, principles. public revenue: meaning, classification of taxes - service tax - canons of taxation, public expenditure: principles - Inflation: meaning, definition, kinds of inflation - welfare economics: meaning, Pareto's optimality - millennium development goals (MDG).

Practical

Law of diminishing marginal utility - Law of equi marginal utility - individual and market demand - indifference curve analysis and consumer equilibrium - Measurement of arc elasticity and point elasticity of demand - own price elasticity, income and cross elasticity of demand - consumer surplus - law of diminishing marginal returns - relationship between TPP, APP and MPP - Cost concepts and graphical derivation of cost curves - Population growth and food grain production - Supply elasticity - causes of inflation and control measures - consumer price index and wholesale price index - types and functions of money - Computation of national income - Study of structural changes in the economy - welfare indicators.

Lecture schedule

1. Nature and scope of economics: Importance - Subject matter, science vs. art, positive vs. normative science - deductive and inductive methods -Different economic systems: merits and demerits.
2. Definitions of Economics - Wealth, welfare, scarcity and growth definitions - Divisions of Economics -Micro and Macro economics - Agricultural/horticultural Economics: definition and scope.
3. Basic concepts - Goods, Service, Value, Cost, Price, Wealth, Welfare. Wants: Characteristics and classification.
4. Utility: Definition, Measurement - Cardinal and ordinal utility - Marginal utility - Law of diminishing marginal utility and law of equi-marginal Utility: Definition - Assumptions - Limitations and Applications.

5. Demand: Definition - Kinds of demand, Demand schedule, Demand curve, Law of demand, Determinants of demand - Extension and contraction Vs Increase and decrease in demand.
6. Elasticity of demand: Types, Degrees of price elasticity of demand, Methods of measuring elasticity, Factors influencing elasticity of demand - Importance of Elasticity of demand.
7. Engel's law of family expenditure - Consumer's surplus: Definition - Importance.
8. Concept of production - Factors of production - Land and its characteristics - Labour - Division of labour.
9. Mid-semester examination.
10. Malthusian theory and modern theory of population.
11. Market Structure - Price determination in perfect competition & monopoly.
12. Capital - characteristics of capital - capital formation - Entrepreneur, characteristics and functions of entrepreneur.
13. Supply: Definition - law of supply - factors influencing supply - elasticity of supply.
14. Pricing of factors of production - rent and Ricardian theory of rent - quasi rent - wage - real wage and money wage - marginal productivity theory of wage.
15. Interest - liquidity preference theory - profit - Risk bearing theory of profit - National Income: Concepts - GNP, GDP, NNP, Disposable income and Per capita income- Measurement of National Income.
16. Public Finance: Meaning, Principles. Public Revenue: Meaning, Classification of taxes - service tax - Cannons of taxation, public expenditure: principles.
17. Inflation: Meaning, definition, kinds of inflation - Welfare Economics: Meaning, Pareto's optimality - Millennium Development Goals (MDG).

Practical schedule

1. Exercise on Law of Diminishing Marginal Utility.
2. Exercise on Law of Equi Marginal Utility.

3. Demand schedule - graphical derivation of individual and market demand.
4. Indifference curve analysis – properties, budget line and consumer equilibrium.
5. Measurement of arc elasticity and point elasticity of demand - Estimation of own price elasticity, income and cross elasticity of demand.
6. Estimation of consumer surplus.
7. Exercise on law of diminishing marginal returns – relationship between TPP, APP and MPP.
8. Cost concepts and graphical derivation of cost curves.
9. Analysis of growth in population and food grain production in India.
10. Estimation of supply elasticity.
11. Market Structure – Price determination.
12. Analysis of causes of inflation and control measures. Measurement of inflation – consumer price index and wholesale price index.
13. Types and functions of money.
14. Approaches to computation of National Income.
15. Analysis of trends in National Income and study of structural changes in the economy
16. Exercise on welfare indicators – HDI, PQLI, PPP, Poverty Line, etc
17. Practical examination.

Reference books

1. Dewett, K.K. 2002. Modern Economic Theory, Syamlal Charitable Trust, New Delhi.
2. Samuelson, P. 2004. Economics, (18/e), Tata Mcgraw-Hill, New Delhi
3. Koutsoyiannis, A. 1983. Modern Microeconomics, The Macmillan Press Ltd., Hongkong
4. Varian, H. R. 1987. Intermediate Microeconomics, WW Norton & Company, New Delhi
5. Seth, M.L. 2000. Principles of Economics, Lakshmi Narain Agarwal Co., Agra. New Delhi

II Year III Semester

Sl. No	Course Number	Course Title	Credit Hours
1.	VSC 201	Production Technology of Temperate Vegetable Crops	2 + 1
2.	AGR 211	Weed and Water Management in Horticultural crops	1 + 1
3.	SAC 201	Fundamentals of Soil Science	2 + 1
4.	AEN 201	Fundamentals of Entomology	2 + 1
5.	SST 211	Principles of Seed Production and Quality control in Horticultural Crops	1 + 1
6.	PAT 201	Fundamentals of Plant Pathology	2 + 1
7.	AMP 201	Livestock and Poultry Production Management	2 + 1
8.	FMP 211	Farm Power and Machinery	1 + 1
9.	AGM 211	Applied Microbiology	1 + 1
Total			14+9=23

VSC 201 Production Technology of Temperate Vegetable Crops 2 + 1

Aim

- ❖ To teach the students about the scenario of vegetable cultivation advanced production technologies and post harvest handling, production constraints of vegetables.

Theory

Unit I Overview

Area, production, world scenario, industrial importance, export potential of tropical vegetable crops - Classification of vegetable crops - Effect of climate, soil, water and nutrients on vegetable crop production and their management- Cropping systems - Seed production techniques and constraints in temperate vegetable crops.

Unit II Cruciferous vegetables

Composition and uses- origin and distribution- area and production- climate and soil requirements - season -warm winter types- varieties and hybrids -seed rate - nursery practices - containerized transplant production and transplanting- preparation of field - spacing - planting systems - planting - water and weed management - nutrient requirement - fertigation - nutrient deficiencies - physiological disorders - use of chemicals and growth regulators - cropping systems - constraints in production - harvest - yield

Crops: cabbage, cauliflower, Brussels sprouts, sprouting broccoli and chinese cabbage.

Unit III Potato, peas, beans and chow chow

Composition and uses- origin and distribution- area and production- climate and soil requirements - season - varieties and hybrids -seed rate - preparation of field - spacing - planting systems - planting - water and weed management - nutrient requirement - fertigation - nutrient deficiencies - physiological disorders - use of chemicals and growth regulators - cropping systems - constraints in production - harvest - yield - use of TPS in potato

Crops: potato, peas, beans, and chow chow.

Unit IV Root crops

Composition and uses- origin and distribution- area and production- climate and soil requirements - season - varieties and hybrids -seed rate - preparation of field - spacing - planting systems - planting - water and weed management - nutrient requirement - fertigation - nutrient deficiencies - physiological disorders - use of chemicals and growth regulators - cropping systems - constraints in production - harvest - yield

Crops: carrot, beet root, radish and turnip.

Unit V Salad vegetables

Composition and uses - area and production- climate and soil requirements - season - varieties and hybrids -seed rate - preparation of field - spacing - planting systems - planting - water and weed management - nutrient requirement - fertigation - nutrient deficiencies - physiological disorders - use of chemicals and growth regulators - cropping systems - constraints in production - harvest - yield

Crops: Kale, cress, celery, rhubarb, asparagus, artichoke, leek, lettuce and spinach.

Practical

Identification and description of temperate vegetable crops -nursery practices and for transplanted vegetable crops- preparation of field and sowing /planting for direct sown/ transplanted vegetable crops- herbicide use in vegetable culture - top dressing of fertilizers and inter-culture - use of growth regulators - identification of nutrient deficiencies - physiological disorders- maturity indices and harvesting - working out cost of cultivation for temperate vegetable crops - Visit to temperate vegetable farms, research stations, commercial farm.

Lecture schedule

1. Area, production, world scenario, industrial importance, export potential of temperate vegetable crops
2. Effect of climate and soil on temperate vegetable crop production and their management
3. Effect of water and nutrients on temperate vegetable crop production and their management

4. Cropping systems
5. Organic farming and GAP in temperate vegetable crops
6. Export standards for temperate vegetable crops
7. Cabbage: Composition and uses - area and production- climate and soil requirements - season -warm winter types- varieties and hybrids -seed rate - nursery practices - containerized transplant production and transplanting- preparation of field - spacing - planting systems - planting - water and weed management
8. Cabbage: Nutrient requirement-fertigation, nutrient deficiencies - physiological disorders - use of chemicals and growth regulators - cropping system - constraints in production - harvest - yield
9. Cauliflower: Composition and uses - area and production- climate and soil requirements - season -warm winter types- varieties and hybrids -seed rate - nursery practices - containerized transplant production and transplanting- preparation of field - spacing - planting systems - planting - water and weed management
10. Cauliflower: Nutrient requirement - fertigation, nutrient deficiencies - physiological disorders - use of chemicals and growth regulators - cropping systems - constraints in production - harvest - yield
11. Brussels sprouts - climate and soil requirements - season -warm winter types- varieties and hybrids -seed rate - nursery practices - containerized transplant production and transplanting- preparation of field - spacing - planting systems - planting - water and weed management
12. Brussels sprouts- Nutrient requirement - fertigation- nutrient deficiencies - physiological disorders - use of chemicals and growth regulators - cropping systems - constraints in production - harvest - yield
13. Sprouting broccoli- composition and uses-area and production - climate and soil requirements - season -warm winter types- varieties and hybrids -seed rate - nursery practices - containerized transplant production and transplanting- preparation of field - spacing - planting systems - planting -

water and weed management -nutrient requirement – fertigation- nutrient deficiencies – physiological disorders - use of chemicals and growth regulators - cropping systems – constraints in production - harvest – yield

14. Chinese cabbage: Composition and uses- area and production- climate and soil requirements – season –warm winter types- varieties and hybrids -seed rate – nursery practices – containerized transplant production and transplanting- preparation of field - spacing - planting systems - planting – water and weed management – nutrient requirement – fertigation- nutrient deficiencies – physiological disorders - use of chemicals and growth regulators - cropping system – constraints in production - harvest – yield
15. Potato: Composition and uses - area and production- climate and soil requirements – season –warm winter types- varieties and hybrids -seed rate – nursery practices – containerized transplant production and transplanting- preparation of field - spacing - planting systems - planting – water and weed management
16. Potato: Nutrient requirement – fertigation, nutrient deficiencies – physiological disorders - use of chemicals and growth regulators - cropping systems – constraints in production - harvest – yield
17. Mid semester examination
18. Peas: Composition and uses - area and production- climate and soil requirements – season –warm winter types- varieties and hybrids -seed rate – nursery practices – containerized transplant production and transplanting- preparation of field - spacing - planting systems - planting – water and weed management
19. Peas: Nutrient requirement – fertigation, nutrient deficiencies – physiological disorders - use of chemicals and growth regulators - cropping systems – constraints in production - harvest – yield
20. Beans: Composition and uses - area and production- climate and soil requirements – season –warm winter types- varieties and hybrids -seed rate –

preparation of field - spacing - planting systems - planting - water and weed management

21. Beans: Nutrient requirement - fertigation, nutrient deficiencies - physiological disorders - use of chemicals and growth regulators - cropping systems - constraints in production - harvest - yield
22. Chow chow: Composition and uses - area and production-climate and soil requirements-season-warm winter types-varieties and hybrids - seed rate-preparation of field-spacing-planting systems-planting-water and weed management- nutrient requirement-nutrient deficiencies-physiological disorders-use of chemicals and growth regulators-cropping systems - constraints in production -harvest-yield.
23. Carrot : Composition and uses - area and production- climate and soil requirements - season -warm winter types- varieties and hybrids -seed rate - preparation of field - spacing - planting systems - planting - water and weed management -nutrient requirement-nutrient deficiencies-physiological disorders-use of chemicals and growth regulators- cropping systems- constraints in production - harvest-yield.
24. Beet root- composition and uses- area and production- climate and soil requirements - season -warm winter types- varieties and hybrids -seed rate - spacing - planting systems - planting - water and weed management - nutrient requirement - fertigation- nutrient deficiencies - physiological disorders - use of chemical and growth regulators - cropping system - constraints in production - harvest - yield
25. Radish- composition and uses-area and production- climate and soil requirements - season -warm winter types- varieties and hybrids -seed rate - preparation of field - spacing - planting systems - planting - water and weed management - nutrient requirement - fertigation - nutrient deficiencies - physiological disorders - use of chemicals and growth regulators - cropping systems - constraints in production - harvest - yield

26. Turnip- composition and uses-area and production- climate and soil requirements – season –warm winter types- varieties and hybrids -seed rate - preparation of field - spacing - planting systems - planting – water and weed management – nutrient requirement – fertigation - nutrient deficiencies – physiological disorders - use of chemicals and growth regulators - cropping systems – constraints in production - harvest – yield
27. Knol khol.- composition and uses- area and production- climate and soil requirements – season –warm winter types- varieties and hybrids -seed rate – nursery practices – preparation of field - spacing - planting systems - planting – water and weed management.
28. Knol khol- nutrient requirement – fertigation - nutrient deficiencies – physiological disorders - use of chemicals and growth regulators - cropping systems – constraints in production - harvest – yield
29. Kale – composition and uses - area and production- climate and soil requirements – season –warm winter types- varieties and hybrids -seed rate – nursery practices – preparation of field - spacing - planting systems - planting – water and weed management – nutrient requirement – fertigation- nutrient deficiencies – physiological disorders - use of chemicals and growth regulators - cropping systems – constraints in production - harvest – yield
30. Cress and Celery – composition and uses - area and production- climate and soil requirements – season –warm winter types- varieties and hybrids -seed rate – nursery practices – preparation of field - spacing - planting systems - planting – water and weed management – nutrient requirement – fertigation- nutrient deficiencies – physiological disorders - use of chemicals and growth regulators - cropping systems – constraints in production - harvest – yield
31. Rhubarb and Asparagus – composition and uses- area and production- climate and soil requirements – season –warm winter types- varieties and hybrids - seed rate – nursery practices – preparation of field - spacing - planting systems - planting – water and weed management – nutrient requirement – fertigation-

- nutrient deficiencies - physiological disorders - use of chemicals and growth regulators - cropping systems - constraints in production - harvest - yield
32. Artichoke and Leek - composition and uses - area and production- climate and soil requirements - season -warm winter types- varieties and hybrids -seed rate - nursery practices - preparation of field - spacing - planting systems - planting - water and weed management - nutrient requirement - fertigation- nutrient deficiencies - physiological disorders - use of chemicals and growth regulators - cropping systems - constraints in production - harvest - yield
33. Lettuce: composition and uses - area and production- climate and soil requirements - season -warm winter types- varieties and hybrids -seed rate - nursery practices - transplanting- preparation of field - spacing - planting systems - planting - water and weed management - nutrient requirement - fertigation- nutrient deficiencies - physiological disorders - use of chemicals and growth regulators - cropping systems - constraints in production - harvest - yield
34. Spinach: composition and uses - area and production- climate and soil requirements - season -warm winter types- varieties and hybrids -seed rate - nursery practices - transplanting- preparation of field - spacing - planting systems - planting - water and weed management - nutrient requirement - fertigation- nutrient deficiencies - physiological disorders - use of chemicals and growth regulators - cropping systems - constraints in production - harvest - yield

Practical

1. Nursery preparation and sowing transplanted temperate vegetables
2. Nursery preparation, seed rate, spacing for direct sown temperate vegetables
3. Soil water conservation, contour planting, crop geometry
4. Use of herbicides, preparation of solution, application
5. Water management practices
6. Nutritional requirement, including major and micro nutrients

7. Scheduling of nutrients for temperate vegetables through drip fertigation
8. Use of growth regulators, preparation of solution and application in temperate vegetables
9. Identification of physiological disorders and nutritional disorders
10. Maturity indices and harvesting
11. Protected cultivation of temperate vegetables
12. Organic practices, GAP, precision farming in temperate vegetables
13. Visit to commercial farms in plains
14. Visit to commercial farms in hills
15. Visit to cold storage / markets / processing centres
16. Project preparation and working out economics
17. Practical examinations

Outcome

- ❖ To provide in depth knowledge about the latest production technology of temperate vegetable crops
- ❖ Knowledge about quality requirement and production techniques for export
- ❖ Managing skill for solving field problems

Text books

1. Pranab Hazra, A. Chattopadhyay, K. Karmakar and S. Dutta. 2010. "Modern technology in vegetable production" New India Publishing Agency, New Delhi.
2. Prem Singh Arya and S. Prakash 2002. "Vegetable growing in India", Kalyani publishers, New Delhi
3. Bose, T. K, Kabir, J., Maity T. K., Parthasarathy V. A., and Som M. G., 2002. Vegetable Crops Vol. II & III Naya Prokash, Kolkata.
4. Sasanka Barooah. 1993. Vegetable growing In India, Kalyani Publishers, New Delhi

Further readings

1. S. P. Singh, 1997. Principles of vegetable production Agrotech publishing Academy - Udaipur

2. Hazra, P. and M. G. Som. 1999. Technology of vegetable production and improvement Naya Prakash, Calcutta
3. Veeraraghavathatham, A, Jawaharlal and Seemanthini Ramdoss. 1991. A guide on vegetable culture, Suri Associates, Coimbatore - 2.
4. Prem Singh Arya, 1999. Vegetable seed production in Hills, M.D. Publications Pvt. Ltd., New Delhi.
5. Bailey, L. H. 1999. Principles of vegetable cultivation, Discovery publishing House, New Delhi.
6. Swider, John. M., George W. Ware, J.P. Mccollum, 1992. "Producing vegetable crops", International book distributing co., Lucknow.

Journals

1. Vegetable sciences
2. Acta Horticulturae
3. Indian Journal of Horticulture
4. Indian Horticulture
5. Progressive Horticulture
6. International Journal of Vegetable Science
7. Scientia Horticulturae

e references

- <http://www.sciencedirect.com/science>
- <http://www.agnet.org/library/eb/476>
- <http://msucares.com/crops/hightunnels/index.html>
- http://gbpihed.gov.in/envis/HTML/vol12_2/VEGETABLE%20PRODUCTION%20.pdf
- <http://www.docstoc.com/docs/49102917/The-use-of-supplemental-lighting-for-vegetable-crop-production>

AGR 211 Weed and Water Management in Horticultural Crops 1 + 1

Theory

Unit I

Weeds – Definition, classification and characteristics of weeds – Weed ecology - Principles and methods of weed management: preventive, cultural, mechanical, chemical, biological and alternate methods – IWM for horticultural crops - management of problematic, parasitic and aquatic weeds.

Unit II

Chemical, weed management - classification herbicide formulations - adjuvants, herbicide protectants and antidotes - Mode and mechanism of action of herbicides - Herbicide selectivity - Principles of herbicide selectivity

Unit III

Herbicide resistant weeds and crops – Principles and concepts - development of transgenic herbicide resistant crops – Success of herbicide resistant crops (HRC) in World and Indian agriculture.

Unit IV

Water resources of India and Tamil Nadu, Importance of irrigation water – soil-water- plant relationship – soil moisture constant – soil water movement – soil moisture extraction pattern – evapotranspiration – water requirement of horticultural crops – critical stages for irrigation.

Unit V

Irrigation methods – surface, sub-surface and advance methods – drip, sprinkler and green house and landscape irrigations – Fertigation - Water use efficiency – Quality of irrigation water - Management of problem waters – Drainage

Practical

Identification of weeds in wet, garden, dry land and hilly ecosystems - Weed control tools and implements - Characteristics of important herbicides - Herbicide spray equipments- Herbicide application techniques – Spray fluid calibration - Effect of herbicide on soil microflora - Economic evaluation of weed control methods in horticultural crops and cropping systems - Soil moisture content by gravimetric method

and instrumentation technique - field capacity and permanent wilting point - Methods of irrigation - landscaping for different surface irrigation methods - Measurement of irrigation water, evapotranspiration, crop water requirement - irrigation efficiency - Design and layout of micro irrigation systems - Economics of drip and sprinkler irrigation systems - Fertigation schedule for horticultural crops - water quality and drainage

Lecture schedule

1. Weeds - Definitions and characteristics of weeds- weed seed dormancy - weed ecology - dissemination of weeds
2. Classification and characteristics of weeds of different agro ecosystems - lowland weeds, irrigated upland rainfed land weeds and hilly weeds
3. Identification, classification and characteristics of weeds of different agro ecosystems - aquatic and parasitic weeds and non crop situation
4. Crop -weed interactions - Critical crop - weed competition, competitive and allelopathic effects of weeds and horticultural crops.
5. Principles and methods of weed management- Preventive, cultural, mechanical, chemical, biological and alternate methods
6. IWM in horticultural crops and cropping systems and Non chemical weed management techniques in organic agriculture
7. Mid semester examination
8. Classification and characteristics of herbicides and herbicide formulations - History and development
9. Herbicide use efficiency - Adjuvants, herbicide protectants and antidotes - Herbicide and herbicide mixtures in India
10. Mode of action of herbicides and their selectivity. Mechanism of action of herbicides and their selectivity
11. Herbicide resistant weeds and their impact on weed management, Development

of transgenic herbicide resistant crops. Success of herbicide resistant crops (HRC) in world and Indian agriculture

12. Water resources of India and Tamil Nadu, Importance of irrigation water, role of water in crop production
13. Soil- water- plant relationship – soil moisture constant – soil water movement
14. soil moisture extraction pattern – evapotranspiration – water requirement of horticultural crops, critical stages for irrigation
15. Irrigation methods – surface, subsurface and advance methods – drip, sprinkler and green house and landscape irrigations
16. Fertigation - Water use efficiency – Agronomic practices for enhancing WUE
17. Quality of irrigation water - Management of problem waters – Drainage

Practical schedule

1. Identification and classification of wet land and garden land weeds
2. Identification and classification of dry land and hilly weeds
3. Practising Skill development on mechanical weed management
4. Identification and classification of herbicides
5. Practising Skill development on herbicide application techniques
6. Practising Skill development on spray equipments and spray fluid calibration
7. Calculation of herbicide quantity and recommendation
8. Economic evaluation of weed control methods in horticultural crops and cropping systems.
9. Estimation of soil moisture content by gravimetric method and instrumentation technique
10. Estimation of field capacity and permanent wilting point
11. Methods of irrigation and acquiring skill in landscaping for different surface irrigation methods.
12. Measurement of irrigation water, estimation of evapo transpiration, estimation of crop water requirement and calculation of irrigation efficiency

13. Design and layout of micro irrigation systems for different horticultural crops
14. Working out economics of drip and sprinkler irrigation systems
15. Developing fertigation schedule for horticultural crops
16. Estimation of water quality and drainage
17. Practical Examination

References

1. Gupta, O. P. 1998. Modern Weed Management. Agro Botanica Bikaner, India.
2. Jaganathan R., and R.Jayakumar, Weed Management, Kalyani Publisher, New Delhi
3. Subramanian, S. A. Mohammed Ali and R. Jayakumar. 1991. All about Weed Control. Kalyani Publishers, New Delhi.
4. Sankara Reddi, G.H. and T.Yellamanda Reddy, 1995. Efficient use of Irrigation Water, Kalyani Publishers, New Delhi.
5. Michael, A.M. 1986. Irrigation Theory and Practices, Vikas, New Delhi

Further Readings

1. Hance, R.J. and K. Holly. 1990. Weed Control Handbook: Principles. Blackwell Scientific Publications, Oxford, London
2. Krieg, A. and J. M. Franj. 1989. Textbook of Biological Pest Control. Verlag Paul Pary, Humberg.
3. Musselman, L. J. 1987. Parasitic Weeds in Agriculture. Vol. I. Striga. CRO Press Inc. Florida, US.
4. Pierterse, A. H. and K.J. Murphy. 1990. Aquatic Weeds: The Ecology and Management of Nuisance Aquatic Vegetation. Oxford Univ. Press. Oxford. U.K.
5. Rao, V. S. 1983. Principles of Weed Science. Oxford and IBH Publishing Co. New Delhi.
6. Dodge, A.d.1989. Herbicides and Plant Metabolism. Cambridge Univ. Press, Cambridge.

7. Lebanon, H.M. and J.Gressel.1982. Herbicide Resistance in Plants. A Wiley Inter Science Publication.
8. Stephan O. Duke, 1996. Herbicide Resistant Crops – Agricultural, Environmental, Economic, Regulatory and Technical aspects. CRC Lewis publishers, Newyork.
9. De Prado, J. Jorin and L. Garcia – Torres, 1997. Weed and Crop Resistance to Herbicides. Kluwer Academic Publishers, London.
10. FAO, 1984. Irrigation Practice and Water Management, Oxford and IBH, New Delhi
11. Isarelson, O.W. and U.S.Hansen. 1962. Irrigation Principles and Practices. Wiley International, New York
12. Misra, R.D. and M.Ahmed, 1987. Manual on Irrigation Agronomy, Oxford and IBH, New Delhi
13. Sivanappan, R.K. 1997. Sprinkler Irrigation. Oxford and IBH publishing Co., Pvt., Ltd., New Delhi

SAC 201 Fundamentals of Soil Science 2 + 1

Aim

This course is designed to provide better understanding of soils and their formation. It is aimed to inculcate knowledge among under graduate students regarding physical, chemical and biological properties of soils. Further, to make the students to understand about pedological and edaphological approaches of soil study.

Theory

Unit I

Soil - Pedological and edaphological concepts - Origin of the Earth - Composition of Earth's crust - Rocks and minerals - primary and secondary minerals.

Unit II

Weathering of rocks & minerals - Physical, chemical and biological weathering - Soil formation - factors-active & passive. Soil forming processes - fundamental and specific soil forming processes- Soil profile.

Unit III

Phases of soil. Soil physical properties and their significance - Soil texture and textural classes - Soil structure and classification - Soil consistency

Unit IV

Bulk density, particle density and porosity - Soil colour - significance - causes and measurement. Soil temperature - Soil air - Soil water- Soil water potentials - Soil moisture constants - Movement of soil water - saturated and unsaturated flow - Infiltration, hydraulic conductivity, percolation, permeability and drainage

Unit V

Soil colloids - Properties, types and significance - Layer silicate clays - their genesis and sources of charges - Ion exchange - CEC, AEC and Base saturation - Factors influencing Ion exchange - significance. Soil reaction, Buffering capacity and EC

Unit VI

Soil organic matter - Composition - decomposition and mineralization, C : N ratio, Carbon cycle - Fractions of soil organic matter - Humus formation. Soil organisms - Beneficial and harmful effects.

Practical

Identification of rocks and minerals - Study of a soil profile - collection and processing of soil samples - Determination of bulk density, particle density and porosity - Particle size analysis - Feel method - International pipette method - Soil moisture determination - Gravimetric method, gypsum block, tensiometer, TDR and neutron probe moisture meter. Determination of infiltration rate and hydraulic conductivity - Soil colour - Munsell colour chart - Soil temperature. Soil pH and EC - Organic carbon - Chemical constituents of soil - Field study of different soil types.

Lecture Schedule

1. Soil definition - soil as a three dimensional natural body - pedagogical and edaphological concepts.
2. Origin of earth - theories - planetesimal and nebular hypothesis - Composition of Earth's crust.
3. Rocks - definition, formation, classification - igneous, sedimentary and metamorphic rocks
4. Brief description of important rocks - mineralogical composition
5. Minerals - definition, occurrence, classification of important soil forming primary minerals - silicate and non silicate minerals, ferro and non-ferro magnesium minerals
6. Formation of secondary minerals - clay minerals and amorphous minerals
7. Weathering of rocks and minerals - Physical, chemical and biological
8. Soil profile description - master horizons - pedon and poly pedon
9. Factors of soil formation - Active soil forming factors
10. Factors of soil formation - Passive soil forming factors
11. Fundamental soil forming process - eluviation, illuviation and humification.
12. Specific Soil forming processes - podzolization, laterization, salinization, alkalization, calcification, decalcification, pedoturbation.
13. Phases of soils - solid, liquid and gaseous phases - Properties of soil - defining the physical, chemical and biological properties

14. Soil texture – particle size distribution – textural classes – textural triangular diagram – significance of soil texture
15. Soil structure – classification – genesis - factors influencing structural stability – significance of soil structure
16. Soil consistence – cohesion, adhesion, plasticity, Atterberg's constants – upper and lower plastic limits, plasticity number- significance of soil consistence
17. Mid semester examination
18. Soil bulk density, particle density and porosity – factors influencing – significance
19. Soil colour – causes and measurement – Munsell colour chart – factors influencing soil colour – significance
20. Soil temperature – measurement, soil air – composition - aeration, measurement - significance of soil temperature and soil air
21. Soil water – forms of water, measurement, units of expression and pF scale
22. Soil water potentials – gravitational, matric, osmotic – soil moisture constants
23. Movement of soil water under saturated and unsaturated flow – infiltration, hydraulic conductivity, percolation, permeability and drainage
24. Soil colloids – types, properties – inorganic colloids and organic colloids
25. Layer silicate clays – genesis and classification – 1:1, 2:1 expanding and non expanding, 2:2 clay minerals, amorphous minerals
26. Sources of charges in expanding and non expanding crystalline lattice clays, amorphous minerals and organic colloids
27. Ion exchange reactions – cation exchange, anion exchange and base saturation - significance
28. Soil reaction (pH) – definition, pH scale, factors affecting soil pH, buffering capacity - signification
29. Soil Electrical Conductivity – factors affecting EC – significance
30. Soil organic matter – composition, decomposition, mineralization and immobilization
31. Carbon cycle, C : N ratio, biomass carbon and nitrogen

32. Fractions of soil organic matter – humus formation and stabilization
33. Soil organisms – soil flora and fauna –beneficial and harmful roles – earth worms
– micro-organisms and their influence on soil properties
34. Importance of soil properties in crop growth

Practical schedule

1. Identification of common rocks and minerals
2. Soil sample collection
3. Visit to soils of different terrains and study of soil profiles
4. Determination of bulk density, particle density and porosity – cylinder, wax coating and core methods.
5. Soil textural analysis – feel method, International pipette method (part 1)
6. International pipette method (part 2)
7. International pipette method (part 3)
8. Determination of soil colour and temperature.
9. Determination of soil moisture– Gravimetric and gypsum block method
10. Determination of soil moisture–Tensiometer, TDR and neutron probe
11. Determination of Infiltration rate
12. Determination of hydraulic conductivity
13. Determination of soil pH and EC
14. Estimation of soil organic carbon
15. Colloquium 1. – Chemical constituents of soil – water soluble elements, total elemental composition – relevance in soil properties and behaviour
16. Colloquium 2. – Preparation of interpretative reports of soil analysis and assignments
17. Final practical examination

Outcome

This course will give a comprehensive knowledge on rocks and minerals, their composition and the types of soils formed from different parent materials. It will enrich the students on the role of soil forming factors and processes in soil formation. The

students will understand the various soil physical, chemical and biological properties and their impact on plant growth. The knowledge gained in this course will be useful in understanding the behaviour of soils in crop production and to manage.

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- [http://www.rootsofpeace.org/assets/Soil%20Testing%20Manual%20V6%20\(Feb%2008\).pdf](http://www.rootsofpeace.org/assets/Soil%20Testing%20Manual%20V6%20(Feb%2008).pdf)
- <http://www.soils.wisc.edu/courses/SS325/morphology.htm>
- www.asssi.asn.au/.../Understanding_Soils_and_Their_Interactions_with_Land_Management_2005.pdf

AEN 201 Fundamentals of Entomology 2 + 1

Theory

Unit I History and importance

Entomology as a science - its importance in Agriculture. History of Entomology in India, Position of insects in the animal kingdom and their relationship with other classes of Arthropoda, Reasons for insect dominance.

Unit II Morphology

General organisation of insect body wall - structure and function, cuticular appendages, moulting. Body regions - insect head, thorax and abdomen, their structures and appendages

Unit III Anatomy and physiology

Elementary knowledge of digestive, excretory, respiratory, circulatory, nervous and reproductive systems in insects. Sense organs and their functions, Exocrine and endocrine glands. Life cycle of insects- immature stages - types of reproduction - metamorphosis- growth and development.

Unit IV Taxonomy of apterygota and exopterygota

Taxonomy, Classification and nomenclature of insects. Distinguishing characters of agriculturally important orders and families of Apterygotes- Collembola and Thysanura, Exopterygotes - Ephemeroptera, Odonata, Orthoptera, Phasmida, Dictyoptera, Embioptera, Dermaptera, Hemiptera, Isoptera, Psocoptera, Mallophaga, Siphunculata and Thysanoptera.

Unit V Taxonomy of endopterygota

Distinguishing characters of agriculturally important families of Lepidoptera, Coleoptera, Diptera, Hymenoptera, Siphonaptera, Strepsiptera and Neuroptera.

Practical

Observations on external features of grasshopper / cockroach, Methods of insect collection, preservation - Preparation of Riker mount. Types of insect head, antenna, mouth parts - Structure of thorax. Types of insect legs, wings and their modifications - wing coupling. Structure of abdomen, and its modifications. Metamorphosis in insects - immature stages in insects. Study of digestive and

reproductive systems of grasshopper / cockroach - Observing the characters of agriculturally important orders and families.

Lecture schedule

1. Study of insects and their importance in Agriculture. History of Entomology in India - Position of insects in the animal kingdom - relationship with other members of Arthropoda.
2. Insect dominance - structural, morphological and physiological factors responsible for dominance.
3. Insect body wall - its structure and function cuticular appendages.
4. Moulting process in insects.
5. Structure of insect head and its appendages.
6. Structure of insect thorax and its appendages.
7. Structure of insect abdomen and its appendages.
8. Digestive system - structure of alimentary canal and its modifications in certain groups. Digestive enzymes, digestion and absorption of nutrients.
9. Excretory system in insects - malpighian tubules - accessory excretory organs and physiology of excretion.
10. Respiratory system in insects - structure of trachea - tracheoles - types of respiratory system - types of spiracles - respiration in aquatic and endoparasitic insects.
11. Circulatory system in insects - haemocoel and dorsal vessel - circulation of blood - composition of haemolymph - haemocytes and their functions.
12. Nervous system in insects - structure of neuron - types of nervous systems.
13. Conduction of nerve impulses - axonic and synaptic transmissions.
14. Male and female reproductive systems in insects - structure and modifications. Spermatogenesis and Oogenesis.
15. Types of reproduction - oviparous, viviparous, paedogenesis, polyembryony

ovoviporous and parthenogenesis.

16. Types of metamorphosis – Growth and development. Immature stages of insects.
17. Mid-semester examination
18. Structure of sense organs - types of sensilla - photoreceptors; chemoreceptors and mechanoreceptors
19. Exocrine and endocrine glands and their function - effect on metamorphosis and reproduction
20. Tropism and Biocommunication in insects – Sound and light production.
21. Taxonomy principles and procedures of classification and nomenclature of insects.
22. Distinguishing characters of insect orders – Apterygota (Collembola and Thysanura)
23. Exopterygota – (Ephemeroptera, Odonata and Phasmida)
24. Dictyoptera, Dermaptera, Embioptera
25. Orthoptera (Families of Agricultural Importance) and Isoptera – social life in termites
26. Hemiptera (Families of Agricultural Importance) and Thysanoptera.
27. Pscoptera, Mallophaga and Siphunculata.
28. Endopterygota – Lepidoptera and families of agricultural importance.
29. Lepidoptera and families of agricultural importance.
30. Coleoptera and families of agricultural importance.
31. Coleoptera and families of agricultural importance.
32. Diptera and families of agricultural importance.
33. Hymenoptera and families of agricultural importance.
34. Neuroptera (Families of Agricultural Importance), Strepsiptera and Siphonaptera.

Assignment

Each student has to submit a minimum of 100 preserved insects representing various orders and families

Practical schedule

1. Observations on external features of grasshopper / cockroach
2. Methods of insect collection, preservation, pinning, labelling, display and storage
3. Types of insect head and antenna
4. Mouth parts of cockroach, modifications in the mouth parts in plant bug, female mosquito, honeybee, thrips, antlion grub, housefly, moths and butterflies
5. Structure of thorax and abdomen and their appendages – modifications in insect legs and wings – wing venation, regions and angles – wing coupling.
6. Types of immature stages of insects.
7. Study of digestive system.
8. Study of male and female reproductive systems.
9. Observing the characters of Apterygota - Collembola and Thysanura and Exopterygota -Odonata and Ephemeroptera and Phasmida
10. Dictyoptera, Dermaptera, Embioptera, Orthoptera (Acrididae, Tettigonidae, Gryllidae and Gryllotalpidae), Mallophaga and Siphunculata
11. Exopterygota – Isoptera and Hemiptera – **Homoptera** (Cicadidae, Cicadellidae, Delphacidae, Aphididae, Cercopidae, Membracidae, Aleyrodidae, Coccidae, Diaspididae, Pseudococcidae, Kerridae and Psyllidae); **Heteroptera** (Reduviidae, Pentatomidae, Miridae, Coreidae, Pyrrhocoridae, Lygaeidae, Nepidae, Belastomatidae, Gerridae, Cimicidae, Tingidae),
12. Observing the characters of orders Thysanoptera and Diptera (Cecidomyiidae, Agromyzidae, Tephritidae, Asilidae, Tabanidae, Tachinidae, Hippoboscidae, Culicidae, Syrphidae and Muscidae)
13. Observing the characters of Hymenoptera (Tenthredinidae, Apidae, Sphecidae, Vespidae, Formicidae, Xylocopidae, Chalcididae, Megachilidae, Ichneumonidae, Bethylidae, Braconidae, Agaonidae, Evaniidae, Encyrtidae,

Eulophidae and Trichogrammitidae).

14. Observing the characters of Coleoptera (Curculionidae, Apionidae, Cicindellidae, Carabidae, Staphylinidae, Dytiscidae, Coccinellidae, Gyrinidae, Lampyriidae, Hydrophilidae, Scarabaeidae, Dynastidae, Cerambycidae, Melolonthidae, Anobiidae, Tenebrionidae, Bruchidae, Meloidae, Cetonidae, Buprestidae, Elateridae and Bostrychidae).
15. Observing the characters of Lepidoptera (Nymphalidae, Lycaenidae, Pieridae, Papilionidae, Satyriidae, Crambidae, Pyraustidae, Noctuidae, Arctiidae, Bombycidae, Cochlidiidae, Geometridae, Gelechiidae, Pterophoridae, Saturniidae, Sphingidae, Lymantriidae and Hesperidae)
16. Observing the characters of Neuroptera (Chrysopidae, Myrmeleonidae, Mantispidae, Ascalaphidae), Siphonoptera. Identification and naming of collected insects based on characters – order and family
17. Practical examination

Text books

1. Borror, D.J., D.M. DeLong and C.A. Triple Horn. 1976. An introduction to the study of insects (IV Edition). Holt, Rinehart and Winston, New York, London and Sydney.
2. Cedric Gillott. 2005. Entomology (Third Edition). Springer, Netherlands.
3. Nayar. K.K., T.N. Ananthakrishnan and B.V. David 1976. General and Applied Entomology. Tata Mc-Graw Hill publishing Company Ltd, New Delhi.
4. Richards O.W. and R.G. Davies 1977. Imm's General Text Book of Entomology Vol.I and II. Chapman and Hall Publication, London.

Further reading

1. Chapman, R.F. 1981. The Insects: Structure Function. Edward Arnold (publishers) Ltd, London.
2. Chapman R.F.1974. Insect Structure and Function, ELBS publishers, New Delhi.
3. Paulson, G.S. 2005. Hand book to the Construction and Use of Insect Collection and Rearing Devises Springer Dordrechse, New York.
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SST 211 Principles of Seed Production and Quality Control in Horticultural Crops

1+1

Theory

Unit I Introduction

Seed - definition - importance - quality characteristics - history of seed industry - classes of seed - generation system - multiplication ratio - seed replacement rate - varietal deterioration - causes - maintenance.

Unit II Principles of seed production

Methods and tools of seed production in variety and hybrid - seed crop management - land requirement-isolation - pre-sowing seed treatment - dormancy - spacing - nutrient- irrigation - contaminants - roguing - plant protection - physiological maturation - pre-harvest sanitation spray - harvest and postharvest techniques-extraction - methods - drying - processing - seed treatment - pre-storage - packing - storage - mid- storage treatment.

Unit III Seed quality control - seed certification

Seed certification - phases - procedures - general and specific standards - field inspection - field counts -contaminants - post harvest inspection - seed standards - bagging - tagging - blending of seed lots - grow out test.

Unit IV Seed testing

Seed testing - importance - seed lot - seed sample - sampling methods - purity analysis - moisture estimation - germination tests - viability test - seed vigour tests - seed health test .

Unit V Seed legislation

Seed Act and Rules -Central Seed Committee - Central Seed Certification Board, State Seed Certification Agency - Central and State Seed Testing Laboratories - Seed Inspector - duties and responsibilities - offences and penalties - Seed Control Order 1983 - New policy on seed development / New Seed Policy 1988- National Seed Policy 2002 - Seed Bill 2004.

Practical

Seed structure - Calculation of SMR and SRR - varietal and hybrid seed production plots - pre sowing seed management techniques - (dormancy, priming, coating and pelleting) - identification of contaminants and practicing roguing - studies on physiological and harvestable maturity and seed extraction - practicing field counting - visit to seed processing unit - visit to Directorate of Seed Certification- - visit to grow out test plots - seed sampling, mixing and dividing - analysis of physical purity - moisture estimation - conducting germination tests - seed health test and seedling evaluation - quick viability test - visit to seed retail shop for observing the method of taking official sample.

