

## FSC 102 Propagation of Horticultural Crops (2 + 1)

### **Aim**

To impart knowledge on multiplication and maintenance of horticultural propagules.

### **Theory**

#### **Unit I Introduction and components of propagation**

Scope and importance of plant propagation - 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 burlapping - media and containers - soil sterilization - manures and manuring - liquid manures - agencies involved in the nursery development - government schemes for development of nurseries.

#### **Unit II Sexual propagation**

Importance, advantages and disadvantages - 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**

Importance, advantages and disadvantages - methods of vegetative propagation - identification of plus trees - mother block and scion bank - raising clonal nursery - genetic variations - chimeras and types - 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 specialized plant parts**

Grafting and budding methods - advantages and disadvantages - rootstocks - factors for successful graft union - selection, pre-curing and collection of scion - bud wood selection and certification - anatomical and physiological basis of graft / bud union - stock - scion relationship - influence of root stock on scion and scion on root stock - inter stock - methods of graft incompatibility - top working - after care and hardening - techniques of propagation through specialized plant parts - stem and root tubers - bulbs - corms - runners - suckers - crown - slips - rhizome - offshoots - quality management and nursery certification - display, packing, transport and marketing.

#### **Unit V Techniques of micropropagation**

Micro propagation - status of micropropagation in India - 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* propagation of important horticultural crops - after care - packing, transport and marketing – constraints.

### **Practical**

Media and containers - tools and implements - structures for propagation - preparation of nursery beds for raising rootstocks and seedlings - seed treatment - sowing - plug transplants - potting, depotting and repotting of plants – preparation of growth regulators for propagation - scion bank - methods of asexual propagation - cuttings, layering, grafting, budding and specialized plant parts - hardening of propagules - project preparation for commercial nurseries – visit to commercial nurseries and tissue culture units.

### **Lecture schedule**

1. Scope and importance of plant propagation
2. Establishment of nursery and site selection
3. Propagation structures, mist chamber, shade net, phytotron, humidifiers, green house, poly house, hot beds, pit nursery and ball and burlapping
4. Media and containers, soil sterilization, manures and manuring and liquid manures
5. Agencies involved in the development of nursery, government schemes and economics
6. Importance, advantages and disadvantages of sexual propagation
7. Micro and megasporogenesis, apomixes, mono embryony and poly embryony
8. Seed quality, dormancy, types of dormancy, viability, germination, longevity, seedling vigour and seed invigoration
9. Seed treatments in sexually propagated crops, formation of nursery bed and plug transplant production
10. Importance, advantages, disadvantages and methods of asexual propagation
11. Identification of plus trees, mother block, scion bank and clonal nursery
12. Genetic variations, chimeras and types
13. Types of cuttings, factors influencing rooting of cuttings and use of growth regulators
14. Advantages and disadvantages and methods of layering
15. Anatomical and physiological basis for rooting
16. Advantages, disadvantages and methods of grafting
17. **Mid semester examination**
18. Rootstocks and factors for successful graft union
19. Budding methods and techniques

20. Selection, procuring and collection of scion, bud wood and certification
21. Top working, anatomical and physiological basis of bud and graft union
22. Influence of stock on scion, scion on stock, interstock and methods of graft incompatibility
23. Propagation through specialized plant parts *viz.*, tubers, corms, bulbs, rhizome, runner, off shoot, crown, slip, sucker and offshoots.
24. Hardening of plants in nurseries and maintenance
25. Quality management, quality standards and nursery act
26. Display, packing, transport and marketing of nursery plants
27. Status of micropropagation in India
28. Different methods - protocols of micropropagation - stage I, Establishment and sterilization - stage II
29. Shoot multiplication - stage III and root formation - stage IV
30. Acclimatization and hardening, specific protocol for aseptic culture
31. Explants, sterilization techniques, types, composition and preparation of media
32. Meristem tip culture and micro-grafting
33. *In vitro* propagation of commercially important horticultural crops
34. Aftercare, packing, transport and marketing, constraints in micro-propagation

### **Practical schedule**

1. Media, containers, tools and implements for propagation
2. Propagation structures *viz.*, mist chamber, poly house, shade net house, cold frames and hot beds and their maintenance
3. Preparation of nursery beds for raising rootstocks and seedlings, seed treatment, sowing and plug transplants
4. Potting, depotting, repotting of plants
5. Preparation of growth regulators for plant propagation and scion bank
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. Techniques and methods of propagation through budding.