Lecture schedule

1. Seed - definition - importance - quality characteristics - history of seed industry
2. Classes of seed - generation system - multiplication ratio- seed replacement rate
3. Varietal deterioration - causes - maintenance
4. Methods and tools of seed production in variety and hybrid
5. Seed crop management- land requirement- isolation - pre-sowing seed treatment -dormancy
6. Spacing - nutrient- irrigation - contaminants- roguing -plant protection
7. Physiological maturation - pre-harvest sanitation spray - harvest and post harvest techniques-extraction- methods - drying
8. Processing - seed treatment-pre-storage - packing -storage -mid storage treatment
9. Mid semester examination
10. Seed certification -phases - procedures- general and specific standards
11. Field inspection - field counts -contaminants --- post harvest inspection
12. Seed standards - bagging - tagging - blending of seed lots - Grow Out Test
13. Seed testing - importance - seed lot - seed sample - sampling methods - purity analysis - moisture estimation
14. Germination tests - viability test - seed vigour tests - seed health test

15. Seed Act and Rules –Central Seed Committee - Central Seed Certification Board, State Seed Certification Agency - Central and State Seed Testing Laboratories
16. Seed Inspector - duties and responsibilities- - offences and penalties -Seed Control Order 1983
17. New policy on seed development / New Seed Policy 1988– National Seed Policy 2002 - Seed Bill 2004

Practical Schedule

1. Seed structure in horticultural crops
2. SMR and SRR - calculation - factors influencing - variety /hybrid - comparison
3. Practicing varietal and hybrid seed production plots and pre sowing seed management techniques (dormancy)
4. Practising pre sowing seed management techniques (priming, coating and pelleting)
5. Identification of contaminants and practising roguing
6. Studies on physiological and harvestable maturity and seed extraction
7. Practicing field counting
8. Visit to seed processing unit
9. Visit to Directorate of Seed Certification
10. Visit to grow out test plots
11. Seed sampling, mixing and dividing
12. Analysis of physical purity and estimation of seed moisture
13. Conducting germination tests
14. Seedling evaluation and seed health test
15. Practising quick viability test
16. Visit to seed retail shop for observing the methods of taking official sample
17. Final examination

Text book

1. P.S.Arya. 1995. Vegetable seed production principles. Kalyani Publishers. New Delhi.

2. S.P.Singh. 1999. Seed production of commercial vegetables. Kalyani Publishers. New Delhi.
3. Raymond A.T. George. 1985. Vegetable seed production. Longman and London, New York.

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Journals

- Asian seed and planting material
- Seed Research
- Journal of Asian Horticulture
- Indian Horticulture
- Agriculture and industry survey
- Seed Science and Technology
- Journal of Seed Science Research

PAT 201 Fundamentals of Plant Pathology 2 + 1

Theory

Unit I Plant pathogenic organisms

Plant Pathology : definition, history – Pathogens : fungi, bacteria, virus, viroid, phytoplasma, Fastidious vascular bacteria, spiroplasma , algae and phanerogamic parasites – Koch's postulates - Types of parasitism - General characters of fungi -- Major symptoms of fungal diseases

Unit II Fungal taxonomy based on molecular phylogeny

Classification of **Kingdom - Protozoa** - important taxonomic characters and symptoms and life cycle of *Plasmodiophora brassicae* -Classification of **Kingdom - Chromista**- General characters - Classification of Oomycetes .Symptoms and life cycle of *Pythium*,*Phytophthora* and *Albugo peronosclerospora*, *Sclerospora*. *Perenospora*, *Pseudoperenospora* and *Plasmopora*-Classification of **Kingdom- Chytridiomycota** and **Zygomycota** - important characters, symptoms and life cycles of *Rhizopus* - Classification of **Kingdom- Ascomycota**- important characters

Symptoms and life cycles of *Erysiphe*, *Leveillula*, *Phyllactinia*, *Uncinula* and *Podosphaera pyricularia* , *Helminthosporium*, *Alternaria*, *Cercospora* and *Curvularia*, *Fusarium*, *Verticillium*, *Colletotrichum*, *Gloeosporium*, *Pestalotia*, *Macrophomina* and *Botryodiplodia*,-Classification of **Kingdom - Basidiomycota** - important characters

Symptoms and life cycles of *Puccinia* ,*Uromyces*, *Ustilago* and *Hemileia*, *Ganoderma*, *Agaricus*, *Pleurotus* , *Volvariella* and *Calocybe*

Symptoms and important characters of *Corticium*, *Rhizoctonia* and *Sclerotium*

Unit III Bacteria, phytoplasma, virus and algal parasites

Classification, general characteristics and symptoms of bacterial diseases, mode of entry and spread - General characteristics and symptoms of viral, viroid and phytoplasma diseases - General characters of algal parasite *Cephaleuros* and phanerogamic parasites.

Unit IV Epidemiology and plant disease management

Epidemiology of crop diseases - role of weather factors in disease development. Survival and spread of plant pathogens - Disease surveillance and forecasting. Principles of Crop disease management - Prophylaxis : Exclusion, Eradication and direct protection and immunization : Cross protection and host plant resistance. Fungicides - classification - characteristics of an ideal fungicide - group of fungicides - Non systemic and systemic. Formulations - methods of application of fungicides. Precautions and safety measures in handling of fungicides. Special methods of application

Unit V Biological control and biotechnological approaches

Biological control of crop diseases and their scope - biocontrol agents - Fungi, bacteria, - use of plant products and anti viral principles in plant disease management. Biotechnological approaches in plant disease management

Practical

General characters of fungi - mycelium - spores - asexual, sexual and vegetative spores- sexual and asexual fruiting body in fungi. Study of symptoms, host parasite relationship and systematic position of pathogens causing the following diseases.

Club root, powdery scab, damping off, foot rot, late blight, bud rot, white blisters, downy mildew, fruit rot, leaf curl, bird's eye spot, scab, sooty mould, sigatoka disease, powdery mildew, rusts, basal stem rot, blister blight, leaf spot, leaf blight, anthracnose, wilt, dry root rot and wet root rot. Bacterial diseases - symptoms - leaf spot, blight, ring rot, head rot, canker, scab, crown gall, wilt and soft rot. Symptoms and vectors of virus and phytoplasma diseases. Algal diseases - phanerogamic parasites. Deficiency diseases.

Various groups of fungicides and antibiotics - Preparation of Bordeaux mixture and Bordeaux paste - Preparation of fungicidal spray solution - Delivery of fungicides, Production of immunized seedlings in citrus - Biological control agents and their mass production - *Trichoderma* and *Pseudomonas* - Methods of application of biocontrol agents - Preparation of botanicals - leaf extracts, oil emulsions and anti viral principles

Herbarium collection - 30 No

Lecture schedule

1. Definition and history of Plant Pathology
2. Cause of Plant diseases - pathogen - fungi - bacteria, viroid, virus and Phytoplasma. Rickettsia like organism, Spiroplasma like organisms, Algal and phanerogamic parasite - Koch's postulates.
3. General characters of fungi - mycelium - asexual, sexual and vegetative spores - asexual and sexual fruiting bodies.
4. Classification of Kingdom - Protozoa - important taxonomic characters and symptoms and life cycle of *Plasmodiophora brassicae*
5. Classification of Kingdom -Chromista- General characters - Classification of Oomycetes .Symptoms and life cycle of *Pythium*,*Phytophthora* and *Albugo*
6. Symptoms and life cycle of *Peronosclerospora*, *Sclerospora*. *Perenospora*, *Pseudoperenospora* and *Plasmopora*
7. Classification of Kingdom- Chytridiomycota and Zygomycota - important characters, symptoms and life cycles of *Rhizopus*
8. Classification of Kingdom- Ascomycota- important characters
9. Symptoms and life cycles of *Erysiphe*, *Leveillula* and *Phyllactinia*,
10. Symptoms and important characters of *Pyricularia* , *Helminthosporium*, *Alternaria*, *Cercospora* and *Curvularia*, *Fusarium*, *Verticillium*
11. Symptoms and important characters of *Colletotrichum*, *Gloeosporium*, *Pestalotia*, *Macrophomina*, and *Botryodiplodia*,
12. Classification of Kingdom - Basidiomycota- important characters
13. Symptoms and life cycles of *Puccinia* ,*Uromyces*, *Ustilago* and *Hemileia*
14. Important taxonomic characters of *Ganoderma*, *Agaricus*, *Pleurotus* , *Volvariella* and *Calocybe*
15. Symptoms and important characters of *Corticium*, *Rhizoctonia* and *Sclerotium*

16. Plant pathogenic bacteria, general characters - Symptoms of bacterial diseases - leaf spot, streak, blight, canker, scab, wilt, crown gall, ring rot, head rot and soft rot.
17. Mid semester examination
18. General characters of virus - Common symptoms of virus and viroid diseases - Chlorosis, mosaic, stripe, vein clearing, vein banding, crinkle, enation, necrosis, dwarfing, rosette, bunchy top, bract mosaic and twisting, cadang cadang of coconut and potato spindle tuber
19. General characters - Symptoms of phytoplasma diseases - phyllody, witches broom, little leaf, dwarf, yellows and sandal spike and algal parasite - *Cephaleuros*
20. Phanerogamic parasites - *Cuscuta*, *Orobanche*, *Loranthus* and *Striga*
21. Epidemiology of crop diseases - weather factors and their role in disease development - temperature, rainfall, relative humidity, dew and inoculum potential.
22. Survival and spread of fungal bacterial and viral pathogen
23. Disease surveillance, assessment and forecasting.
24. Principles of disease management exclusion - plant quarantine- domestic and foreign embargo - exotic diseases, phytosanitary certificate.
25. Eradication - physical, chemical and cultural methods.
26. Protection - chemical protection, cultural methods.
27. Fungicides - formulations and adjuvants - characteristics of an ideal fungicide
28. Fungicides - definition, , protectant, eradicant, therapeutant, fungistat. Groups of fungicides - copper fungicide and sulphur fungicide,
29. Heterocyclic nitrogen compound, quinones, and miscellaneous fungicides.
30. Systemic fungicides and antibiotics
31. Methods of application of fungicides - seed treatment, dry and wet, soil drenching, foliar spray, post harvest treatment, corm injection, root feeding, capsule application and acid delinting and precautions while handling fungicides.

32. Immunization – cross protection -types of resistance, vertical resistance and horizontal resistance, mechanism of resistance - morphological, physical and chemical.
33. Biological control – biocontrol agents, fungi, bacteria, vesicular arbuscular mycorrhizae and plant products – methods of application of biocontrol agents – plant products and anti viral principles.
34. Biotechnological approaches of crop disease management such as meristem tip culture and somaclonal variation.

Practical schedule

1. General characters of fungi – types of mycelium, asexual, sexual and vegetative spores – types of sexual and asexual fruiting bodies.
2. Study of symptoms, fungal characters and host parasite relationships of *Plasmodiophora brassicae* (club root), *Pythium* (damping off), *Phytophthora* (late blight)
3. Study of symptoms, fungal characters and host parasite relationships of *Plasmopara*, *Peronospora*, *Pseudoperonospora* and *Rhizopus* (Jack fruit rot)
4. Study of symptoms, fungal characters and host parasite relationships of *Taphrina* (leaf curl), *Protomyces* (stem gall), *Capnodium* (sooty mould), *venturia* (scab) and *Mycosphaerella* (leaf spot)
5. Study of symptoms, fungal characters and host parasite relationships of *Erysiphe*, *Podosphaeria*, *Sphaerthea*, *Leveillula* (powdery mildew), *Puccinia*, *Uromyces*, *hemileia* (rust) and *Ganoderma* (basal stem rot)
6. Study of symptoms, fungal characters and host parasite relationships of *Helminthosporium*, *Cercospora* (leaf spot), *Alternaria* ((leaf blight), *Colletotrichum* (anthracnose) and *Gloeosporium* (fruit rot)
7. Symptoms of bacterial diseases – leaf spot, blight, canker, scab, crown gall, wilt and soft rot.
8. Symptoms and vectors of viral diseases – chlorosis, mosaic, vein clearing, vein banding, leaf crinkle and leaf curl, enation, necrosis, dwarfing, rosette, bunchy top and bract mosaic.

9. Symptoms of phytoplasma (little leaf and phyllody) algal diseases – *Cephaleuros*. and phanerogamic parasites
10. Study of various groups of fungicides.
11. Preparation of Bordeaux mixture and Bordeaux paste.
12. Methods of application of fungicides – seed treatment, dry, wet – foliar spraying and soil drenching, Root feeding, corm injection, and capsule application, Acid delinting, pairing and prolinage and post harvest treatment.
13. Cross protection – demonstration of production of immunized seedling against citrus tristeza.
14. Biocontrol agents – mass production of *Trichoderma viride* and *Pseudomonas fluorescens*.
15. Preparation of leaf extracts, oil emulsion of neem and other botanicals and antiviral principles.
16. Survey and assessment of foliar crop diseases, post harvest diseases, soil borne and viral diseases
17. Practical examination

Text books

1. Agrios, G.N. . Plant Pathology, 2008 5th Edition Academic Press, New York
2. Alexopolus, C. J. and Mims, 2010. Introductory Mycology, Willey Eastern Ltd., New Delhi.
3. Chattopadhyay, S.G. 1998. Principles and procedure of plant protection – Oxford and IBH publication, New Delhi.
4. Maramorach, K. 1998. Plant diseases of viral, viroid, Mycoplasma and uncertain etiology, Oxford and IBM publications, New Delhi.
5. Mehrotra, R.S. 1990. An introduction to mycology, Willey Eastern Ltd., New Delhi.
6. Narayanasamy, P 1997. Plant Pathogens and detection and disease diagnosis , CRC Publication, USA.
7. Nene, Y.L. and Thapliyal, P. N. 1998. Fungicides in plant disease control. Oxford and IBH Publishing Co. Ltd., New Delhi.
8. Prakasam, V., T. Raguchander, and K. Prabakar, 1998. Plant Disease Management, A.E. Publication, Coimbatore.
9. Vidyasekaran, P. 1993. Principles of Plant Pathology, CBS Publishers and Distributors, New Delhi.

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- www.mycology.net
- www.bspp.org.uk
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- <http://edis.ifas.ufl.edu>
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AMP 201 Livestock and Poultry Production Management 2 + 1

Theory

Unit I Introduction to livestock management

Prelusion - Significance of livestock and poultry in Indian economy - Livestock and poultry census - Different livestock development programmes of Government of India - Various systems of livestock production-extensive - semi intensive - intensive-mixed- Integrated and specialized farms.

Unit II Dairy cattle management

White and black cattle breeds-classification-indigenous and exotic - Breed characteristics - Breeding - cross breeding- upgrading - economic traits of cattle - Estrus Cycle - artificial insemination - Introduction to embryo transfer - Housing - space requirement calf and adult stock - System and types of housing - Feeding and management of calf, heifer, pregnant, milch animal and working animals - Nutrition - ration - Balanced Ration - Characteristics of ration and classification of feed and fodder - composition of concentrate mixture for different stages - Milking methods - Clean milk production - Factors affecting milk composition - Diseases of cattle - classification - symptoms - preventing and control measures.

Unit III Sheep and Goat management

Breeds - sheep and goat classification -- economic traits - system of rearing - Housing management - floor space requirement - care and management of young and adult stock - Nutrition - feed and fodders of small ruminants - flushing - common diseases - prevention and control.

Unit IV Management of swine

Classification of breeds - Economic traits - housing - nutrition - creep feeding - care and management of adult and young stock - common disease- prevention and control.

Unit V Poultry management

Classification of breeds - commercial strains of broilers and layers - housing - brooding - deep litter and cage system - care and management of broilers and layers - nutrition of chick, grower, layer and broiler - Incubation and Hatching of eggs - common diseases - control and prevention.

Practical

Study of external parts of livestock - Identification of livestock and poultry- Tattooing-ear tags-wing and leg bands-Common restraining methods-Disbudding (or) dehorning-Different methods of castration- dentition-Study of type design of animal and poultry houses-Selection of dairy cow and work bullock-Determination of specific gravity, fat percentage and total solids of milk- Common adulterants and preservatives of milk- Demonstration of cream separation, butter, ice cream and ghee making- Identification of feeds and fodder- Economics of dairy, goat and swine farming - Study of external parts of fowl - Preparation of brooder house - brooder management- Identification of layer and non layer-debeaking, delousing and deworming of poultry- vaccination schedule for broiler and layer-dressing of broiler chicken - Economics of broiler and layer farming - Visit to a modern dairy plant and commercial layer and broiler farms - Demonstration of incubator and setter.

Lecture schedule

1. Prelusion-significance of livestock and poultry in Indian economy-livestock and poultry census. Different livestock development programmes of Government of India
2. Various systems of livestock production-extensive - semi intensive, intensive-mixed- integrated and specialized farms.
3. Definition of breed-classification of indigenous white and black cattle-breed characteristics of Sindhi, Kangayam and Umblacherry.
4. Breed-characteristics of exotic cattle -Jersey and Holstein Friesian - Indian Buffaloes- Murrah and Surti.
5. Breeding-cross breeding-upgrading-economic traits of cattle

6. Estrous cycle – signs of estrous - artificial insemination-merits and demerits- Principles and outline of embryo transfer
7. Housing management-farm site selection and floor space requirement for calves, heifer, milch animal and work bullocks.
8. Systems of housing-single row system-double row system- head to head and tail to tail-merits and demerits - Type design of house.
9. Care and management of new born calf and heifers
10. Care and management of pregnant animal and lactating animals.
11. Care and management of dry cows and work bullock.
12. Nutrition-definition-ration-balanced ration-desirable characteristics of a ration. Classification of feed stuffs-concentrate and roughage-comparison
13. Model composition of concentrate mixture of young and adult stock-age wise feed and fodder requirement-Importance of green fodder.
14. Milking methods-clean milk production-factors affecting milk yield and composition
15. Diseases-classification-viral, bacterial and metabolic-general control and preventive measures.
16. Viral diseases-foot and mouth andr. bacterial diseases, anthrax, hemorrhagic septicemia- black quarter - metabolic- tympanites, acidosis, ketosis and milk fever.
17. Mid semester examination.
18. Sheep and goat farming-classification of breeds of Indian and exotic origin – nomenclature alone - economic traits.
19. Systems of rearing-housing management - type design- floor diagram-space requirement for adult and young stock.
20. Care and management of ram, ewe and lamb-nutrition- feeds and fodder for small ruminants.
21. Care and management of buck, doe and kid- nutrition- flushing.
22. Common ailments of sheep and goat-sheep pox-foot and mouth-blue tongue-enterotoxaemia –Ecto and endo parasites.

23. Swine husbandry –Common breeds of exotic origin-nomenclature alone-economic traits- housing of Swine.
24. Care and management of sow, boar and piglets-nutrition- creep feeding.
25. Disease prevention and control of swine diseases –hog cholera, foot and mouth, ecto and endo parasites.
26. Interrelationship between poultry husbandry and agriculture-classification of breeds *viz.* layer, broiler and dual purpose-nomenclature of commercial strains of layer and broiler.
27. Care and management of new arrivals-brooder management.
28. Systems of housing- deep litter and cage system- floor space requirement- common litter material-litter management-merits and demerits.
29. Care and management of layers- vaccination schedule. preservation of eggs
30. Care and management of broilers-vaccination schedule.
31. Incubation and hatching of eggs.
32. Nutrition-feed formulation-composition of chick, grower, layer broiler starter and Finisher mashes-Feed Conversion Ratio /dozen egg or kg of meat production.
33. Classification of disease –viral – bacterial - protozoan- causative organisms, symptoms and prevention – viral diseases- ranikhet – IBD-avian flu.
34. Bacterial disease-E.coli-coryza-salmonellosis-protozoan–coccidiosis-casulative organism, symptoms and preventive measures.

Practical schedule

1. Study of external parts of livestock
2. Identification of livestock and poultry
3. Common restraining methods of livestock
4. Disbudding, dehorning, castration and dentition of livestock
5. Study of type design of animal and poultry houses
6. Selection of dairy cow and work bullock
7. Determination of specific gravity, fat percentage and total solids of milk.
Common adulterants and preservatives of milk

8. Demonstration of cream separation, butter, ice cream and ghee making
9. Identification of feeds and fodder
10. Economics dairy, goat and swine farming
11. Study of external parts of fowl. Preparation of brooder house
12. Identification of layer and non layer
13. Debeaking, delousing and deworming of poultry-vaccination schedule for broiler and layer
14. Demonstration of dressing of broiler chicken. economics of broiler and layer farming
15. Visit to a modern dairy plant and commercial layer and broiler farms
16. Demonstration of incubator and setter.
17. Final practical examination

Text books

1. Banerjee, G.C. 2010. The Text Book of Animal Husbandry. Oxford Book Company, Calcutta.
2. Dairy India Year Book 2007. A-25, Priyadarshini Vihar, Delhi
3. Gopalakrishnan, C.A.,and Lal, D.M.M., 1992. Livestock and Poultry Enterprises for Rural Development. Vikas Publications Private Limited, GHAZIABAD, Uttar Pradesh.
4. ICAR, 2007. A Hand Book of Animal Husbandry
5. Jull,M.A.(2003) Successful Poultry Management
6. Kadirvel, R., and Balakrishnan, V., 1998. Hand Book of Poultry Nutrition. Madras Veterinary College, TANUVAS., Chennai.
7. Prabakaran, R., 1998. Commercial Chicken Production. Publisher P.Saranya, 5/2, Ramalingam Street, Seven Wells, Chennai
8. Radostitis.O.M.,Gray,C.C.,Blood,D.C.and Hinchcliff,K.W.(2000). A text book of the diseases of Cattle, Sheep, Pigs , Goats and Horses. IX edition,Book Power-WB Saunders, London.
9. Sastry, N.S.R., Thomas, C.K. and Singh, R.A. 1982. Farm Animal Management and Poultry Production. Vikas Publishing House Private Limited, Ghaziabad, UP
10. Sastry, N.S.R., Thomas, C.K. 2005. Livestock Production Management. Kalyani Publishers, Ludhiana
11. Watson,J.A.S. and Mills,W.J.(2005). Farm animals and their Management.

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www.intervet.com/species/pigs/websites.aspx
www.britishangoragoats.org.uk/management.htm
www.indigoatfarm.com
www.indiadairy.com
www.indiagronet.com
www.foodsci.uoguelph.ca
www.fil-idf.org

FMP 211 Farm Power and Machinery 1 + 1

Aim

To equip the students with sufficient theoretical knowledge and practical skills about tractor power and implement resources used in agriculture

Theory

Unit I Farm power

Farm power in India- sources, IC engines- working principles, two stroke and four stroke engines, IC engine terminology, different systems of IC engine. Tractors- types, selection of tractors and cost of tractor power - Tractor and implement selection for different agricultural operations

Unit II - Tillage, sowing and planting machinery

Tillage implements- primary and secondary tillage implements - Sowing methods - seed drills, seed cum fertilizer drills - implements for intercultural operations - wet land equipment - Paddy transplanters - field and nursery requirements

Unit III - Plant protection and harvesting machinery

Plant protection equipment - Harvesting tools and equipment- reapers and combine - Harvesting machinery for groundnut, tuber crops - Sugarcane harvesters - Equipment for land development and soil conservation -Tools for horticultural crops

Practical

Study of different components of IC engine, four stroke petrol engine, two stroke petrol engine. Study of MB plough, disc plough, seed-cum-fertilizer drills, their mechanisms. Operation of tractor and implements - operation and maintenance of power tiller - Study of different inter-cultivation equipments - Sprayers and dusters - their operation, repairs and adjustment - Harvester for paddy, sugarcane and horticultural crops - Field capacity and cost analysis

Lecture schedule

1. Farm power in India - human, animal, mechanical and electrical energy sources and their use in agriculture
2. Two stroke and four stroke engines, working principles, applications - types, power and efficiency
3. Different systems of IC engine - cooling, lubricating, fuel injection systems
4. Tractors- types and utilities
5. Tillage, objectives, types - ploughing methods. Field capacity and field efficiency.
6. Primary tillage, objectives, mould board ,disc plough, chisel plough and subsoiler, components and functions, types, advantages and disadvantages.
7. Secondary tillage equipments - harrows, land forming equipments - rotaravators - wet land equipment - puddlers and manure trawlers - cage wheels
8. Sowing methods - seed drills, seed cum fertilizer drills - components and functions
9. Mid semester examination
10. Paddy transplanters, types, working principle, field and nursery requirements
11. Implements for intercultural operations - cultivators, sweep, junior hoe, manual weeders and power operated weeders for wet and garden land
12. Sprayers and their functions, classification, manually operated sprayers, power sprayers - Dusters, types and uses
13. Harvesting tools and equipments- sickles, paddy reapers and combine - Harvesting machinery for groundnut, tuber crops - Sugarcane harvesters
14. Tools for horticultural crops - propagation tools, planters and harveting tools and machinery
15. Equipment for land development and soil conservation - dozers, levelers, chisel plough, sub soil plough, blade harrow, bund former
16. Cost of operation of farm machinery - problem solving
17. Tractor and implement selection for different agricultural operations

Practical schedule

1. Study of working of two and four stroke petrol IC engine

2. Study of MB plough and disc plough, measurement of plough size, different parts, horizontal and vertical suction,
3. Study of disc harrows, bund former, leveller and rotavator
4. Study of seed-cum-fertiliser drills- furrow opener, metering mechanism and calibration
5. Study of tractors - their operation and maintenance
6. Learning to drive tractor
7. Learning to operate tractor with mounted implement
8. Study of power tillers - their operation and maintenance
9. Study of different inter-cultivation equipments in terms of efficiency, field capacity
10. Study of plant protection equipments - power sprayers, knapsack sprayers, dusters - minor repairs and adjustment of sprayers
11. Study of paddy transplanters - allied machinery for raising mat nursery
12. Study of paddy reaper and paddy combine - registration and alignment of cutter bars
13. Study of sugarcane, turmeric and groundnut harvesters.
14. Tools for horticultural crops - propagation tools, planters and harveting tools and machinery
15. Study of land development and soil conservation machinery - dozers, levelers, chisel plough, blade harrow, bund former and trenchers
16. Problems on field capacity and cost of operation of farm machinery
17. Final practical examination

Outcome

Students will be equipped with sufficient theoretical knowledge and practical skills on the availability and handling of tractors, power tillers and various implements used in land preparation, sowing, inter cultivation, plant protection and harvesting operations

Text books

1. Jagadishwar Sahay, 1992. Elements of agricultural engineering. Agro book agency, Patna-20.
2. Michael and T.P.Ojha, 1996. Principles of agricultural engineering. Jain brothers, New Delhi.

Reference

1. Nakra C.P 1970. Farm Machinery and equipment,,: Dhanpat Rai & Son
2. Bindra, O.S. and Harcharan Singh, 1971. Pesticide application equipment. Oxford and IBH pub Co., New Delhi.
3. Srivastava, A.C., 1990. Elements of farm machinery. Oxford IBH pub Co., New Delhi.

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- www.farmmachineryshow.org

AGM 202 Applied Microbiology 1 + 1

Aim

This course is designed to give students an understanding of the role of microorganisms in industrial processes pertaining to microbial products. The course encompasses the use of microorganisms in the manufacture of industrial products like enzymes, organic acids, vitamins, alcoholic beverages, microbial production of therapeutic agents, microbial fuels, fermented foods and the like.

Theory

Unit I Industrial processes and Microbial whole cell products- an overview

Introduction to industrial processes for microbial products - Development and range of fermentation processes - component parts of a process; commercially important fermentations - organisms - strain improvement, process, applications; Microbial biomass production - Baker's yeast; SCP.

Unit II Alcoholic and acid fermentation products

Alcohol fermentations - Microbial production processes for beer, wine, ethanol; Production of organic acid - citric acid, acetic acid, lactic acid.

Unit III Microbial enzymes and other products

Commercial microbial enzymes – amylase, protease, cellulase - production processes and their application; Immobilization techniques; Amino acid - glutamic acid, lysine; Vitamins – B2 and B12.

Unit IV Secondary metabolites and other products

Antibiotics- penicillin, streptomycin; Microbial production of solvents; microbial fuels – methane, hydrogen, ethanol and algal biodiesel; Biopolymers: bioplastics, xanthan and dextran; microbial pigments.

Unit V Fermented foods

Microbiological production of fermented foods – bread; traditional fermented food products; Fermented dairy products - cheese, yogurt, kefir and other fermented foods - sauerkraut, pickles, green olives and sausages, tea; probiotics; Good manufacturing practices – containment of contaminants in industries – standard tests for assessment of microbial quality.

Practical

Isolation of industrially important microorganisms; production of wine; microbial enzyme production – solid state fermentation – organic acid production; isolation and screening of microorganisms producing antibiotics; experimental set up for demonstration of methane and hydrogen production; microbial colourants production; production of fermented dairy and vegetable products; probiotic formulations; standard tests for assessing microbial quality in industrial products.

Lecture schedule

1. History, scope and microbes used in industry.
2. Development and range of fermentation processes - component parts of fermentation process
3. Biocatalyst - Methods of strain improvement: selection-mutation-genetic manipulation
4. Media; Basic functions of a fermentor and component parts
5. Fermentation technology- batch-fed batch and continuous fermentation
6. Process control and downstream processing
7. Whole cell products: Microbial biomass production – Baker's yeast; SCP
8. Alcoholic beverages- beer, wine and industrial production of ethyl alcohol

9. Mid semester examination
- 10 Organic acids: lactic acid - citric acid - vinegar-production and uses; Microbial production of solvents.
- 11 Microbial enzymes – amylase, protease, cellulase - production processes and their application; Immobilization techniques.
- 12 Amino acid - glutamic acid and lysine - production and application; Vitamin - B12 - production and application.
- 13 Antibiotics-penicillin-streptomycin- production- modifications-assay
- 14 Microbial fuels – methane, hydrogen, ethanol and algal biodiesel; Biopolymers - Microbial pigments.
- 15 Microbiological production of fermented foods – traditional fermented food products - probiotics.
- 16 Fermented dairy products – Vegetable and meat fermented foods.
- 17 Good manufacturing practices – containment of contaminants in industries – standard tests for assessment of microbial quality.

Practical schedule

1. Isolation of industrially important microbes -yeast/ actinomycetes.
2. Fermentor – components and functions.
3. Primary metabolite: Alcohol fermentation.
4. Solid state fermentation – cellulose.
5. Production and assay of amylase.
6. Secondary metabolite: Antibiotic production by *Streptomyces*.
7. Extraction and down streaming.
8. Microbial production of GA3.
9. Microbial production of food colourants.
- 10 Production of Single Cell Protein.
- 11 Dairy fermentation: Cheese making.
- 12 Cereal fermentation: Bread making.
- 13 Soy sauce fermentation.
- 14 Probiotics: yogurt preparation.
- 15 Detection of food-borne pathogens (*Salmonella*, *E.coli*).
- 16 Industrial visit.
- 17 Practical examination.

Outcome

At the end of the course, the learner is expected to be able to:

1. Identify the main features that confer a microorganism the potential interest to industry.
2. Determine the system for the production of a particular product. Design strategies to optimize an industrial process.
3. Integrating the knowledge achieved by proposing procedures to hypothetical industries, to produce a metabolite, with features you need.
4. Understand the concepts of probiotics and the good bacteria involved in the production of fermented beverages and foods.

Further reading

1. Adams, M. R. 2008. Food Microbiology (3rd edition), Panima Publishing Corporation, New Delhi
2. Casida, L.E. 2006. Industrial Microbiology, New Age International Publishers, New Delhi.
3. Cruger, W and A. Cruger. 2004. Biotechnology-A Textbook of Industrial Microbiology, 2nd Ed. Panima.
4. Demain, A.L and Davies, J.E. 1999. Manual of Industrial Microbiology and Biotechnology, IInd Edition, ASM press, Washington, D.C.
5. El-Mansi and Bryce. 2002. Fermentation Microbiology and Biotechnology, S.Chand and Co., New Delhi.
6. Frazier, W.C., Westhoff, D. C. 2003. Food Microbiology, 4th Edition. Mc Graw - Hill, Inc, USA.

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II Year IV Semester

Sl. No	Course Number	Course Title	Credit Hours
1.	FSC 201	Production Technology of Sub Tropical and Temperate Fruits Crops	2 + 1

2.	PSM 201	Production Technology of Spices and Plantation Crops	2 + 1
3.	HOR 204	Study Tour I	0 + 1
4.	ABT 201	Principles of Biotechnology	1 + 1
5.	SST 212	Seed Production Technology of Horticultural Crops	1 + 1
6.	SER 201	Sericulture Technology	1 + 1
7.	ARM 201	Fundamentals of Agribusiness Management	1 + 1
8.	STA 201	Applied Statistics	1 + 1
9.	SWE 211	Fundamentals of Soil and Water Conservation Engineering	2 + 1
10.	ERG 211	Renewable Energy	1 + 0
11.	FOR 211	Forest Resource Management	1 + 1
Total			13+10=23

FSC 201 Production Technology of Sub Tropical and Temperate Fruit Crops 2 + 1

Aim

- ❖ To impart knowledge about the cultivation aspects of sub tropical and temperate fruit crops

Theory

Unit I

Subtropical, temperate and humid zones of India and Tamil Nadu - Classification of subtropical and temperate fruits - Area, production, scope and importance, role on national economy of temperate and subtropical fruit crops.

Unit II

Composition and uses - origin and distribution - species and cultivars, soil and climatic requirements - propagation - main field preparation - spacing, planting density and cropping systems. Planting and after care - nutrients, water and weed management - training and pruning - flowering, pollination and fruit set - use of plant growth regulators - Physiological disorders and remedies - maturity indices and harvest - post harvest handling - ripening and storage - production constraints of hill banana, mandarin, grapefruit, pummelo, grapes and avocado.

Unit III

Composition and uses - origin and distribution - species and cultivars. soil and climatic requirements - propagation - main field preparation - spacing, planting density and cropping systems. Planting and after care - nutrients, water and weed management - training and pruning - flowering, pollination and fruit set - use of plant growth regulators - Physiological disorders and remedies - maturity indices and harvest - post harvest handling - ripening and storage - production constraints of pine apple, mangosteen, litchi, loquat, rambutan, carambola, durian, passion fruit and rose apple.

Unit IV

Composition and uses - origin and distribution - species and cultivars. soil and climatic requirements - propagation - main field preparation - spacing, planting density and cropping systems. Planting and after care - nutrients, water and weed management - training and pruning - problems in flowering, pollination and fruit set - planting of pollinizers - use of plant growth regulators - Physiological disorders and remedies - maturity indices and harvest - post harvest handling and storage - production constraints of apple, pear, peach, plum, strawberry, sweet and sour cherry, black and raspberry, currants, apricot, kiwi, persimmon.

Unit V

Composition and uses - origin and distribution - species and cultivars. soil and climatic requirements - propagation - main field preparation - spacing, planting density and cropping systems. Planting and after care - nutrients, water and weed management - training and pruning - flowering, pollination and fruit set - planting of pollinizers - use of plant growth regulators - Physiological disorders and remedies - maturity indices and harvest - post harvest handling and storage - production constraints of pistachio nut, macadamia nut, almond, walnut, pecan nut, chest nut and hazel nut.

Practical

Description and identification of important varieties of sub tropical and temperate fruits - selection, pre-treatment and intercultural operations in hill banana - systems of training, pruning, propagation methods, use of growth regulators in grapes - physiological disorders and remedies in major fruit crops - Study of varieties - propagation methods in mangosteen, loquat, carambola, pine apple - planting systems and growth regulation in pine apple - Description of varieties, propagation and growth regulation in apple, pear, plum and peach - Identification and description of temperate nut crops - study of maturity indices in major sub tropical and temperate fruit crops - visit to sub tropical and temperate zones and study of sub tropical and temperate fruit crops

Lecture schedule

1. Temperate, Subtropical and humid zones of India and Tamil Nadu - Classification of temperate and subtropical fruits.
2. Area, production, scope and importance, role on national economy of subtropical and temperate fruits.
3. Hill Banana - Composition and uses - origin and distribution - species and cultivars soil and climate requirements - propagation - main field preparation - spacing, planting density and cropping systems. Planting and after care - nutrients, water and weed management, training and pruning - use of plant growth regulators - physiological disorders and remedies - maturity indices and harvest - post harvest handling - ripening and storage
4. Mandarin - Composition and uses - origin and distribution - species and cultivars soil and climate requirements - propagation - main field preparation - spacing, planting density and cropping systems. Planting and after care - nutrients, water and weed management - training and pruning - flowering, pollination and fruit set - use of plant growth regulators, physiological disorders and remedies - maturity indices and harvest - post harvest handling - ripening and storage - production constraints
5. Grape fruit and Pummelo - Composition and uses - origin and distribution - species and cultivars soil and climate requirements - propagation - main field preparation - spacing, planting density and cropping systems. Planting and after care - nutrients, water and weed management - training and pruning - flowering, pollination and fruit set - use of plant growth regulators, physiological disorders and remedies - maturity indices and harvest - post harvest handling - ripening and storage of - production constraints
6. Grapes - Composition and uses - origin and distribution - species and cultivars soil and climate requirements - propagation - main field preparation - spacing, planting density and cropping systems. Planting and after care - nutrients, water and weed management - training and pruning - flowering, pollination and fruit set - use of plant growth regulators

7. Grapes - physiological disorders and remedies - maturity indices and harvest - post harvest handling - ripening and storage - production constraints
8. Avocado - Composition and uses - origin and distribution - species and cultivars soil and climate requirements - propagation - main field preparation - spacing, planting density and cropping systems. Planting and after care - nutrients, water and weed management - training and pruning - flowering, pollination and fruit set - use of plant growth regulators, physiological disorders and remedies - maturity indices and harvest - post harvest handling - ripening and storage, production constraints
9. Pineapple - Composition and uses - origin and distribution - species and cultivars soil and climate requirements - propagation - main field preparation - spacing, planting density and cropping systems. Planting and after care - nutrients, water and weed management - training and pruning - flowering, pollination and fruit set - use of plant growth regulators, physiological disorders and remedies - maturity indices and harvest - post harvest handling - ripening and storage.
10. Litchi - Composition and uses - origin and distribution - species and cultivars soil and climate requirements - propagation - main field preparation - spacing, planting density and cropping systems. Planting and after care - nutrients, water and weed management - training and pruning - flowering, pollination and fruit set - use of plant growth regulators, physiological disorders and remedies - maturity indices and harvest - post harvest handling - ripening and storage.
11. Mangosteen and loquat - Composition and uses - origin and distribution - species and cultivars soil and climate requirements - propagation - main field preparation - spacing, planting density and cropping systems. Planting and after care - nutrients, water and weed management - training and pruning - flowering, pollination and fruit set - use of plant growth regulators, physiological disorders and remedies - maturity indices and harvest - post harvest handling - ripening and storage.

12. Rambutan and Carambola - Composition and uses - origin and distribution - species and cultivars soil and climate requirements - propagation - main field preparation - spacing, planting density and cropping systems. Planting and after care - nutrients, water and weed management - training and pruning - flowering, pollination and fruit set - use of plant growth regulators, physiological disorders and remedies - maturity indices and harvest - post harvest handling - ripening and storage.
13. Durian and Rose apple - Composition and uses - origin and distribution - species and cultivars soil and climate requirements - propagation - main field preparation - spacing, planting density and cropping systems. Planting and after care - nutrients, water and weed management - training and pruning - flowering, pollination and fruit set - use of plant growth regulators, physiological disorders and remedies - maturity indices and harvest - post harvest handling - ripening and storage - production constraints
14. Passion fruit - Composition and uses - origin and distribution - species and cultivars soil and climate requirements - propagation - main field preparation - spacing, planting density and cropping systems. Planting and after care - nutrients, water and weed management - training and pruning - flowering, pollination and fruit set - use of plant growth regulators, physiological disorders and remedies - maturity indices and harvest - post harvest handling - ripening and storage - production constraints
15. Introduction to temperate fruit crops - climatic requirements and growth physiology
16. Bearing habits and training systems of temperate fruit crops
17. Apple - Composition and uses - origin and distribution - species and cultivars soil and climate requirements - propagation - main field preparation - spacing, planting density and cropping systems. Planting and after care - nutrients, water and weed management - training and pruning - problems in flowering, pollination and fruit set - planting pollinizers

18. Apple - use of plant growth regulators, physiological disorders and remedies maturity indices and harvest - post harvest handling and storage.
19. Mid semester examination.
20. Pear - Composition and uses - origin and distribution - species and cultivars soil and climate requirements - propagation - main field preparation - spacing, planting density and cropping systems. Planting and after care - nutrients, water and weed management - training and pruning - problems in flowering, pollination and fruit set - planting pollinizers - use of plant growth regulators, physiological disorders and remedies maturity indices and harvest - post harvest handling and storage.
21. Peach - Composition and uses - origin and distribution - species and cultivars soil and climate requirements - propagation - main field preparation - spacing, planting density and cropping systems. Planting and after care - nutrients, water and weed management - training and pruning - problems in flowering, pollination and fruit set - planting pollinizers - use of plant growth regulators, physiological disorders and remedies maturity indices and harvest - post harvest handling and storage.
22. Plum - Composition and uses - origin and distribution - species and cultivars soil and climate requirements - propagation - main field preparation - spacing, planting density and cropping systems. Planting and after care - nutrients, water and weed management - training and pruning - problems in flowering, pollination and fruit set - planting pollinizers - use of plant growth regulators, physiological disorders and remedies maturity indices and harvest - post harvest handling and storage.
23. Strawberry - Composition and uses - origin and distribution - species and cultivars soil and climate requirements - propagation - main field preparation - spacing, planting density and cropping systems. Planting and after care - nutrients, water and weed management - training and pruning - flowering, pollination and fruit set use of growth regulators, maturity indices and harvest - post harvest handling and storage

24. Cherries - Composition and uses – origin and distribution – species and cultivars soil and climate requirements - propagation - main field preparation - spacing, planting density and cropping systems. Planting and after care - nutrients, water and weed management - training and pruning - flowering, pollination and fruit set use of growth regulators, maturity indices and harvest - post harvest handling and storage
25. Raspberry, Black Berry and Currants - Composition and uses – origin and distribution – species and cultivars soil and climate requirements - propagation - main field preparation - spacing, planting density and cropping systems. Planting and after care - nutrients, water and weed management - training and pruning - flowering, pollination and fruit set use of growth regulators, maturity indices and harvest - post harvest handling and storage
26. Apricot - Composition and uses – origin and distribution – species and cultivars soil and climate requirements - propagation - main field preparation - spacing, planting density and cropping systems. Planting and after care - nutrients, water and weed management - training and pruning - flowering, pollination and fruit set - use of growth regulators, maturity indices and harvest - post harvest handling and storage
27. Kiwi - Composition and uses – origin and distribution – species and cultivars soil and climate requirements - propagation - main field preparation - spacing, planting density and cropping systems. Planting and after care - nutrients, water and weed management - training and pruning - flowering, pollination and fruit set - use of growth regulators, maturity indices and harvest - post harvest handling and storage
28. Persimmon - Composition and uses – origin and distribution – species and cultivars soil and climate requirements - propagation - main field preparation - spacing, planting density and cropping systems. Planting and after care - nutrients, water and weed management - training and pruning - flowering, pollination and fruit set - use of growth regulators, maturity indices and harvest - post harvest handling and storage

29. Pistachio nut - Composition and uses – origin and distribution – species and cultivars soil and climate requirements - propagation - main field preparation - spacing, planting density and cropping systems. Planting and after care - nutrients, water and weed management - training and pruning - flowering, pollination and fruit set - use of growth regulators, maturity indices and harvest - post harvest handling and storage
30. Macadamia nut - Composition and uses – origin and distribution – species and cultivars soil and climate requirements - propagation - main field preparation - spacing, planting density and cropping systems. Planting and after care - nutrients, water and weed management - training and pruning - flowering, pollination and fruit set - use of growth regulators, maturity indices and harvest - post harvest handling and storage
31. Almond - Composition and uses – origin and distribution – species and cultivars soil and climate requirements - propagation - main field preparation - spacing, planting density and cropping systems. Planting and after care - nutrients, water and weed management - training and pruning - flowering, pollination and fruit set - use of growth regulators, maturity indices and harvest - post harvest handling and storage
32. Walnut - Composition and uses – origin and distribution – species and cultivars soil and climate requirements - propagation - main field preparation - spacing, planting density and cropping systems. Planting and after care - nutrients, water and weed management - training and pruning - flowering, pollination and fruit set - use of growth regulators, maturity indices and harvest - post harvest handling and storage
33. Pecan Nut - Composition and uses – origin and distribution – species and cultivars soil and climate requirements - propagation - main field preparation - spacing, planting density and cropping systems. Planting and after care - nutrients, water and weed management - training and pruning - flowering, pollination and fruit set - use of growth regulators, maturity indices and harvest - post harvest handling and storage

34. Chestnut and hazel Nut - Composition and uses - origin and distribution - species and cultivars soil and climate requirements - propagation - main field preparation - spacing, planting density and cropping systems. Planting and after care - nutrients, water and weed management - training and pruning - flowering, pollination and fruit set - use of growth regulators, maturity indices and harvest - post harvest handling and storage - production constraints of nuts.

Practical schedule

1. Hill banana - description, pre treatment of suckers - intercultural operations viz., de suckering and clump management
2. Description of mandarin, pummelo and grape fruit, budding and training practices
3. Visit to sub-tropical fruit zones and identification of sub-tropical varieties
4. Grape varieties, propagation methods and use of growth regulators
5. Training and pruning practices in grapes
6. Identification of physiological disorders and remedies in grapes, mandarin, pummelo and grape fruit
7. Identification and description of varieties of avocado, litchi and passion fruit
8. Study of varieties, propagation, propagation, planting systems and growth regulation in pine apple
9. Description of varieties and propagation methods of mangosteen, loquat and carambola
10. Visit to temperate orchards and identification of temperate fruit varieties
11. Description of apple and pear varieties
12. Study of propagation and growth regulation of apple and pear
13. Description of plum and peach varieties
14. Study of propagation and growth regulation of plum and peach
15. Identification and description of temperate nut crops
16. Study of maturity indices in major sub tropical and temperate fruit crops
17. Practical Examination

Text Books

1. Bose, T. K. S. K. Mitra, and D. S. Rathore. 1998. Temperate Fruits - Nayaprakash, Calcutta
2. Bose, T. K. 1996. Fruits of India - Tropical and sub - tropical. Nayaprakash, Calcutta
3. Bose, T.K., S.K. Mitra and D. Sanyal 2001, Fruits : Tropical and Subtropical (2 volumes) Naya Udyog, Calcutta.
4. Bose, T.K., S.K.Mitra, A.A. Farooqi and M.K. Sadhu (Eds) 1999. Tropical Horticulture Vol.1. Naya Prokash, Calcutta.
5. Chadha, K.L. 2001. Handbook of Horticulture. ICAR, Delhi
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2. Pal, J.S. 1997. Fruit Growing. Kalyani Publishers, New Delhi.
3. Sadhu, M.K. and P.K. Chattopadhyay.2001. Introductory Fruit Crops. Naya Prokash, Calcutta.
4. Singh, S.P. 1995. Commercial Fruits. Kalyani Publishers, Ludhiana

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- ❖ www.hort.purdue.edu/newcrop/morton
- ❖ www.bouquetoffruits.com
- ❖ <http://www.ishs.org>

Journals

- Punjab Hort. J.
- J. of Ameri. Soc. of Hort. Sci.
- Acta Hort.
- South Indian Horticulture

PSM 201 Production Technology of Spices and Plantation Crops 2 + 1

Theory

Unit I Spices I

Scope and Importance - History - Indian and world scenario - Classification -Institutions involved in research and development - Export potential.

Crops: Black pepper, Cardamom, Turmeric, Ginger, Coriander, Fenugreek and Fennel,

Origin and distribution - Area and production - Composition and uses - soil and climate -varieties - propagation - planting - nutrient management - irrigation - weed control - mulching - intercropping - training and pruning practices - role of growth regulators - shade regulation - harvest and yield -GAP- Organic production -post harvest technologies - storage - value added products - methods of extraction of essential oil - oleoresin - precision farming -constraints.

Unit II Spices II

Crops: Clove, Nutmeg, Cinnamon and Tamarind

Origin and distribution - Area and production - Composition and uses - Soil and climate -varieties - propagation - planting - irrigation - nutrition management - weed control - mulching - mixed cropping, intercropping, multi-tier cropping - cover cropping - training and pruning practices - role of growth regulators- harvest and yield- GAP -Organic production of Tree Spices- post harvest technologies - processing - storage - value added products -organic production - constraints

Unit III Plantation crops I

Crops: Coffee, Tea, Rubber, Cashew

Origin and distribution -cultivars- area and production- composition and uses - soil and climate - varieties - propagation- seed and vegetative propagation - planting systems and method - multi-tier cropping systems - gap filling - systems of cultivation - mulching - cover cropping - shade regulation - flowering physiology - weed and water management - training, pruning and handling - Nutrition management - foliar feeding - role of plant growth regulators - soil management - liming- tipping- top working and other agricultural practices - physiological disorders

- harvest and yield -GAP-Organic production -post harvest handling, processing - value addition and by-products utilization - packing and marketing and constraints.

Unit IV Plantation crops II

Crops: Coconut, Arecanut, Oil palm, Cocoa and Palmyrah

Origin and distribution - cultivars - composition and uses - soil and climate - varieties - propagation -- planting systems and method - Multi tier cropping systems - gap filling - systems of cultivation mulching - weed and water management - Nutrition - harvest and yield- GAP- Organic production - post harvest handling, processing - value addition and by-products utilization - packaging and marketing and constraints.

Unit V Other spices and plantation crops

Crops: Cumin, Ajowan, All Spice, Kokum, Paprika, Vanilla, Curry leaf, Thyme, Celery, Parsley, Betel vine

Origin and distribution - Area and production - Composition and uses - Soil and climate - varieties - seed/vegetative propagation - planting systems and methods - irrigation - nutrition management- harvesting and yield- GAP-Organic production - post harvest technologies - processing - value addition - storage

Practical

Spices

Identification of varieties - practices in propagation - main field preparation and lay out -seed treatment- sowing / planting - nutrient management - use of herbicides and plant growth regulators - training and pruning - study of maturity indices - harvesting - curing - visit to processing, essential oil and oleoresin extraction units - visit to spices research stations- Visit to private spice gardens raised under conventional system and precision farming system, organic spice gardens and industries - working out cost economics

Plantation crops - Raising nursery - propagation - softwood grafting in cashew - mother palm and seed nut selection of coconut and arecanut - nursery preparation - sowing seed nuts - nursery management - practice in manuring and root feeding in coconut - drip and fertigation - nutrient schedule - cropping systems and

intercropping in coconut, arecanut and palmyrah- visit to coffee board - study of varieties - nursery management - intercropping and top working - harvesting and processing in coffee - implements used for harvest - visit to plantation with multi tier cropping systems, High Density Planting systems, visit to cashew, rubber and cocoa fields - visit to private plantations - working out cost economics

Lecture schedule

1. Scope and importance of spices - History and development - Indian and world scenario of spice production - export and import of spices
2. Spice development in India -Institutions involved in spices research and development.
3. Black pepper - importance - origin and distribution - area and production - composition and uses - varieties - soil and climate - propagation - planting - nutrient, water and weed management - mulching - cropping systems - multi-tier system - shade regulation - role of growth regulators - maturity indices - harvest and yield - processing - constraints.
4. Cardamom - importance - origin and distribution - area and production - composition and uses - varieties - soil and climate - propagation - planting - nutrient, water and weed management - cropping systems - shade regulation - role of growth regulators - harvest and yield - grading - processing - constraints.
5. Turmeric - importance - origin and distribution - area and production - composition and uses - varieties - soil and climate - propagation - planting - nutrient, water and weed management - cropping systems - intercropping - harvest and yield - storage - processing - constraints.
6. Ginger - importance- origin and distribution-area and production-composition and uses- varieties - soil and climate - propagation - planting - nutrient, water and weed management- cropping systems - intercropping - harvest and yield - storage - processing - constraints.
7. Coriander - importance - origin and distribution - area and production - composition and uses - varieties - soil and climate - propagation -sowing - nutrient, water and weed management - cropping systems - maturity indices -

harvest and yield- processing – storage – methods of extraction of essential oil - constraints.

8. Fenugreek and Fennel - importance-origin and distribution-area and production-composition and uses- varieties - soil and climate - propagation - planting - nutrient, water and weed management – cropping systems – harvest and yield - processing - constraints.
9. Clove and Nutmeg – importance - origin and distribution - area and production - composition and uses – varieties - soil and climate - propagation - planting - nutrient, water and weed management – mixed cropping system – harvest and yield - processing - constraints.
10. Cinnamon and Tamarind - importance-origin and distribution-area and production-composition and uses- varieties - soil and climate - propagation - planting - nutrient, water and weed management – cropping systems – harvest and yield-processing - constraints.
11. History and development – scope and importance – Indian and world scenario of plantation crops.
12. Area and production of plantation crops – export and import potentials – role in national and state economy - institutions involved in research and development
13. Coffee - importance – soil and climate – varieties – composition and uses – propagation - Nursery management - planting of coffee – nutrient, water and weed management – mulching- Mixed and inter cropping- shade management – training and pruning – role of growth regulators – nutritional disorders – harvest and yield – pulping – grading - organic production - constraints.
14. Tea - importance – soil and climate -varieties - propagation – nursery management - Planting of tea – nutrient, water and weed management – mulching – cropping systems- mixed and inter cropping – shade regulation – training and pruning – role of growth regulators – nutritional disorders – harvest and yield - processing- organic production-constraints.

15. Rubber - importance - soil and climate - varieties -- propagation - planting - nutrient, water and weed management - cropping systems - Tapping - harvest and yield - processing - organic production - constraints.
16. Cashew - importance - soil and climate - varieties - propagation - planting - nutrient, water and weed management - cropping systems - training and pruning - nutritional disorders - harvest and yield - processing - constraints.
17. Mid semester examination
18. Coconut - importance - soil and climate - varieties - propagation - planting - nutrient, water and weed management - cropping systems - intercropping - multi-tier cropping - nutritional disorders - harvest and yield - storage processing - constraints.
19. Arecanut - importance - soil and climate - varieties - propagation - planting - nutrient, water and weed management - cropping systems - intercropping - multi-tier cropping - nutritional disorders - harvest and yield - processing - constraints.
20. Oil palm -importance - soil and climate - varieties - propagation - planting - nutrient, water and weed management - mulching -harvest and yield - processing - constraints.
21. Palmyrah - importance - soil and climate - varieties - propagation - planting - nutrient, water and weed management - Pruning - Tapping - harvest and yield - processing- economics of cultivation - organic production - constraints.
22. Cocoa - importance - soil and climate - varieties - propagation - planting - training - nutrient, water and weed management - cropping systems - pruning - shade regulation - harvest and yield - constraints.
23. Cumin and Ajowan - importance - origin and distribution - area and production -composition and uses - varieties - soil and climate - sowing - nutrient, water and weed management - harvest and yield - processing - storage - value added products - methods of extraction of essential oil - constraints.
24. All spice and Kokum - importance-origin and distribution-area and production-composition and uses- varieties - soil and climate - propagation - planting -

- nutrient, water and weed management - cropping systems - maturity indices - harvest and yield - processing - constraints.
25. Paprika - importance - origin and distribution - area and production - composition and uses - varieties - soil and climate - sowing - nutrient, water and weed management - maturity indices - harvest and yield - processing- storage - constraints.
 26. Vanilla - importance - origin and distribution - area and production - composition and use - varieties - soil and climate - propagation - nutrient, water and weed management - harvest and yield - processing / curing - value added products -constraints.
 27. Curry leaf - importance - origin and distribution - area and production - composition and uses - varieties - soil and climate - propagation - Planting - nutrient, water and weed management - harvest and yield - value added products - constraints.
 28. Thyme, Celery and Parsely - importance - origin and distribution - area and production - composition and uses- varieties - soil and climate - sowing - nutrient, water and weed management - harvest and yield -constraints.
 29. Betel vine - importance - origin and distribution - area and production - composition and uses - varieties - soil and climate - propagation - land preparation and planting - nutrient, water and weed management - harvest and yield - grading - packaging and storage -constraints.
 30. GAP in Spices and Plantation Crops
 31. Organic Production of Spices and Plantation Crops
 32. Precession farming in Turmeric and Coriander
 33. IPR for Spices and Plantation Crops
 34. Final theory examination.

Practical schedule

1. Identification of major spices and plantation crops varieties - Rapid multiplication technique and nursery management in black pepper.

2. Seed spices - main field preparation - manuring - use of herbicides- seed treatment - sowing and irrigation.
3. Turmeric and Ginger - main field preparation - rhizome selection - treatment and planting - nutrient, water and weed management - use of PGR - maturity indices, harvesting and curing.
4. Tamarind, Curry leaf - practices in propagation - nursery preparation and maintenance - planting - nutrient, water and weed management - use of PGR - maturity indices and harvest .
5. Tree spices - Practices in propagation - cropping - harvest. Visit to Spices Gardens
6. Coffee - study of varieties - nursery management- training and pruning - intercropping - harvesting and processing in coffee. Visit to Coffee board, Thandikudi.
7. Coconut and Arecanut - mother palm and seed nut selection - preparation of nursery - sowing of seed nuts and nursery management.
8. Coconut - practice in manuring- study of nutritional disorders and correction - root feeding of coconut tonic and implements used for harvesting.
9. Harvesting, curing and cleaning of seed spices. Working out cost economics of spice crops.
10. Cashew - raising nursery and practicing grafting techniques
11. Visit to HRS Pechiparai and rubber plantations - identification of spice varieties - tapping of latex - processing of rubber.
12. Visit to cashew, cocoa farmers field and cashew processing unit
13. Visit to spices processing, essential oil and oleoresin extraction units
14. Extraction of essential oil and oleoresin in spices
15. Visit to spices board and e- auction center for cardamom.
16. Working out cost economics of major spice crops
17. Practical examination

References

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2. Nybe, E.V., N. Miniraj and K.V. Peter. 2007. Spices - Horticulture Science Series Vol. 5. New India Publishing Agency, New Delhi.
3. Alice Kurian and K.V. Peter. 2007. Commercial Crops Technology, Horticultural Sciences Series Vol-8. ed. by K.V. Peter, New India Publishing Agency, New Delhi.
4. Parthasarathy, V.A., P.K. Chattopadhyay and T.K. Bose 2006. Plantation Crops. Vol I and II. Parthasankar basu Naya Udyog, Kolkata.
5. Ravindran, P.N., K.N. Shiva, Johny. A. Kallapurackal and K. Nirmalbabu. 2006. Advances in Spices Research. Agrobios, India.
6. Shanmugavelu, K.G., N. Kumar and K.V. Peter 2005. Production Technology of Spices and Plantation Crops. Agrobios (India), Jodhpur.
7. Tiwari, R.S and Ankur Agarwal 2004. Production technology of spices. International book distributing Co., Lucknow.
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9. Pruthi, J.S, 2001. Minor Spices and Condiments. Crop management and Postharvest technology. ICAR publication, New Delhi.
10. Sanjeev Agarwal, E.V. Divakara Sastry and R.K. Sahrama. 2001. Seed Spices: Production, quality and export. Pointer Publishers, Jaipur.
11. Pruthi, J.S, 1998. Major Spices of India. Crop management and Postharvest technology. ICAR publication, New Delhi.
12. Chadha, K.L and P. Rethinam (ed.) 1994. Advances in Horticulture. Vol. 10 & 11. Spices and Plantation Crops.
13. Kumar, N, Md. Abdul Khader, P. Rangasamy, and I. Irulappan, 1994. Spices, Plantation Crops, Medicinal and Aromatic plants, Rajalakshmi Publications, Nagercoil
14. Purselove, J. W., E.G. Brown, C. L. Green and S. R. J. Robbins. 1991. Spices, Vol. I and II. Longman Scientific and Technical, England.

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- <http://www.cabi.org/>

- www.aicc.gov.ap
- <http://www.spices.rec.in>
- www.iisr.org
- www.kissankerala.net
- www.coconutboard.nic.in

Journals

1. Indian J. Arecanut, Spices and Medicinal Plants
2. J. Plantation Crops
3. Spice India
4. Indian Journal of Horticulture
5. Indian Journal of Agriculture Sciences
6. Journal of Spices and Aromatic Crops.

HOR 204 Study Tour - I 0+1

Visit to places of commercial cultivation of fruits and vegetables in tropical temperate and sub-tropical zones of Tamil Nadu – study of cropping systems- varieties – constraints in production – marketing – economic analysis – case studies.

Practical schedule

1. Visit to SHF, Srivilliputhur.
2. Visit to SHF, Courtalam for sub-tropical fruits.
3. Visit to HRS, Pechiparai for high rainfall zone crops.
4. Visit to AC&RI, Killikulam for tropical fruits and vegetables.
5. Visit to ARS, Paramakudi and Ramnad for tropical fruits and vegetables.
6. Visit to RRS, Aruppukottai and AC&RI, Madurai for arid zone fruits.
7. Visit to HRS, Kodaikanal and Thadiyankudisai for sub-tropical and temperate fruits and vegetables.

ABT 201 Principles of Biotechnology 1 + 1

Aim

- ❖ To impart knowledge on basic principles of tissue culture, molecular biology and genetic engineering.

Theory

Unit I Basics in plant tissue culture

History and concepts, Nutritional requirements, morphogenesis-organogenesis and embryogenesis, tissue culture techniques-callus and suspension cultures, shoot tip and meristem tip culture, anther and pollen culture, ovule and embryo culture, endosperm culture and protoplast culture.

Unit II Basics in molecular biology

Structure of nucleic acids-an overview, central dogma of life - DNA replication, transcription and translation, fine structure of a gene, regulation of gene expression, polymerase chain reaction, blotting techniques, DNA sequencing methods.

Unit III Recombinant DNA technology

Recombinant DNA, vectors: plasmids, phagemids, cosmids, BAC and YAC, DNA manipulation enzymes - polymerase, restriction endonucleases and ligases - construction of recombinant DNA molecules - bacterial transformation.

Unit IV Genetic transformation

Design of plant transformation vectors-selectable markers, reporter genes, promoters. Methods of gene transfer-direct: microinjection, electroporation, particle bombardment, indirect: *Agrobacterium* mediated gene transfer.

Unit V Immunotechnology

Antigens, antibodies and their structure, antigen-antibody interaction, monoclonal and polyclonal antibodies.

Practical

Laboratory organization -sterilization techniques-preparation of MS medium - inoculation of explants - shoot tip and embryo culture-extraction of plasmid and plant genomic DNA. DNA quantification -quality assessment. Electrophoresis of DNA. Restriction digestion, ligation, competent cell preparation, bacterial transformation, blue

white colony screening. *Agrobacterium* mediated transformation and confirmation of genetic transformants- PCR. Antigen-antibody interaction - Ouchterlony double immunodiffusion.

Lecture schedule

1. History and concepts in plant tissue culture- totipotency, dedifferentiation and redifferentiation
2. Nutritional requirements for plant tissue culture
3. Morphogenesis- direct and indirect organogenesis and embryogenesis
4. An overview about different tissue culture techniques -Callus and suspension cultures, shoot tip and meristem tip culture, anther and pollen culture
5. Ovule and embryo culture, endosperm culture and protoplast culture
6. Structure of nucleic acids
7. Central dogma of life – replication, transcription and translation.
8. Fine structure of gene and prokaryotic gene regulation - Lac operon
9. Mid semester examination
10. Polymerase Chain Reaction, blotting techniques and DNA sequencing methods
11. Recombinant DNA, vectors - plasmids, phagemids, cosmids, BAC, YAC
12. DNA manipulation enzymes- polymerase, restriction endonucleases and ligases
13. Construction of recombinant DNA molecules and bacterial transformation
14. Design of plant transformation vectors - selectable markers and reporter genes, promoters.
15. Methods of gene transfer- microinjection, electroporation, particle bombardment, *Agrobacterium* mediated methods
16. Antigens, antibodies and their structure, antigen-antibody interaction
17. Monoclonal, polyclonal antibodies and hybridoma technology

Practical schedule

1. Laboratory organization and sterilization techniques
2. Preparation of MS medium
3. Inoculation of explant -shoot tip

4. Embryo culture
5. Preparation of reagents for plasmid and DNA isolation
6. Isolation of plasmid DNA from bacteria
7. Extraction of genomic DNA from leaf tissue
8. Quantification of DNA by spectrophotometer
9. Genomic DNA visualization using agarose gel electrophoresis
10. Restriction digestion and ligation
11. Competent cell preparation
12. Bacterial transformation and blue white colony screening
13. Demonstration of *Agrobacterium* mediated transformation method
14. Amplification of DNA using thermocycler
15. Analysis of PCR products in agarose gel electrophoresis
16. Ouchterlony double immunodiffusion
17. Practical examination.

Outcome

Students will acquire both basic knowledge and hands on experience in plant tissue culture, molecular biology and genetic engineering

Text books

1. Bhojwani, S.S. and Razdan, M.K. 2006. Plant Tissue Culture Studies – Theory and Practice. Elsevier Publication.
2. Gupta, P.K. 2005. Elements of Biotechnology. Rastogi Publication, India.
3. Malacinski, M. and D. Friefelder. 2003. Essentials of molecular biology. IV Ed. Jones and Bartlett publishers, Boston
4. Singh, B.D. 2004. Frontier areas in Biotechnology. Kalyani Publications, New Delhi.

Further reading

1. Chawla, H.S. 2005. Introduction to plant biotechnoogy, India.
2. Lehninger. 2004. Principles of Biochemistry. CBS Publications, New Delhi.
3. Brown, T.A. 2006. Gene cloning - An introduction. V Ed. Chapman Hill, U.K.

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SST 212 Seed Production Technology of Horticultural Crops 1 + 1

Theory

Unit I Introduction to seed production

Seed production - importance - seed and crop production - variety and hybrid seed production - factors influencing seed production. - seed production planning

Unit II Seed production in tropical vegetables

Seed production in tomato, brinjal and chilli (solanaceae) - bhendi - malvaceae) and cowpea, lablab and cluster bean (fabaceae) - ash gourd, bitter gourd, ribbed gourd, snake gourd and bottle gourd (cucurbitaceae) - onion (alliaceae), amaranthus (amaranthaceae) moringa (oleiferae) and yam (amaryllidaceae)

Unit III Seed production in temperate vegetables

Seed production in cabbage, cauliflower (cruciferae) - carrot (umbelliferae) and beetroot (chenopodiaceae) - peas and french beans (fabaceae) - potato (solanaceae)

Unit IV Seed production in annual flowers and medicinal plants

Seed production - flower crops - marigold, petunia and cock's comb - medicinal plants -ashwagandha , periwinkle , senna and phyllanthus

Unit V Seed handling in spices, plantation and fruits crops

Seed production - coriander and fenugreek -seed handling in plantation crops- cocoa, cashew, coffee and coconut -fruit crops- aonla and jamun, difference between Orthodox and recalcitrant seeds **Lecture schedule**

1. Seed production - importance - seed and crop production - variety and hybrid seed production and factors influencing seed production
2. Seed production planning for horticultural crops (variety and hybrid)
3. Seed production in tomato, brinjal and chilli (solanaceae)
4. Seed production in bhendi (malavaceae) cowpea, lablab and cluster bean (fabaceae)
5. Seed production in ash gourd, bitter gourd, ribbed gourd, snake gourd and bottle gourd (cucurbitaceae)

6. Seed production in onion (alliaceae), amaranthus (amaranthaceae) moringa (oleiferae) and yam (amaryllidaceae)
7. Seed production in cabbage, cauliflower (cruciferae)
8. Seed production in carrot(umbelliferae) and beetroot (chenopodiaceae)
9. Mid semester examination
10. Seed production in peas and french beans (fabaceae)
11. Seed production in potato (solanaceae)
12. Seed production in marigold, petunia and cock's comb
13. Seed production in ashwagantha , periwinkle , Senna and phyllanthus
14. Seed production in coriander and fenugreek
15. Seed production in cocoa ,cashew ,coffee, and coconut
16. Seed handling techniques in aonla and jamun
17. Orthodox and recalcitrant seed behavior in horticultural crops

Practical

Planning seed production - identification of off types in vegetables seed production plot - - emasculation and dusting techniques (tomato/ brinjal /okra) - different seed extraction methods - pre- germinated seed and ethrel spray in cucurbits - visit to vegetable seed industry - dormancy breaking treatments - visit to seed production plots of temperate vegetables (ICHS, Ooty) - seed grading techniques - seed production standards for vegetative propagules - visit to seed potato production plots - germination enhancement techniques - tropical vegetables - temperate vegetables - medicinal crops - flower crops - pre-storage seed treatment and packing materials - seed storage structures and godown maintenance - recalcitrant seed storage.

Practical schedule

1. Planning seed production
2. Identification of off types in vegetables seed production plot
3. Practising emasculation and dusting techniques (tomato/ brinjal /okra)
4. Practising different seed extraction methods
5. Study on pre germinated seed and ethrel spray in cucurbits
6. Visit to vegetable seed industry
7. Practising dormancy breaking treatments
8. Visit to seed production plots of temperate vegetables (ICHS, Ooty)
9. Practising seed grading techniques
10. Study on seed production standards for vegetative propagules
11. Visit to seed potato production plots
12. Germination enhancement techniques in tropical and temperate vegetables
13. Germination enhancement techniques in flower and medicinal crops
14. Practising pre storage seed treatment and packing materials
15. Study on seed storage structures and maintenance
16. Study on recalcitrant seed storage
17. Final practical examination

References

Text book

- ❖ P.S.Arya. 1995. Vegetable seed production principles. Kalyani Publishers. New Delhi.
- ❖ S.P.Singh. 1999. Seed production of commercial vegetables. Kalyani Publishers. New Delhi.
- ❖ Raymond A.T. George. 1985. Vegetable seed production. Longman and London, New York.

Further reading

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2. R.Umarani, R.Jerlin, N.Natarajan, P.Masilamani and A.S.Ponnuswamy (2006) Experimental Seed Science and Technology, Agrobios, Jodhpur.
3. T.S.Verma and S.C.Sharma (2000) Producing Seeds of Biennial Vegetables in Temperate Regions. ICAR, New Delhi.

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Journals

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2. Seed Research
3. Journal of Asian Horticulture
4. Indian Horticulture
5. Agriculture and industry survey
6. Seed Science and Technology
7. Journal of Seed Science Research

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www.apsa.org

www.seedassociationofindia.com

www.apaseed.com

www.apaseed.org

SER 201 Sericulture Technology 1 + 1

Theory

Unit I

Importance and history of sericulture - organizations involved in sericulture - silkworm types- mulberry cultivation - varieties - morphology of mulberry plant - identification of popular mulberry genotypes - methods of propagation - nursery and main field preparation - planting methods - identification of nutrient deficiency symptoms - identification of weeds - herbicide application methods - irrigation methods and management practices

Unit II

Pruning and harvesting - pests, diseases and nematodes of mulberry and their management.

Unit III

Mulberry silkworm - origin - classification based on voltinism, moultinism, geographical distribution and genetic nature - pure races -multivoltine, bivoltine - cross breeds - bivoltine hybrids - double hybrids - morphology and biology of silkworm - mouth parts of larva -sex limited characters - anatomy and physiology of digestive and excretory systems of larva - structure and function of silk glands.

Unit IV

Rearing house - types - disinfection - room and bed disinfectants - egg incubation methods - chawki rearing - feeding, cleaning and spacing - rearing of late age worms - feeding, cleaning, spacing and moulting care different stages - spinning - mountages - harvesting. Visit to sericulture farms - interaction with sericulturists- visit to grainage and cocoon market- economics of mulberry silkworm rearing.

Unit V

Pests and diseases of silkworm and their management – post cocoon technology – stifling to weaving. Byproducts of sericulture - non -mulberry silkworms - eri, tasar and muga silkworms.

Lecture schedule

1. Importance of sericulture - History of sericulture - silk road - Organizations in sericulture industry - Mulberry - origin - species - Morphology of mulberry plant - importance of different morphological characters influencing leaf yield.
2. Ecological requirements for mulberry cultivation - soil type - mulberry varieties - Methods of propagation - merits and demerits - selection of semi hard wood cuttings - Nursery preparation - Main field preparation - methods of planting - pit, row, paired row and Kolar system of planting - merits and demerits.
3. Nutritional requirements - organic, inorganic and biofertilizers - Intercropping - Water management - Types of weeds and their management.
4. Pruning methods - bottom, middle, Kolar or strip system of pruning - Methods of harvesting - preservation of leaves.
5. Pests of mulberry - foliage feeders - sucking insects - subterranean insects - management of pests.
6. Diseases of mulberry - foliar diseases - soil borne pathogens - Nematodes - management of diseases and nematodes.
7. Types of silkworm - Mulberry silkworm - origin - classification based on voltinism, moultnism, geographical distribution and genetic nature - Characters of multivoltine races, bivoltine races, cross breeds and bivoltine hybrids - double hybrids- suitability for rearing in different seasons.
8. Morphology and biology of silkworm - sexual dimorphism in immature and adult stages - silkworm genetics - chromosome number - sex limited characters in egg, larva and cocoon for grainage use.
9. Mid semester examination
10. Anatomy of digestive system - physiology of digestion and excretion - silk glands - silk synthesis - physico chemical properties of silk.

11. Rearing house - types - Hygienic rearing - Methods of disinfection - disinfectants - Egg transportation and incubation methods - black boxing.
12. Environmental requirements for different stages of silkworm - Chawki rearing - Concept of Community Chawki Rearing Centres (CRC) - brushing - spacing - feeding - cleaning - selection of leaves for feeding - care during feeding, moulting, mounting and bed cleaning.
13. Rearing of late age worms - different methods - floor, shelf and shoot feeding - cleaning - spacing - mounting - Different mountages - merits and demerits - spinning - harvesting of cocoons.
14. Pests of silkworm - uzifly - dermestid beetle - management practices.
15. Diseases of silkworm - pebrine - flacherie - grasserie - muscardine - pathological symptoms - management practices.
16. Post cocoon technology - selection of cocoons - methods of stifling - cooking for different races - Reeling devices - charka - cottage basin - multi end reeling machine - automatic reeling centres - advantages - re reeling - twisting - degumming - dyeing - weaving - SMOI - By product utilization.- Seribiotechnology
17. Non - mulberry silkworm - Eri, Tasar and Muga Silkworms - food plants - rearing methods.

Practical schedule

1. Morphology of mulberry plant - description - distinguishing characters of promising mulberry genotypes. Nursery bed preparation - care in selection of planting materials - Biofertilizer treatment in nursery.
2. Main field preparation - methods of planting, methods of irrigation - Identification of nutrient deficiency symptoms - corrective measures.
3. Identification of weeds - Herbicide application method. Pruning methods - leaf / shoot harvest- preservation of leaves.
4. Identification of pests of mulberry and damage symptoms.
5. Identification of symptoms of diseases and nematodes of mulberry.

6. Morphology of silkworm - different stages - Identification of races by cocoon shape, colour and larval marking -Dissection of mouth parts and silk glands.
7. Rearing house and appliances - Methods of disinfection. Incubation of eggs - methods - Chawki rearing - brushing - feeding.
8. Silkworm rearing - shelf and shoot rearing - skill involved in brushing - feeding- moulting care - bed cleaning - spacing - mountages -- spinning and cocoon harvest.
9. Identification of pests and diseases of silkworm - damage - symptoms - Mass multiplication of hyperparasitoid.
10. Integrated Farm System with Sericulture in Integrated Farming system - Mechanization in sericulture.
11. Visit to grainage and cocoon market - observing the activities involved in selection of parent races - pairing - depairing - egg collection - acid treatment- cold storage - mother moth testing - fixing up of cocoon price - auction procedures.
12. Visit to silk reeling centre - observing various processes -stifling - cooking - reeling - rereeling - winding - rewinding - bleaching - dyeing - weaving - silk grades - Byproducts from reeling units.
13. Eri silkworm - morphology - food plants - methods of rearing - methods of spinning -Tasar silkworm - morphology - food plants - early and late instar larval rearing.
14. Economics of silkworm rearing.
15. Visit to CSR&TI, Mysore; CSB, CSTRI, SSTL and SBRL Institutes at Bangalore
16. Visit to sericulture farms - Interaction with sericulturists.
17. Final Practical Examination.

Assignment

1. Rearing of 50 larvae of silkworm from larva to cocoon by each student
2. Group assignments and individual assignments on various aspects of Sericulture.

Outcome

1. The course gives an exposure to the students on mulberry cultivation, silkworm rearing, post cocoon technologies, non-mulberry sericulture and value addition of sericulture by products
2. Hands on training of sericultural technologies would strengthen the knowledge base of the students for establishing commercial sericultural enterprise.

References

1. CSB. 2003. Seri Business Manual- Vol. III Farm & Industry Sectors, Central Silk Board, Bangalore.
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3. Jolly, M.S., S.K. Sen, T.N. Sonwalkar and G.K. Prasad 1980. Non – mulberry Silks. FAO Agicultural Services Bulletin 29. Food and Agriculture Organisation of the United Nations, Rome,178 p.
4. Krishnaswami,S., M.N. Narasimhanna, S.K Suryanarayan and S.Kumararaj. 1978. Seiculture Manual 2 and 3 – Silkworm Rearing . FAO Agricultural Services Bulletin 15/2. Food and Agriculture Organisation of the United Nations, Rome, 131 p.
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- www.silkbase.org
- www.papilo.ab.a.u.tokyo.ac.jp

Journals

- Indian Journal of Sericulture – published from CSR&TI, Mysore
- Indian Silk – published from Central Silk Board, Bangalore

ARM 201 Fundamentals of Agribusiness Management 1 + 1

Aim

- ❖ To expose the students to the structure and scope of agribusiness
- ❖ To make the students familiar with management functions
- ❖ To expose the students on the functional areas of agribusiness management and their applications

Theory

Unit I Agribusiness

1. Agribusiness – definition – structure of agribusiness (input, farm and product sectors)
2. Agribusiness management - special features of agribusiness - importance of agribusiness in Indian economy.

Unit II Management

3. Management – definition and importance – management functions – nature
4. Management - skills, levels and functional areas of management
5. Forms of business organisation – sole proprietorship – partnership –private and public limited, cooperatives, MNCs

Unit III Management functions I

6. Planning – definition – types of plans (purpose or mission, goals or objectives, strategies, policies, procedures, rules, programmes, budget)
7. Steps in planning – characteristics of sound plan. Objectives – MBO
8. Organizing – principles of organizing – concept of departmentation - delegation-centralization – decentralization
9. Mid semester examination

Unit IV Management functions II

10. Staffing – concept – human resource planning – process.
11. Directing – concept – principles – techniques, supervision.
12. Motivation – concept - maslow's "Need Hierarchy Theory – types – techniques.

13. Communication – definition and process – models – types – barriers.

14. Leadership – definition – styles – difference between leadership and management

Unit V Management functions III

15. Controlling – concept - steps – types – importance – process.

16. Project- definition- project cycle- identification- sources of projects

17. Formulation- issues and budgeting the project, appraisal

Practical schedule

1. Exercise on operations management in agribusiness firms
2. Logistics management
3. Inventory management - inventory types, costs and economic order quantity
4. Procurement systems and vendor rating methods
5. ABC analysis
6. Exercise on supply chain management
7. Market research and segmentation
8. Demand forecasting methods
9. Visit to agri hi-tech bank branch / commercial banks/RRB/ NABARD
10. Exercises on human resource planning and management
11. Farmers survey – buying behaviour of agricultural inputs
12. Market promotion measures
13. Pricing methods
14. Assessing and acquiring finance for agribusiness firms
15. Procedure and constraints in establishing agro based industries
16. New agribusiness venture proposal preparation
17. Final practical examination

Outcome

1. The student will be familiar with the important activities and scope of agribusiness and will be able to understand the essence of management functions.

2. The Students would gain knowledge in the different functional areas of agribusiness namely Production, Human Resource Management, Marketing, Finance and project management.

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2. Richard, B Chase, Nicholas J., Acquilano and F.Robert Jacobs, 2007, 'Production and Operations Management - Manufacturing and service, Tata Mc Graw Hill Publishing Company Limited, New Delhi.
3. Aswathappa, K, Human Resource Management: Text and Cases, Tata McGraw-Hill Pub. Co. Ltd. New Delhi, 5th Edition, 2008.
4. Philip Kotler, Marketing Management, Pearson Education, India, 2003.
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6. R.K.Sapru, Project Management, Excel Books, New Delhi, 1997.

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STA 201 Applied Statistics 1 + 1

Aim

To provide a good knowledge of basic statistical techniques for the analysis and interpretation of data including descriptive statistical measures, tests of significance and applications of various design of experiments.

Theory

Unit I Descriptive statistics

Measures of central tendency: arithmetic mean, geometric mean, harmonic mean, median and mode – properties – Measures of dispersion: range, standard deviation, variance and coefficient of variation – properties. computation of the above measures for raw data.

Unit II Probability distributions and sampling theory

Distributions – theoretical distribution – binomial, poisson and normal distributions – definitions and properties.

Sampling theory – population – sample – parameter and statistic – sampling vs complete enumeration – deliberate sampling – simple random sampling – selection using random numbers.

Unit III Tests of significance

Tests of significance – large sample test – single mean and difference between two means – single proportion and difference between two proportions. Small sample tests – t-test for testing the significance of single mean – independent t-test (equal variances only) and paired t test – chi square test for testing the association of a 2 x 2 contingency table.

Unit IV Correlation and regression

Correlation – Karl Pearson's correlation coefficient – computation – properties of correlation coefficient.

Regression – simple linear regression – fitting of simple linear regression equation of y on x – properties of regression coefficient.

Unit V Analysis of variance and experimental designs

Analysis of variance (ANOVA) – assumptions – one way ANOVA – two way ANOVA.

Experimental designs – randomization, replication and local control – completely randomised design (CRD) (for equal replications) – randomised block design (RBD) – latin square design (LSD).

Practical

Measures of central tendency – calculation of arithmetic mean, geometric mean, harmonic mean, median and mode for raw data – Measures of dispersion – calculation of standard deviation and variance for raw data – computation of coefficient of variation (CV) – calculation of the above measures using MS Excel functions.

Probability distributions – simple problems in binomial, poisson and normal distribution – sampling theory – selection of simple random sample using random numbers.

Testing of hypothesis – large sample test – single mean and difference between two means – single proportion and difference between two proportions – small samples test – t-test for testing the significance of single mean – testing the significance of two means for independent samples (equal variance only) and paired t test – chi square test for testing the association of a 2 x 2 contingency table.

Correlation – computation of correlation coefficient – regression – fitting of simple linear regression equation – correlation and regression using MS Excel functions.

Experimental designs – analysis of completely randomised design (CRD) (for equal replications only), randomised block design (RBD) and latin square design (LSD) – analysis of CRD, RBD and LSD using software package (AGRES).