13. Propagation through specialized plant parts
14. Hardening of propagules
15. Project preparation for establishment of commercial nurseries
16. Visit to private nurseries and commercial tissue culture units
17. **Final practical examination.**

## REFERENCES

### Text Books

1. Bose, T.K., S.K. Mitra, M. K. Sadhu and B. Mitra. 1991. Propagation of Tropical and Subtropical Horticultural Crops. NayaPrakash 206, BidhanSarani, Calcutta. Six. India
2. Hartmann, H.T., D.E. Kester, F.T. Davies and R.L. Greeneve. 1997. Plant Propagation - Principles and Practices. Prentice Hall of India Private Ltd., New Delhi.
3. Sadhu, M.K.1989. Plant Propagation. Wiley Eastern Ltd., 4835/24, Ansari Road, Daryaganj, New Delhi 110 002.

### Further reading

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2. Edmond, J.B., T.L. Senna, F.S. Andrews and R.G. Halfacre. 1990. Fundamentals of Horticulture. Tata McGraw Hill Publishing Co. Ltd.
3. Nanda, K.K and V.K. Kochhar. 1995. Vegetative Propagation of Plants. Kalyani Publishers, Ludhiana.
4. Rao, M. K. 1991. Text Book of Horticulture. Macmillan India Ltd., 2/10, Ansari Road, Daryaganj, New Delhi 110 002.
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6. Singh, S.P. 1983. Mist Propagation. Metropolitan Publishing Company, 1, NethajiSubhashMarg, New Delhi 110 032. India.
7. Kumar, U. 2002. Methods in Plant Tissue culture, Second Edition, Agro Bios, Jodhpur.
8. Parthasarathy, V.A.2001. Biotechnology of Horticultural Crops Vol.I, II & III, Nayoprakash, Calcutta.
9. Ramswat, K. G. and J.M. Merillan 1999. Biotechnology – secondary Metabolites Oxford & IBH Publishers, Co (P) Ltd., New Delhi.
10. Purohit, S. S. 1998. Biotechnology: Fundamentals and Applications II Edition; Agro Botanica Bikaner, India.

11. Kains, M. G. 2008. Plant Propagation: Greenhouse and Nursery Practice. Singh, B.D. 1999. Biotechnology, [kessinger publishing](#), New York.
12. Razdon, M.K. 1993. An introduction to plant tissue culture plant tissue culture. Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi.

### **Journals**

1. Journal of Horticulture Sciences and Biotechnology
2. Acta Horticulture
3. Plant Cell Reporter
4. Indian Journal of Horticulture

### **Web resources**

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

## **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**

Scope and importance of tropical fruits - global, national and regional levels - area, production and export potential- horticultural zones of India and Tamil Nadu with emphasis on tropical fruits- GAP and organic production

#### **Crops : Mango and banana**

Composition and uses - origin and distribution - species - climate and soil requirements species and varieties - propagation techniques - planting systems and planting density - after care - water management, macro and micronutrient management, weed management - cropping systems - special horticultural techniques - use of plant growth regulators - harvest and yield - production constraints - physiological disorders - post harvest handling.

#### **Unit II Tropical fruits**

#### **Crops : Papaya, sapota and guava**

Composition and uses - origin and distribution - climate and soil requirements - varieties - propagation techniques - planting systems and planting density - after care - water management, macro and micronutrient management, weed management - cropping systems- special horticultural techniques - use of plant growth regulators - harvest and yield - production constraints - physiological disorders - post harvest handling.

#### **Unit III Tropical fruits**

#### **Crops: Acid lime, sweet orange and jackfruit**

Composition and uses - origin and distribution - climate and soil requirements - varieties - propagation techniques - planting systems and planting density - after care - water management, macro and micronutrient management, weed management - cropping systems - special horticultural techniques - use of plant growth regulators - harvest and yield - production constraints - physiological disorders - post harvest handling.

#### **Unit IV Arid zone fruits**

Scope and importance of dry land horticulture in India and Tamil Nadu.