Lecture schedule

1. Introduction – definition of statistics – data – qualitative and quantitative classification – tabulation
2. Measures of Central Tendency – definition – mean, geometric mean, harmonic mean median and mode for raw data – properties
3. Measures of Dispersion – definition – range, standard deviation, variance and coefficient of variation for raw data – properties

4. Distributions - Binomial distribution and Poisson distribution
5. Normal distribution and standard normal distribution - definition - properties
6. Population - sample - sampling - sampling vs complete enumeration - parameter and statistic - need for sampling - deliberate sampling - probability sampling method - simple random sampling - selection using random numbers
7. Tests of significance - basic concepts - null and alternative hypothesis - level of significance - critical region - degrees of freedom - test statistic - types of errors - type I and type II error - standard error and its uses
8. Large samples test - single mean and difference between two means - single proportion and difference between two proportions
9. Mid semester examination
10. Small sample tests - t-test for single mean and difference between two means for equal variances - paired t test - chi square test for testing the association of a 2 x 2 contingency table
11. Correlation - meaning - assumptions - scatter diagram - types - positive and negative correlation - Karl Pearson's correlation coefficient - definition - computation and interpretation of correlation coefficient - properties of correlation coefficient - uses of correlation analysis
12. Regression - meaning - cause and effect - simple linear regression - regression coefficients - definition - fitting of simple linear regression equation y on x - properties of regression coefficient - uses of regression analysis.
13. Analysis of Variance - definition - assumptions - uses - one way and two way ANOVA
14. Experimental designs - basic concepts - experiment, experimental unit, treatment, block, experimental error - Principles of experimental design - randomization, replication, local control
15. Completely randomised design (CRD) - for equal replications only - randomization - analysis (one way analysis of variance)
16. Randomised block design (RBD) - randomization - analysis (two way analysis of

variance)

17. Latin square design (LSD) – randomization – analysis

Practical schedule

1. Computation of arithmetic mean, geometric mean, harmonic mean, median and mode for raw data
2. Computation of range, standard deviation, variance, coefficient of variance for raw data – calculation of the above measures using MS Excel functions
3. Simple problems in Binomial distribution and Poisson distribution
4. Simple problems in Normal distribution
5. Selection of sample using simple random sampling method
6. Large sample test – test for single proportion and difference between two proportions
7. Large sample test – test for single mean and difference between two means
8. Small samples test – t-test for single mean – t test for difference between two sample means (equal variances only)
9. Paired t-test
10. Chi square test for testing the association of a 2 x 2 contingency table
11. Computation of Karl Pearson's correlation coefficient
12. Fitting of simple linear regression equation y on x – correlation and regression using MS Excel functions
13. Analysis of Completely Randomised Design (CRD) – for equal replications only
14. Analysis of Randomised Block Design (RBD)
15. Analysis of Latin Square Design (LSD) – analysis of CRD, RBD and LSD using statistical package (AGRES).
16. Field visit
17. Final practical examination

Outcome

1. The students will acquire skills in statistical analysis manually and using statistical packages and interpretation of data collected from agricultural experiments.

Text Books

1. G. Nageshwara Rao, 2007, Statistics for Agricultural Sciences, BS Publications, Andhra Pradesh.
2. Rangaswamy, R. 2009, A Text book of Agricultural Statistics, Wiley Eastern Limited, New Delhi.

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1. S.C. Gupta & V.K. Kapoor, Fundamentals of Applied Statistics, 2006, Sultan Chand & Sons, New Delhi.
2. Chandel, S.R.S., 1999, A hand book of Agricultural Statistics, Achal Prakashan Mandhir, Kanpur.
3. Gomez, K.A. and Gomez, A.A., 1984, Statistical Procedures for Agricultural Research, John Wiley and Sons, New York.
4. Sahu P.K, 2009, Agriculture and Applied Statistics-I and II, Kalyani Publishers, Ludhiana.
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- www.statsoft.com
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- www.stats.gla.ac.uk/steps/glossary/index.html
- <http://davidmlane.com/hyperstat/>
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- <http://www.businessbookmall.com/Statistics Internet Library.htm>
- <http://www.stat-help.com/>
- www.statsci.org/jourlist.html

Theory

Unit I Surveying

Surveying and levelling - chain, compass and plane table survey - levelling - land measurement and computation of area - Simpson's rule and Trapezoidal rule.

Unit II Soil erosion

Soil Erosion - causes and evil effects of soil erosion - geologic and accelerated erosion - water erosion - causes - erosivity and erodibility - mechanics of water erosion - splash, sheet, rill and gully erosion - ravines - land slides - wind erosion - factors influencing wind erosion - mechanics of wind erosion - suspension, saltation, surface creep

Unit III Soil conservation

Erosion control measures for agricultural lands - biological measures - contour cultivation - strip cropping - cropping systems - vegetative barriers - windbreaks and shelterbelts - shifting cultivation - mechanical measures - contour bund - graded bund - broad beds and furrows - basin listing - random tie ridging - mechanical measures for hill slopes - contour trench - bench terrace - contour stone wall - gully control structures - permanent and temporary structures. Farm ponds - percolation ponds- watershed management.

Unit IV Irrigation and drainage

Irrigation - measurement of flow in open channels - velocity area method - rectangular weir - Cippoletti weir - V notch - orifices - Parshall flume - duty of water - irrigation efficiencies - conveyance of irrigation water - canal lining - underground pipe line system - surface irrigation methods - borders, furrows and check basins - drip and sprinkler irrigation- agricultural drainage - surface drainage systems - sub-surface drainage systems - drainage coefficient-design of open ditches.

Unit V Wells and Pumps

Groundwater occurrence - aquifers - types of wells and sizes - pump types - reciprocating pumps - centrifugal pumps - turbine pumps - submersible pumps - jet pumps - airlift pumps - selection of pumps - operation and their maintenance.

Practical

Study of survey instruments - chains and cross staff surveying - linear measurement - plotting and finding areas. Compass survey - observation of bearings - computation of angles- radiation, intersection. Levelling - fly levels - determination of difference in elevation. Contouring - area and volume computation. Design of contour bund and graded bund. Visit to erosion affected areas. Layout of sprinkler and drip systems. Problems on water measurement. Problems on duty of water, irrigation efficiencies. Problems on water requirement - agricultural drainage. Study of different types of wells and selection. Study of reciprocating pump, centrifugal pump, submersible pumps and jet pumps- selection of pumps.

Lecture schedule

1. Introduction - land surveying - uses in agriculture.
2. Chain cross staff and compass surveying - computation of angles.
3. Radiation, intersection and traversing.
4. Dumpy level - setting, observation and tabulation of readings - computation of land slope - difference in elevation.
5. Computation of area and volume - Simpson's rule and Trapezoidal rule.
6. Soil Erosion - causes and evil effects of soil erosion - geologic and accelerated erosion
7. Water erosion - causes - erosivity and erodibility - mechanics of water erosion
8. Splash, sheet, rill and gully erosion - ravines - land slides
9. Wind erosion - factors influencing wind erosion - mechanics of wind erosion - suspension, saltation, surface creep
10. Effects of water and wind erosion

11. Erosion control measures for agricultural lands – biological measures – contour cultivation – strip cropping
12. Cropping systems – vegetative barriers - windbreaks and shelterbelts - shifting cultivation
13. Mechanical measures – contour bund – graded bund
14. Broad beds and furrows – basin listing – random tie ridging
15. Mechanical measures for hill slopes – contour trench – bench terrace – contour stone wall
16. Gully control structures – permanent and temporary structures.
17. Mid semester examination.
18. Farm ponds – percolation ponds.
19. Irrigation - measurement of flow in open channels - velocity area method
20. Rectangular weir - Cippoletti weir - V notch
21. Orifices - Parshall flume
22. Duty of water - irrigation efficiencies
23. Conveyance of irrigation water - canal lining
24. Underground pipe line system
26. Surface irrigation methods - borders, furrows and check basins
26. Components of drip and sprinkler irrigation system
27. Agricultural drainage – need - surface drainage systems
28. Surface drainage systems - drainage coefficient
29. Groundwater occurrence – aquifers types
30. Types of wells and sizes
31. Pump types – reciprocating pumps – centrifugal pumps
32. Turbine pumps – submersible pumps
33. Jet pumps – Airlift pumps
34. Selection of pumps – operation and their maintenance.

Practical schedule

1. Study of survey instruments - chains - compass - plane table - dumpy level.

2. Chains and cross staff surveying - linear measurement - plotting and finding areas.
3. Compass survey - observation of bearings - computation of angles.
4. Compass - radiation, intersection.
5. Levelling - fly levels - determination of difference in elevation.
6. Contouring - area and volume computation.
7. Design of contour bund and graded bund.
8. Visit to erosion affected areas.
9. Layout of sprinkler and drip systems.
10. Problems on water measurement.
11. Problems on duty of water, irrigation efficiencies.
12. Problems on water requirement - agricultural drainage.
13. Study of different types of wells and its selection.
14. Study of reciprocating pump & centrifugal pump
15. Study of submersible pumps & jet pumps
16. Selection of pumps.
17. Practical examination.

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- <http://www.eng.uwi.tt/depts/mech/ugrad/courses/31d.html>

Journals

- ASCE journal of irrigation and drainage engineering
- ISAE Journal of agricultural engineering
- Journal of the Indian society of soil and water conservation published by CSWCRTI, Dehradun

ERG 211 Renewable Energy 1 + 0

Theory

Unit I Energy scenario

Introduction -energy crisis -energy sources- classification -availability-renewable energy sources- significance- potential and achievements in India. Energy requirements of important horticultural crops.

Unit II Methods of energy conversion and biogas technology

Methods of energy conversion – thermochemical and biochemical conversion methods- combustion, pyrolysis and gasification - applications- biogas and ethanol production- applications.

Biogas technology-science of production -feed stocks - factors affecting biogas production- types and capacity of biogas plants- KVIC, Janatha and Deenbandhu model biogas plants- construction and working principles- comparison features of biogas plants. Applications of biogas – biogas requirements-biogas appliances-environmental considerations – enrichment and uses of biodigested slurry (BDS).

Unit III Thermochemical conversion methods

Principles of combustion, pyrolysis and gasification – types of gasifiers – producer gas and its utilization. Briquettes – types of briquetting machines – uses of briquettes – shredders.

Unit IV Applications of solar energy

Solar energy – solar flat plate and focusing plate collectors – solar air heaters – solar space heating and cooling – solar energy applications/ solar energy gadgets – solar cookers – solar water heating systems – solar grain dryers – solar refrigeration system – solar ponds – solar photo voltaic systems – solar lantern - solar street lights – solar fencing – solar pumping systems.

Unit V Wind energy, energy plantation and bio-fuels

Wind energy - types of wind mills – constructional details and applications. Energy crops-definition and use of energy plantation- availability- selection of species - calorific value and rating index- calculation of area needed for power production from

energy crops. Energy from agricultural wastes –liquid Bio fuels -bio diesel and ethanol from agricultural produce – its production & uses.

Lecture schedule

1. Energy crisis-renewable energy sources- significance- potential and achievements in India-energy requirements of important crops like banana, mango, areca nut, coconut, etc.
2. Methods of energy conversion – thermo chemical conversion methods-principles of combustion, pyrolysis and gasification and applications-biochemical conversion methods – biogas and ethanol production-principles-applications.
3. Biogas technology-science of production of biogas-feed stocks used - factors affecting biogas production- types of biogas plants- capacity determination.
4. Biogas plants - construction and working principles – KVIC, Janata and Deen bandhu model biogas plants- performances.
5. Applications of biogas – biogas requirements for cooking , lighting and engine operation and electricity production- biogas appliances-environmental considerations - enrichment and uses of biodigested slurry(BDS).
6. Combustion-improved chulha –single pot chulha – double pot chulha-conventional chulha- biomass gas stove- constructional features, working principles and applications.
7. Thermo-chemical conversion – principle –chemistry of gasification-gasifiers – types- operation -applications
8. Briquetting-definition-MED, VED –need for briquetting- benefits of biomass briquettes -elemental composition and physical properties of agro-residues - densification methods.
9. Mid semester examination
10. Briquetting machines – types - principles, features and operation - properties and uses of briquettes.
11. Solar Energy-characteristics of solar radiation- advantages and disadvantages-types of radiation- solar constant-availability of solar radiation-solar thermal

- devices - solar water heaters - principle and applications -solar cookers- evacuated tube collector.
12. Solar driers - natural and forced convection types - working principle -drying of agro-produces in natural as well as forced convection type solar dryers.
 13. Solar PV systems - principle-water pumping applications-solar lantern-principle.
 14. Solar refrigeration- advantages- applications- absorption refrigeration - principle- ammonia-water and Lithium bromide absorption refrigeration systems -solar mechanical refrigeration. Solar pond-principle-types-applications-solar distillation- principle-applications.
 15. Energy available in wind -wind mills -types-water pumping windmills - components- wind power transmission - controls-applications-aerogenerator - components -working principle -types of rotors- wind power transmission - power generation -controls-applications.
 16. Energy crops-definition and use of energy plantation- availability-advantages and disadvantages of energy plantation - selection of species -calorific value and rating index- calculation of area needed for power production from energy crops.
 17. Bio-fuels -Importance-use in agricultural sector -demand and growth of bio-fuels- biodiesel production method-flowchart-components-byproducts-utilization-TNAU biodiesel pilot plant.. Bio-ethanol -principle of production from cellulosic substances-flowchart - effects of different parameters on ethanol fermentation -types of fermenters-ethanol from sugar substrates-applications in agriculture.

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1. Renewable Energy Sources and Conversion Technology, Bansal N.K.et al 1990. Tata McGraw Hill publishing Co.Ltd., New Delhi.
2. Non Conventional Energy Sources, Rai GD 1996. Khanna publishers, New Delhi.

3. Biomass Briquetting and utilization, Srivastava et al 1995 Jain Brothers New Delhi 110 005.

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2. Solar Energy Utilization, Rai G.D 1984 Khanna Publishers, New Delhi
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FOR 211 Forest Resource Management 1 + 1

Aim

- ❖ To know the importance and significance of forest and agroforestry
- ❖ To understand the various forest operations
- ❖ To meet the demands of various end users on a sustainable basis in an eco - friendly manner.

Theory

Unit I Forestry and forest regeneration

Indian forest - forestry -- role of forests - classification of forests -silvics - silviculture locality factors - regeneration of forests - natural and artificial regeneration

Unit II Silvicultural techniques for tree species

Site selection - choice of species - modern silvicultural techniques in site preparation - planting and tending operations - mechanization in silviculture - silvicultural packages for timber species (teak, sal, sandal wood and rosewood), pulpwood species (eucalyptus, casuarina, bamboo), Fuel wood species (acacias, prosopis), match wood species (ailanthus, melia), tree borne oilseeds (neem, pungam, bassia), fodder trees (subabul, white babul). .

Unit III Forest utilization

Forest utilization - wood and non-wood forest products - solid wood- timber- wood composites- plywood, fibre board and particle boards - non wood forest products

Unit IV Agroforestry

Social forestry concepts and applications -JFM concepts - agroforestry- agroforestry classification -agroforestry systems for different agro climatic zones of Tamil Nadu -distinction between social forestry and agroforestry

Unit V Urban and recreation forestry

Techniques and management of urbanforestry and recreation forestry - ecotourism concepts and applications.

Practical

Nursery layout and other nursery techniques - nursery technology for teak, dalbergia, neem, eucalyptus, casuarina, bamboo and acacias - clonal propagation methods - tree planting techniques - tending and cultural operations - felling, transportation and conversion methods - pulp and paper technology- plywood production technology - match manufacturing process -social forestry - agroforestry system .

Lecture schedule

1. Indian forest - forest - forestry - classification of forest - role of forests - production and protection role.
2. Silvics - silviculture - locality factors (climate, edaphic, physiographic and biotic factors).
3. Regeneration techniques for forest trees - natural regeneration.
4. Artificial regeneration - quality planting stock production techniques - clonal forestry techniques.
5. Silvicultural techniques for some primary timber species - teak, sal, rose wood and sandal
6. Silviculture techniques for some pulpwood species - eucalyptus, casuarina, bamboo.
7. Silvicultural techniques for some TBOs& Fodder - neem, pungam, and bassia, subabul and white babul
8. Silvicultural techniques for some fuel wood species - (acacias, prosopis) and match wood species (ailanthus and melia)
9. Mid semester examination
10. Forest utilization - solid wood- timber and its products.
11. Forest utilization - non wood forest products (fibres, flosses, grasses, bamboos and canes) - value addition to non wood forest products.
12. Non wood forest products (oil, tannin, dyes, gum, resins) - status and value addition.
13. Social forestry concepts,history, objectives and applications-JFM concepts

14. Agroforestry –agroforestry concepts,objectives and classifications - distinction between social forestry and agroforestry
15. Agroforestry systems and their applications for different agro climatic zones of Tamil Nadu.
16. Techniques for urban forestry ,recreation forestry
17. Eco-tourism – concepts and its application.

Practical schedule

1. Nursery layout and other nursery techniques.
2. Nursery technology for teak and sandal,dalbergia,neem
3. Nursery technology for rose wood
4. Nursery technology for eucalyptus
5. Nursery technology for casuarina.
6. Nursery technology for bamboo and acacia
7. Nursery technology for TBO's.
8. Visit to a forest nursery to study the nursery techniques
9. Visit to a agro forestry model unit.
10. Clonal propagation techniques for forest trees.
11. Practicing tree planting techniques.
12. Practicing tending and cultural operations in forest plantations.
13. Visit to pulp and paper manufacturing industry
14. Study of plywood production technology – visit to plywood industry.
15. Study of match manufacturing process – visit to matchwood industry.
16. Visit to a NWFP value addition unit
17. Practical examination.

Outcome

1. The students will acquire basic knowledge on forestry and agroforestry.
2. They will gain confidence in establishing forest nursery and plantations.
3. They will gain knowledge on wood and non wood forest products and its utilization.

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1. Brown, H. 1989. Indian wood technology. IBD Publishers, Dehra Dun.
2. Dwivedi, A.P. 1992. Agroforestry – Principles and practices. Oxford and IBH Publishing Co., New Delhi.
3. Khanna. L.S 1999 Principles and Practice of Silviculture, IBD Publishers, Dehra Dun
4. Negi. S.S.2008 Hand Book of Forestry, IBD Publishers, Dehra Dun

Further reading

1. Heygreen, G. and J.L.Bowyer. 1982. Forest products and wood science. The Ohio State University Press, Ames.
2. Lal, J.B. 1992. India's forest – Myth and reality. Natraj Publishers, Dehra Dun.
3. Indian Journal of Forestry
4. Indian Journal of Agroforestry

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III Year V Semester

Sl. No	Course Number	Course Title	Credit Hours
1.	FLG 307	Protected and Precision Horticulture	2 + 1
2.	FLG 301	Production Technology of Commercial Flower crops	2 + 1
3.	PSM 301	Production Technology of Medicinal and Aromatic crops	2 + 1
4.	VSC 301	Practical Crop Production	0 + 1
5.	HOR 304	Study Tour - II	0 + 1
6.	ABT 301	Applied Plant Biotechnology	1 + 1
7.	AEN 311	Pest Management in Horticultural Crops	2 + 1
8.	AEC 301	Production Economics and Farm Management	1 + 1
9.	PBG 301	Principles and Methods of Plant Breeding	2 + 1
Total			12+9=21

FLG 307 Protected and Precision Horticulture 2 + 1
(Team teaching – Hort & Remote Sensing)

Aim

- ❖ To impart knowledge on the protected cultivation of vegetables, fruits and flower crops.
- ❖ To sensitize the students on hi-tech production technology of fruits, vegetables and flower crops.

Theory

Unit I Importance and methods of protected culture in horticultural crops

Importance and scope of protected cultivation – different growing structures of protected culture viz., green house, poly house, net house, poly tunnels, screen house, protected nursery house - study of environmental factors influencing green house production – cladding / glazing / covering material – ventilation systems – cultivation systems including nutrient film technique / hydroponics / aeroponic culture – growing media and nutrients – canopy management – micro irrigation and fertigation systems.

Unit II Protected cultivation technology for vegetable crops

Hi-tech protected cultivation techniques for tomato, capsicum nursery, cucumber, gherkins strawberry and melons – integrated pest and disease management – postharvest handling.

Unit II Protected cultivation technology for flower crops

Hi-tech protected cultivation of cut roses, cut chrysanthemum, carnation, gerbera, asiatic lilies, anthurium, orchids, cut foliage and fillers – integrated pest and disease management – postharvest handling.

Unit IV Concept and introduction of precision horticulture

Importance of precision horticulture – definition, principles and concepts – Role of geographic information systems (GIS) – global positioning systems (GPS) – Mobile mapping system and its application in precision farming – design, layout and installation of drip and fertigation in horticultural crops – role of computers in developing comprehensive systems needed in site specific management (SSM) –

georeferencing and photometric correction - Sensors for information gathering - geostatistics - robotics in horticulture - postharvest process management (PPM) - remote sensing - information and data management and crop growth models - GIS based modeling.

Unit V Precision farming techniques for horticultural crops

Precision farming techniques for tomato, chilli, bhendi, bitter gourd, bottle gourd, cauliflower, cabbage, grapes, banana, rose, jasmine, chrysanthemum, marigold, tuberose, china aster, turmeric, coriander, coleus and gloriosa.

Practical

Study of different kinds of protected structures - designs, components and construction - types and structures of auto control systems in green house - study of heating and cooling systems - study of different media, solarization and fumigation - study of special horticultural practices for vegetables / flowers under protected cultivation - visit to protected cultivation units. Positioning systems viz., GPS and positioning accuracy - understanding GPS Specifications - utilization of GIS software - soil salinity and compaction - Soil test crop response (STCR) - Grid soil sampling - canopy management in precision farming - water use efficiency in annuals, perennials and landscape horticulture - visit to commercial unit - searching internet resources for precision horticulture.

Lecture schedule

1. Importance and scope of protected cultivation.
2. Different growing structures of protected culture viz., poly house, net house, poly tunnels and screen house.
3. Study of environmental factors influencing protected culture, roofing materials and ventilation systems.
4. Cladding / glazing / covering and roofing materials and ventilation systems.
5. Nutrient film techniques, hydroponics, aeroponic culture
6. Growing media and nutrients for protected cultivation.

7. Micro irrigation and fertigation management in protected culture.
8. Protected cultivation techniques for tomato
9. Green house cultivation techniques for cucumber, gherkins and melons.
10. Protected cultivation techniques for capsicum and strawberry
11. Integrated pest and disease management for vegetable crops in protected cultivation.
12. Integrated pest and disease management for flower crops in protected cultivation.
13. Protected cultivation techniques for roses and gerbera
14. Protected cultivation techniques for chrysanthemum and carnation.
15. Protected cultivation techniques for anthurium and orchids.
16. Protected cultivation techniques for cut foliages and fillers.
17. Mid semester examination
18. Precision horticulture – definition, principles and concepts.
19. Geographic information system (GIS) and its application in precision farming.
20. Global positioning system (GPS) and its application in precision farming.
21. Mobile mapping systems and its application in precision farming.
22. Precision equipments for seeding and chemical application
23. Role of computers in developing comprehensive system needed in site specific management (SSM) system and postharvest process management (PPM)
24. Remote sensing and its application in precision farming.
25. Georeferencing and photometric correction
26. Sensors for information gathering, geostatistics and robotics in horticulture
27. Design, layout and installation of drip and fertigation in precision farming
28. Information and data management, crop growth models and GIS based modeling.
29. Precision farming techniques for grapes and banana.
30. Precision farming techniques for tomato, chilli and bhendi.
31. Precision farming techniques for bitter gourd, bottle gourd, cauliflower and cabbage.

32. Precision farming techniques for coleus and gloriosa.
33. Precision farming techniques for rose, jasmine, chrysanthemum marigold china aster and tube rose
34. Precision farming techniques for turmeric and coriander.

Practical schedule

1. Study of different protected structures – designs, components, orientation and construction of greenhouse.
2. Types and structures of auto control system in green house.
3. Study of heating and cooling systems in green house.
4. Study of different media, solarization and fumigation for green house cultivation.
5. Study of special cultural practices for production of vegetable crops under protected cultivation.
6. Study of special cultural practices for flower crops under protected cultivation.
7. Visit to protected culture units.
8. Project preparation of protected cultivation of important horticultural crops.
9. Positioning systems understanding of GPS, positioning accuracy specifications and utilization of GIS software.
10. Study of soil salinity, soil compaction, soil test crop response (STCR) and grid soil sampling.
11. Practicing design and layout of precision farming system
12. Canopy management in precision farming
13. Water use efficiency in annual, perennials and landscape horticulture
14. Visit to commercial computerized irrigation control unit.
15. Project preparation of precision cultivation in important horticultural crops
16. Searching internet resources for precision horticulture
17. Practical examination

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1. Joe.J.Hanan. 1998. Green houses: Advanced Technology for Protected Horticulture, CRC Press, LLC. Florida.

2. Paul V. Nelson. 1991. Green house operation and management. Ball publishing USA.

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1. Lyn. Malone, Anita M. Palmer, Christine L. Vloghat Jach Dangeermond. 2002. Mapping out world: GIS lessons for Education. ESRI press.
2. David Reed. 1996. Water, media and nutrition for green house crops. Ball publishing USA.
3. Adams, C.R. K.M. Bandford and M.P. Early. 1996. Principles of Horticulture. CBS publishers and distributors. Darya ganj, New Delhi.

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Journals

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- Horticultural Technology
- Floriculture Today
- Hi-tech Horticulture

FLG 301 Production Technology of Commercial Flower Crops 2 + 1

Aim

- ❖ To educate the students on commercial cultivation of loose flowers, protected cultivation of cut flowers and value addition in flower crops.

Theory

Unit I Principles of growing commercial flowers

History- importance and scope - distribution - area and production - export potential - international and national floral industry. Institutions and developmental agencies involved in promotion of floriculture. Soil and climate - Botany - species and varieties - propagation - principles and practices - planting systems and methods - pinching, training and pruning practices - nutrient and water management - role of growth regulators - intercultivation - Harvest and yield of rose, jasmine, chrysanthemum and tuberose.

Unit II Loose flowers

Soil and climate - botany - species and varieties - propagation - principles and practices - planting systems and methods - pinching, training and pruning practices - nutrient and water management - role of growth regulators - inter cultivation - Harvest and yield of crossandra, marigold, nerium, gomphrena, celosia and china aster.

Unit III Principles of protected cultivation

Protected structures - controlled environmental conditions - Soil sterilization - factors influencing protected cultivation - cut flower production- flower forcing.

Soil and climate - Botany - species and varieties - propagation - principles and practices - planting systems and methods - pinching, training and pruning practices - nutrient and water management - role of growth regulators - inter cultivation - Harvest and yield of cut roses, carnation, gerbera, cut chrysanthemum and gladiolus.

Unit IV Cut flowers

Soil and climate – botany – species and varieties – propagation – principles and practices – planting systems and methods – pinching, training and pruning practices – nutrient and water management – role of growth regulators – inter cultivation – Harvest and yield of orchids, anthurium, china aster, bird of paradise, Asiatic lily, heliconias, alstromeria and flowering fillers viz., limonium, asparagus, ivy, gypsophila and baby eucalyptus.

Unit V Post harvest handling of flowers

Postharvest handling – principles and methods of extension of shelf life – methods of extraction of floral concrete from rose, jasmine and tuberose – natural dye extraction from flowers crops – uses – grading – export standards – packaging – marketing – constraints in flower production – future thrust.

Practical

Botany – description and identification of species and varieties in rose, jasmine, crossandra, chrysanthemum, tuberose, marigold, nerium, gomphrena, celosia, cut rose, carnation, gerbera, gladiolus, orchids and anthurium – propagation and planting – seed treatment and sowing – planting of tubers and suckers – lay out and planting of rose and jasmine – media preparation and potting of orchids and anthurium – After culture practices in rose, jasmine, chrysanthemum, marigold and dahlia – harvesting, postharvest handling and storage – extraction of floral concrete from rose, jasmine and tuberose – visit to commercial fields, extraction units and flower markets – working out benefit cost ratio for loose flowers and cut flowers – preparation of project reports for fresh flower production and floral concrete extraction.

Lecture schedule

1. History and importance – area and production – export potential – industrial importance – floriculture industry in India and Tamil Nadu
2. Rose – importance and uses – origin and history – area and production – botany – species and varieties – classification.

3. Rose - propagation - soil climate season and planting-nutrition and irrigation - management practices - role of growth regulators-pruning - plant protection - harvest and yield
4. Jasmine- importance and uses-origin and history- area and production - botany - species and varieties
5. Jasmine - soil climate propagation - season and planting-nutrition and irrigation -management practices - role of growth regulators-pruning methods- plant protection - harvest and yield.
6. Chrysanthemum - importance and uses-origin and history- area and production -botany soil climate - species and varieties-propagation - season and planting-nutrition and irrigation - management practices - role of growth regulators-pinching and disbudding - plant protection - harvest and yield.
7. Tuberose - importance and uses-origin and history-distribution-area and production-botany - species and varieties - propagation- season and planting-nutrition and irrigation soil climate - management practices - nematode management - role of growth regulators- plant protection -harvest and yield.
8. Crossandra - importance and uses-origin and history-distribution-area and production-botany - species and varieties - propagation- season and planting-nutrition and irrigation - management practices - role of growth regulators-nematode management - plant protection -harvest and yield.
9. Marigold - importance and uses-origin and history- area and production - botany - species and varieties-propagation - season and planting-nutrition and irrigation - management practices - role of growth regulators-pinching and disbudding- plant protection -harvest and yield.
10. Nerium and Gomphrena importance and uses-origin and history- area and production - botany - species and varieties-propagation - season and planting-nutrition and irrigation - management practices - role of growth regulators-plant protection - harvest and yield.
11. Celosia and China aster importance and uses-origin and history- area and production - botany - species and varieties-propagation - season and planting-

nutrition and irrigation – management practices -role of growth regulators- plant protection -harvest and yield.

12. Field visit – Loose flower growing areas and exporters
13. Economics - loose flower production
14. Designing and erection of controlled structures for cut flower production
15. Flower forcing and factors affecting flower production under controlled atmospheric conditions.
16. Cut rose - importance and uses-origin and distribution-area and production- botany and varieties -propagation and planting – environmental factors- pruning - pinching - production constraints-inter culture- plant protection - harvesting and yield.
17. Mid semester examination
18. Carnation-importance and uses-origin and distribution-area and production- botany, species and varieties -propagation-media and planting-environmental factors- netting - inter culture - pinching-production constraints-plant protection-harvesting and yield.
19. Gerbera -importance and uses-origin and distribution-area and production- botany and varieties -propagation and planting-media - inter culture - production constraints-harvesting and yield.
20. Chrysanthemum-importance and uses-origin and distribution-area and production- botany and varieties -propagation and planting-media environmental factors- inter culture - pinching-production constraints-plant protection-harvesting and yield.
21. Gladiolus-importance and uses-origin and distribution-area and production- botany and varieties -propagation and planting-media - environmental factors- inter culture - production constraints-plant protection-harvesting and yield.
22. Orchids - importance and uses-origin and history-distribution-area and production- botany and varieties -environmental factors- methods of propagation media and methods of nutrient management - irrigation - plant protection-harvesting and yield.

23. Anthurium - importance and uses-origin and history-distribution-area and production- botany and varieties - environmental factors - methods of propagation - media and methods of nutrient management - irrigation - plant protection-harvesting and yield.
24. Bird of paradise and heliconia - importance and uses-origin and history-distribution-area and production- botany and varieties - media and climate - methods of propagation - nutrient management - irrigation - plant protection-harvesting and yield.
25. Guest lecture - Cut flower production
26. Asiatic lily, alstromeria, Foliage and flowering fillers limonium, asparagus ivy, gypsopals, baby eucalyptus - importance and uses - origin and distribution-botany and varieties - propagation - planting - inter culture - plant protection-harvesting and yield.
27. Post harvest - principles and methods of extension of shelf life
28. Prospects and constraints in green house production of cut flowers.
29. Methods of floral concrete extraction from rose, jasmine and tuberose
30. Natural dye extraction of flower crops.
31. Packaging, grading and export standards for important commercial flowers.
32. Industry visit - Dye extraction / Concrete extraction
33. Economics - cut flower production
34. Constraints in flower production and future thrust.

Practical schedule

1. Rose-identification and description of species/varieties - propagation and planting -pruning management.
2. Jasmine sp.-identification and description of species/varieties - propagation and planting -pruning management.
3. Tuberose and crossandra - identification, description of species/varieties, propagation and planting
4. Chrysanthemum and marigold- identification and description of species/varieties - propagation and planting

5. Nerium and gomphrena - identification, description of species/varieties, nursery raising and planting
6. Celosia and china aster - identification, description of species/varieties, nursery raising and planting
7. Visit - Flower market and flower growing areas - loose flowers.
8. Preparation of project - loose flower production - open condition
9. Cut rose - identification and description of species/varieties - media - planting
10. Carnation and gerbera - identification and description of species/varieties - media - planting
11. Cut chrysanthemum and gladiolus - identification and description of species/varieties - media - planting
12. Anthurium and orchids - identification and description of species/varieties - media preparation - planting
13. Bird of paradise and heliconia - identification and description of species/varieties - propagation - media preparation - planting
14. Asiatic lily, alstromeria, flowering and foliage fillers - identification and description of species/varieties - propagation - media preparation - planting
15. Visit to flower growing areas - Cut flowers
16. Rose, jasmine and tuberose-extraction of floral concrete - lecture / Field visit
17. Preparation of project - Cut flower production - controlled condition
18. Practical examination

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1. Bhattacharjee and De. L.C. 2004 - Advanced Commercial Floriculture. Vol. I & II.
2. Bhattacharjee, S.K., 2004 - Advanced commercial floriculture. Vol. I and II.
3. Bhattacharjee, S.K., 2004 - Landscape gardening and design with plants.
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PSM 301 Production Technology of Medicinal and Aromatic Crops 2 + 1

Aim

- ❖ To impart knowledge on the current status and export potential of medicinal and aromatic plants.
- ❖ To sensitize the students on hi-tech production technology and extraction methods

Theory

Unit I Importance and scope of medicinal crops

Importance and scope - medicinal plant wealth of India and states - area and production - exports and imports - Demand of medicinal plants in phytochemicals and AYUSH - Conservation strategies, exsitu and insitu - Classification of medicinal plants based on family, habit, climate, soil and ecological factors- Organized production- GAP, GMP guidelines, contract farming- Institutions for promotion of medicinal plants- Constraints and challenges in production.

Unit II Production technologies of medicinal crops I

Soil and climate - varieties - propagation - nursery practices - planting methods - nutrient management- irrigation- intercropping - harvest Crops: senna, periwinkle, glory lily, ashwagandha, medicinal coleus, aloe, long pepper, *Phyllanthus amarus* and stevia.

Unit III Production technologies of medicinal crops II

Soil and climate - varieties - propagation - nursery practices - planting methods - nutrient management- irrigation- intercropping - harvest Crops: isabgol, opium poppy, medicinal solanum - medicinal dioscorea, rauwolfia, vasambu, vallarai and noni.

Unit IV Importance and scope of aromatic crops

Importance and scope- aromatic plant wealth of India- area and production - exports and imports of essential oil - Demand of aromatic crops in perfumery and cosmetic industries - International standards for perfumes - Classification of essential oils-Methods of distillation of essential oil - Fractional distillation-Aromatherapy.

Unit V Production technologies of aromatic crops

Soil and climate - varieties - propagation - nursery practices - planting methods - nutrient management- irrigation- intercropping - harvest Crops: ocimum, davana, mint, lemon grass, citronella, palmarosa, vetiver, geranium, patchouli and rosemary.

Practical

Botany - Identification and description of varieties - parts used and their products - propagation techniques - processing methods - active principle and extraction of essential oil content of senna, periwinkle, glory lily, ashwagandha, phyllanthus, medicinal coleus, isabgol, aloe, gymnema, acorus, andrographis, medicinal dioscorea, rauvolfia, digitalis, ocimum, davana, mint, long pepper, lemon grass, citronella, geranium, palmarosa and vetiver.

Lecture schedule

1. Importance and scope – current status – Medicinal plant wealth of India and states – Area and production- Exports and imports- Demand in AYUSH and phytochemicals – medicinal plant wealth of India and states – area and production.
2. Conservation of medicinal and aromatic plants-Strategies and methods
3. Classification system in medicinal plants based on family, habit, climate, soil and ecological conditions
4. Promotional organizations involved in medicinal plants production - Policies, guidelines
5. Organised production of medicinal crops- Contract farming- Need for GAP, GMP
6. Opportunities, challenges and constraints in medicinal plants
7. Soil and climate – varieties – propagation – nursery practices – planting methods – nutrient management- irrigation and intercropping – harvest and yield of senna and periwinkle
8. Soil and climate – varieties – propagation – nursery practices – planting methods – manuring, irrigation and intercropping – harvest and yield of glory lily
9. Soil and climate – varieties – propagation – nursery practices – planting methods – manuring, irrigation and intercropping – harvest and yield of aswagandha and Aloe
10. Soil and climate – varieties – propagation – nursery practices – planting methods – manuring, irrigation and intercropping – harvest and yield of medicinal Coleus
11. Soil and climate -varieties – propagation – nursery practices – planting methods – manuring, irrigation and intercropping – harvest and yield of long pepper and *Phyllanthus amarus*

12. Soil and climate -varieties - propagation - nursery practices - planting methods - manuring, irrigation and intercropping - harvest and yield of Stevia and medicinal solanum
13. Soil and climate -varieties - propagation - nursery practices - planting methods - manuring, irrigation and intercropping - harvest and yield of Isabgol and medicinal Dioscorea
14. Soil and climate -varieties - propagation - nursery practices - planting methods - manuring, irrigation and intercropping - harvest and yield of rauwolfia and opium poppy
15. Soil and climate -varieties - propagation - nursery practices - planting methods - manuring, irrigation and intercropping - harvest and yield of vasambu and vallarai
16. Soil and climate -varieties - propagation - planting methods - manuring, irrigation and intercropping - harvest and yield of noni
17. Mid semester examination
18. Importance and scope- current status on area and production of aromatic crops- Exports and imports of essential oil
19. Demand of aromatic crops in perfumery and cosmetic industries - Classification of essential oils
20. Soil and climate -varieties - propagation - nursery practices - planting methods - manuring, irrigation and intercropping - harvest and yield of Ocimum and davana
21. Soil and climate -varieties - propagation - nursery practices - planting methods - manuring, irrigation and intercropping - harvest and yield of lemon grass
22. Soil and climate -varieties - propagation - nursery practices - planting methods - manuring, irrigation and intercropping - harvest and yield of citronella
23. Soil and climate -varieties - propagation - nursery practices - planting methods - manuring, irrigation and intercropping - harvest and yield of palmarosa.
24. Soil and climate -varieties - propagation - nursery practices - planting methods - manuring, irrigation and intercropping - harvest and yield of vetiver.

25. Soil and climate - varieties - propagation - nursery practices - planting methods - manuring, irrigation and intercropping - harvest and yield of geranium
26. Soil and climate - varieties - propagation - nursery practices - planting methods - manuring, irrigation and intercropping - harvest and yield of patchouli
27. Soil and climate - varieties - propagation - nursery practices - planting methods - manuring, irrigation and intercropping - harvest and yield of Mentha
28. Soil and climate -varieties - propagation - nursery practices - planting methods - manuring, irrigation and intercropping - harvest, coppicing and yield of Eucalyptus
29. Soil and climate -varieties - propagation - nursery practices - planting methods - manuring, irrigation and intercropping - harvest and yield of rosemary
30. Methods for extraction of secondary metabolites in medicinal plants
31. Methods of distillation of essential oil from aromatic plants
32. Fractional distillation of essential oil
33. Quality standards in medicinal and aromatic plants
34. Aromatherapy and use of essential oil in various ailments

Practical

1. Identification of major medicinal crops - parts used and their products
2. Identification of major aromatic crops- essential oil content
3. Study of varieties, propagation techniques of Senna and Periwinkle
4. Study of varieties, propagation techniques of ashwagandha
5. Study on propagation, pollination, standards in glory lily
6. Study of propagation techniques of medicinal coleus and aloe
7. Study of varieties, propagation techniques of vallarai and vasambu
8. Study of propagation techniques, use of media, growth regulators for rooting of long pepper.
9. Study of seed treatment techniques for enhancing germination of noni

10. Study of species, propagation techniques of Mint and Rosemary
11. Study of species, propagation techniques of ocimum and davana
12. Working out the benefit cost ratio for medicinal Coleus and Glory lily
13. Working out the benefit cost ratio for Ocimum and davana
14. Extraction of medicinal products using Soxhlet apparatus
15. Distillation of essential oil from aromatic crops using Clevenger apparatus
16. Visit to commercial medicinal and aromatic plantation
17. Practical examination

Text Books

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2. Kumar, N. Md. Abdul Khader, JBM, Rangasamy, P. and I. Irulappan. 1998. Introduction to Spices, Plantation crops, Medicinal and Aromatic Plants. Oxford IBH Publishers, New Delhi.
3. Raychaudhuri, S. P. 1998. Recent advances in medicinal, aromatic and spice crops. Vol. I and Vol. II. Today and Tomorrow's printer and Publishers, New Delhi.
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- www.traffic.org.
- <http://www.pubmed.com>

Journals

- Amruth
- Journal of medicinal and aromatic plants
- Journal of Indian Perfumer

VSC 301 Practical Crop Production 0 +2

Practical

Practical training - cum - cultivation in vegetable, flower and spice crop production in any two transplanted crop (tomato, brinjal, chilli, marigold, gomphrena) and any two direct sown crop (bhendi, amaranthus, radish, aggregatum onion, vegetable crops coriander) - seed treatment - raising nursery - sowing seeds- field preparation- transplanting, manuring, irrigation, weed control, inter culture - plant protection and harvesting - postharvest handling - seed extraction - maintenance of cultivation sheet - working out benefit/cost ratio.

Practical Schedule

1. Practice in raising nursery for transplanted vegetables.
2. Seed treatment, sowing and after care.
3. Practicing application of FYM and main field preparation.
4. Formation of beds, ridges and furrows.
5. Application of basal dressing of fertilizers.
6. Practising transplanting of vegetables.
7. Practising herbicide application.
8. Practising scheduling of irrigation.
9. Practising gap filling operation.
10. Practising top dressing and earthing up operation.
11. Practising PGR preparation and application.
12. Practising pesticide, fungicide application and other inter cultural operations.
13. Practising harvest and assessing maturity index
14. Practising seed extraction, processing, cleaning, grading, packaging and marketing.
15. Practising grading, packaging and marketing
16. Cost economics of production
17. Practical examination
18. Practising raising nursery for transplanted flower and spice crops

19. Seed treatment, sowing, after care and collection of stubbles
20. Practising application of FYM .
21. Formation of beds, ridges and furrows.
22. Application of basal dressing of fertilizers.
23. Practising transplanting and direct sowing of spice crops .
24. Practising herbicide application.
25. Practising scheduling of irrigation.
26. Practising gap filling operation.
27. Practising top dressing and earthing up operation.
28. Practising PGR preparation and application.
29. Practising pesticide, fungicide application and other inter cultural operations.
30. Practising harvest and assessing maturity index
31. Practising seed extraction, processing, cleaning, grading, packaging and marketing.
32. Practising grading, packaging and marketing.
33. Cost economics of production
34. Practical examination

Reference books

1. Azhar Ali Farooqi, B.S. Sreeramu, K.N. Srinivasappa - 2005 Cultivation of spice crops. Universities press India Pvt., Ltd., Hyderabad.
2. Battacharjee, S.K., & L.C. De, 2003. Advanced commercial floriculture (Vol. I&II), Aavishkar publishers and distributors, Jaipur.
3. Arun. K. Sharma. 2002. A Hand book of Organic Farming. Agrobios (India)
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8. Hazra, P. and M. G., Som. 1999. Technology for vegetable production and improvement, Naya Prakash, Kolkatta.

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10. Pal, A.K., A.B. Sarangi and U. Thapa. 2006. Varieties of horticultural Crops. Agro-tech Publishing Academy, New Delhi.
11. Prem Singh Arya. 2002. A text book of vegetable culture, Kalyani Publishers, New Delhi.

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HOR 304 Study Tour - II 0 + 1

Visit to places of commercial cultivation of flower crops, spices and plantation crops (other than coffee and tea) in Tamil Nadu - study of cropping system - varieties - adoption of scientific crop production technology - constraints in production - marketing - economic analysis.

Practical schedule

1. Visit to Agricultural Research Station, Aliyarnagar - Coconut and coconut based intercrop systems.
2. Tamil Nadu Agricultural University, Coimbatore campus.
3. Visit to Thudiyalur- arecanut area-Forest Research Station, Mettupalayam - Eence Aromatics.
4. Visit to Ooty, Coonoor and Bhavanisagar.
5. Visit to mango orchards, Regional Research Station, Paiyur-processing unit.
6. Visit to Giant Orchards, Melchengam
7. Visit to Regional Research Station, Vridhachalam - Cashew.
8. Visit to Tamil Nadu Rice Research Institute, Aduthurai.- oilpalm
9. Visit to Sugarcane Research Station, Sirugamani - Betelvine

Aim

- ❖ To impart knowledge on recent advances in the applications of plant molecular biology and biotechnology in crop improvement

Theory

Unit I Plant tissue culture and applications

Micropropagation and successful examples- meristem culture and production of virus free plants - protoplast isolation and fusion - somatic hybrids. Somaclonal variation, synthetic seeds - Doubled haploids - National certification system for TC plants- *in vitro* germplasm conservation

Unit II Molecular marker technology

DNA markers -different kinds -hybridization based RFLP -PCR based markers - AFLP, RAPD, SSR and SNPs - DNA fingerprinting of varieties -gene tagging - marker assisted selection and its application in crop improvement.

Unit III Transgenic technology

Transgenic plants for biotic and abiotic stress resistance and quality improvement-current status at national and international level- detection of GMOs - biosafety and bioethics

Unit IV Molecular pharming

Plants as biofactories - production of vaccines, therapeutic proteins, industrial enzymes and bioplastics

Unit V Bioprospecting

Discovery of novel compounds from plants - secondary metabolites - callus and cell suspension culture, bioreactors for plant cell culture.

Practical

Micropropagation of banana and rose. Meristem culture of cassava-virus indexing -DNA fingerprinting using RAPD and SSR markers- NTsys analysis - an example of marker assisted selection -transformation of tobacco, analysis of transgenic plants- PCR, strip assay of Bt cotton, ELISA for protein expression analysis -Callus and cell suspension culture-extraction and quantification of secondary metabolites-antimicrobial assay, visit to GC-MS, HPLC lab

Lecture schedule

1. Micropropagation of commercially viable crops – banana and ornamental plants
2. Meristem culture and production of virus free plants - disease detection and indexing- PCR ,ELISA
3. Protoplast isolation and fusion- production of somatic hybrids
4. Synthetic seeds, Somaclonal variation and applications,
5. National certification system for TC plants
6. Herbicide tolerant, biotic stress resistant transgenic plants- pest and disease resistant
7. Abiotic stress resistant transgenic plants – Drought, salinity and temperature
8. Transgenic plants engineered for quality traits- enhancement of nutrition quality , shelf life
9. Mid semester examination
10. Detection of GMOs, Indian regulatory guidelines, biosafety and bioethics
11. Current status of transgenic crops at national and global level
12. DNA markers -hybridization and PCR based markers
13. DNA fingerprinting of varieties and gene tagging
14. Marker Assisted Selection and its application in crop improvement.
15. Plants as biofactories – Production of recombinant proteins- Vaccines, therapeutic proteins, industrial enzymes and bio plastics
16. Discovery of novel compounds from plants- importance of secondary metabolites.
17. Callus and Cell suspension culture, bioreactors for plant cell cultures.

Practical schedule

1. Micropropagation of banana
2. Micropropagation of rose
3. Meristem culture of tapioca
4. Virus indexing in banana and tapioca
5. Transformation of tobacco and analysis of transgenic plants - PCR
6. Visit to Bt cotton field and strip assay for detecting Cry protein
7. ELISA for Cry protein expression analysis
8. DNA isolation
9. DNA fingerprinting using RAPD primers
10. NTsys analysis
11. Hybrid identification using SSR marker
12. Callus culture
13. Cell suspension culture
14. Extraction of secondary metabolites
15. Antimicrobial assay using food poisoning technique
16. Visit to commercial tissue culture lab / biotech lab/GC-MS, HPLC lab
17. Practical Examination

Outcome

Students are exposed to current status of the applications of molecular manipulations in crop improvement.

Text Book

1. Bhojwani, S.S. and Razdan, M.K. 2006. Plant Tissue Culture Studies – Theory and Practice. Elsevier Publication.
2. Gupta, P.K. 2005. Molecular Biology and genetic engineering. Rastogi Publication, India.
3. Malacinski, M. and D. Friefelder. 2003. Essentials of molecular biology. IV Ed. Jones and Bartlett publishers, Boston
4. Singh, B.D. 2004. Frontier areas in Biotechnology. Kalyani Publications, New Delhi.

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2. Lehninger. 2004. Principles of Biochemistry. CBS Publications, New Delhi.
3. Brown, T.A. 2006. Gene cloning - An introduction. V Ed. Chapman Hill, U.K.
4. Slater A, 2008.Plant Biotechnology The Genetic Manipulation of Plants
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- <http://www.cropgen.org>.
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- <http://www.agbiosafety.unl.edu/>.

AEN 311 Pest Management in Horticultural Crops 2 + 1

Theory

Unit I Insect ecology and components of pest management

Insect Ecology- Effect of abiotic and biotic factors on insect population. Pest - definition, categories of pests, factors governing pest outbreaks. Concept of economic threshold level and economic injury level. Principles and components of pest management

Unit II Methods of pest control

Cultural, physical, mechanical and legal methods of pest control. Biological control-parasitoids, predators, viruses, bacteria, fungi and nematodes and their role in insect management. Host plant resistance - Types and mechanisms of resistance. Chemical control - Classification of pesticides, role of insecticides in pest management. Biorational pest management - Semiochemicals - pheromones, allomones , kairomones and synomones - role of pheromones in pest management. Insect growth regulators - moult inhibitors, JH mimics, insect antifeedants, repellants and botanicals in pest management. Biotechnology in pest management.

Unit III Pests of fruits, vegetables and tubers

Distribution, bionomics, symptoms of damage and management strategies of insect and non insect pests of Brinjal, Bhendi, Tomato, Crucifers, Cucurbits, Moringa, Amaranthus, Potato, Sweet potato, Tapioca, Mango, Guava, Sapota, Citrus, Banana, Grapevine, Jack, Jamun, Aonla, Pomegranate, Papaya, Ber, Apple, Pear, Peach and Plum,

Unit IV Pests of spices and plantation crops

Distribution, bionomics, symptoms of damage and management strategies of insect and non insect pests of chilli, onion, garlic, turmeric, curry leaf, coconut, arecanut, coffee, tea, cashew, rubber, cocoa, cardamom, pepper and betel vine

Unit V Pests of ornamental and medicinal plants, tree crops, lawn, turf, dry fruits and apiculture

Distribution, bionomics, symptoms of damage and management strategies of insect and non insect pests of rose, jasmine, crossandra, chrysanthemum, tuberose and gloriosa, coleus, phyllanthus, aswagantha, neem, teak, subabul, tamarind, sandalwood, eucalyptus, casurina, lawn, turf and cutflowers, dry fruits, nuts and other horticultural products. maintenance of honey bee colonies in orchards

Practical

Identification of symptoms of damage and life stages of important pests of different horticultural crops: vegetables, fruits, tubers, spices, plantation crops, ornamentals, medicinal plants lawn, turf, cut flowers, tree crops, dry fruits, nuts and other horticultural products. Establishment and maintenance of honeybee colonies

Assignment

Collection and submission of 50 pests of horticultural crops

Rearing a minimum of 20 insect pests and preparation of two riker mounts of pests of horticultural crops

Lecture schedule

1. Insect ecology -Role of biotic (food, competition, parasitoids and predators, host plants) and abiotic factors (temperature, humidity, rainfall, microclimate etc) on pest abundance.
2. Pest - definition, categories and causes of outbreak, Economic injury level (EIL) and economic threshold level (ETL). Principles of integrated pest management-methods.
3. Cultural, physical, mechanical and legal methods of pest control - different components
4. Host plant resistance - types and mechanisms of resistance
5. Biological control - definition, parasitoids and predators and entomopathogens and their role in pest management.
6. Chemical control - classification of insecticides and their role in pest management

7. Semiochemicals – definition, Interspecific (allomone, kairomone and synomone), Intraspecific (pheromones) –Pheromones in pest management.
8. Insect growth regulators (IGRs)- moult inhibitors, JH mimics, insect antifeedants, repellents and botanicals in pest management
9. Biotechnological approaches in pest management
10. Pests of brinjal and bhendi
11. Pests of amaranthus, tomato and moringa
12. Pests of cucurbits and crucifers
13. Pests of potato, sweetpotato and tapioca
14. Pests of mango I
15. Pests of mango II and guava
16. Pests of citrus and sapota
17. Mid semester examination
18. Pests of grapevine and banana
19. Pests of jack, pomegranate, pine apple and aonla
20. Pests of jamun, papaya and ber
21. Pests of apple, pear, peach and plum
22. Pests of coconut and arecanut
23. Pests of coffee and tea
24. Pests of cashew, rubber and cocoa
25. Pests of chillies, onion, garlic and turmeric
26. Pests of curry leaf, cardamom, pepper and betel vine
27. Pests of rose and jasmine
28. Pests of crossandra, chrysanthemum and tuberose
29. Pests of gloriosa, coleus, phyllanthus and aswagantha
30. Pests of tamarind, casuarina, subabul and neem
31. Pests of teak, eucalyptus and sandalwood
32. Pests of dry fruits, nuts and other horticultural products
33. Pests of lawn , turf and cut flowers
34. Maintenance of honey bee colonies in orchards

Practical schedule

Identification of symptoms of damage and life stages of important

1. Pests of brinjal, bhendi and tomato
2. Pests of amaranthus, moringa, chillies, coriander and curry leaf
3. Pests of crucifers and cucurbits
4. Pests of mango, citrus and sapota
5. Pests of banana, grapevine, guava and jamun
6. Pests of Pomegranate, amla, papaya, ber and apple
7. Pests of potato, sweet potato and tapioca
8. Pests of coconut and arecanut
9. Pests of coffee and tea
10. Pests of cashew, rubber and cocoa
11. Pests of onion, turmeric and tamarind
12. Pests of cardamom, pepper and betelvine
13. Pests of rose, jasmine, crossandra, chrysanthemum and tuberose
14. Pests of gloriosa, coleus, neem, teak and subabul
15. Pests of sandalwood, eucalyptus, lawn, turf, and cut flowers
16. Pests of dry fruits, nuts and other horticultural products
17. Practical examination

Text Books

1. Ayyar, T.V.R. 1963, Hand Book of Economics Entomology for South India. Govt. Press Madras.
2. David, B.V. 2006. Elements of Economic Entomology. Popular Book Depot, Chennai.
3. Butani, D.K. 2009. Insects and Fruits. Periodical Expert Book Agency, New Delhi.
4. Butani, D.K. and M.G.Jotwani, 1984. Insects of Vegetables. Periodical Expert Book Agency, New Delhi.
5. Srivastava, K.P. and D.K.Butani, 1998. Pest Management in Vegetables (Part I &

II) Research Periodicals and Book Publishing House, India.

AEC 301 Production Economics and Farm Management 1 + 1

Unit I Nature and scope

Production economics: Meaning - definition - nature and scope - Farm Management : Definition - objectives of farm management - production economics vs farm management - farm management decisions - decision making process - scope of farm management. Types and systems of farming: types - specialized and diversified-mixed systems of farming - peasant farming - state farming - capitalistic - collective-co-operative farming.

Unit II Factor product relationship

Factor - product relationship: Meaning Agricultural/horticultural production function: Meaning - definition- Laws of returns: increasing, constant and decreasing returns- Classical production function and three stages of production - Elasticity of production - Types/forms of production functions- Linear, Cobb-Douglas and Quadratic - Cost concepts and cost curves: total, average and marginal cost - Economics of scale - determination of optimum input and output - physical and economic optimum.

Unit III Factor factor relationship

Factor-factor relationship : Meaning- isoquant - definition and types - isoquant map - marginal rate of technical substitution - factor intensity - isocline- ridge line - returns to scale - elasticity of factor substitution- iso-cost line - principle of factor substitution and least cost combination of inputs -Expansion path - Effect of input price changes on the least cost combination.

Unit IV Product product relationship

Product-product relationship: Meaning - production possibility curve - marginal rate of product transformation - Enterprise relationship: joint products - complementary - supplementary - competitive products - iso-revenue line - optimum combination of products - principle of equi-marginal returns - Principle of opportunity cost.

Unit V Farm planning and budgeting

Farm planning: importance – characteristics of good farm plan – farm planning procedure – Budgeting: definition and types – complete budgeting – partial budgeting – enterprise budgeting – cash flow budgeting – limitations of budgeting – Linear programming: assumptions – linear programming model defined – graphical solution – advantages and limitations – Risk and uncertainty: definition – types of risk and uncertainty – safeguards against risk and uncertainty.

Practical

Problems on factor-product relationship- determination of least-cost combination-determination of optimum product combination-computation of cost concepts- cost of cultivation and cost of production of agricultural/horticultural crops, horticultural and livestock products - depreciation-methods of calculation of depreciation- Farm records and accounts – analysis of farm records and accounts - Farm inventory analysis – Net worth statement – Profit and loss statement – Break-even analysis -- preparation of complete and partial budgets - preparation of farm plan – graphical solution to linear programming problem.

Lecture schedule

1. Production Economics : Meaning- Definition – Nature and Scope - Farm Management : Definition - Objectives of Farm Management - Production Economics Vs Farm Management
2. Farm Management Decisions - Decision making process - Scope of farm management
3. Types and systems of farming: types - specialized and diversified-mixed – systems of farming – peasant farming – state farming – capitalistic – collective-co-operative farming.
4. Factor-Product relationship : Meaning - Agricultural/horticultural Production Function : Meaning – Definition- Laws of returns: increasing, constant and decreasing returns
5. Classical production function and three stages of production – Elasticity of production
6. Types of Production functions- Linear, Cobb-Douglas and Quadratic

7. Cost concepts and cost curves: total, average and marginal cost concepts and curves, economics of scale.
8. Determination of optimum input and output: input approach and output approach - physical and economic optimum.
9. Mid semester examination
10. Factor-factor relationship : meaning- isoquant - definition and types - isoquant map - marginal rate of technical substitution - factor intensity - isoclines - ridge line
11. Returns to scale - elasticity of factor substitution- iso-cost line - principle of factor substitution and least cost combination of inputs - Expansion path - Effect of input price changes on the least cost combination
12. Product-product relationship: Meaning - production possibility curve - marginal rate of product transformation - Enterprise relationship: joint products - complementary - supplementary - competitive products
13. Iso-revenue line - optimum combination of products - principle of equi-marginal returns - Principle of opportunity cost
14. Farm planning : importance - characteristics of good farm plan - farm planning procedure
15. Budgeting : definition and types - complete budgeting - partial budgeting - enterprise budgeting - cash flow budgeting - limitations of budgeting
16. Linear programming : Assumptions - Linear programming model defined - graphical solution - advantages and limitations
17. Risk and uncertainty : definition - types of risk and uncertainty - safeguards against risk and uncertainty

Practical schedule

1. Estimation of Optimum input - output combination.
2. Determination of least-cost combination
3. Determination of optimum product combination
4. Computation of cost concepts- cost of cultivation and cost of production of agricultural/horticultural crops

5. Cost of cultivation and production of perennial crops/ horticultural crops.
6. Cost of production of livestock products
7. Depreciation: methods of calculating depreciation
8. Visit to a farm (government/private/corporate) to study the layout and organization
9. Farm records and accounts : Usefulness, types of farm records–farm production records-farm financial records
10. Visit to a private agricultural/horticultural farm to collect information on farm business
11. Farm inventory analysis: Examination of assets – valuation of assets by different methods
12. Preparation and analysis of Net worth statement and Profit and loss statement
13. Estimation of Break-even analysis
14. Preparation of complete budget and partial budgets
15. Preparation of farm plan
16. Graphical solution to Linear programming problem
17. Final practical examination

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1. Sankayan, P.L. Introduction to Farm Management, (New Delhi:Tata Mc Graw Hill Publishing Company Ltd) 1983
2. Johl SS & Kapoor TR. (1973). Fundamentals of Farm Business Management. Kalyani Publ.India
3. Kahlon AS & Singh K. (1992). Economics of Farm Management in India. Allied Publ.New Delhi
4. Doll, J.P. and F. Orazem.(1983)Theory of Production Economics with Applications to Agriculture John Wiley, New York.
5. Debertin, D.L. (1986) Agricultural Production Economics. Macmillan, New York.
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7. Jensen, H.R. (1977). 'Farm Management and Production Economics, 1946-70', A Survey of Agricultural/horticultural Economics Literature, University of Minnesota Press, Minneapolis, Vol. 1, pp. 1-89.
8. Kay, Ronald D., and William M. Edwards, and Patricia Duffy ;(2004) Farm Management, Fifth Edition, McGraw-Hill, Inc., New York.
9. Panda SC. (2007). Farm Management & Agricultural/horticultural Marketing. Kalyani Publ. Ludhiana India

PBG 301 Principles and Methods of Plant Breeding In Horticultural Crops 2 + 1

Aim

- ❖ To expose the students to basic and applied principles of plant breeding in horticultural crops.

Theory

Unit I Reproductive systems and plant breeding

Introduction to plant breeding - objectives and role - historical perspective- centres of origin - germplasm - conservation - plant introduction - reproduction in plants- systems of mating - self incompatibility - sterility- apomixes.

Unit II Breeding methods of self pollinated crops

Breeding methods: self pollinated crops- genetic basis - pureline selection - mass selection - hybridization and selection - pedigree breeding - bulk breeding - single seed descent - backcross breeding - multiline.

Unit III Breeding methods of cross pollinated crops

Breeding methods: cross pollinated crops - genetic structure - Hardy Weinberg law - mass selection - modified mass selection; Heterosis breeding - use of male-sterility systems - types of hybrids; recurrent selection - synthetics - composites; asexual breeding system: genetic structure - breeding methods

Unit IV Special breeding methods

In vitro selection techniques; mutation breeding - polyploidy breeding and distant hybridization -- Introduction to markers - morphological - biochemical- DNA markers - Use of markers for crop improvement

Unit V Maintenance breeding

Maintenance breeding - procedure for release of new varieties - stages in multiplication - certification - Nucleus and breeder seed production techniques - Current trends in plant breeding

Practical

Observation on reproductive and pollination systems in plants - Alternation of generation and life cycle - Description and drawing of different pollination systems - Mechanisms enforcing self and cross pollination - Morphology of pollengrains - Assessment of pollen fertility and sterility in A, B, and R line - Maintenance of A, B lines. Emasculation technique - Selfing and crossing techniques - Breeder kit - Layout of different trials - Irradiation - dosimetry - Half life period - Procedure for irradiation - Chemical mutagenesis - Molar solution - Procedure for treatment - Calculation of heterosis, PCV, GCV, heritability, genetic advance - genetic divergence - Records maintained - Wild species maintenance and utilization - screening method for specific traits - marker assisted selection.

Lecture schedule

1. Objectives and role of plant breeding - historical perspective - activities in Plant Breeding.
2. Centres of origin - contribution of Vavilov, Harlan, Zhukovosky - law of homologous series.
3. Plant genetic resources - importance - germplasm - types - activities - gene erosion - gene bank - collection - conservation - types of conservation - agencies - quarantine.
4. Germplasm: evaluation - use of descriptors, documentation, utilization; Agencies - national and international; germplasm exchange - quarantine.
5. Modes of reproduction - sexual - asexual - self and cross fertilization - significance of pollination.
6. Self incompatibility - classifications - mechanisms - application - measures to overcome and limitations.
7. Sterility - male sterility - introduction - classification - CMS,GMS,CGMS - inheritance and applications.
8. TGMS,PGMS, Gametocides, Transgenic Male sterility and applications.
9. Apomixis-introduction-classification-applications.

10. Basic biometrics-nature and significance of qualitative and quantitative variation-phenotypic, genotypic and environmental-heritability and genetic advance
11. Plant introduction as a breeding method - types of introduction - objectives - quarantine - acclimatization - achievements - merits and demerits.
12. Genetic basis of self pollinated crops - Vilmorin principle of progeny selection - Johannsen's pure line theory.
13. Breeding methods for self pollinated crops - pure line selection - procedure - merits and demerits - achievements; Mass selection in self pollinated crops - procedure - types - comparison of mass and pureline selection - achievements.
14. Creating variability in self pollinated crops - Hybridization and selection - objectives types - choice of parents - combining ability - combination breeding and transgressive breeding.
15. Pedigree breeding - procedure - mass pedigree - merits - demerits - achievements; Bulk breeding - procedure - merits - demerits - achievements.
16. Comparison of pedigree and bulk breeding methods. Single Seed Descent (SSD) method - procedure - application - merits and demerits.
17. Mid semester examination
18. Backcross breeding - genetic principles - pre-requisites - procedures for transferring dominant and recessive genes.
19. Back cross breeding - merits - demerits - multi lines and multi blends - population improvement approach in self-pollinated crops.
20. Genetic structure of a population in cross pollinated crop - Hardy Weinberg law - gene frequencies in random mating population - principles in population improvement.
21. Mass selection in cross pollinated crops - modified mass selection - unit selection - mass selection with progeny testing - half sib family selection - full sib family selection.
22. Recurrent selection principles - types - merits and demerits.

23. Heterosis breeding – genetic basis – hybrid vigour – estimation of heterosis – inbreeding depression – development of inbreds.
24. Heterosis breeding – procedure – use of male-sterility systems – types of hybrids – achievements – merits and demerits.
25. Steps in development of synthetics and composites – achievements – merits and demerits.
26. Genetic characters of asexual reproduction – breeding methods – clonal selection – hybridization and clonal selection – merits and demerits – achievements.
27. *In vitro* selection techniques – somaclonal variation – utilization in crop improvement ; Use of double haploids in crop improvement.
28. Mutation breeding: mutation – types – mutagens – breeding procedure – applications – achievements – limitations.
29. Polyploidy breeding – classification – induction of polyploidy – achievements – limitations.
30. Wide hybridization-history-importance-barriers and techniques for overcoming barriers-utilization
31. Introduction to markers – morphological – biochemical- DNA markers – uses of marker assisted selection - major genes – merits – demerits – achievements.
32. Types of cultivars – procedure for release of new varieties – stages in seed multiplication – certification.
33. Maintenance Breeding: General seed production techniques – steps in nucleus and breeder seed production – varietal rundown and renovation.
34. Breeding for biotic and abiotic stresses; Current trends in plant breeding – Marker assisted breeding -Transgenic crops - Varietal protection .

Practical schedule

1. Pollination and reproduction in plants - Alternation of generation and life cycle.
2. Description and drawing different pollination systems - Mechanisms enforcing self and cross pollination in crops.

3. Pollen morphology - Exine structure of different crops. Fertility and sterility in A, B, R and TGMS lines.
4. Breeder kit and its components - uses; Principles of selfing and crossing techniques
5. Emasculation, and pollination techniques in horticultural crops.
6. Emasculation, and pollination techniques in horticultural crops.
7. Layout of different yield trials - Observing the experimental plots.
8. Calculation of PCV, GCV, heritability, genetic advance
9. Estimation of heterosis.
10. Maintenance of A, B and R line and TGMS lines. Hybrid seed production techniques
11. Studies on segregating generations and maintenance of records.
12. Irradiation - dosimetry - half life period - procedure for irradiation. Chemical mutagenesis - molar solution preparation - procedure for chemical mutagenesis.
13. Studies on different wild species in crop plants and wide hybridization.
14. Screening methods - laboratory and field - for biotic and abiotic stresses.
15. Observation on germplasm preservation - evaluation - records maintained in research stations
16. Procedure for marker assisted selection
17. Practical examination

Text books

1. Singh, B.D. 2005. Plant breeding - Principles and methods. Kalyani Publishers, New Delhi.
2. Phundhan Singh. 2001. Essentials of plant breeding, Kalyani publishers, New Delhi.
3. Daniel Sundararaj, G. Thulasidas and M. Stephen Dorairaj. 1997. Introduction to Cytogenetics and Plant Breeding. Popular Book Depot. Chennai - 15.

Further reading

- a. Chopra, V. L., 1994. Plant breeding theory and practice. Oxford and IBH Publishing Co. Pvt. Ltd.
- b. Sharma, J. R. 1994. Principles and practice of plant breeding Tata McGraw-Hill publishing Co., New Delhi.
- c. Allard, R. 1989. Principles of plant breeding. John Wiley and Sons, New Delhi.
- d. Russell, G. E. 1985. Progress in Plant Breeding. Butter Worths, England.
- e. Chaudhary, H. K. 1980. Elementary principles of plant breeding. Oxford and IBH publication Co., New Delhi

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- http://en.wikipedia.org/wiki/Plant_breeding
 - <http://www.edugreen.teri.res.in/explore/bio/breed.htm>
 - <http://cuke.hort.ncsu.edu/gpb/>
 - <http://www.stumbleupon.com/tag/plant-breeding/>
- <http://www.iaea.org/>

III Year VI Semester

Sl. No	Course Number	Course Title	Credit Hours
1.	VSC 302	Breeding of Horticultural Crops	2 + 1
2.	FLG 302	Ornamental Gardening, Landscaping and Turf Management	2 + 1
3.	EXP 301	Experiential Learning	0 + 5
4.	ENS 311	Waste Management in Horticulture Industry	1 + 1
5.	NST 301	Fundamentals and Applications of Nanotechnology	1 + 0
6.	PSM 401	Internship in Plantation and Hill Horticultural Crops	0 + 2
7.	ENG 301	Soft Skills for Career Development	0 + 1
8.	FSN 311	Principles of Processing and Value Addition of Horticultural Produces	2 + 1
9.	AEX 301	Extension Methodologies and Transfer of Agricultural Technologies	1 + 1
10.	AEC 302	Agricultural Marketing, Trade and Prices	1 + 1
Total			10+14=24

VSC 302 Breeding of Horticultural Crops 2 + 1

Aim

- ❖ To study the basics of floral biology, pollination mechanism, breeding strategies, methods of crossing in horticultural crops.

Theory

Unit I Breeding of self and cross pollinated and asexually propagated crops

Methods of breeding and achievements in crop improvement of self and cross pollinated and asexually propagated crops

Unit II Fruit crops

Floral biology, methods of breeding and achievements in crop improvement of fruit crops : mango, banana, acid lime, mandarin orange, sweet orange, grapes, sapota, papaya, aonla, guava, pomegranate and custard apple.

Unit III Vegetable crops

Floral biology, methods of breeding and achievements in crop improvement of vegetable crops : tomato, brinjal, chilli, bhendi, bitter gourd, cucumber, watermelon, bottle gourd, peas, beans, potato, tapioca, sweet potato, onion, amaranth, moringa, carrot, cabbage and cauliflower.

Unit IV Spices and plantation crops

Floral biology, methods of breeding and achievements in crop improvement of spice crops: black pepper, cardamom, clove, nutmeg, coriander, garlic, turmeric and ginger and plantation crops : tea, coffee, cocoa ,cashew, coconut, arecanut and palmyrah.

Unit V Flower crops, medicinal and aromatic crops

Floral biology, methods of breeding and achievements in crop improvement of flower crops: rose, jasmine, chrysanthemum, marigold, tuberose, crossandra, carnation and tropical orchids, medicinal crops : senna, gloriosa and coleus and aromatic crops: mint and cymbopogon.

Practical

Floral biology and pollination mechanism- study of wild relatives-practices in selfing and crossing procedures in the crops: mango, banana, citrus, sapota, pomegranate papaya, guava, aonla, custard apple, tomato, chilli, brinjal , bhendi, tapioca , sweet potato, peas, beans, bitter gourd, watermelon and cucumber, onion, amaranth, annual moringa, coriander, coconut and gloriosa - Exploitation of heterosis and techniques of F₁ hybrid production-Mutation and mutagenic treatments-Methods of induction of polyploidy- Identification of elite trees – Procedure for release of new varieties DUS testing.

Lecture schedule

1. Breeding strategies, with its of self pollinated crops merits and demerits and methods of improvement
2. Breeding strategies, merits and demerits and methods of improvement of cross pollinated crops
3. Breeding strategies, merits and demerits and methods of improvement of asexually propagated crops
4. Floral biology, breeding strategies and achievements made in crop improvement of Mango.
5. Floral biology, breeding strategies and achievements made in crop improvement of banana.
6. Floral biology, breeding strategies and achievements made in crop improvement of acid lime, sweet orange, mandarin orange.
7. Floral biology, breeding strategies and achievements made in crop improvement of grapes
8. Floral biology, breeding strategies and achievements made in crop improvement of sapota
9. Floral biology, breeding strategies and achievements made in crop improvement of papaya

10. Floral biology, breeding strategies and achievements made in crop improvement of pomegranate and aonla
11. Floral biology, breeding strategies and achievements made in crop improvement of guava and custard apple
1. Floral biology, breeding strategies and achievements made in crop improvement of tomato
2. Floral biology, breeding strategies and achievements made in crop improvement of brinjal.
3. Floral biology, breeding strategies and achievements made in crop improvement of chilli
4. Floral biology, breeding strategies and achievements made in crop improvement of bhendi.
5. Floral biology, breeding strategies and achievements made in crop improvement of onion
6. Mid semester examination
7. Floral biology ,breeding strategies and achievements made in crop improvement of bitter gourd and cucumber
8. Floral biology ,breeding strategies and achievements made in crop improvement of watermelon and bottle gourd
9. Floral biology ,breeding strategies and achievements made in crop improvement of moringa and amaranth
10. Floral biology ,breeding strategies and achievements made in crop improvement of tapioca and sweetpotato
11. Floral biology ,breeding strategies and achievements made in crop improvement of peas and beans
12. Floral biology ,breeding strategies and achievements made in crop improvement of potato
13. Floral biology ,breeding strategies and achievements made in crop improvement of carrot, cabbage and cauliflower

14. Floral biology ,breeding strategies and achievements made in crop improvement of black pepper and cardamom
15. Floral biology, breeding strategies and achievements made in crop improvement of clove, nutmeg, coriander and garlic.
16. Floral biology ,breeding strategies and achievements made in crop improvement of turmeric and ginger
17. Floral biology ,breeding strategies and achievements made in crop improvement of tea and coffee
18. Floral biology, breeding strategies and achievements made in crop improvement of cocoa and cashew.
19. Floral biology, breeding strategies and achievements made in crop improvement of coconut, arecanut and palmyrah.
20. Floral biology ,breeding strategies and achievements made in crop improvement of rose and jasmine
21. Floral biology ,breeding strategies and achievements made in crop improvement of chrysanthemum and marigold
22. Floral biology ,breeding strategies and achievements made in crop improvement of tuberose, crossandra, carnation and tropical orchids
23. Floral biology ,breeding strategies and achievements made in crop improvement of senna, gloriosa, coleus ,mint and cymbopogon

Practical schedule

1. Study of floral biology and pollination mechanism, practices in selfing and crossing in mango and banana.
2. Study of floral biology and pollination mechanism, practices in selfing and crossing in citrus, sapota and pomegranate.
3. Study of floral biology and pollination mechanism, practices in selfing and crossing in papaya, guava and aonla.
4. Study of floral biology and pollination mechanism, practices in selfing and crossing in tomato and chillies

5. Study of floral biology and pollination mechanism, practices in selfing and crossing in brinjal and bhendi
6. Study of floral biology and pollination mechanism, practices in selfing and crossing in tapioca and sweet potato
7. Study of floral biology and pollination mechanism, practices in selfing and crossing in peas and beans
8. Study of floral biology and pollination mechanism, practices in selfing and crossing in bitter gourd, watermelon and cucumber.
9. Study of floral biology and pollination mechanism, practices in selfing and crossing in onion, amaranth and annual moringa
10. Study of floral biology and pollination mechanism, practices in selfing and crossing in coriander, coconut and gloriosa.
11. Study of mutagenic treatments and various methods of mutation
12. Study of polyploidy and methods of development of polyploids.
13. Exploitation of heterosis and techniques of F₁ hybrid production in self-pollinated crops.
14. Exploitation of heterosis and techniques of F₁ hybrid production in cross-pollinated crops.
15. Identification of elite or plus trees in major fruit crops.
16. Variety release, procedures involved and DUS testing.
17. Practical examination.

Text Books

1. Chahal, G. S. and S. S. Gosal. 2002. Principles and procedures of plant breeding. Biotechnological and conventional approaches. CRC Press, U.K.
2. Kalloo, 1990. Vegetable Breeding, Vol. I II and III CRC Press, Florida.
3. Kumar, N. 2006. Breeding of Horticultural Crops Principles and Practices. New India Publishing Agency, Pitam Pura, New Delhi.

Further Reading

1. Kuckkuck, M, Kobafe, G and Wenzal, G. 1991. Fundamentals of Breeding, Springer- Verlage, London.

2. Singh B. D, 2002. Plant Breeding, Principles and Methods. Fifth Edition, Kalyani Publishers, New Delhi.
3. Prem Singh Arya, 2003. Vegetable breeding, production and seed production, Kalyani publishers, New Delhi.
4. Chahal, G. S. and S. S. Gosal. 2002. Principles and procedures of plant breeding. Biotechnological and conventional approaches. CRC Press, U.K.
5. Kuckkuck, M, Kobafe, G and Wenzal, G. 1991. Fundamentals of Breeding, Springer-Verlage, London.
6. Singh B. D, 2002. Plant Breeding, Principles and Methods. Fifth Edition, Kalyani Publishers, New Delhi.
7. Daniel Sundarraj, G. Thulasidas and M. Stephen Dorariraj. 1997. Introduction to Cytogenetics and Plant Breeding. Popular Book Depot, Chennai.
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- http://www.ilvo.vlaanderen.be/EN/Research/ResearchAppliedGeneticsandBreeding_new/ProductQualityImprovement/Breedingofagriculturalandhorticulturalcrops/tabid/2314/Default.aspx
- <http://www.agricultureinformation.com/forums/jobs-resumes-projects/7081-vegetable-breeding-research-job-required.html>
- <http://www.agron.iastate.edu/faculty/fehr/BVC/00BVC.PDF>
- <http://www.amazon.com/Genetic-Improvement-Vegetable-Crops-Kaloo/dp/0080408265>

Journals

- J of cytogenetics
- Economic botany
- Acta Horticulture

FLG 302 Ornamental Gardening, Landscaping and Turf Management 2 + 1

Aim

- ❖ To educate students on ornamental gardening special type of gardens, computer aided designing of landscape (CAD) and turf management

Theory

Unit I Importance and scope

Importance and scope of gardening - historical background - gardens in India - definition, principles and concepts of landscape gardening - styles and types of gardens - Hindu, Moghul, English, Italian, Persian and Japanese gardens - bioaesthetic planning - definition and need - ornamental landscaping in environmental protection.

Unit II Garden designs

Garden components and adornments - importance and designing - plant components and non-plant components - rosary, topiary, trophy, rockery, pond, sunken garden, flower beds, arboretum, conservatory, roads, walks, paths, hedges, edges, carpet garden, arch, pergola, arbour, fountains, cascades, garden seats, statues, hanging baskets, trellies, ornamental vases, ornamental urns and window boxes. Special types of gardens - principles and design - dish, terrarium, water and bog garden, traffic islands - terrace garden, rockery, vertical garden and tree transplanting.

Unit III Garden plants for landscaping

Study of foliage and flowering plants and their design and values in landscaping - ornamental annuals - shrubs - trees - herbaceous perennials - climbers and creepers - palms and palmatum- ferns and fernery - cacti and succulents. Dry flower- principles and types - Flower arrangement - principles, designs and styles - ikebana, moribana - bouquet making - bonsai - methods, styles and maintenance.

Unit IV Computer Aided Design

Landscape architecture - design, planning and management of natural and built environments. Computer aided design (CAD) - Geographical Information system (GIS) -landscape planning - home garden, public, urban and industrial gardening. Avenue planting - principles, plants suitability and planting.

Unit V Turf management

Importance and scope – turf grasses – species and types – selection of site – media and field preparation – types of lawn making – turf establishment for golf ground, cricket pitch and football field – turf management – renovation of lawns – astroturf and management.

Practical

Identification and description of annuals – shrubs – trees – herbaceous perennials – climbers and creepers – palms and ferns – cacti and succulents. Software tools in landscape architecture – landscape with CAD – Planning and designing of garden components – special types of gardens – avenue planting – site design creation – urban and rural planting – Dry flower and bonsai making – turf management – visit to gardens – visit to institutional, sports and games lawns and turf nurseries – renovation of lawns – economics.

Lecture schedule

Theory

1. History, development, scope and importance of landscape gardening
2. Definition and basic principles and of landscaping gardening
3. Principles of landscape architecture
4. Study of styles of garden
5. Study of types of garden – Hindu garden, Persian garden and Moghul garden
6. Study of types of garden – English garden, Japanese garden and Italian garden
7. Bio aesthetic planning – definition and need
8. Role of ornamental landscaping in environmental protection
9. Study of principles and designing of plant components
10. Study of principles and designing of non plant components
11. Study of special types of gardens - dish, terrarium, water garden and bog gardens
12. Study of special types of gardens – roof garden, rockery and traffic islands
13. Study of special types of gardens - vertical garden.
14. Principles and method of tree transplanting - Berlapping

15. Study of trees and their role in landscaping
16. Role of annuals and herbaceous perennials in landscape gardening
17. Mid Semester examination
18. Study of shrubs and their role in landscaping
19. Study of climbers and ground covers in landscaping gardening
20. Study of palms and ferns in landscaping
21. Study of cacti and succulents in landscaping gardening
22. Study of principles and methods dry flower production
23. Study of principles and methods of flower arrangement
24. Study of styles and types of bonsai making
25. Planning and designing of natural and built environments
26. Study of CAD and GIS in landscape designing
27. Study of water and bog garden
28. Designing of home gardens
29. Designing public, urban and industrial gardens
30. Study of roadside and avenue planting.
31. Importance, scope and species of lawn
32. Establishment of lawn, maintenance and rejuvenation of lawn
33. Study of golf ground and cricket pitch and management
34. Study of astroturf and management

Practical schedule

1. Identification and description of annuals shrubs and herbaceous perennials
2. Identification and description of trees, climbers and ground covers
3. Identification and description of cacti, succulents, palms, ferns and ornamental grasses.
4. Description and designing of garden components – arches, bowers, pergolas, paths, walks, bridges, fountains and statues
5. Designing of garden components – edges, hedges, rosary, flower borders.
6. Designing and layout of rockery and terrace garden

7. Designing and layout of water garden and bog garden
8. Designing and practicing bonsai, flower arrangements and bouquet preparation
9. Dry flower technology - practice, preparation of floral crafts and cards
10. Practice of handling software tools in landscape architecture
11. Practice of landscape with CAD (Computer Aided Design)
12. Practicing landscape design and plan - home and industrial garden
13. Project preparation and estimate preparation for landscaping
14. Practicing landscape design for urban and rural locations
15. Lawn and turfs - preparation of land, planting, after care and turf economics
16. Visit to large scale gardens, dam sites, lawns and turf nurseries
17. Practical examination.