#### **Crops: Aonla, ber, pomegranate and date palm**

Composition and uses - origin and distribution -- climate and soil requirements - varieties - spacing and planting patterns for rainfed horticulture - *in situ* grafting and budding techniques - mulching - soil and moisture conservation methods - application of anti-transpirants - water, weed and nutrient management practices - cropping systems - special horticultural practices - use of plant growth regulators - harvest and yield- production constraints - post harvest handling.

### **Unit V Arid zone fruits**

#### **Crops: Custard apple, jamun, bael, wood apple and manila tamarind**

Composition and uses - species and cultivars - climate and soil requirements - varieties - spacing and planting patterns - cropping systems - soil and moisture conservation methods - management of nutrients, water, weeds - special horticultural practices - use of plant growth regulators - harvest and yield- production constraints- post harvest handling.

#### **Practical**

Description and identification of cultivars/varieties - nursery preparation, seed sowing and raising seedlings / rootstocks, practicing 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 - 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 - practicing harvesting methods - ripening of fruits - grading and packaging - visit to commercial orchards - project preparation for commercial cultivation of fruit crops.

#### **Lecture Schedule**

1. Scope and importance - overview: global, national and regional level. Area, production, 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 - composition and uses - origin and distribution - varieties - Climate and soil requirements.
4. Propagation techniques - planting - High Density Planting- Nutrition-nutrient deficiency and management - after care-weed and water management.

5. Flowering, fruit set, bearing problems – special horticultural techniques - production constraints - physiological disorders.
6. Harvesting techniques – postharvesthandling- ripening of fruits - storage and processing.
7. Banana - composition and uses – origin and distribution - climate and soil requirements - varieties. Genome classification - 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 - composition and uses – origin and distribution- climate and soil requirements – sex forms - varieties – propagation – planting system, manures and manuring - nutrient deficiency and management -weed and water management – physiological disorders.
11. Thinning –use of growth regulators - production constraints - harvesting – latex extraction – postharvesthandling – storage – processing.
12. Sapota - composition and uses – origin and distribution- 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 - composition and uses – origin and distribution- climate and soil requirements - varieties – propagation – planting system - 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 - composition and uses – origin and distribution- climate and soil requirements – varieties - propagation – planting system –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 - composition and uses – origin and distribution- climate and soil requirements – varieties – propagation – planting system – manures and manuring.-



nutrient deficiency and management - weed and water management - use of growth regulators - physiological disorders - production constraints - harvesting - postharvest handling -storage - processing.

19. Jackfruit - composition and uses - origin and distribution - climate and soil requirements - varieties - propagation - planting system - 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 - Present status, overview : national and regional level.
22. Cropping systems and intercropping - crops suitable for dry land system - spacing and planting patterns for rainfed horticultural crops
23. Special practices - *insitu* grafting and budding - mulching - Soil and moisture conservation methods - application of anti-transpirants for cultivation of arid zone fruits
24. Aonla- composition and uses - origin and distribution- climate and soil requirements - varieties - propagation - planting method -planting density - pollination - nutrient, weed and water management - use of growth regulators - harvest - production constraints -grading - postharvest handling.
25. Ber-composition and uses - origin and distribution - climate and soil requirements - varieties- propagation - planting density - nutrient, weed and water management - use of growth regulators - harvest and production constraints - grading - postharvest handling.
26. Pomegranate -composition and uses - origin and distribution- climate and soil requirements - varieties - propagation - planting density - nutrient, weed and water management - training and pruning
27. Growth regulation by chemical regulators and harvest -production constraint - grading - postharvest handling.
28. Custard apple-composition and uses - origin and distribution - climate and soil requirements - varieties - propagation - planting density - nutrient, weed and water management - crop regulation - use of growth regulators - harvest -production constraints - grading - postharvest handling and processing.
29. Date palm -composition and uses - origin and distribution - climate and soil requirements - varieties -sex forms - propagation - planting density - nutrient, weed

- and water management - growth regulation - harvest - production constraints - grading - postharvest handling.
30. Jamun -composition and uses - origin and distribution - climate and soil requirements - varieties - propagation - planting density - nutrient, weed and water management - training and pruning - use of growth regulators - harvest -production constraints - grading - postharvest handling
  31. Wood apple - composition and uses - origin and distribution - climate and soil requirements - varieties - production constraints - propagation - planting density - nutrient, weed and water management - growth regulators - production constraints - harvest - grading - postharvest handling
  32. Bael -composition and uses - origin and distribution - climate and soil requirements - varieties - propagation - planting density - nutrient, weed and water management
  33. Use of growth regulators - harvest - production constraints -grading - postharvest handling in bael.
  34. Manila tamarind - composition and uses - origin and distribution - climate and soil requirements - varieties - propagation - planting density - nutrient, weed and water management training and pruning - use of growth regulators - harvest - production constraints -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. Banana sucker treatment and desuckering practices.
5. Practices in planting, growth regulation treatments and special practices in banana.
6. Visit to mango and banana fields
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. Study of varieties and propagation techniques for acid lime and sweet orange
12. Study of varieties and propagation techniques for aonla, pomegranate, custard apple, Jamun, bael and manila tamarind
13. Visit to fields of arid zone fruit crops
14. Assessment of maturity standards for tropical and arid zone fruit crops.

15. Practices in harvesting and postharvest handling of major tropical and arid zone fruit crops
16. Project preparation for commercial cultivation of tropical and arid zone fruit crops
17. Practical examination.

## REFERENCES

### Text Books

1. Chattopadhyay, T. K. 1997. A text book of Pomology (Vol 1-3). Kalyani Publishers, New Delhi.
2. Shanmugavelu, K. G. 1987. Production technology of fruit crops. SBA Publications, Calcutta.
3. Singh, S. S. Krishanmurthi and S. L. Katyal. 1967. Fruit culture in India, ICAR publications, New Delhi.

### Further reading

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2. Chadha, K.L. 2001. Hand book of Horticulture. ICAR New Delhi.
3. Pal, J.S. 1997. Fruit Growing, Kalyani Publishers, New Delhi.
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5. Veeraraghavathatham, D., M. Jawaharlal, S. Jeeva, S. Rabindran and G. Umamathi 2003. Scientific Fruit culture, Suri Associates, Coimbatore.

### Journals

1. Journal of Indian Horticulture
2. Journal of Acta Horticulture
3. Journal of Progressive Horticulture
4. Journal of Chronica Horticulture

### Web resources

1. [www.fruits-mg.com](http://www.fruits-mg.com)
2. [www.fruits.com](http://www.fruits.com)
3. [www.hort.purdue.edu/newcrop/morton](http://www.hort.purdue.edu/newcrop/morton)
4. [www.bouquetoffruits.com](http://www.bouquetoffruits.com)
5. <http://www.ishs.org>

## VSC 102 Production Technology of Tropical Vegetable Crops (2 + 1)

### **Aim**

To impart knowledge on the production technology of tropical vegetable crops

### **Theory**

#### **Unit I Scope and importance of tropical vegetables**

Scope and importance- area and production, global and national scenario, institutions involved in vegetable crops research - export potential- classification of vegetable crops - vegetable production in nutrition garden, kitchen garden, truck garden, market garden, roof garden, floating garden - types of vegetable farming - contract farming- rice fallow cultivation, river bed cultivation, rainfed cultivation, organic farming - GAP in vegetable production - export standards of vegetables.

#### **Unit II Solanaceous and Malvaceous vegetable crops**

**Crops** Tomato, brinjal, chilli and bhendi

Area and production- composition and uses - climate and soil requirements - season-varieties and hybrids - seed rate- nursery practices - containerized transplant production and transplanting - preparation of field - spacing - cropping system - planting methods - manuring and nutrient management - water and weed management - mulching- fertigation - nutrient deficiencies- physiological disorders - growth regulators - maturity indices- harvest -yield and storage.

#### **Unit III Cucurbitaceous vegetable crops**

**Crops** Ash gourd, pumpkin, bitter gourd, snake gourd, ribbed gourd, bottle gourd, watermelon, musk melon, coccinia, cucumber and gherkin.

Area and production- composition and uses - climate and soil requirements - season-varieties and hybrids - seed rate- nursery practices - containerized transplant production and transplanting - preparation of field - spacing - cropping systems - planting methods - manuring and nutrient management - water and weed management - mulching- nipping- fertigation - nutrient deficiencies- physiological disorders - sex expression in cucurbits - growth regulators - maturity indices - harvest - yield and storage.

#### **Unit IV Legumes and greens**

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

Area and production- composition and uses - climate and soil requirements - season-varieties and hybrids - seed rate- nursery practices - containerized transplant production and transplanting - preparation of field - spacing - cropping systems - planting methods - manuring

and nutrient management - water and weed management - fertigation - mulching- special horticultural practices - nutrient deficiencies - physiological disorders - growth regulators - maturity indices- harvest -yield and storage.