Text Books

1. McCarty, L.B. 2005. Best Golf Course Management Practices. 2nd Edition. Pearson Prentice Hall, Upper Saddle River, NJ.
2. S.K. Bhattacharjee, 2004. Landscape Gardening and Design with plants. Aavishkar Publishers and Distributors, Jaipur.
3. Bose T.K., B. Chowdhury and S.P. Sharma 2001. Tropical garden plants in colour. Horticulture and Allied Publishers, Kolkata.
4. Auto CAD - 2010 Edition

Further reading

1. Randhawa, G.S. and A. Mukhopadyay. 1998. Floriculture in India. Allied publishers Limited, New Delhi
2. K.M.P. Nambisan 1992 - Design elements of landscape gardening - Oxford and IBH publishing Co, New Delhi.
3. Lancaster, P. 1991. Gardening in India. Oxford and IBH publishers Pvt. Ltd., Calcutta.
4. Gopalasamy lyengar. 1990. Complete gardening in India. IBH. Bangalore.

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- www.webct.uark.edu
- www.personal.psu.edu
- www.sunny.crk.umn.edu/courses
- www.lawngrasses.com
- www.mediatoday@vsnl.com
- www.hsi1942.org

Journals

- J. of ornamental Hort. Indian Society of Ornamental Horticulture, Division of Floriculture and Landscaping, Indian Agricultural Research Institute, New Delhi.
- Ind. J. of Hort. The Horticultural Society of India, Indian Agricultural Research Institute, New Delhi.
- “Floriculture Today” - published from E 11/47A, New Colony, Malviya Nagar, New Delhi.

EXP 301 Experiential Learning 0 + 5

- Pruning in high density planting (0+1)
- Rejuvenation of old orchards (0+1)
- Off season mango production (0+1)
- Pruning in grapes (0+1)
- Precision farming in Banana (0+1)
- Post harvest treatments for enhancing the shelf life of fruits (0+1)
- Nursery technology and vegetable seed production (0+1)
- F₁ hybrid vegetable seed production (0+1)
- Protected cultivation of vegetable crops (0+1)

- Precision farming in turmeric (0+1)
- Propagation techniques in coriander (0+1)
- Drip irrigation in coriander (0+1)
- Commercial seed production in loose flowers (0+1)
- Propagation techniques of commercial ornamental and medicinal crops (0+1)
- Exterior and interior flower arrangements (0+1)

ENS 311 Waste Management in Horticulture Industry 1 + 1

Aim

- ❖ To impart Knowledge on the process of recycling of solid wastes from horticultural industries
- ❖ Exposing and updating the UG students in waste management

Theory

Unit I Introduction to environment

Environmental components - environmental segments - atmosphere, hydrosphere, lithosphere and biosphere - energy fundamentals - bio nutrient cycling- biological interactions - environmental resources - air, water and soil.

Unit II Characteristics of horticulture industrial wastes

Horticultural industries -Tamil Nadu and India - liquid and solid wastes - characteristics - impacts - fruit and vegetable processing industries - case studies - mango, cocoa, sago and coffee processing industries.

Unit III Waste water management

Waste water treatment processes - aerobic and anaerobic treatment - bioreactors - biomethanation - microbial remediation - biofilters, biosorption - reed bed technologies.

Unit IV Solid wastes management

Solid wastes - sources, disposal problems and management technologies -- recycling - resource recovery - value addition - composting and vermicomposting - bioconversion - Recycling of green house cladding material - Packaging materials and recycling - land application of solid wastes and its impact on soil and crops

Unit V Environmental monitoring and regulations

Green technologies - CDM - eco labeling - biosensors - Bio indicators - environmental impact assessment (EIA), EMS - environmental education and awareness - environmental laws and organizations.

Practical

Horticultural industry waste water characterization - solids, alkalinity, acidity, hardness, DO, BOD, COD, enumeration of aerobes and anaerobes - water borne pathogens - treatments - physical, chemical and biological, anaerobic treatment - solid waste recycling- biogas production -- bio composting - pectin extraction - visit to identified horticultural industries for assessing pollution status.

Lecture schedule

1. Environmental components and Environmental segments - Atmosphere, Hydrosphere, Lithosphere and Biosphere
2. Energy fundamentals - bio nutrient cycling and Biological interactions
3. Environmental resources -air, water and soil.
4. Horticultural industrial wastes-liquid and solid waste -Characteristics -impacts
5. Fruit and vegetable processing industries -case studies -coffee processing industries
6. Fruit and vegetable processing industries -case studies-Mango ,Cocoa and Sago processing industries
7. Waste water treatment Processes - Aerobic and anaerobic treatment
8. Bioreactors - biomethanation - Microbial remediation - Biofilters, Biosorption
9. Mid semester examination
10. Reed bed Technologies - constructed wetlands -Engineered reed bed system
11. Solid wastes - sources, disposal problems and management technologies
12. Recycling - resource recovery - value addition - composting and vermicomposting
13. Bioconversion - recycling of green house cladding material and Packaging materials
14. Land application of solid wastes and its impact on soil and crops
15. Green Technologies - CDM - Eco labeling - Biosensors - bio indicators
16. Environmental Impact Assessment (EIA) and Environmental laws and organizations
17. EMS - Environmental education and awareness

Practical schedule

1. Sampling methods for fruit and vegetables processing industry wastes
2. Estimation of Solids, Alkalinity and acidity of fruit and vegetables processing wastewater
3. Estimation of hardness of fruit and vegetables processing wastewater
4. Estimation of dissolved oxygen and BOD of Fruit and vegetables processing wastewater
5. Estimation of Chemical oxygen demand (COD) of Fruit and vegetables processing wastewater
6. Enumeration of aerobic microorganisms from Fruit and vegetables processing wastes
7. Enumeration of anaerobic microorganisms from Fruit and vegetables processing wastes
8. Detection of waterborne pathogens in fruit processing industry wastewater
9. Visit to horticulture industry and studying its pollution status
10. Physical and chemical methods of horticultural industry wastewater treatment
11. Biological methods of horticultural industry wastewater treatment
12. Anaerobic treatment of coffee and rubber processing wastewater using bioreactors
13. Biogas production from Horticultural industry wastes
14. Visit to horticultural industry studying its pollution status
15. Management of horticultural industry solid wastes by Composting and Vermicomposting
16. Extraction of pectin from banana wastes.
17. Practical Examinations

Outcome

Create awareness among the students on pollution management & industrial hygiene and mitigation measures for management of horticulture industrial wastes.

Textbooks

1. Gilbert M.Masters 2004 . Introduction to Environmental Engineering and Science. Prentice Hall of India Private Ltd.New Delhi.
2. Bala Krishnamoorthy 2005. Environmental Management .Prentice- Hall of India Private Ltd. New Delhi.

Further Reading

1. Singh ,Shree N; Tripathi and Rudra D. 2007. Environmental Bioremediation Technologies. Springer Verlag Publishers.
2. Sharma, P.D.2009. Ecology and Environment. Narosa Publishers, New Delhi.
3. Stanley E.Manahan. 2006. Environmental Science and Technology : A Sustainable Approach to Green Science and Technology, Second Edition CRC press.
4. Jogdhand S.N. 2006. Environmental Biotechnology: Industrial Pollution Management (III ed). Himalaya Publishing House, New Delhi.

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- www.geocities.com /hotspur311
- <http://faculty.rio.edu/lindas/essyl.html>
- <http://www.cplbookshop.com>

Journals

- Indian Journal of Environmental Quality
- Indian Journal of Environmental Health

Theory

Unit I Principles of nanoscience

History, definition, terminologies in nanoscience - importance of Moore's law - introduction to nanomaterials - semiconductor - diode - Quantum Dots - Buckyball - CNT - Polymers - types - PLGA - coreshell nanoparticles - micelle - introduction to nanobiosensor - types - properties and applications

Unit II Synthesis of nanomaterials

Top-down and bottom-up approaches - physical, mechanical, chemical and biological synthesis of nanomaterials

Unit III Properties and characterization of nanomaterials

Physical, mechanical, optical, magnetic, thermal and electrical properties - characterization - SEM, TEM, AFM, FT-IR, XRD

Unit IV Application of Nanotechnology

Agriculture, food industry, energy, environment, health - social, economic and ethical issues - nanotoxicology

Lecture schedule

1. History, definition, terminology in nanoscience and importance of Moore's law.
2. Nanomaterials - semiconductor - diode - quantum dots - Buckyball - CNT - characteristics - applications.
3. Nanomaterials: polymers - types - PLGA - Coreshell nanoparticles - Micelles - characteristics - applications.
4. Biosensors - principle, components, types, applications.
5. Top-down and bottom-up approaches - physical method, Physical Vapour Deposition (PVD), etching - molecular beam epitaxy - sputtering - lithography.

6. Mechanical synthesis - Ball milling – types - mechanical alloying.
7. Chemical synthesis – Sol-gel method – Chemical Vapour Deposition (CVD) – electro-deposition- thin film.
8. Biological synthesis using microorganisms and plants.
9. Mid semester examination.
10. Mechanical, magnetic and thermal properties of nanomaterials.
11. Optical and electrical properties of nanomaterials.
12. Principle, components and application of nanotechnology equipments: Scanning Electron Microscope (SEM) and Transmission Electron Microscope (TEM).
13. Principle, components and application of nanotechnology equipments: X-ray diffraction (XRD) – Fourier Transform Infra Red Spectroscopy (FT-IR) – Atomic Force Microscope (AFM).
14. Agriculture – nano fertilizers – nano-herbicides – nano-pesticides – seed technology.
15. Energy, environment and health.
16. Nanotechnology in food systems – nano foods, nano-encapsulation of functional foods, nano-packaging, quality assessment.
17. Social, economic and ethical issues in nanotechnology and nano-toxicology.

References

1. Nano: The essentials understanding nanoscience and Nano- T. Pradeep - 2009 - Mc Graw Hill.
2. Nano materials - B. Viswanathan - 2009 - Narosa.
3. Introduction to nanotechnology - Charles P. Poole; Frank J. Owens – 2008 – Wiley.
4. Fundamentals of biomems and medical microdevices - Steven S. Saliterman – 2006 - Wiley Interscience.
5. Instrumental methods of analysis - Hobart H. Willam; Lynne L. Merrit – 2006 - CBS.
6. Fundamentals of physics - David Halliday; Robert Resnick – 2007 – Willey.
7. Chemistry Raymond Chang – 2009 - Tata Mcgraw Hill.

8. Nanomaterial chemistry - C.N. Rao, A.K. Chettam, A. Muller - 2007 - Wiley - VCH.
9. Nanotechnology Applications in Agriculture - C.R. Chinnamuthu, B. Chandrasekaran and C. Ramasamy - 2008.

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<http://www.nanowerk.com>.

PSM 401 Internship in Plantation and Hill Horticultural Crops 0 + 2

Practical

Plantation training in tea at UPASI, The Nilgris and training on temperate horticultural crops at Ooty. Training in coffee and other subtropical horticultural crops at Horticultural Research Station, Thadiyankudisai or Yercaud - visit to estates, factories, auction centres and blending units. Project preparation for the establishment of estates (16 days).

Practical schedule

Tea training at UPASI, Coonoor (7 days)

6. Practice in field or jungle clearing, lay out and planting of tea and shade tree seedlings and identification of different varieties of tea
7. Practice in nursery management of tea, application of fertilizers, identification of nutrient deficiencies, foliar feeding of nutrients, mulching and weed management in tea.
8. Practice in training and pruning, rejuvenation, replanting and shade management in tea.
9. Identification of pests and diseases and their management in tea, practice in tea plucking and organic tea production.
10. Estate management, budgeting, preparation of project for establishment of tea estates and visit to various estates in the Nilgiris located at different altitudes.
11. Hands on training on hill fruit crops at Pomological Station, Coonoor.
12. Hands on training on temperate horticultural crops at Horticultural Research Station, Ooty.

Coffee training at HRS, Thadiyankudisai /HRS, Yercaud (7 days)

1. Practice in field or jungle clearing, lay out and planting of coffee and shade trees and identification of different varieties.
2. Practice in nursery management, fertilizer application, identification of different nutrient deficiencies and weed control.

3. Practice in shade regulation, training and pruning, identification of pest and diseases and their management.
4. Practice in harvesting, processing and grading.
5. Visit to different coffee estates, curing units, auction centres, coffee boards and markets.
6. Estate management, budgeting, preparation of projects for establishment of coffee estates
7. Hands on training on other hill horticultural crops
8. Final examination.

ENG 301 Soft Skills for Career Development 0 + 1

Aim

- ❖ To impart soft skills including life skills for enabling the students to become employable
- ❖ To enable out students advanced speaking skills and writing skills
- ❖ To train our students communicate with confidence and conviction in group discussions and interviews.
- ❖ To facilitate learners learn some of the corporate skills

Practical

Unit I Overview

Soft skills and hard skills – career skills and corporate skills – lateral thinking ego styles – different types – on being a professional.

Unit II – Life Skills

1. Attitude

Psychological and Sociological definitions – types of attitude (positive and negative) and consequences – suggestions to keep a good attitude.

2. Emotional Intelligence (EI)

Introduction and Definitions – four branch model of EQ and its detailed explanation - five point scale to measure EI – suggestions to improve EI

3. Interpersonal skills

Study of character traits - discussion of formal interpersonal skills like greeting, enquiring, answering, complimenting and acknowledging.

4. Self Development/Empowerment

Self awareness and motivation – Maslow's theory of hierarchy and needs - Self analysis through SWOC and Johari Window – Elements and seven rules of motivation – Goal setting based on principle of SMART – Strategies of self motivation – Knowledge enhancing through reading of Newspapers, magazines and journals.

Unit III Communication Skills

5. Process of communication

Objectives of communication – Types of communication – Formal Vs informal communication – LSRW components of communication – Barriers to communication

6. Listening skills

Purpose and significance of listening – Process of listening – Different types of listening – How to be a good listener – Guidelines for effective listening – Barriers to listening – Tips to overcome the barriers

7. Reading skills

Purpose and significance of Reading – Benefits of reading – Process/Types of reading – Understanding/Inferring/Note making – SQ3R technique – How to be a good reader – Barriers/Distractions to good reading – Tips to overcome the barriers

8. Speaking Skills

Purpose and significance of speaking clearly – Verbal code and visual code – Benefits of good speaking – Process/ components of good speech – Informative speaking & its types – persuasive speaking & its types – Presentation skills – Barriers of speaking – Tips to overcome the barriers

9. Writing skills

Purpose and significance of writing – features of good writing – How to develop writing skills – choice construction, paragraph design, etc. – letter writing skills – formal & informal – parts of a good letter – layout & format of a letter – preparing a curriculum vitae – report writing – preparing a conference paper – writing a book review – editing – punctuation, spelling, grammar and vocabulary.

10. Telephone skills

The right environment – formal greetings – telephone courtesies – effective listening skills – interpersonal skills – concluding formality.

11. Mid Semester

Unit IV Employability Skills

12. Interview skills - I

Definitions of interview - two types of group interview - preliminary requirements for success - telephone interview - specially designed interviews.

13. Interview skills - II

Five stages of interview - how to answer the questions

14. Group discussion

Definition - contexts - why and how? - techniques for successful participation - skills required - simulation - based - group discussion.

Unit V Corporate Skills

15. Leadership qualities

Definition - basic requirements - (responsibility - self - knowledge - knowledge of, and rapport with subordinates- knowledge of the assignment- goal setting- decision making - team work) leadership with primates - leadership and vision.

16. Negotiation skills

Select definitions - functions of negotiation - two kinds of negotiation - phases of the process - rules - steps to improve negotiation skills.

17. Time management

Basic skills of time management - relationship between stress management and time management - time management techniques for prudent time management - tips for time management.

17. Stress management

Definition of stress -kinds - stress at work - causes, effects and solution - stress and stroke -different kinds of stroke - stress in interview.

Practical sessions

Session No.	Title	Activity
1.	Soft Skills- an overview	Brainstorming session
2.	Life skills/ Attitude	Interactive software and discussion pm [positive thinking
3.	Interpersonal skills	Demonstration
4.	Self Development/ Empowerment role-play	Role-play
5.	Process of communication	Interactive software Effective Communication
6.	Listening and speaking	Audio listening and close tasks
7.	Reading and writing Skills	Reading an unfamiliar text writing simulation
8.	Presentation Skills.	Listening to a software and demonstration by students and peer group evaluation
9.	Professional writing strategies	Discussion on article scientific and conference paper by means of handouts
10.	Writing a rejoinder	Divergent simulation
11.	Group discussion	Audio listening on group discussion and structured, timed Group Discussion.
12.	Interview skills - I	Listening to software on being interviewed and preparing a resume
13.	Interview skills - II	Interview simulation by subject experts and the course teacher
14.	Leadership qualities	Brainstorming session and convergent simulations
15.	Negotiation skills	Role Play
16.	Stress management and time management listening	To a software on stress and role play

Reference books

Text books

1. Hariharan,S. , S. N.Sundararajan, and S.P.Shanmugapriya.(2010). **Soft Skills**. MJP Publishers, Chennai.

Further reading

1. Alex. (2009). *Soft skills: Know yourself and know the world*. S. Chand & Co. Publishing House, New Delhi.
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4. Gloria. J. Galanes, Kathreine Adams, John. K. and Brillhart. (2004). *Effective Group Discussion*. Tata McGraw - Hill, New Delhi.
5. Jagadeesan. G. and Santhanakrishnan, R. (2007). *Soft Skills Development*. ICFAI University Press. New Delhi.
6. Martin Avis. (2010). *Effective Time Management Skills for Everyone*. Avis Consultancy, London, U.K.
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8. Patsy McCarthy and Caroline Hatcher. (2002). *Presentation Skill: The Essential Guide for Students*. Sage Publications, CA.
9. Peggy Claus. (2007): *The Hard Truth about Soft Skills*. Harper Collins Publishers, New York, USA.
10. Peter. J. Gosling. (2002), *Scientists Guide to Poster Presentations*, Kluwar Academic Pub, N.Y, USA.
11. Richard Ellis. (2009). *Communication Skills; Step ladders to success for professionals*. Intellect Books, Chicago, USA.
12. Robert, A. Day. (2000). *How to Write a Scientific Paper*. ELBS, U.K.
13. Sarvesh Gulati. (2006). *Corporate Soft Skills*. Rupa Publishers, New Delhi.
14. Soleman. D. (1998). *Working with Emotional Inteligence*. Bloomsbury Publishing, London.

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- www.softskills.com
- www.reportingskills.com
- www.writing-skills.com
- www.negotiation.com
- www.businessballs.com
- www.study-habits.com
- www.timethoughts.com

FSN 311 Principles of Processing and Value Addition of Horticultural Produces 2 + 1

Aim

- ❖ This course provides information on the principles and methods of processing and value addition of horticultural produces. This will also enhance the knowledge on value addition of horticultural produces.

Theory

Unit I Importance of processing and value addition

Introduction: Scenario of fruit and vegetable production and processing at national and international level - contribution of horticulture produces to human nutrition: nutritive value, nutraceutical properties - concept, principles and scope of processing and value addition of horticultural produces. Tools, equipments, lay out and other requirements of a small scale food processing unit.

Unit II Principles of processing and value addition using sugar and salt

Processing using sugar: principle - processing of jam, jelly, marmalade, squash, RTS, nectar, fruit bar, preserves and candies. Processing using salt: Principle - brining preservation of horticultural produces - preparation of pickles and sauces.

Unit III Principles of processing and value added dehydrated and canned products

Drying and dehydration: definition, principle, method, suitability - Types of driers: solar, cabinet, spray drier, drum drier, fluidized bed drier, freeze drying - methods of concentration : open kettle, flash evaporators - equipments used. Processing of dehydrated fruit, vegetable and spice products, fruit pulps. Canning: principles, methods - preparation of canned products - spoilage of canned foods and its prevention.

Unit IV Principles of preservation by low temperature, CA, MAP and irradiation

Preservation by low temperature: definition, principle, method, suitability - refrigeration, freezing - preparation of frozen foods - preservation by controlled atmosphere, modified atmosphere: definition, principle, method, suitability -

processing by irradiation: definition, principle, method, suitability – application of irradiation in food industry.

Unit V Recent technologies in fruit and vegetable processing

Minimal processing of fruits and vegetables – techniques involved. Recent trends in processing – high pressure processing and processing using pulse electric field. Utilization of fruit and vegetable waste.

Practical

Survey on processed foods – shelf life studies of fruits and vegetables at different temperatures and atmospheric conditions. Preparation of jam, jelly, squash, marmalade, pickles, steeping preservation, dehydrated, canned and frozen products.

Lecture schedule

1. Scenario of food processing
2. Nutritive value and nutraceutical properties of horticulture produces
3. Concept, principle and scope of value addition
4. Tools and equipments for a food processing unit
5. Lay out and requirements of a food processing unit
6. Principle of processing using sugar for single and blended fruit products
7. Processing of jam, jelly, marmalade
8. Processing of squash and nectar
9. Processing of Ready To Serve beverage
10. Processing of fruit bars
11. Processing of preserves and fruit candies
12. Principle of processing using salt
13. Preservation by brining and processing of pickles and sauces
14. Need , principle, method and suitability of processing by dehydration
15. Types of driers : solar, cabinet, spray drier, drum drier, fluidized bed drier
16. Processing of dehydrated fruit products
17. Mid semester examination

18. Processing of osmo dried fruit products
19. Processing of dehydrated vegetable products
20. Processing of dehydrated spice products
21. Need , principle, method and suitability of processing by concentration
22. Methods of concentration and equipments used: open kettle, flash evaporators, dehydro freezing.
23. Processing of concentrated fruit pulps
24. Principle of preservation using low temperature
25. Canning of fruits
26. Canning of vegetables
27. Spoilage in canned foods and its prevention
28. Need , principle, method and suitability of processing by Controlled Atmosphere and Modified Atmospheric Packaging
29. Need , principle, method and suitability of processing by irradiation
30. Application of irradiation in food industry
31. Need , principle and methods of minimal processing of foods
32. Need , principle, method of high pressure processing
33. Need , principle, method of application of pulse electric field
34. Utilization of industrial fruit and vegetable wastes

Practical schedule

1. Market survey of processed foods
2. Packaging and evaluation of the shelf life of fruits at different temperatures
3. Packaging and evaluation of the shelf life of vegetables at different temperatures
4. Packaging and evaluation of the shelf life of fruits and vegetables under CAP and MAP
5. Processing of jam and jelly
6. Processing of squash and RTS
7. Processing of fruit bar and candies
8. Processing of pickles and sauces
9. Steeping preservation of fruits and vegetables
10. Processing of osmo dried fruit slices
11. Processing of dehydrated vegetables
12. Processing of dehydrated spices
13. Canning of fruits
14. Canning of vegetables
15. Processing of frozen fruits and vegetables
16. Visit to fruit and vegetable processing unit
17. Practical examination

Outcome

This course will enable the students to understand the concepts and principles of food processing and value addition and give an overview of the various value addition technologies.

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Shaifur Rehman. M. 2007. Handbook of food preservation. Second Edition. CRC, Press.
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Singh.N.P. 2007. Fruits and vegetables preservation. Oxford Book Company. Jaipur.
India.

Giridharilal., Sidappa.G.S and Tandon.G.L.1979. Preservation of fruits and vegetables.
ICAR. New Delhi

Journals

Journal of Food Science and Technology

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Indian Food Packer

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AEX 301 Extension Methodologies and Transfer of Agricultural Technologies 1

+ 1

Aim

1. To inculcate knowledge and skill on various extension methodologies needed for effective transfer of agricultural technologies.

Theory

Unit I Communication and programme planning

Communication - meaning - definition - models - elements and their characteristics - types and barriers in communication. Programme planning - meaning, definition, principles, steps in programme development process, monitoring and evaluation of extension programmes.

Unit II Extension teaching methods

Extension teaching methods - audio-visual aids - definition - classification - purpose, planning and selection, combination and use - individual, group and mass contact methods - merits and demerits.

Unit III Modern communication gadgets

Modern communication sources - internet, video and teleconferencing, Interactive Multimedia Compact Disk (IMCD), village kiosks, Kissan Call Centre (KCC), mobile phone

Unit IV Diffusion and adoption

Diffusion - meaning and elements. Adoption - meaning -adopter categories and factors influencing adoption, stages of adoption, innovation decision process and attributes of innovation consequences of adoption.

Unit V Capacity building

Capacity building of extension personnel and farmers - meaning - definition, types of training, training to farmers, farm women and rural youth, FTC and KVK.

Practical

Communication pattern in TOT organizations - ongoing agricultural and rural development/TOT programmes, ATMA and SHGs - preparation of visual aids - extension literature - news stories, feature stories - interview articles - photo journalism - activities of Directorate of ODL / Educational Media Centre - activities of Community Radio Centre - writing script for radio and television - spread and acceptance of farm technologies at village level.

Lecture schedule

1. Communication-meaning, definition, functions, elements and their characteristics.
2. Types and barriers of communication and models of communication.
3. Programme planning-definition, scope, principles, importance, steps, evaluation, keys for evaluation.
4. Extension teaching methods-definition, meaning, functions, selection and classification.
5. Individual contact methods-farm and home visit, office call, telephone call and personal letter-observation and result demonstration.
6. Group contact methods-method demonstration, meeting, lecture, debate, workshop, seminar, forum and conference
7. Group contact methods-symposium, panel, brainstorming, buzz session, role playing and simulation games.
8. Mass contact methods-campaign, exhibition, farmers day and field trips - purpose, procedures, advantages and limitations.
9. Mid semester examination.
10. Mass contact methods-written communication-circular letter, leaflet, folder, pamphlet-purpose, procedures, advantages and limitations.

11. Audio visual aids-definition, scope and importance, classification-merits and demerits-factors influencing planning and selection.
12. Modern communication gadgets-computer networks, internet, video and teleconferencing.
13. Modern communication sources (e-extension)-multimedia devices-mobile phone, Kisan Call Centre, Village Knowledge Centre/information kiosks, portal, websites.
14. Diffusion-meaning, definition, elements. Innovation-adoption, meaning, definition, attributes of innovation and stages of adoption
15. Innovation-decision process, functions, adopter categories-factors influencing adoption-impact and constraints in technology transfer programmes.
16. Capacity building of extension personnel and farmers-meaning, definition and importance
17. Training-types, institutions training for farmers, farm women and rural youths and importance (FTC and KVK)

Practical schedule

1. Understanding the communication pattern in State Department of Agriculture/Horticulture.
2. Study on communication pattern in University TOT Centres.
3. Study of on going agricultural development programmes.
4. Preparation and practicing of posters, charts, graphs, circular letter, folders and leaflets
5. Visit to the State Department of Agricultural Engineering to study the transfer of technology efforts in farm mechanization.
6. Visit to village and fixing the priorities and selecting a most important problem for preparation of a project.
7. Visit to ATMA implemented village.
8. Studying the role of print media communication in publishing the activities of agriculture and allied fields.
9. Visit to Educational Media Centre.
10. Practicing skill on photo journalism

11. Studying the distance learning efforts of Directorate of ODL/Educational Media Centre
12. Studying the role of Community Radio Centre in TOT
13. Script writing for Radio and Television
14. Preparation of interview schedule to study the spread and acceptance of farm technologies at village level.
15. Data collection and tabulation
16. Presentation of reports.
17. Final practical examination

Outcome

The course will be of immense help to the students to acquire first hand knowledge on various extension methodologies in the area of transfer of technologies in agriculture and allied sciences.

Text Books

1. Ray, G.L., 1999. Extension Communication and Management, Naya Prokash, 206, Bidhan Sarani, Calcutta.
2. Rogers, E.M. 1995. Diffusion of Innovations, The Free Press, Newyork
3. Sandhu, A.S. 1996. Extension Programme Planning, Oxford & IBH Publishing Co. pvt. Ltd, New Delhi
4. Sandhu, A.S. 1996. Agricultural Communication: Process and Methods, Oxford & IBH Publishing Co. Pvt. Ltd, New Delhi.

Journals

1. Indian Journal of Social Sciences, Serials Publications, New Delhi
2. Agricultural Extension Review, Department of Agriculture and Co-operation, Ministry of Agriculture, New Delhi
3. Journal of Rural Development, NIRD, Rajendra Nagar, Hyderabad
4. MANAGE, NAARM, Hyderabad
5. Yojana, Ministry of Rural Development, New Delhi

References

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www.panasia.org
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AEC 302 Agricultural Marketing, Trade and Prices 1 + 1

Theory

Unit I Agricultural/horticultural marketing - nature and scope

Market and marketing: definitions, components and dimensions of a market. Agricultural/horticultural Marketing: Concepts and definitions, scope and subject matter. Classification of markets. Role of market functionaries - market forces and price determination. Marketing of agricultural/horticultural vs manufactured goods. Producer surplus of agricultural/horticultural commodities: Definition, producer surplus. Marketable and marketed surplus: Definition, importance and factors affecting marketable surplus.

Unit II Marketing functions and SCP paradigm

Marketing functions: buying and selling- packaging and transportation --grading and standardization--storage and warehousing -- processing and value addition. Market structure--conduct--performance paradigm (SCP) - market structure meaning, components, dynamics of conduct and performance.

Unit III Marketing efficiency and marketing institutions

Marketing channels: definition and channels for different products. Market integration: definition and types. Marketing efficiency: meaning and definition. Marketing costs, margins and price spread. Factors affecting marketing costs. Reasons for higher marketing costs. Ways of reducing marketing costs. Concepts of supply chain management and value enhancement. Marketing of agricultural/horticultural inputs. Role and objectives of marketing institutions: State and central-objectives -Cooperatives, commodity groups, state trading, warehousing, FCI, PDS, - quality control, AGMARK.

Unit IV Trade in agricultural/horticultural products

Theories of trade: absolute and comparative advantage - Status of agricultural/horticultural exports / imports from India and their share. Barriers to trade - tariff and non-tariff measures. Role of institutions like UNCTAD and WTO in promoting trade in agricultural/horticultural products. Free trade agreements - implications of AoA- market access, domestic support and export subsidies. New EXIM

policy of India - advantages of AEZs. - export promotion organization: APEDA, MPEDA, NHB, commodity boards .

Unit V Agricultural/horticultural prices and risk analysis

Price characteristics of agricultural/horticultural products. Objectives of price policy - Role of CACP - concept of MSP, FRP (SMP) and SAP. Risk in marketing - meaning and importance-types of risk- speculation and hedging - futures trading - Role of contract farming in risk mitigation.

Practical

Farm survey-Preparation of survey schedules- farmers' marketing practices-regulated market and its role in marketing of farm produce- Cooperative marketing society -- Farmers' market- estimation of marketed and marketable surplus- Identification of marketing channels- price spread estimation for agricultural/horticultural / livestock products-Role of Food Corporation of India (FCI)/Civil Supplies Corporation in Marketing of Agricultural/horticultural Produce- Central Warehousing Corporation (CWC) / State Warehousing Corporation (SWC) and their role in storage of farm produce - Functions of NAFED and TANFED - Agmark laboratory/grading institutions-commodity boards-export oriented units- analyzing the implications of trade liberalization-time series analysis of prices - trend and seasonal variations, cyclical and irregular variations -index numbers.

Lecture schedule

1. Market -definitions-components-dimensions. Agricultural/horticultural Marketing- definition - scope and subject matter. Classification of market and approaches to the study of marketing - functional, institutional, commodity, behavioral system.
2. Market functionaries and market forces. Marketing of agricultural/horticultural Vs manufactured goods. Characteristics of agricultural and horticultural commodities in relation to marketing.

3. Producer surplus of agricultural/horticultural commodities: Definition and types of producer surplus. Marketable and marketed surplus- importance and relationship - factors affecting marketable surplus.
4. Marketing functions- buying and selling- packaging and transportation --grading and standardization--storage and warehousing -- processing and value addition
5. Market SCP paradigm. Market Structure, Conduct & Performance - definitions- components and their dynamics
6. Marketing channel -definition-channels for different products. Marketing costs, margins and price spread - concepts- importance-factors affecting cost of marketing. Reasons for higher marketing costs. Ways of reducing marketing costs.
7. Marketing efficiency-operational and pricing. Market integration-vertical, horizontal and conglomeration.
8. Factor market--marketing of various agricultural/horticultural inputs-channel of distribution- Input market promotional activities by firm.
9. Mid semester examination
10. Role of Government in promoting agricultural/horticultural marketing viz., regulated markets, cooperative markets and farmers markets. Advantages of modern marketing system over traditional agricultural/horticultural marketing system .
11. Directorate of Marketing and Inspection - AGMARK - grading and quality control. NAFED and TANFED, State Agricultural/horticultural Marketing Boards, and FCI. Activities of National Horticultural Board, NDDB and Commodity Boards.
12. Legal measures for improving agricultural/horticultural marketing- APMC Act. Supply Chain Management for agricultural/horticultural commodities and value enhancement.
13. Absolute and comparative advantage trade theories - Concepts of Domestic trade, Free trade and International trade. Share of agricultural/horticultural

commodities in total trade. Major exports and imports of agricultural/horticultural and Agri-allied commodities.

14. Institutions for promoting trade in agricultural/horticultural commodities – national and international- GATT, UNCTAD and WTO. Agreement on Agriculture/horticulture – Market access, Domestic Support and Export subsidy.
15. New EXIM policy of India - Role of Agri. Export Zones – Export promotion Councils – APEDA, MPEDA and ITPO.
16. Agricultural/horticultural Prices - function and scope - price characteristics of agricultural/horticultural products. Food policy and prices -Procurement of food grains- buffer stock. Role of administered prices – MSP, SMP & SAP.
17. Risk in marketing - types of risk- speculation and hedging. Price risk – futures trading. Forward Vs Futures market. Role of Contract farming in risk management.

Practical schedule

1. Farm Survey-Preparation of survey schedules for collection of data.
2. Farm visit to collect information on marketing practices of agricultural/horticultural commodities and marketing problems.
3. Visit to weekly shandy/vegetable market/ farmers market.
4. Regulated market and its role in marketing of farm produce – field visit.
5. A visit to Cooperative marketing society to study the services and marketing of farm produce.
6. Visit to Wholesale market/ commission mundy.
7. Estimation of marketable and marketed surplus
8. Price spread estimation for major agricultural/horticultural and agri-allied products
9. Estimation of marketing efficiency and market integration
10. Vist to FCI / CSC
11. CWC/ SWC and their role in storage of farm produce.
12. Agmark Laboratory/Grading institutions-visit.
13. Marketing of farm inputs - visit to farm input dealer .

14. Visit to commodity boards/ AEZ/Export oriented Units.
15. Time series analysis of prices - TCSI variations.
16. Index number-construction and uses.
17. Practical Examination.

References

1. Acharya S.S. and N.L.Agarwal, 2002. Agricultural Marketing in India, Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi.
2. Acharya S.S. and N.L.Agarwal,1994 Agricultural Prices - analysis and policy, Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi.
3. Kahlon A.S. and S.D.Tyagi, 2000. Agricultural Price Policy in India - Allied Publishers Pvt. Ltd., Bombay.
4. Sak Onkvisit. John J.Shaw.1999 International Marketing Analysis and Strategy, Prentice Hall of India, New Delhi.
5. Sivarama Prasad A., 1999. Agricultural Marketing in India - Mittal Publications, New Delhi.
6. Kohls R.L. and N. Uhl. Joseph, 1980. Marketing of Agricultural Products, Collier Macmillan, New York.

IV Year VII Semester

Sl. No	Course Number	Course Title	Credit Hours
1.	HOR 401	Rural Horticultural Work Experience - RHWE (60+10+10+10 days)	0 + 6
2.	HOR 402	All India Study Tour (15days)	0 + 1
3.	HOR 403	Project Work	0 + 4
Total			0+11=11

HOR 401 Rural Horticulture Work Experience 0 + 6

The students in groups (4 to 5) shall be placed under different horticultural industries across the country for practical exposure for setting up an industry, working of the industry, technology in adoption, marketing of the products and its logistic management. The different horticulture industries include

- Processing of fruits and vegetables
- Processing of spices and condiments
- Processing of medicinal plants
- Landscaping and turfing
- Marketing and logistic management
- Dry flower Industry
- Green house production of cut flowers and vegetables
- Tissue culture

In addition, the students in groups shall be placed in different districts, in particular villages to study and explore the potentialities of horticulture crops as **Village Stay Programme**. The students shall survey the village, collect general information on the village, infrastructure, cropping pattern, technology adoption, awareness on recent scientific advancements, social culture etc. They shall interview the individual farmers (marginal and big farmers) on different aspects and conclude with a report on the status of the village for exploring the horticulture potentialities.

The students shall be attached with concerned **Assistant Director of Horticulture** at different districts of Tamil Nadu to study the organizational set up of Department of Horticulture and the schemes in operation, subsidy provision to farmers on different inputs, other activities etc.

The students shall also be attached with major **Non-Government Organizations (NGO)** in different districts of Tamil Nadu to study the organizational set up, role of NGO in upliftment of farmers, the schemes offered by NGO other activities etc.

HOR 402 All India Study Tour 0 + 1

The students will visit various national and international institutions related to agriculture, horticulture, forestry and other allied fields in various regions of the country. During the tour programme, the students will gain first-hand information on different agro-climatic zones, crops grown, cultivation practices, socio-cultural and economic status of the farming communities. The duration of the tour will be 16 days. The students will be evaluated as indicated below:

Item	Marks
Attendance	10
Behaviour	15
Tour diary	15
Tour record	15
Written test	30
Viva voce	15
Total	100

Practical schedule

The following institutes may be visited based on the requirement.

1. Visit to CRIDA, Hyderabad, AP.
2. Visit to IIHR and Gardens, Bangalore.
3. Visit to seed production units, Bangalore.
4. Visit to Jain irrigation and banana hi-tech field at Jalgaon, Maharashtra
5. Visit to NRC for Grapes, Pune and near by pomegranate orchards.
6. Visit to NRC for Onion and Garlic, Nasik.
7. Visit to Dr. Y. S. Parmar University of Horticulture and Forestry, Nauni, Solan
8. Visit to CPRI, Shimla and Mushroom Research Institute, Shimla.
9. Visit to PAU, Ludhiana
10. Visit to Rose Garden and Rock Garden, Chandigarh
11. Visit to Moghul Gardens at Taj Mahal, Agra
12. Visit to Forest College, Dehradun
13. Visit to Remote sensing unit, Dehradun

14. Visit to IARI, NBPGR & NSC, New Delhi.

HOR 403 Project Work 0 + 4

Practical

A group of 5 to 8 students will work on a specified topic suggested by the course teachers on various aspects of agri - horti business, rural farming, small and cottage industry and cooperative firms. A project report will be prepared and submitted by the students group.

Programme

Identification of thrust area - attachment of students group with the agri - horti business units, small and cooperative firms - details on establishment - type of ownership - private limited - public limited - cooperative society - functions - employment generation - raw materials - availability - end user industries - quality evaluation - standard of operation - total quality management.

Evaluation pattern

Selection of topic	: 10
Basic data collection for the project work:	10
Time management for project work	: 5
Project report	: 75

IV Year VIII Semester

Sl · No	Course Number	Course Title	Credit Hours
1.	FSC 401	Post Harvest Handling of Horticultural Produces	2 + 1
2.	EXP 401	Experiential Learning	0 + 5
3.	HNM 311	Nematode Management in Horticultural Crops	1 + 1
4.	PAT 411	Diseases of Horticultural Crops and their Management	2 + 1
5.	TAM 401 /ENG 401	,yf;fpa';fspy; ntshz;ika[k; mwptpay; jkpH; gadhf;fKk; (or) Development education	0 + 1
6.	SAC 401	Nutrient Management and Fertilizer Technology	2 + 1
7.	AEC 401	Agricultural Finance, Banking and Cooperation	1 + 1
Total			8+11=19

FSC 401 Post Harvest Handling of Horticultural Produces 2 + 1

Aim

2. To teach the students on the principles of postharvest technology, postharvest physiology and postharvest handling techniques in horticultural crops.

Theory

Unit 1 Principles of postharvest technology

Importance and scope of postharvest technology in horticultural crops - structure of horticultural produce - pre-harvest factors influencing postharvest life - pre-harvest treatments to enhance the shelf life. Maturity indices - harvesting methods - mechanical harvesting.

Unit II Cooling, packing and packinghouse operations

Pre-cooling - cooling methods - cool chain - packing and packinghouse operations - postharvest treatments to enhance shelf life - ripening - physical, physiological and biochemical changes after harvest in fruits and vegetables. Ripening methods - ethylene in postharvest technology. Physiological changes in spices and plantation crops during storage. Physiological changes in cut flowers during storage. Sorting, grading and washing - machineries

Unit III Packaging and storage

Packaging - types of containers and cushioning materials - packaging methods - waxing - types of waxes - methods of storage for domestic and export market - *In situ* storage - storage using sand and coir - storage in pit - storage using windbreaks - storage in barns - storage in cellars - bulk storage of dried bulb crops - storage in *clamps* - storage using evaporative coolers - night ventilation storage - refrigerated storage - low temperature storage - hypobaric storage - controlled atmosphere (C.A.) storage - modified atmospheric storage - compatibility of horticulture produce for storage - pre-storage treatments.

Unit IV Waxing, transport, postharvest disorders, pest and disease management

Waxing-types of waxes-modes of transportation – constraints-transit hazards-postharvest disorders, pest and disease management in major horticultural crops.

Unit V Export

WTO guidelines for export of horticultural produces – CODEX standards and export standards for major fruits, vegetables and cut flowers - food safety practices - HACCP - minimal processing of fruits and vegetables - physiology - constraints and thrust areas.

Practical

Assessment of maturity indices – methods of harvest – Pre-harvest treatments to enhance the postharvest life - assessment of physical, physiological and biochemical changes during ripening – determination of physiological loss in weight and quality - sorting, grading and washing of horticultural produce – Postharvest treatments to enhance the postharvest life – packaging of fruits, vegetables, cut flowers, dry flowers and medicinal plants using different packing materials – vase life of cut flowers - waxing - methods of storage – drying technology of medicinal plants – postharvest disorders. Identification of storage pests and diseases. Visit to cold storage, processing units and markets.

Lecture schedule

1. Importance of postharvest technology for fruits.
2. Importance of postharvest technology for vegetables, spices, plantation crops and cut flowers.
3. Maturity indices for fruits crops
4. Maturity indices for vegetables crops
5. Harvesting, handling and grading of fruits.
6. Harvesting, handling and grading of vegetables.
7. Harvesting, handling and grading of plantation crops.
8. Harvesting, handling and grading of spices.
9. Harvesting, handling and grading of cut flowers.
10. Pre-harvest factors affecting postharvest life.

11. Physical, physiological and biochemical changes during ripening and storage of fruits.
12. Physical, physiological and biochemical changes during ripening and storage of vegetables.
13. Ripening changes – related enzymes.
14. Physiological changes in spices and plantation crops during storage.
15. Physiological changes in cut flowers during storage.
16. Hastening and delaying ripening.
17. Mid semester examination
18. Pre harvest and postharvest treatments and shelf life of horticultural crops.
19. Waxing - effect of wax coating on shelf life of produce
20. Types of packaging materials.
21. Types of cushioning materials.
22. Preparation for market, pre-cooling, cooling, storage.
23. Packaging technology for export by air, road and sea for fruits.
24. Packaging technology for export by air, road and sea for vegetables.
25. Packaging technology for export by air, road and sea for plantation crops and spices.
26. Packaging technology for export by air, road and sea for cut flowers.
27. Methods of storage of horticultural produce.
28. Methods of storage – small scale and large scale storage.
29. Methods of storage for local and distant markets.
30. Postharvest pests, diseases and disorders, constraints in postharvest management and thrust areas - fruit and vegetables.
31. Postharvest pests, diseases and disorders, constraints in postharvest management and thrust areas - flowers
32. Postharvest pests, diseases and disorders, constraints in postharvest management and thrust areas - spices and plantation crops
33. WTO guidelines for export of horticultural produce - export standards for major fruits and vegetables - food safety practices
34. Minimal processing of fruits and vegetables - constraints and thrust areas.

Practical

1. Assessment of maturity indices and methods of harvest
2. Pre-harvest treatments to enhance the postharvest life
3. Assessment of physical, physiological and biochemical changes during ripening
4. Determination of physiological loss in weight and quality
5. Sorting, grading and washing of horticultural produce
6. Postharvest treatments enhance the postharvest life
7. Packaging of fruits, vegetables, cut flowers, dry flowers and medicinal plants using different packing materials
8. Packaging of cut flowers and dry flowers using different packing materials
9. Vase life of cut flowers
10. Packaging of medicinal and aromatic plants using different packing materials
11. Waxing
12. Methods of storage
13. Drying technology of medicinal plants
14. Postharvest disorders.
15. Identification of storage pest and diseases.
16. Visit to cold storage, processing units and markets.
17. Practical examination.

Outcome

The students will acquire the knowledge on postharvest physiology and handling techniques of horticultural produce for export.

Text books

1. Salunkhe, D. K., N. R. Bhatt, B. B. Desai. 1990. Post harvest biotechnology of flowers and ornamental plants, Nayaprakash, Calcutta - 700 006.
2. Saraswathy, S., T.L.Preethi, S.Balasubramanyan, J.Suresh, N.Revathy and S.Natarajan. 2007. Postharvest management of Horticultural Crops. Agrobios Publishers, Jodhpur.

Further reading

1. Chadha, K .L. and O. P. Pareek, 1996. Advances in horticulture. Malhotra Publishers, New Delhi.
2. Haid, N.F. and S.K. Salakahe.1997. Post harvest physiology and hardening of fruits and vegetables. Greada Publication, London.
3. Jacob John, P.,2008.A Handbook on postharvest management of fruits and vegetables.Daya publishing House, Delhi.
4. Joseph, J. Jen. 1989. Quality factors of fruits and vegetables. Chemistry and technology 1989. American Chemical Society, Washington.
5. Mridula Mirajkar and Sreelata Menon. 2002. Food Science and processing technology. Vol. 2 Kanishka Publishers, New Delhi
6. Mridula Mirajkar and Sreelata Menon. 2002. Food Science and processing technology vol. 1 Biochemistry of food and nutrition. Kanishka Publishers, New Delhi
1. Pandey, P. H. 1997. Post harvest technology of fruits and vegetables 1997. Technical publishers of India, Allahabad.
2. Pandey, P. H. 1998. Principles and practices of post harvest technology. Kalyani Publishers, New Delhi.
3. Ranganna, S. 1997. Handbook of analysis and quality control for fruits and vegetables products, Tata, Mc Graw – Hill Publishers Co. Ltd., New Delhi.

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<http://postharvest.ucdavis.edu/Produce/ProduceFacts/Fruit/mango.shtml>

<http://www.horticultureworld.net/hort-india>

<http://www.india.exports.com>

<http://www.sus-veg-thai.de/>

<http://www.iari.res.in>

Journals

1. Punjab Hort. J.
2. Indian Food Packer
3. J. of vegetable crop production
4. J. of Ameri. Soci. of Hort. Sci.
5. Acta Hort.
6. Floriculture today

HOR 406 Experiential Learning 0 + 5

1. Pruning in high density planting (0+1)
2. Rejuvenation of old orchards (0+1)
3. Off season mango production (0+1)
4. Pruning in grapes (0+1)
5. Precision farming in Banana (0+1)
6. Post harvest treatments for enhancing the shelf life of fruits (0+1)
7. Nursery technology and vegetable seed production (0+1)
8. F₁ hybrid vegetable seed production (0+1)
9. Protected cultivation of vegetable crops (0+1)
10. Precision farming in turmeric (0+1)
11. Propagation techniques in coriander (0+1)
12. Drip irrigation in coriander (0+1)
13. Commercial seed production in loose flowers (0+1)
14. Propagation techniques of commercial ornamental and medicinal crops (0+1)
15. Exterior and interior flower arrangements (0+1)

HNM 201 Nematode Management in Horticultural Crops 1 + 1

Theory

Unit I Introduction and economic importance

Introduction to nematology - economic importance of nematodes - beneficial nematodes

Unit II Morphology, anatomy and taxonomy

Morphology of nematodes. Anatomy of nematodes - digestive, excretory, nervous and reproductive system of nematodes. Biochemical/molecular tools for nematode identification - Taxonomy of nematodes upto super family and classification of nematodes based on parasitism.

Unit III Lifecycle, symptom and interaction

Life cycle of important nematodes - *Meloidogyne*, *Globodera*, *Rotylenchulus*, *Tylenchulus*, *Radopholus* and *Pratylenchus*. Symptoms of nematode damage - interaction of nematodes with other microorganisms.

Unit IV Nematode management

Principles of nematode management - legislative (plant quarantine); physical methods (soil solarisation, hot water treatment, seed cleaning); cultural methods (deep ploughing, fallowing, crop rotation, antinemic plants, other land management practices); host plant resistance to nematodes; Improved techniques for nematode resistance breeding; biological control (nematode trapping fungi, egg parasitic fungi, obligate parasites, PGPR bacteria and predators); chemical control. Integrated nematode management.

Unit V Nematode diseases of crops

Nematode diseases of fruits (banana, citrus, grapevine, papaya) - vegetables (tomato, brinjal, bhendi, chilli, potato) - spices (turmeric, pepper, cardamom) flowers (crossandra, rose, jasmine, tuberose) plantation crops (tea, coffee, betelvine) - mushroom, medicinal and aromatic plants and nematode problem in protected cultivation.

Practical

Sampling techniques for nematode assay. Processing of soil samples for extraction of active nematodes - Extraction of nematodes by centrifugal floatation method and separation of cyst nematodes - Extraction of nematodes from plant samples. Staining techniques, direct examination of nematodes and warring blender technique. Killing, fixing, preservation and counting of nematodes - Processing and mounting of nematodes. Observation of morphological characters of Tylenchida (*Hoplolaimus*) and Dorylaimida (*Xiphinema*) - Identification of nematodes *Holicotylenchus* and *Tylenchorhynchus* - *Pratylenchus Longidorus*, *Xiphinema* - *Hemicriconemoides*, *Aphelenchoides*, *Tylenchulus*. Study of life stages of *Meloidogyne*, *Globodera* - *Rotylenchulus* and *Radopholus*.

Nematode disease symptoms in fruits, vegetables, spices, flower crops and medicinal and aromatic plants. Nematicides, biocontrol agents, application methods and calculation of dosages.

Lecture schedule

1. Introduction to nematology
2. Economic importance of nematodes
3. Beneficial nematodes - predatory, entomopathogenic nematodes etc.
4. Morphology and anatomy of nematodes - digestive and excretory system of nematodes.
5. Morphology and anatomy of nematodes (Contd.) - nervous and reproductive system of nematodes.
6. Taxonomy of nematodes up to super family and classification of nematodes based on parasitism.
7. Biochemical/ molecular tools for nematode identification.
8. Life cycle of important nematodes - *Meloidogyne*, *Globodera*, *Rotylenchulus Tylenchulus*, *Radopholus* and *Pratylenchus*.
9. Mid semester examination.
10. Symptoms of nematode damage.

11. Interaction of nematodes with other microorganisms.
12. Principles and methods of nematode management and IPM.
13. Nematode diseases of fruit crops (Banana, Citrus, Grapevine, Papaya)
14. Nematode diseases of vegetable crops (Tomato, Brinjal, Bhendi, Chillies, Potato).
15. Nematode diseases of spices (turmeric, pepper, cardamom) flower (crossandra, jasmine, tuberose) and plantation crops (tea, coffee, betelvine)
16. Nematode diseases of mushroom, medicinal and aromatic plants and nematode problems in protected cultivation.
17. Improved techniques for nematode resistance breeding.

Practical schedule

1. Sampling techniques for nematode assay.
2. Processing of soil samples for extraction of active nematodes by Cobb's method
3. Extraction of nematodes by centrifugal floatation and extraction of cyst nematodes.
4. Extraction of nematodes from plant samples.
5. Staining techniques, direct examination and Blender technique.
6. Killing, fixing, preservation and counting of nematodes.
7. Processing and mounting of nematodes.
8. Observation of morphological characters of Tylenchida (*Hoplolaimus*) and Dorylaimida (*Xiphinema*)
9. Identification of nematodes *Helicotylenchus*, *Tylenchorhynchus*, *Hoplolaimus*.
10. Identification of nematodes *Pratylenchus*, *Longidorus*, *Xiphinema*.
11. Identification of nematodes *Hemicriciconemoides* / *Hemicycliophora* and *Tylenchulus* and *Aphelenchoides*.
12. Study of life stages of *Meloidogyne* and *Globodera*
13. Study of life stages of *Rotylenchulus* and *Radopholus*
14. Nematode disease symptoms in fruit crops.
15. Nematode disease symptoms in vegetables, spices, flower crops and medicinal plants.

16. Nematicides, bio-control agents, application methods and calculation of dosages.
17. Practical examination.

Text books

1. Jonathan, E.I. 2010. Fundamentals of Plant Nematology, Devi Publications, Triruchirapalli. P. 232.
2. Ravichandra, N.G. 2008. Plant Nematology. I.K. International Publishing House, New Delhi. P 688.

Further reading

1. Bhatti, D.S. and R.K.Walia. 1992. Nematode pests of crops, CBS Publishers and Distributors, Delhi, P381.
2. Goodey, J.B. 1963. Technical Bulletin No 2 - Laboratory methods for work with plant and soil nematode., Ministry of Agriculture, Fisheries and food, London, p. 72.
3. Gopal Swarup and Dasgupta, D. 1986 Plant parasitic nematodes of India - Problems and progress, ICAR, New Delhi. 76.
4. Webster, J. 1972. Economic Nematology. Academic Press, London, p. 396.
5. Ravichandra, N.G. 2010. Methods and Techniques in Plant Nematology. PHI Learning Private Limited. New Delhi. 595.

Journals

- I. Indian Journal of Nematology
- II. Journal of Nematology

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<http://tau.tnau.ac.in/ms/claroline/document/document.php>

<http://www.iari.res.in/divisions/nematology/teaching.php>

ucdnema.ucdavis.edu/imagemap/nemmap/Ent156htm/nem110.syllabus.htm

PAT 401 Diseases of Horticultural Crops and Their Management 2 + 1

Theory

Unit I Fruit crops

Etiology, symptoms, mode of spread, survival and integrated management of important diseases due to fungi, bacteria, viruses, phytoplasma, phanerogamic parasites and non-parasitic causes of the following crops- mango, banana, citrus, grapes, guava, sapota, pomegranate, annona, papaya, jack, pineapple, ber, aonla, apple, pear, peach and plum.

Unit II Vegetable crops

Brinjal, tomato, bhendi, cucurbits, crucifers, beans, peas, potato, sweetpotato, beetroot, radish ,yam , colocasia and cassava.

Unit III Spices and condiments

Onion, garlic, chilli, cardamom, pepper, betelvine, turmeric, ginger, fenugreek, coriander, clove, nutmeg and cinnamon

Unit IV Plantation crops

Tea, coffee, cocoa, rubber, coconut, arecanut and vanilla.

Unit V Flower crops, medicinal plants and mushroom cultivation

Jasmine, rose, crossandra, chrysanthemum, tuberose, carnation, lillium and marigold gloriosa, stevia and coleus, aloe. cultivation of *Pleurotus*, milky mushroom, *Agaricus* and *Volvariella*

Practical

Study of symptoms and host parasite relationship of the following crops: Mango, banana, citrus, grapes, guava, sapota, pomegranate, annona, jack, papaya, pineapple, ber, aonla, apple, pear, plum, peach, tomato, brinjal, cucurbits, crucifers, beans, peas, potato, cassava, sweet potato, yam and colocasia, onion, garlic, chilli, pepper, betel vine, turmeric, ginger, cardamom, fenugreek, coriander, clove, nutmeg, and cinnamon, tea, coffee, rubber, coconut, arecanut , vanilla, rose, jasmine, crossandra, chrysanthemum, tuberose, marigold, lillium, carnation, gloriosa, stevia, coleus and aloe.

Postharvest diseases of fruits and vegetables -mushroom cultivation : *Pleurotus* and *Calocybe* -field visit.

Students should submit 50 well-pressed diseased specimens.

Lecture schedule

Etiology, symptoms, mode of spread, survival, epidemiology and management of diseases of

1. Mango
2. Banana
3. Citrus and grapes
4. Guava, sapota, pomegranate, annona and jack.
5. Papaya, pineapple, ber and aonla.
6. Apple, pear, plum and peach.
7. Post harvest diseases – apple, mango, banana, citrus, grapes and papaya
8. Brinjal and bhendi
9. Tomato
10. Cucurbits
11. Cabbage, cauliflower, radish and beetroot
12. Potato, sweet potato, and cassava
13. Yam , colocasia, beans and peas
14. Onion and garlic.
15. Postharvest diseases – tomato, potato, carrot, and onion
16. Chilli
17. Mid semester examination
18. Pepper and betelvine
19. Fenugreek, cinnamon, nutmeg, clove and coriander
20. Turmeric and ginger.
21. Tea
22. Coffee.
23. Coconut and areca nut

24. Rubber
25. Cocoa , vanilla and cardamom
26. Jasmine and rose.
27. Crossandra and chrysanthemum.
28. Marigold, carnation, liliium and tuberose
29. Medicinal plants - *Gloriosa* and *Stevia*
30. *Coleus* and *Aloe*
31. Mushroom cultivation : *Agaricus*
32. Mushroom cultivation : *Pleurotus* and *Calocybe*
33. Mushroom cultivation : *Volvariella*
34. Biotic and abiotic stresses of mushroom

Practical schedule

Study of symptoms and host parasite relationship of

- ❖ Diseases of mango and banana.
- ❖ Diseases of citrus and grapes.
- ❖ Diseases of guava, sapota, pomegranate, annona, jack, papaya, pineapple, ber and aonla.
- ❖ Diseases of apple, pear, plum and peach.
- ❖ Diseases of tomato and brinjal.
- ❖ Diseases of cucurbits and crucifers.
- ❖ Diseases of beans, peas and potato.
- ❖ Diseases of cassava, sweetpotato, yam and colocasia.
- ❖ Diseases of onion, garlic , chilli, pepper and betelvine
- ❖ Diseases of turmeric, ginger, cardamom, fenugreek, coriander, clove, nutmeg, and cinnamon
- ❖ Diseases of tea, coffee and rubber.
- ❖ Diseases of coconut, arecanut and vanilla.
- ❖ Diseases of rose, jasmine, crossandra and chrysanthemum, tuberose, marigold, lillium and carnation

- ❖ Diseases of gloriosa, stevia, coleus and aloe.
- ❖ Mushroom cultivation : *Pleurotus* and *Calocybe*
- ❖ Field visit
- ❖ Practical examination.

Note: Students should submit 50 well-pressed diseased specimens.

Reference books

- ❖ Arjunan.G. Karthikeyan, G, Dinakaran ,D. Raguchander,T. 1999 Diseases of Horticultural Crops, AE Publications, Coimbatore.
- ❖ Rangaswamy C.2005, Diseases of crop plants in India -. Prentice Hall of India, Pvt. Limited, New Delhi
- ❖ Pathak V.N. 1980. Diseases of Fruit crops -. Oxford and IBH publishing Co.Pvt.Limited
- ❖ Das Gupta M.K. and Mandel W.C.1989. Post harvest pathogens of Perishables. Oxford and IBH Publishing Company,New Delhi.
- ❖ Neeta Sharma and Mashkoo Alam. 1997. Post harvest diseases of Horticultural crops, International Book publishing Co. UP.
- ❖ Parvatha Reddy P. 2008 Diseases of Horticultural Crops Author ISBN8172335431 Scientific Publishers

Further reading

1. Snowden, A.L.1990. A color atlas of post harvest diseases and disorders. Vol. I and II Wolfe Scientific Limited.
2. Cook AA, 1981. Diseases of Tropical and sub tropical Field, Fiber and oil palms -. Mac. Millan Publishing Co. New Park
3. Sohi, H.S, 1992. Diseases of Ornamental plants in India -. ICAR, New Delhi.
4. Singh, R.S. 1994. Diseases of vegetable crops -. Oxford & IBM Publishing Co.Pvt.Ltd.New Delhi

5. Madhu Meeta, 2005. Diseases of Ornamental Plants in India: Reference Book Cum Bibliography/. 320 p.,
6. Alfred Steferud., 2005, Diseases of Plantation Crops. Delhi, Biotech Books, , x, 317 p., ISBN 81-7622-136-8.
7. Srikant Kulkarni and Yashoda R. Hegde, 2002, Diseases of Plantation Crops and Their Management. Udaipur, Agrotech, 176 p., ISBN 81-85680-58-2.
8. Alfred Steferud, 2005, Diseases of Vegetable Crops. Delhi, Biotech Books, xi, 210 p., ISBN 81-7622-137-6.
9. Sonia Ahuja, 2005, Plant Diseases. New Delhi, Vishvabharti, viii, 286 p, ISBN 81-89000-42-X.
10. Pravin Chandra Trivedi, 2003, Plant Protection: A Biocontrol Approach. Jaipur, Aavishkar, xiv, 386 p., figs., tables, plates, ISBN 81-7910-035-9
11. [Naqvi](#) S. A. M. H.2004 Diseases of Fruits and Vegetables Volume I
Diagnosis and Management ISBN: 978-1-4020-1822-0

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www.ucmp.berkeley.edu/fungi

www.ictv.org

www.vivo.library.cornell.edu

www.plantdisease.org

ENG 401 Development Education 0 + 1
(Equivalent course for non-Tamil students)

Practical

Basic principles of learning- taxonomy of educational objectives- transferable skills - multiple intelligence-career development-success story of entrepreneurs-group learning-brainstorming, simulation, role play, ice breakers- transactional communication- types of ego- interpersonal communication- writing- fax and e-mail, applying for a job, interviews, project report- strategies and skills- basic principles of scientific article editing.

Practical schedule

1. Basic principles of learning. Binary terms viz - growth and development, education - for - life and life - long education, motivation and morale - occupation and profession, training and education, lateral thinking and conventional thinking, teaching and learning - discussion.
2. Bloom's classification of educational objectives - Cognitive, Affective, Psychomotor domain(s) - discussion
3. Career development - opportunity for graduates of agriculture and allied sciences - discussion
4. Success story of a farmer - factors involved - role - play
5. Brainstorming - Demonstration
6. Simulation - Convergent task - demonstration
7. Simulation - Divergent task - demonstration
8. Role - play - interpersonal communication - Fax, email - Transactional communication - ice breaker
9. Mid semester examination
10. Verbal and analytical skills - interactive CD-ROM
11. Writing and Editing - demonstration
12. Writing popular articles

13. Project Report – discussion on a mutilated cloze text
14. Project Report – Role play
15. Scientific articles – Selection, organization and presentation – a discussion
16. Writing a scientific article
17. Practical Examination

References

1. Anderson, L. W. and David R. Krathwohl, D. R., et al (Eds..) (2001) *A Taxonomy for Learning, Teaching, and Assessing: A Revision of Bloom's Taxonomy of Educational Objectives*. Allyn & Bacon. Boston, MA (Pearson Education Group)
2. David H. Janessen (2009) *Learning to solve problems: A handbook for solving learning Environments* Routledge. USA
3. [Gay Lumsden](#) , Donald Lumsden, Carolyn Wiewtstoff (2009) *Communicating in Groups and Teams: Sharing Leadership*: Wadsworth Cengage Learning. Boston. USA
4. [Michael, Michalko](#) . *Thinkertoys: A Handbook of Creative-Thinking Techniques* (2nd Edition) (June 8, 2006) Ten Speed Press. Canada
5. Sudarsanam. R (1985) *Development Education*: Vibhuvan publishers. Coimabatore.

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www.mindstools.com

www.nwlink.com

www.evancarmichael.com

www.richland.edu

www.aaps-journal.org

SAC 401 Nutrient Management And Fertilizer Technology 2 + 1

Aim

This course is designed to understand about essential nutrients, soil fertility, nutrients transformations in soil, manures, fertilizers and management of sustained soil fertility. It also aims to acquire skill by the students in assessing soil fertility and its management through various approaches.

Theory

Unit I

Soil fertility and productivity. Essential nutrients- functions, deficiency and toxicities. Concepts and methods of soil fertility evaluation.

Unit II

Nutrients - sources, forms, mobility, transformations, fixation, losses and availability of nitrogen, phosphorus, potassium, calcium, magnesium, sulphur, iron, manganese, zinc, copper, boron and molybdenum in soils.

Unit III

Fertilizers - definition and classification, sources, properties and reactions of macro and micro nutrient fertilizers in soil. Manufacture of urea, ammonium sulphate, SSP, DAP, MOP and SOP. Complex, mixed fertilizers, water soluble fertilizers and Micronutrient mixtures- preparation, characteristics and compatibility - fertilizer control order (FCO). Manures- classification, nutrient contents. Composting techniques.

Unit IV

Methods of fertilizer application - fertigation - fertilizer solubility, interaction between irrigation water and fertilizers, fertigation scheduling. Comparison of fertilizer application methods.

Unit V

Nutrient management concepts - INM, STCR, IPNS, SSNM and RTNM. Nutrient use efficiencies of major and micronutrients and enhancement techniques (soil, cultural and fertilizer strategies). Soil health - quality indices and their management. Long term effect of fertilization on soil.

Practical

Soil nutrient analysis - available nutrient status (N, P, K, S and DTPA extractable micronutrients) in soils- fertilizer nutrient analysis- analysis of nutrient contents in urea, ammonium nitrate, SSP, RP, MOP and SOP- manure analysis-determination of nutrient contents (N, P & K) in FYM/GM - colloquium on soil testing laboratories - Soil test based fertilizer prescription - visit to fertilizer mixing unit.

Lecture schedule

1. Soil fertility and productivity - essential nutrients- criteria of essentiality - N, P and K nutrients -functions, deficiency and toxicity symptoms
2. Calcium, Magnesium, Sulphur and Micro nutrients - functions, deficiency and toxicity symptoms
3. Concepts and approaches of soil fertility evaluation - Liebig's Law , Mitscherlich's law and Bray's nutrient mobility concept. Approaches- Deficiency symptoms, tissue analysis, biological tests and chemical tests.
4. Techniques/ methods of soil fertility evaluation - Inductive ,deductive, A value technique, croplogging, critical level, DRIS and agronomic approach.
5. Sources, forms, mobility, transformation, fixation, losses and availability of nitrogen in soil
6. Sources, forms, mobility, transformation, fixation, losses and availability of phosphorous in soil
7. Sources, forms, mobility, transformation, fixation, losses and availability of potassium in soil
8. Sources, forms, mobility, transformation, fixation, losses and availability of calcium and magnesium in soil
9. Sources, forms, mobility, transformation, fixation, losses and availability of sulphur in soil
10. Sources, forms, mobility, transformation, fixation, losses and availability of micro nutrients in soil
11. Fertilizers- definition, classification of N,P and K fertilizers

12. N fertilizers- Urea, ammonium sulphate, ammonium nitrate, CAN, properties and their reactions in soil.
13. Manufacture of urea and ammonium sulphate.
14. P fertilizers- Rock phosphate, bone meal, basic slag, single super phosphate, diammonium phosphate, triple super phosphate, properties and their reactions in soil.
15. Manufacturing of SSP and DAP.
16. K fertilizers- MOP and SOP- properties and reactions in soil.
17. Mid Semester Examination
18. Manufacture of MOP and SOP.
19. Complex fertilizers- definition, manufacture of ammonium phosphate, nitro phosphate and N,P,K complexes
20. Mixed fertilizer – definition, preparation and compatibility
21. Micro nutrient mixtures – Preparation and characteristics
22. Fertilizer Control Order
23. Organic manures- Definition, classification and sources
24. Composting techniques- Aerobic and anaerobic (Bangalore & Coimbatore method) enriched FYM and vermicompost. Composting of organic waste- Sugarcane trash and coir waste
25. Methods of fertilizer application for different soil types - Fertigation – Definition – Soluble fertilizers – Fertilizer solubility
26. Interaction between water and fertilizer
27. Types of fertigation- Fertilizer schedule.
28. Comparison of fertilizer application methods.
29. Nutrient management concepts – INM, STCR, IPNS, SSNM and RTNM.
30. Nitrogen use efficiency – Slow release N fertilizers – Significance and enhancement techniques.
31. Nutrient use efficiency of P, K and micronutrients and their enhancement techniques.

32. Soil health - Definition - Soil Quality Indices - Physical, chemical and Biological indicators

33. SOM maintenance - Role of SOM in sustaining soil health

34. Long term effect of fertilization on soil

Practical schedule

1. Soil nutrient analysis – Available N status in soil
2. Soil nutrient analysis – Available P status in soil
3. Soil nutrient analysis – Available K and S status in soil
4. Soil nutrient analysis – DTPA extractable micronutrients in soil
5. Fertilizer sampling technique.
6. Fertilizer nutrient analysis – Estimation of N in Urea
7. Fertilizer nutrient analysis – Estimation of ammoniacal and nitrate N in ammonium nitrate
8. Fertilizer nutrient analysis – Estimation of water soluble P in SSP
9. Fertilizer nutrient analysis – Estimation of P in rock phosphate
10. Fertilizer nutrient analysis – Estimation of K in KCl and K₂SO₄
11. Manure analysis – Estimation of N in FYM / Compost
12. Manure analysis – Estimation of P in FYM / Compost
13. Manure analysis – Estimation of K in FYM / Compost
14. Colloquium on soil testing laboratories -Soil test based fertilizer prescription
15. Visit to STL and FTL
16. Visit to fertilizer manufacturing / mixing unit
17. Practical Examination.

Out come

The knowledge gained by students through this course will be useful in making decisions on nutrient dose, choice of fertilizers and method of application etc. practiced in crop production. The skill acquired from this course can be practiced for assessing soil fertility. The students will also gain confidence in managing soil health for sustained productivity.

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AEC 401 Agricultural Finance, Banking And Cooperation 1 + 1

Theory

Unit I Agricultural/horticultural finance - nature and scope

Agricultural/horticultural finance - importance - nature and scope - definition. Agricultural/horticultural credit - meaning, definition, need, classification. Sources of credit - Role of institutional and non-institutional agencies - advantages and disadvantages. Rural indebtedness. History and development of rural credit in India.

Unit II Financial institutions

Institutional agencies - commercial banks- nationalization, AD Branches - area approach - priority sector lending, regional rural banks, lead bank, kisan credit card (KCC) scheme, scale of finance. DIR scheme - relief measures and loan waiver scheme. Higher financial institutions - RBI, NABARD, AFC, ADB, World Bank, insurance and Credit Guarantee Corporation of India. rural credit policies. Microfinance - its role in poverty alleviation - self-help groups - Non-governmental organizations.

Unit III Cooperation

Cooperation - philosophy and principles. History of Indian cooperative credit movement - pre and post independence periods. Cooperation in different plan periods. cooperative credit institutions - structure - short term and long term credit - functions. Strength and weakness of cooperative credit system. Policies for revitalizing cooperative credit - salient features of Vaithyanathan Committee on revival of rural cooperative credit institutions. Reorganization of cooperative credit structure in Andhra Pradesh and single window system. Successful cooperative credit systems in Gujarat, Maharashtra, Punjab, etc. Special cooperatives - LAMPS, FSS - objectives, role and functions.

Unit IV Banking and insurance

Negotiable instruments - meaning, importance, types. Central bank - functions. Credit control - objectives and methods - CRR, SLR, Repo rate. Credit rationing - dear money and cheap money. Non- banking financial institutions (NBFI). Financial inclusion- credit widening and credit deepening. Assessment of crop losses, determination of compensation. Crop insurance -schemes, coverage, advantages and limitations in application, estimation of crop yields. Livestock insurance schemes.

Unit V Farm financial analysis

Principles of credit - 5C's, 3R's and 7 P's of credit. Repayment plans. Project management - feasibility - preparation - time value of money - compounding and discounting - concept of agricultural/horticultural project proposal/appraisal of agricultural/horticultural development projects - undiscounted and discounted measures. Evaluation of farm credit proposal. Farm financial statements - Balance sheet, income statement, cash flow statement - financial ratio analysis.

Practical

Visit to farm - estimation of credit needs, identification of problems and suggestions in the use of farm credit. Visit to a primary agricultural/horticultural cooperative credit society and DCCB to study their functions. Visit to a commercial bank branch to study its functions. Visit to lead bank to study the preparation and implementation of credit plans. Visit to NABARD to study its role and functions. Time value of money - compounding and discounting. Project preparation and appraisal - undiscounted and discounted methods. Visit to SHGs. Study of crop insurance products. Banking procedure for availing loan. Repayment plans.

Lecture schedule

1. Agricultural/horticultural finance – definition, importance, nature and scope. Agricultural/horticultural credit – definition, need, classification.
2. Source of credit – Institutional and Non- institutional agencies – types, roles, advantages and disadvantages. Rural indebtedness. History and development of rural credit in India.
3. Institutional agencies - Commercial banks- nationalization of commercial banks – their role in rural credit. AD Branches – Area approach. Priority sector lending, Regional rural banks.
4. Role and functions of Lead bank – preparation of district credit plan. Kisan Credit Card Scheme. DIR Scheme – Relief Measures and Loan waiver Scheme. Rural credit policies.
5. Higher financial institutions - RBI, NABARD, AFC, ADB, World Bank, Insurance and Credit Guarantee Corporation of India – role and its functions in rural credit.
6. Microfinance – definition, role in poverty alleviation – Self-Help Groups – characteristics, role, functions, growth and development in India. Role of Non-Governmental Organizations in promoting SHGs.
7. Co-operation – philosophy and principles – History of Indian Co-operative credit movement – pre and post independence period. Co-operation in different plan periods.
8. Co-operative credit institutions – structure - short term and long term credit – its functions - Strength and weakness of co-operative credit system.
9. Mid semester examination
10. Policies for revitalizing co-operative credit - salient features of Vaidyanathan Committee on revival of rural co-operative credit institutions. Special Co-operative Institutions – LAMPS, FSS - objectives, role and functions.

11. Reorganization of Co-operative credit structure in Andhra Pradesh and single window system. Successful co-operative credit systems in Gujarat, Maharashtra, Punjab, etc.
12. Negotiable instruments - meaning, importance, types - Hundis, Bills of Exchange, Promissory Note, Cheque and Demand Draft. Central bank - functions. Credit control - objectives and methods - CRR, SLR, Repo rate. Credit rationing - Dear money and cheap money.
13. Non- Banking Financial Institutions (NBFI). Financial Inclusion- credit widening and credit deepening.
14. Assessment of crop losses, determination of compensation. Crop Insurance - schemes, coverage, advantages and limitations in application, estimation of crop yields. Livestock Insurance Schemes.
15. Principles of Credit - 5C's, 3R's and 7 P's of credit. Project Management - feasibility report preparation
16. Time value of money - compounding and discounting. Preparation and concept of agricultural/horticultural project proposal/appraisal of agricultural/horticultural development projects - undiscounted and discounted methods.
17. Evaluation of farm credit proposal. Farm Financial Statements - Balance Sheet, Income Statement and Cash flow Statement - Financial Ratio Analysis.

Practical schedule

1. Visit to a farm to study the credit needs, problems and suggestions in the use of farm credit.
2. Visit to Primary Agricultural/horticultural Co-operative Bank (PACB) to study its role, functions and procedures for availing loan
3. Visit to District Central Co-operative Bank (DCCB) to study its role, functions and procedures for availing loan – Fixation of Scale of Finance
4. Visit to land development Bank to study long term credit.
5. Visit to a Commercial Bank Branch to study its role, functions and procedures for availing loan and lead bank to study the District Credit Plan, Primary Co operative Bank for Agricultural and Rural Development..
6. Visit to NABARD to study Potential Linked Credit Plan.
7. Project preparation and appraisal –undiscounted methods
8. Project preparation and appraisal –discounted methods
9. Evaluation of farm credit proposals
10. Exercise on preparation of Repayment plans
11. Visit to Self-Help Group to study its characteristics, roles and functions
12. Analysis of Different Crop Insurance Products / visit to crop insurance implementing agency.
13. Visit to RRB to study its role, functions & procedures for availing loans.
14. Preparation of Balance Sheet and Income Statement
15. Preparation of Cash flow Statement
16. Financial Ratio Analysis
17. Practical Examination

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5. Patnaik, V.E and A.K. Roy, 1988. Cooperation and Cooperative Management, Kalyani Publishers, Ludhiana.

B.Sc. (Hort) - Experiential Learning Courses

Sl. No.	Title	Credit
1	Genetic Manipulation and Breeding of Horticultural Crops	0 + 5
2	Hybrid Seed Production in Vegetable Crops	0 + 5
3	Commercial Nursery Production Technology for Fruit Crops	0 + 5
4	Protected Cultivation of Vegetable Crops	0 + 5
5	Commercial Landscaping and Dry Flower Production	0 + 5
6	Value Addition and Quality Control in Horticultural Produce	0 + 5
7	Commercial Production of Bio-Fertilizers	0 + 5
8	Commercial Production of Biocontrol Agents	0 + 5
9	Mass Media and Communication	0 + 5

Genetic manipulation and breeding of horticultural crops (0+5)

Syllabus - Practical

Unit I-Genetics

Study of cell and cell organelles - significance of mitosis and meiosis- gene symbolization in genetic experiments- solving problems in mono,di and trihybrid crosses- incomplete dominance and lethal genes- gene interactions-multiple alleles-multiple factors- linkage and estimation of linkage- drawing genetic maps- interference and coincidence.

Unit II-Cytogenetics

Principles of microscopy-preparation of fixatives and strains-killing and fixing-study of mitosis and meiosis (squash and smear techniques)-study of pollen morphology and pollen fertility in horticultural crops.

Unit III-Breeding

Gametogenesis and fertilization-study of reproductive structures and pollination mechanisms in horticultural crops- plant breeder's kit- selfing and crossing techniques-preparation and lay out of experimental plots

Unit IV-Biometrics

study and assessment of variability in population identification of superior genotypes by simple ANOVA- estimation of heterosis in hybrids- recording variations in segregating generations- mutation breeding-physical and chemical mutagens-dosimetry and LD50- maintenance of records and registers - study of A,B and R lines and hybrid seed production-study of wild relatives of horticultural crops.

Unit V-Horticulture

Study of floral biology, pollination mechanisms in major horticultural crops- heterosis breeding and production of hybrids- mutation breeding in horticultural crops- methods of induction of polyploidy-breeding- vegetatively propagated crops- resistance breeding in horticultural crops

Practical schedule

1. Methods of gene symbolization
2. Working out of segregation ratios using checker board and forking method.
3. Significance of chi-square test and goodness of fit with monohybrids.
4. Modification of monohybrid ratio- incomplete dominance-lethal genes.
5. Solving problems with test cross and back cross.
- 6 and 7. Solving problems with dihybrid ratio.
8. Gene interactions in horticultural crops.
9. Dominant epistasis(12: 3:1) and recessive epistasis(9:3:4).
10. Complementary gene interaction (9:7)
11. Duplicate gene interaction (15:1) and additive gene interaction (9:6:1)
12. Multiple factor hypothesis.
13. Principles of linkage-coupling and repulsion.
14. Two point test cross.
15. Three point test cross.
16. Co-incidence and interference.
17. Drawing linkage maps.
18. Study of cell and cell organelles.
19. Significance of mitosis and meiosis.
20. Principles of microscopy and stages of mitosis and meiosis.
21. Preparation of stains and fixatives.
22. Preparation of killing and fixing agents.
- 23, 24 and 25. Study of mitosis in onion root tips and karyotype analysis.
- 25 to 30. Study of meiosis in major horticultural crops.
31. Study of gametogenesis and fertilization.
32. Reproduction and alternation of generation-life cycle of plants.
33. Study of pollination mechanisms in horticultural crops.
- 34 and 35. Study of pollen morphology in different horticultural crops by acetocarmine and Iodine staining.
- 36 to 40. Practicing selfing and crossing techniques in horticultural crops
- 41 and 42. Layout of field experiments, RT, RRT, PYT, CYT, MLT and ART.
43. Mid semester Examination
44. Analysis of variance and identification of superior genotypes
45. Working out of first degree statistics
46. Biometrical observations in segregating populations
47. Working out of heritability and genetic advance
- 48 to 50. Collection of data F1 hybrids parents and estimation of heterosis (di, dii & diii)
51. Maintenance of records and registers (Pedigree record, crossing register and Germplasm cataloguing)
52. Mutagenic treatment in horticultural crops and fixing LD 50 value
- 53 to 55. Hybrids seeds production techniques in horticultural crops
56. Maintenance of A, B and R lines

- 57. Identification of wild species in horticultural crops
- 58 to 65. Study of floral biology and pollination mechanism, practicing selfing and crossing techniques in fruit crops
- 66 to 70. Study of floral biology and pollination mechanism, practicing selfing and crossing techniques in vegetable crops
- 71 to 75. Study of floral biology and pollination mechanism, practicing selfing and crossing techniques in flower and medicinal crops
- 76 and 77. Study of floral biology and pollination mechanism, practicing selfing and crossing techniques in spices and plantation crops
- 78 and 79. Heterosis breeding in horticultural crops
- 80 and 81. Mutation breeding in horticultural crops
- 82 and 83. Ploidy breeding in horticultural crops
- 84. Resistance breeding in horticultural crops
- 85. Final Practical examination

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Hybrid seed production in vegetable crops (0+5)

Unit - I - Introduction to seed industry and heterosis

Present status, scope, importance and future prospects of vegetable seed industry. Heterosis - definition, history, achievements, heterosis breeding types - genetic, physiological, biochemical importance of heterosis - exploitation on commercial scale for seed production.

Pollination :

Types, natural cross pollination, extent of it in vegetable crops, factor determining NCP, its role in vegetable seed production, pollination vectors in vegetable crops.

Unit - II - Techniques in hybridization

Hybridization:

Definition, techniques, steps, equipments, use of gametocides in emasculation, methods of pollination - hand pollination, rubbing, hooking, electric bees etc.,

Male sterility and self incompatibility

Devices for hybrid seed production - Genetic male sterility, cytoplasmic male sterility cytoplasmic genetic male sterility - definition, examples, mechanisms, merits and demerits, seed production of CMS, GMS and CGMS lines (A), (B) and (R) line. Self incompatibility- types, genetic control, manipulation, crosses between the parents - single, double cross hybrids, three way back and triple cross etc.,

Unit - III: Practicing in hybrid seed production in important vegetable crops

Land requirement - isolation distance -seedling production - nursery management- planting - maintenance of planting ratio-breeding methods used - rouging- certification - plant protection - seed harvesting extraction - seed drying - processing - methods - grading- seed treatment- packing-labelling-storage-factors affecting storage- seed health management.

Tomato, brinjal, chilli, bhendi

Unit - IV: Practicing in hybrid seed production in important vegetable crops

Land requirement - isolation distance -seedling production - nursery management- planting - maintenance of planting ratio-breeding methods used - rouging- certification - plant protection - seed harvesting extraction - seed drying - processing - methods - grading- seed treatment- packing-labelling-storage-factors affecting storage- seed health management.

bitter gourd, pumpkin, snake gourd, ridge gourd, ash gourd, cucumber, watermelon, cowpea, moringa, onion.

Unit - V : Seed quality control

Seed certification - phases procedures - genetic purity verification - certification agency, standards, records and reporting -seed village - contract farming - Seed Act - Rules - seed law enforcement - seed control order - New seed policy - seed testing - objectives, organizations - seed quality parameters - seed health and test and grow out test.

Practical schedule

1. Present status, scope, importance and future prospects of vegetable seed industry
2. Introduction to heterosis breeding - definition, history and achievements
3. Genetic, physiological, biochemical importance of heterosis
4. Exploitation of heterosis on commercial scale for seed production
5. Types of pollination, natural cross pollination, extent of it in vegetable crops, factor determining NCP, its role in vegetable seed production,
6. Pollination vectors in vegetable crops.
7. Hybridization - definition, techniques, steps, equipments
8. Male sterility -definition and types
9. Genetic male sterility- definition, examples, mechanisms, merits and demerits, seed production of GMS -(A), (B) and (R) line.
10. Cytoplasmic male sterility- definition, examples, mechanisms, merits and demerits, seed production of GMS -(A), (B) and (R) line.
11. Cytoplasmic genetic male sterility- definition, examples, mechanisms, merits and demerits, seed production of GMS -(A), (B) and (R) line.

12. Use of gametocides in emasculation, methods of pollination
13. Hand pollination, rubbing, hooking, electric bees etc.,
14. Self incompatibility- types, genetic control, manipulation
15. Crosses between the parents - single, double cross hybrids, three way back and triple cross etc.,
16. Hybrid seed production in tomato-land requirement, isolation distance -seedling production-nursery management
17. Tomato -planting- maintenance of planting ratio
18. Tomato-Breeding methods used -hand emasculation and pollination
19. Tomato-rouging -certification
20. Tomato-practicing plant protection
21. Tomato-fruit harvesting and seed extraction-seed drying - processing - methods - grading
22. Tomato-seed treatment- packing-labelling-storage-factors affecting storage- seed health management.
23. Hybrid seed production in brinjal -land requirement, isolation distance -seedling production-nursery management
24. Brinjal -planting- maintenance of planting ratio
25. Brinjal -Breeding methods used -hand emasculation and pollination
26. Brinjal -rouging -certification, practicing plant protection
27. Brinjal - Brinjal -fruit harvesting, seed extraction, seed drying, processing, methods - grading-
28. Brinjal -seed treatment- packing-labelling-storage-factors affecting storage- seed health management.
29. Hybrid seed production in chilli -land requirement, isolation distance -seedling production-nursery management
30. Chilli-planting- maintenance of planting ratio
31. Chilli-Breeding methods used -hand emasculation and pollination
32. Chilli-rouging -certification, practicing plant protection

33. Chilli-fruit harvesting and seed extraction, seed drying – processing – methods – grading
34. Chilli-seed treatment- packing-labelling-storage-factors affecting storage- seed health management.
35. Hybrid seed production in bhendi -land requirement, field preparation, sowing - maintenance of planting ratio
36. Bhendi -Breeding methods used –hand emasculation and pollination
37. Bhendi -rouging –certification, practicing plant protection
38. Bhendi -pod harvesting and seed extraction, seed drying – processing – methods – grading-
39. Bhendi -seed treatment- packing-labelling-storage-factors affecting storage- seed health management.
40. Hybrid seed production in bitter gourd, snake gourd and ridge gourd-land requirement, field preparation, sowing - maintenance of planting ratio
41. Bitter gourd, snake gourd and ridge gourd -Breeding methods used –hand emasculation and pollination
42. Bitter gourd, snake gourd and ridge gourd -rouging –certification, practicing plant protection
43. Mid term examination
44. Bitter gourd, snake gourd and ridge gourd -pod harvesting and seed extraction, seed drying – processing – methods – grading
45. Bitter gourd, snake gourd and ridge gourd -seed treatment- packing-labelling-storage-factors affecting storage- seed health management.
46. Hybrid seed production in pumpkin and ash gourd-land requirement, field preparation, sowing - maintenance of planting ratio
47. Pumpkin and ash gourd -Breeding methods used –hand emasculation and pollination
48. Pumpkin and ash gourd -rouging –certification, practicing plant protection
49. Pumpkin and ash gourd -pod harvesting and seed extraction, seed drying – processing – methods – grading

50. Pumpkin and ash gourd -seed treatment- packing-labelling-storage-factors affecting storage- seed health management.
51. Hybrid seed production in cucumber and watermelon-land requirement, field preparation- sowing-maintenance of planting ratio
52. Cucumber and watermelon -Breeding methods used -hand emasculatation and pollination
53. Cucumber and watermelon -rouging -certification-plant protection
54. Cucumber and watermelon -pod harvesting and seed extraction-seed drying - processing - methods - grading-
55. Cucumber and watermelon -seed treatment- packing-labelling-storage-factors affecting storage- seed health management.
56. Hybrid seed production in cowpea-land requirement, field preparation- sowing-maintenance of planting ratio
57. Cowpea -Breeding methods used -hand emasculatation and pollination
58. Cowpea -rouging -certification-plant protection
59. Cowpea -pod harvesting and seed extraction-seed drying - processing - methods - grading-
60. Cowpea -seed treatment- packing-labelling-storage-factors affecting storage- seed health management.
61. Hybrid seed production in annual moringa -land requirement, field preparation- sowing-maintenance of planting ratio
62. Annual moringa -Breeding methods used -hand emasculatation and pollination
63. Annual moringa -rouging -certification-plant protection
64. Annual moringa -pod harvesting and seed extraction-seed drying - processing - methods - grading-
65. Annual moringa -seed treatment- packing-labelling-storage-factors affecting storage- seed health management.
66. Hybrid seed production in onion-land requirement, field preparation- sowing-maintenance of planting ratio
67. Onion -Breeding methods used -hand emasculatation and pollination

68. Onion -rouging -certification-plant protection
69. Onion -pod harvesting and seed extraction-seed drying - processing - methods - grading-
70. Onion -seed treatment- packing-labelling-storage-factors affecting storage- seed health management.
71. Visit to seed production plots
72. Visit to national and multinational seed companies
73. Study of maintenance of records and registers including seed processing and seed stock register for the verification of seed inspectors
74. Seed drying methods
75. Study of seed processing and grading
76. Seed treatment, packing, labelling and storage
77. Visit to seed processing unit
78. Calculation of seed production economics
79. Seed certification - phases procedures genetic purity verification
80. Study on certification agency, standards, records and reporting
81. Visit to seed certification department, seed testing lab
82. Seed village - contract farming
83. Seed Act - Rules - seed law enforcement - seed control order - New seed policy
84. Seed quality parameters, seed testing, seed health and test and grow out test
85. Final Practical examination

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Commercial Nursery Production technology of fruit crops (0+5)

Aim

To impart skill oriented practical knowledge on commercial nursery techniques of fruit plants through experiential learning.

Unit I Media, containers and nursery techniques

Media for propagation - Types of containers - preparation of media - Tools and implements for bed preparation and propagation - Preparation of nursery beds - pro tray culture - soil sterilization - sowing and maintenance - nutrition - practices - use of plant growth regulators, biofertilizers - pesticides - fungicides for nursery - seed treatments - raising root stocks for propagation of fruit plants - Potting, pot bound condition and repotting of plants

Unit II Propagation structures

Different types of propagation structures - Mist chamber - Shadenet house - phytotron - Polyhouse - greenhouse - Polytunnel nursery and cold frames structures - Hot beds, lath house and pit nursery - ball and bur lapped culture - structures and maintenance for propagation of fruit plants - Economics of construction - Practices - erection of low cost polyhouses

Unit III Methods of propagation - seeds, cutting and layering

Propagation introduction - Sexual and Asexual methods of propagation - Principles and differences - Seed propagation techniques - Seed treatment - Seed dormancy factors - Seed viability, germination, longevity, seedling vigour - Merits and Demerits of seed propagation of fruit plants - apomixis - polyembryony and principles - practices - types of cuttings - Methods of layering - Practices - different methods of layering - Maintenance, separation and potting of layers and hardening.

Unit IV Grafting and budding techniques

Methods of grafting and budding - Merits and demerits of grafting methods - Selection criteria of root stock and scion - Stock -scion relationship - Bud wood selection and budwood certification and incapability - Anatomical and physiological basis of graft and bud union - Practices - different types of grafting and budding methods - maintenance - Nutrition and plant protection of grafted and budded plants - Visit to commercial fruit plant nurseries - Rejuvenation and top working of fruit plants - practices - top working - Bridge grafting and buttress grafting - Project preparation - establishment of commercial fruit plant nurseries

Unit V Micro propagation

Plant tissue culture laboratory- different types - organization and establishment- basic structural units - stages of micropropagation - Preparation of stock solutions - Plant tissue media preparation - Sterilization and inoculation techniques - shoot tip or Meristem tip culture - Micro grafting techniques in citrus - Tissue culture banana plants - commercial production-meristem culture for induction-proliferation and rooting - Hardening techniques - hill banana production-selection of mother plants- somaclonal variation in tissue culture- potential draw backs and elimination - Project preparation for establishment of plant tissue culture lab

Practical schedule

1. Media – rooting and growing media, rooting media ratio and pH for propagation of fruit plants.
2. Types of containers for propagation of fruit plants
3. Preparation of media for filling containers for fruit plants.
4. Tools and implements for soil working and nursery bed preparation for fruit plants.
5. Tools and implements for vegetative propagation of fruit plants.
6. Visit to industrial units manufacturing containers, tools and implements
7. Preparation of nursery beds, pro tray culture, soil sterilization and sowing and maintenance of nursery beds for propagation of fruit plants
8. Practicing the use of PGRs in nursery for propagation of fruit plants
9. Nursery maintenance and nutrition for propagation of fruit plants
10. Practicing the use of Use of biofertilizers for propagation of fruit plants
11. Practicing the use of Use of pesticides in nursery
12. Practicing the use of Use of fungicides in nursery
13. Seed treatments – raising root stocks for propagation of fruit plants
14. Potting, pot bound condition and repotting of plants
15. Different types of propagation structures of fruit plants
16. Mist chamber – structures – maintenance for propagation of fruit plants
17. Use of mist chamber for seed and vegetative propagation and hardening and maintenance of plants in mist chamber.
18. Economics of construction of mist chamber for propagation of fruit plants
19. Shadenet house, phytotron – structures and maintenance for propagation of fruit plants
20. Polyhouse – structures and maintenance for propagation of fruit plants
21. Economics of construction of shadenet house and polyhouse
22. Types of greenhouse – principles of construction for propagation of fruit plants
23. Uses and maintenance of greenhouses in propagation of fruit plants
24. Economics of construction of greenhouse structures
25. Polytunnel nursery and cold frames for propagation of fruit plants
26. Hot beds, lath house, pit nursery, ball and bur lapped culture for propagation of fruit plants

27. Practicing erection of low cost polyhouses for propagation of fruit plants
28. Propagation introduction – sexual method of propagation
29. Asexual methods of propagation
30. Anatomical and physiological basis for rooting
31. Principles and differences between sexual and asexual method of propagation.
32. Seed propagation techniques and seed treatment of fruit plants
33. Seed dormancy factors, Seed viability, germination, longevity and seedling vigour of fruit plants
34. Factors influencing seed propagation of fruit plants
35. Merits of seed propagation of fruit plants
36. Demerits of seed propagation of fruit plants
37. Nursery techniques – apomixis – polyembryony and principles
38. Practicing leaf and leaf bud cuttings
39. Practicing different types of stem cuttings
40. Practicing and planting of single nodal cuttings and root cuttings.
41. Methods of layering for propagation of fruit plants
42. Practicing different methods of layering.
43. Mid Semester Examination
44. Practicing different methods of layering
45. Maintenance, separation and potting of layers and hardening.
46. Methods of grafting for propagation of fruit plants
47. Methods of grafting for propagation of fruit plants
48. Merits of grafting methods
49. Demerits of grafting methods
50. Selection criteria of root stocks for propagation of fruit plants
51. Selection criteria of scion for propagation of fruit plants
52. Stock –scion relationship and factors influencing stock-scion relationship of fruit plants
53. Bud wood selection and budwood certification and incapability
54. Anatomical and physiological basis of graft and bud union
55. Practicing different types of grafting methods
56. Practicing different types of grafting methods
57. Practicing different types of grafting methods
58. Separation of grafts from mother plants in approach grafting - maintenance of grafted plants in the nursery.
59. Nutrition and plant protection of grafted plants
60. Methods of budding for propagation of fruit plants
61. Practicing different types of budding
62. Practicing different types of budding
63. Maintenance of budded plants.
64. Nutrition and plant protection of budded plants
65. Visit to commercial fruit plant nurseries
66. Visit to commercial fruit plant nurseries
67. Visit to commercial fruit plant nurseries

68. Visit to commercial fruit plant nurseries
69. Rejuvenation and top working of fruit plants
70. Practicing top working of unproductive and old trees
71. Bridge grafting and buttress grafting of fruit plants
72. Project preparation for establishment of commercial fruit plant nurseries
73. Project preparation for establishment of commercial fruit plant nurseries.
74. Plant tissue culture laboratory- organization and establishment- basic structural units, stages of micropropagation
75. Preparation of stock solutions - Plant tissue media preparation.
76. Sterilization and inoculation techniques for general micro propagation
77. Inoculation of shoot tip or Meristem tip culture of fruit crops
78. Micro grafting techniques in citrus for virus free planting material
79. Production of tissue culture banana plants- media for shoot tip culture
80. Banana-commercial production-meristem culture for induction-proliferation and rooting
81. Hardening techniques-commercial hardening methods- primary and secondary hardening
82. Scale up studies for hill banana production-selection of mother plants- ELISA and its uses for disease elimination
83. Assessment and identification of somaclonal variation in tissue culture-potential draw backs and elimination
84. Project preparation for establishment of plant tissue culture lab
85. Final practical Examination

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9. Purohit, S. S. 2003. Agri – Biotech, Agrobios (India), Jodhpur.
10. Salunkhe, D. K., 1990. Post Harvest Biotechnology of Flower and Ornamental Plants. Naya Prakash, 206 Bidhan Sarani, Calcutta.

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2. J. Appl.Hort.
3. Acta Hort.
4. J.Hort.Sci.
5. J.Ornamental Hort.
6. Floriculture Today
7. J.Amer.Soc.Hort.
8. J. Hort.Sci. Biotech.
9. Plant cell rep.

Outcome

Students will gain practical knowledge and hands on experience in the all the aspects of nursery production and micropropagation of fruit plants

Protected cultivation of vegetable crops (0 + 5)

Unit - I: Overview of protected cultivation and green house structures

Profiles of crop production systems - Hi - tech culture- overview - global scenario of protected cultivation of vegetable crops - scope of hi-tech culture in India, Tamil Nadu for vegetable crops - export potentials of vegetable crops grown in green house in India and Tamil Nadu - Off-season production of vegetable crops.

Study of greenhouse type - based on shape, construction, covering materials, utility - greenhouse benches - design of the fan and pad cooling system. Design and lay out of protected structures - green house, glass house, polyhouse, poly tunnels, shadenet, portable greenhouses, mist chamber and working out the cost of establishment.

Unit - II: Nursery production and environmental control

Nursery production system - ball culture - automatic filling and planting systems
nutrient management and irrigation systems - plant protection - transport of seedlings
- study of environmental control systems -light, temperature, humidity, oxygen,
carbon - dioxide and ethylene - study of climate walls, roofing materials, fogging
systems, ventilation systems -cooling systems- heating system for protected structures.

Unit - III: Greenhouse media, irrigation systems and fertigation

Root media - properties- components- soil mixing systems - soil less culture -
NFT, hydroponics, aeroponics - Soil testing - visual diagnosis and corrective procedures
- - media for hi-tech vegetable culture - preparation of beds - media sterilization-
irrigation systems - fertigation, water soluble fertilizers and micro fertilizer mixtures.

Unit - IV: Greenhouse production technology for vegetable crops

Varieties and hybrids suitable for protected cultivation- seed rate- containerized
transplant production - field preparation inside protected structures - spacing- planting
systems- irrigation- mulching-special cultural practices- pruning, pinching, training,
trellising-pollination-nutrient requirement- fertigation- nutrient deficiency-
physiological disorders and corrective measures - role of growth regulators - plant
protection -study of constraints in protected cultivation- harvest- yield- post harvest
handling -export standards - storage and marketing of tomato , capsicum and paprika.

Visit to commercial vegetable growing protected structures and project
preparation for the establishment of commercial units for the above crops

Unit - V: Greenhouse production technology for vegetable crops

Varieties and hybrids suitable for protected cultivation- climate and soil
requirements- seed rate- containerized transplant production - field preparation inside
protected structure - spacing- planting systems- irrigation- mulching-special cultural
practices- pruning, pinching, training, pollination-nutrient requirement- fertigation-
nutrient deficiency- physiological disorders and corrective measures - role of growth

regulators – plant protection –study of constraints in protected cultivation- harvest-yield- post harvest handling -export standards – storage and marketing of cucumber, melons, coriander.

Visit to commercial vegetable growing protected structures and project preparation for the establishment of commercial units for the above crops.

Practical schedule

1. Profiles of crop production systems of horticultural crops
2. Hi-tech culture- overview – global scenario of protected cultivation of vegetable crops
3. Scope of hi-tech culture in India and Tamil Nadu for vegetable crops
4. Export potentials of horticultural crops grown in green house in India and Tamil Nadu
5. Off-season production of vegetable crops- means and techniques
6. Study of greenhouse type based on shape and construction
7. Study of greenhouse type based on covering materials
8. Study of greenhouse type based on utility
9. Study of greenhouse components- benches, design of the fan and pad cooling system
10. Design and lay out of green house
11. Design and lay out of poly house
12. Design and lay out of glass house
13. Design and lay out of poly tunnels and mist chamber
14. Design and lay out of shade net
15. Working out the cost of establishment of green house, glass house
16. Working out the cost of establishment poly house
17. Working out the cost of establishment poly tunnels, mist chamber and shadenet
18. Practicing containerized nursery production system
19. Practicing automatic filling and planting systems

20. Practicing nutrient management and irrigation systems for containerized transplant production
21. Practicing plant protection measures in containerized nursery production system and transport of seedlings
22. Study of environmental control systems- light and temperature
23. Study of environmental control systems - humidity, oxygen, carbon - dioxide and ethylene
24. Study of climate walls inside the greenhouse
25. Study of roofing materials for greenhouse
26. Study of fogging systems for greenhouse
27. Study of ventilation systems for greenhouse
28. Management of Greenhouse summer cooling systems
29. Management of Greenhouse winter cooling systems
30. Study on the properties and components of a root medium for greenhouse
31. Preparation of root media for protected cultivation
32. Media sterilization
33. Study of Nutrient Film Technique
34. Study of hydroponics and aeroponics
35. Soil testing for greenhouse crops
36. Preparation of beds inside the greenhouse
37. Irrigation systems for greenhouse
38. Fertigation, water soluble fertilizers and micro fertilizer mixtures
39. Visual diagnosis and corrective procedures for greenhouse crops
40. Selection, identification and description of cultivars suitable for protected cultivation of tomato
41. Sowing of seeds under containerized transplant production for tomato
42. Bed preparation and transplanting of tomato
43. Mid Semester examination
44. Irrigation management systems inside the protected structures
45. Practicing mulching, training, pruning, trellising in tomato

46. Scheduling of nutrients for tomato through drip fertigation
47. Identification of nutrient deficiencies - physiological disorders and corrective measures and growth regulator application
48. Study of plant protection measures in tomato under protected conditions
49. Study of constraints of tomato under protected cultivation
50. Harvest indices and maturity standards and post harvest handling of tomato
51. Exports standards - storage and marketing of tomato
52. Visit to commercial tomato growing units under protected structures
53. Project preparation for the establishment of commercial units for tomato
54. Selection, identification and description of cultivars suitable for protected cultivation of capsicum and paprika
55. Sowing of seeds under containerized transplant production for capsicum and paprika
56. Bed preparation and transplanting of capsicum and paprika
57. Irrigation management systems inside protected structures
58. Practicing mulching, training, pruning, trellising in capsicum and paprika
59. Scheduling of nutrients for capsicum and paprika through drip fertigation
60. Identification of nutrient deficiencies - physiological disorders and corrective measures and growth regulator application
61. Study of plant protection measures in capsicum and paprika under protected conditions
62. Study of constraints of capsicum and paprika under protected cultivation
63. Harvest indices and maturity standards and post harvest handling of capsicum and paprika
64. Exports standards - storage and marketing of capsicum and paprika
65. Visit to commercial capsicum and paprika growing units under protected structures
66. Project preparation for the establishment of commercial units for capsicum and paprika
67. Selection, identification and description of cultivars suitable for protected cultivation of cucumber and melons

68. Sowing of seeds under containerized transplant production for cucumber and melons
69. Bed preparation and transplanting of cucumber and melons
70. Irrigation management systems inside protected structures
71. Practicing mulching, training, pruning, trellising in cucumber and melons
72. Scheduling of nutrients for cucumber and melons through drip fertigation
73. Identification of nutrient deficiencies - physiological disorders and corrective measures and growth regulator application
74. Study of plant protection measures in cucumber and melons under protected conditions
75. Study of constraints of cucumber and melons under protected cultivation
76. Harvest indices and maturity standards and post harvest handling of cucumber and melons
77. Exports standards - storage and marketing of capsicum and paprika
78. Project preparation for the establishment of commercial units for cucumber and melons
79. Sowing seeds of leafy type coriander under protected condition
80. Practicing thinning and gap filling in coriander
81. Practicing irrigation management and fertigation in coriander
82. Practicing plant protection measures for coriander
83. Harvesting, postharvest handling and marketing in coriander
84. Visit to commercial markets to study the feasibility
85. Final Practical examination

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- Acta Horticulture
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- Asian Journal of Horticulture
- Indian Horticulture

- Progressive Horticulture

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Commercial Landscaping and Dry Flower production (0+5)

Unit - I

Identification of ornamentals

History and development of gardening - present status and future prospects of landscape gardening - concepts and principles of landscaping - Bio aesthetic planning and landscaping - Identification, description and propagation of trees - annuals - shrubs - herbaceous perennials - climbers and creepers -palms and cycads - cacti and succulents - grasses, ferns and selaginellas. Visit to ornamental nurseries

Unit - II

Garden Types

Planning, designing and execution of home garden, institutional garden, public garden, corporate garden and factory garden. Role of CAD on landscaping - Planning, designing and execution of rock garden, roof garden, water garden/lily ponds, vertical garden, dish garden / terrariums.

Unit III

Designing garden components

Planning, designing and execution of garden components - hedges - edges - flower beds - trophy - topiary - hanging baskets - pruning and training of climbers over arches, pergolas and arbors. Pot mixture preparation - Potting and repotting - trimming and pruning. Guest lecture on use of LANCAD and commercial landscaping - Visit to commercial landscaping sites.

Unit - IV

Bonsai and Turf

Bonsai - plant suitability and plant collection - styles and types of bonsai - tools and implements - trays, containers and media - designing and making of bonsai - training and pruning - irrigation and nutritional management.

Turf - Introduction - scope, importance and value of turfs in landscape industry - turf grass - species and types - criteria for selection of turf grass - site selection and

basic requirement - field preparation and media - Methods of turf establishment - Golf ground, Cricket pitch and Foot ball ground - irrigation and drainage systems in turfs- selection and application of manures, fertilizers and turf growth regulators (TGR's) - weed management - lawn mowing - principles and methods - plant protection measures for lawn grasses - renovation of lawn. Visit to playground sites and turf areas.

Unit - V

Dry flower production and arrangements

Scope, importance and current scenario - suitable plant species - identification and collection of materials - methods of dry flower production - air drying - water drying - embedded method - oven drying - skeletonising - drying by immersion - bleaching and dyeing - preservation, fumigation, and storage - marketing of dry flowers- national and international market of dry flower industry.

Principles and methods of flower arrangement - craft making - table top arrangements - preparation - bouquet, floral basket, wall hangers, wreath and cones- potpourri - wet and dry method- preparation of greeting cards - final product preparation - trimming, glue painting, ribbon fixing, packing - containers and cartons - local and export markets - transport - study of domestic and global markets - constraints in dry flower industry.

Practical schedule

1-2 Identification, description and propagation of ornamental tree species

3-4 Identification, description and propagation of annuals

5-7 Identification, description and propagation of ornamental shrubs of
ornamental shrubs

8-9 Identification, description and propagation of ornamental
herbaceous
perennials

10-11 Identification, description and propagation of climbers and creepers

12-13 Identification, description and propagation of palms and cycads

14-15 Identification, description and propagation of grasses, ferns and
selaginellas

16-17 Visit to ornamental commercial nurseries

18 Planning, designing and execution of home garden

19-20 Planning, designing and execution of institutional garden

21-22 Planning, designing and execution of public garden

23-24 Planning and designing of corporate and factory garden

25-26 Role of CAD on landscape components

27-28 Planning, designing and execution of rock garden

29-30 Planning, designing and execution of roof garden

31-32 Planning, designing and execution of water garden/lily ponds

33-34 Planning, designing and execution of vertical garden

35-36 Planning, designing and execution of dish garden and terrariums
37-38 Planning, designing and execution of hedges
39-40 Planning, designing and execution of edges
41-42 Planning, designing and preparation of flower beds / carpet beds
43 Mid - Semester
44-45 Planning, designing and execution of topiary
46-47 Planning, designing and execution of trophy
48-49 Planning, designing and preparation of hanging baskets
50-51 Planting, training and pruning of climbers over arches, pergolas and arbors
52 Pot mixture preparation, Potting and repotting
53-54 visit to corporate and industrial landscapes

**55-61 Bonsai - Identification and collection of suitable planting materials
- Tools, containers and preparation of media - Styles, designing and
making of bonsai - Training and pruning techniques in bonsai -
Irrigation, manuring, pest and disease maintenance**

62-71 Turf - Identification and description of turf grass species- Site selection and field preparation of turfs - Methods of turf laying -Methods of turf laying -Irrigation and drainage layout in turfs - Turf mowing - methods and techniques - Manures, fertilizers and turf growth regulators (TGR's) management - Renovation of turf - Visit to commercial playground sites.

**72-79 Dry flower - Identification and collection of planting materials -
Method of drying - Air drying - Water drying - Embedding (Sand,
Silica gel and Borax) - Oven drying - Immersion and skeletanizing -
Bleaching of dry flower - Dyeing of dry flower - Preservation,
fumigation and storage of dry flowers - Craft making and table top
arrangements**

80-84 Flower arrangement - preparation of bouquet, wall hangers, wreath

and cones - Potpourri - wet and dry method - Preparation of greeting cards - Trimming, glue painting and ribbon fixing - Packaging and transport - Visit to dry flower industry - Visit to plant quarantine centre

85 Final Practical Examination

Text Books

1. *Alex Laurie and Victor H.Ries, 2004. Floriculture Fundamentals and Practices, Agrobios, India.*
2. *Auto CAD. 2004. A problem solving approach, Tickoo, ISBN 1-4018-51339*
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5. *Chadha, K.L., 2001. Handbook of horticulture. ICAR, New Delhi,*
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7. *Raj Edwin Biles, 2003. The complete book of gardening, biotech books, Delhi.*
8. *Randhawa, G.S., and Amitabha Mukhopadhyay, 2000. Floriculture in India, Allied publishers, India.*
9. *Rupinder Khullar, 2006, Flowering trees, shrubs and climbers of India, Pakistan, Srilanka, Bhutan and Nepal, Timeless Books, New Delhi.*

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7. www.webct.uark.edu

Value addition, quality control in horticultural produce (0+5)

AIM

To impart knowledge on preservation technology, preparation of value added products and quality control.

PRACTICAL

Equipment used in food processing unit, preparation of beverages - Squash, RTS, Nectar, Cordial, Crush, Syrup, Wine and juice concentrate, preservation with sugar - Jam, Jelly, Marmalade, Candy, Preserve, Glazed candies and Crystallized fruits, preservation with salt & vinegar - Pickle, Chutney, Sauce - dehydration of horticultural produces, by products from waste - freezing of fruit and vegetables, canning of fruit and vegetables - value added product from spices, preparation of herbal drinks - quality control of value added products - quality analysis of horticultural produces - visit to food processing industries, spice and coffee board.

PRACTICAL SCHEDULE

1. Equipment used in food processing unit.
2. Preparation of Squash.
3. Preparation of RTS.
4. Preparation of Nectar.
5. Preparation of Cordial.
6. Preparation of Crush.
7. Preparation of Syrups.
- 8-10 Preparation of Wine.
11. Preparation of juice concentrate.
12. Preparation of Jam.
13. Preparation of Jelly.
14. Preparation of Marmalade.
- 15-19. Preparation of Candy.
- 20-23. Preparation of Preserve.
- 24-28. Preparation of Glazed candies.
- 29-33. Preparation of Crystallized fruits.
34. Preparation of Pickle.
35. Preparation of Chutney.
36. Preparation of Sauce/Ketchup.
37. Dehydration of fruits.
38. Dehydration of vegetables.
- 39&40. Development of Instant soup mix powders.
- 41&42. Development of fruit juice powders.
43. Mid semester Examination

- 44&45.Osmotic dehydration of fruits.
- 46&47.Preparation of resins.
48. Preparation of desiccated coconut.
49. Preparation of pectin from peel waste.
50. Developing products from fruit waste.
51. Developing of flour from mango kernels.
52. Extraction of natural food colour from grape skins.
53. Freezing of fruits.
54. Freezing of vegetables.
55. Canning of fruits.
56. Canning of vegetables.
57. Preparation of pepper products.
58. Developing of herbal drinks.
59. Determination of TSS.
60. Determination of moisture.
61. Determination of acidity.
62. Determination of pH.
63. Firmness of fruits.
64. Estimation of Vitamin C.
65. Estimation of reducing sugar.
66. Estimation of Total sugar.
67. Determination of total of pectin.
68. Determination of beta carotene.
69. Determination of chlorophyll.
70. Determination of Anthocyanin
71. Determination of Lycopene.
72. Estimation of protein.
73. Assay the non enzymatic browning of products.
74. Estimation of Ash.
75. Estimation of Calcium.
76. Estimation of phosphorous.
77. Estimation of Iron.
78. Estimation of crude fibre.
79. Estimation of tannins.
80. Sensory evaluation for fruit and vegetable products.
81. Visit to the processing units.
82. Visit to the commercial caning units.
83. Visit to coffee board.
84. Visit to Spice board.
85. Final Practical Examination

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1. Vennila, P. and S.Kanchana. 2003. Principles and preservation of fruits and vegetables. Ratna Publications, Madurai.
2. Vijay sethi, shruti sethi, B.C. Deka and Y.R Meena, 2005. Processing of fruits and

vegetables for value addition. Indus Publishing Company

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2. Desrosier, N.W. and Desrosier, J.N. 1987. The technology of food preservation. CBS publishers and distributors, New Delhi.
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4. Ranganna, S. 1997. Handbook of Fruit and vegetable analysis and quality control for fruit and vegetable products. Tata McGraw - Hill Publishers Co.Ltd., New Delhi.
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Journals

1. Indian food packer
2. Processed Food Industry

COMMERCIAL PRODUCTION OF BIOFERTILIZERS (0 + 5)

Unit I

Introduction - Historical development - Types of Biofertilizers - Importance of biofertilizers in integrated nutrient management - sources of biofertilizer - bacteria, fungi, actinomycetes, Plant-microbe interaction-Rhizosphere, Phyllosphere and spermosphere microbiology, beneficial and harmful relationship microscopy- principles and types of microscopes - resolution, staining techniques, magnification, sterilization, principles and equipments- morphology and growth characteristics of microorganisms

Unit II

Isolation, Purification and preservation methods of bacteria, fungi and actinomycetes biofertilizers, Nitrogen cycle- biological nitrogen fixation - symbiotic, associative, non symbiotic Nitrogen fixers - *Rhizobium*, *Azospirillum*, *Azotobacter*, *Glucanacetobacter*, *Cyanobacteria*, *Azolla* and *Frankia* - Isolation, characterization and screening for efficiency - process of nodulation-Biochemistry of Nitrogen fixation. PGPR microorganisms and its importance, Biofertilizer for P nutrition - P solubilising microorganisms

Unit III

P mobilizing microorganisms - ecto & endomycorrhiza. Importance of mycorrhizal fungi in horticulture-Orchid & ericoid mycorrhiza colonization, Biofertilizers for K nutrition - mechanism- K- solubilizing microorganism, Biofertilizers for Zinc and sulphur - mechanism - Zinc and sulphur solubilizing microorganism - screening of efficient strain for mass production, Biofertilizer production - Fermentation - fermenter types and operation-downstream processing

Unit IV

Mass Production techniques of biofertilizers- Bacteria, fungi and actinomycetes, Newer formulations of biofertilizer, quality assessment - storage and application methods of various Biofertilizers - economics of Biofertilizer application - visit to commercial biofertilizer production unit - project preparation.

Practical

1. Introduction and historical developments
2. Types and importance of biofertilizers in horticultural crops
3. Role of biofertilizers in integrated nutrient management
4. Sources of biofertilizer - bacteria, fungi, actinomycetes
5. Microbial interrelationship in soil - Rhizosphere- R:S ratio

6. Rhizosphere, Phyllosphere and spermosphere microbiology
7. Determination of R:S ratio
8. Distribution and importance of microorganisms
9. Beneficial and harmful relationship
10. Microscopy- principles – resolution- magnification
11. Different types microscope
12. Sterilization, principles and equipments
13. Staining techniques
14. Simple and differential staining
15. Study of morphology of bacteria
16. Examination of Growth curve in bacteria
17. Study of morphology and growth characteristics of fungi and actinomycetes
18. Factors influencing growth of microorganisms
19. Nutritional requirements in bacteria, fungi and actinomycetes biofertilizers
20. Media preparation for bacteria, fungi and actinomycetes biofertilizers
21. Methods for isolation of bacteria, fungi and actinomycetes biofertilizers
22. Purification and preservation methods of bacteria, fungi and actinomycetes
23. Nitrogen cycle
24. Biological nitrogen fixation – symbiotic, associative, non symbiotic
25. Biochemistry of nitrogen fixation
26. Nitrogen fixer – isolation and characterization of Rhizobium
27. Rhizobium – cross inoculation group – nodulation process
28. Isolation and characterization, screening of Azotobacter
29. Isolation and characterization, screening of Azolla
30. Isolation and characterization, screening of Cyanobacteria
31. Frankia - biofertilizer
32. Isolation and characterization, screening of Frankia
33. Bacterial and fungal endophytes
34. Isolation and characterization screening of Gluconoacetobacter
35. PGPR microorganisms types mechanisms of plant growth promotion
36. PGPR- isolation, characterization, screening
37. Screening of efficient nitrogen fixers and strain selection for mass production
38. Phosphorus cycle
39. Biofertilizers for P nutrition
40. P solubilizing microorganism – mechanism
41. P mobilizing microorganism - Mycorrhizal fungi
42. Importance of mycorrhizal fungi in horticulture
43. Mid-semester examination
44. Ectomycorrhiza – colonization – role in nutrient transformation
45. Endomycorrhiza – AM fungi- colonization
46. Orchid & ericoid mycorrhiza colonization
47. Screening of mycorrhiza fungi for host preference
48. Biofertilizers for K nutrition – mechanism
49. K- solubilizing microorganism – isolation and Characterization, screening

50. Screening of efficient K- solubilizers and strain selection for mass production
51. Sulfur cycle
52. Biofertilizers for Zinc and sulphur - mechanism
53. Isolation and characterization of Zinc and sulphur solubilizing microorganism
54. Screening of efficient Zinc and sulphur solubilizers and strain selection for mass production
55. Principles of fermentation process- types of fermentor
56. Fermentor operation and maintenance
57. Downstream processing
58. Strain improvement
59. Strain selection for inoculants production
60. Mass multiplication of Rhizobium
61. Mass multiplication of Azospirillum
62. Mass multiplication of Azotobacter
63. Mass multiplication of Gluconoacetobacter
64. Mass multiplication of Azolla and cyanobacteria
65. Mass multiplication of Frankia
66. Mass multiplication of Phosphobacteria
67. Mass multiplication of AM fungi
68. Mass multiplication of Ectomycorrhiza
69. Mass multiplication of K solubilizers
70. Mass multiplication of Zinc and sulphur solubilizers
71. Selection and processing of bacterial biofertilizers
72. Selection and processing of fungal biofertilizers
73. Preparation of carrier based bacterial inoculants
74. Preparation of carrier based fungal inoculants
75. Quality control and BIS specifications for different biofertilizers
76. Demand and marketing
77. Newer formulations of different biofertilizers
78. Storage methods
79. Bacterial biofertilizers application methods
80. Fungal and actinomycetes biofertilizers application methods
81. Economics of biofertilizers application- constraints in production
82. Application of biofertilizers for horticultural crop – fruits, vegetables
83. Application of biofertilizers for horticultural crop – Spices and plantation crops
84. Visit to commercial biofertilizer production unit
85. Final Practical Examination

References

1. Subba Rao, N.S. 1999. **Biofertilizers in Agriculture and Agroforestry**. Oxford and IBH, New Delhi.
2. Subba Rao, N. S. 2000. **Soil Microbiology**. Oxford and IBH, New Delhi.
3. Alexander, M. 1985. **Introduction to Soil Microbiology**, John Willey and Sons Inc. N. Y. and London

4. Pelzar, M. J., E. C. S. Chan and N. R. Kreig. 2002. **Microbiology** Mc. Graw Hill, New York.
5. Rangaswami, G. and D. J. Bagyaraj, 1999. **Agricultural Microbiology**, Asia Publishing House, New Delhi.
6. Madigan, M. T., Martinko, J. M. and Parker, J. 2000. **Brock biology of Microorganisms**, 8th Edn. Prentice-Hall Inc.NJ
7. Stainer, R. S. J. Ingrahan, M. G. Wheels & Painfor, 1986. **Microbial World**. Prentice Hall, New Jersey.
8. Tauro, P., K. K. Kapoor and K. S. Yadav, 1989. **An Introduction to Microbiology**, Willey Publications, New Delhi.

COMMUNICATION MEDIA (0+5)

Syllabus

Preparation and practicing of traditional media - Leaf lets - Pamphlets - Folders - Booklets

Understanding the Newspaper - News Story - Success Story - Feature Story

Preparation of Newsletter - Magazine - Powerpoint presentation and multimedia presentation

Practicing - Photoshop - web designing and understanding web hosting

Knowledge on e-Velanmai - agritech portal - e-Arik -a-AQUA - social networking - mobile usage - DMI -Kissan Call Centre

Practicing radio - video recording -photography -field publicity methods like posters, charts-graphs.

Understanding the media usage by stake holders

Lecture Schedule

1. Preparation of Leaf lets
2. Practice in preparation of Leaf lets
3. Practice in preparation of Leaf lets
4. Preparation of Pamphlets
5. Practice in preparation of Pamphlets
6. Practice in preparation of Pamphlets
7. Preparation of Folders
8. Practice in preparation of Folders
9. Preparation of Booklets
10. Visit to TNAU Press
11. Preparation of News Story
12. Practice in preparation of News Story
13. Preparation of Success Story

14. Practice in preparation of Success Story
15. Practice in preparation of Success Story
16. Preparation of Feature Story
17. Practice in preparation of Feature Story
18. Practice in preparation of Feature Story
19. Visit to Newspaper Press
20. Preparation of Newsletter
21. Practice in preparation of Newsletter
22. Practice in preparation of Newsletter
23. Preparation of Magazine
24. Practice in preparation of Magazine
25. Practice in preparation of Magazine
26. Preparation of Power Point Presentation
27. Preparation of Power Point Presentation
28. Animation in powerpoint presentation
29. Preparation of Multi Media Presentation
30. Practice in preparation of Multi Media Presentation
31. Practice in preparation of Multi Media Presentation
32. Practicing Photoshop
33. Practicing Photoshop
34. Web Designing
35. Web Designing
36. Web hosting
37. Concept and development of e- velanmai
38. Functioning of e-velanmai
39. Functioning of e-velanmai
40. www.agritechprotal.com
41. Horticulture under www.agritechprotal.com
42. Allied aspects on www.agritechprotal.com
43. Extension through www.agritechprotal.com

44. Mid semester examination
45. Learning e-ARIK.a-AQUA, DACNET
46. Learning of digital extension activities in India
47. Learning of digital extension activities in the world
48. Social networking methods
49. Social networking methods
50. Use of Mobile for extension Indian and International experiences
51. Dynamic Market Information (DMI)
52. Dynamic Market Information (DMI)
53. Kissan Call Centre
54. Use of Radio in extension
55. Preparation of Radio Script
56. Visit to Community Radio Station
57. Visit to AIR, Madurai
58. Preparation of Video Script
59. Video recording
60. Video editing
61. Sound mixing
62. Visit to educational media centre
63. Agriculture programmes in Various TV Channels
64. Photography
65. Practice in Photography
66. Practice in Photography
67. Photo journalism
68. Practicing digital photo editing
69. Practicing digital photo editing
70. Sharing of photos and videos over the internet
71. Practice on Field Publicity Method – Posters
72. Practice on Field Publicity Method – Posters
73. Digital printing of posters

74. Practice on Field Publicity Method –Charts
75. Practice on Field Publicity Method – Graphs
76. Practice on Field Publicity Method – Graphs
77. Practice on Field Publicity Method – Graphs
78. Preparation of models
79. Preparation of models and collection of specimens
80. Use of bulletin boards
81. Media usage by the Department of Horticulture
82. Media usage by the University
83. Media usage by KVKs
84. Media usage by NGOs
85. Final practical examination

Reference

Textbooks

Sandhu,A.S. 1994. Textbook on Agriculture Communication. Oxford and IBH Publishing Coimbatore, New Delhi.

Ray,G.L, 1971. Extension Communication and Management. Naya Prakash, Calcutta.

Dahama, O.P and O.P Bhatnagar, 1985. Education and Communication for development. Oxford and IBH Publishing Coimbatore, New Delhi.

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