### **Unit V Bulbous and Tuber crops**

**Crops:** Onion, cassava, sweet potato, colocasia, vegetable coleus, elephant foot yam, edible dioscorea and yam bean

Area and production- composition and uses - climate and soil requirements - season-varieties and hybrids - seed rate- nursery practices-containerized transplant production and transplanting - preparation of field- spacing- cropping systems - planting methods - manuring and nutrient management - water and weed management - mulching- fertigation -nutrient deficiencies- physiological disorders - growth regulators - maturity indices- harvest - yield and storage.

### **Practical**

Identification and description of tropical vegetable crops - layout of kitchen garden - nursery practices and transplanting - preparation of field and sowing /planting for direct sown/ transplanted vegetable crops - manures and fertilizer application/ fertigation schedule and intercultural operations - growth regulators - identification of nutrient deficiencies - physiological disorders - harvest indices and maturity standards - post harvest handling and storage - marketing - cost of cultivation - 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. Classification of vegetable crops.
2. Effect of climate, soil, water and nutrients on vegetable crop production and their management. Cropping systems in vegetable crops.
3. 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 and rainfed cultivation. Organic farming - GAP in vegetable production.Export standards of vegetables
4. 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 methods.
5. Tomato - manuring and nutrient management - water and weed management - fertigation - nutrient deficiencies - physiological disorders - use of chemical and growth regulators- constraints in production - harvest - yield and storage.
  6. 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 methods.
  7. Brinjal -manuring and nutrient management - water and weed management -fertigation - nutrient deficiencies - physiological disorders - use of chemical and growth regulators- constraints in production - harvest - yield and storage.
  8. Chilli - 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 methods.
  9. Chilli - manuring and nutrient management - water and weed management -fertigation - nutrient deficiencies - physiological disorders - use of chemical and growth regulators- constraints in production - harvest - yield and storage.
  10. 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 methods.
  11. Bitter gourd - manuring and nutrient management - water and weed management - fertigation - nutrient deficiencies - physiological disorders - sex expression - use of chemical and growth regulators- constraints in production - harvest - yield and storage.
  12. 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 methods.
  13. Snake gourd and ribbed gourd - manuring and nutrient management - water and weed management -fertigation - nutrient deficiencies - physiological disorders - sex expression - use of chemical and growth regulators- constraints in production - harvest - yield and storage.

14. 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 methods.
15. Ash gourd and pumpkin - manuring and nutrient management - water and weed management -fertigation - nutrient deficiencies - physiological disorders - sex expression - use of chemical and growth regulators- constraints in production - harvest - yield and storage.
16. Bottle 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 methods - manuring and nutrient management - water and weed management -fertigation - nutrient deficiencies - physiological disorders - sex expression - use of chemical and growth regulators- constraints in production - harvest - yield and storage.
- 17. Mid-semester examination**
18. Coccinea, 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 methods.
19. Coccinea, Cucumber and gherkin - manuring and nutrient management - water and weed management -fertigation - nutrient deficiencies - physiological disorders - use of chemical and growth regulators- constraints in production - harvest - yield and storage.
20. 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 methods. Manuring and nutrient management - water and weed management -fertigation - nutrient deficiencies - physiological disorders - use of chemical and growth regulators- constraints in production - harvest - yield and storage.
21. Cluster beans - 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 methods - manuring and nutrient management - water and

- weed management -fertigation – nutrient deficiencies - physiological disorders - use of chemical and growth regulators- constraints in production – harvest – yield and storage.
22. Vegetable Cowpea and Lab lab - 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 methods.
  23. Vegetable Cowpea and Lab lab - manuring and nutrient management – water and weed management -fertigation – nutrient deficiencies - physiological disorders - use of chemical and growth regulators- constraints in production – harvest – yield and storage.
  24. Moringa -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 methods - manuring and nutrient management – water and weed management -fertigation – nutrient deficiencies - physiological disorders - use of chemical and growth regulators- constraints in production – harvest – yield and storage.
  25. Amaranth - 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 methods - manuring and nutrient management – water and weed management -fertigation – nutrient deficiencies - physiological disorders - use of chemical and growth regulators- constraints in production – harvest – yield and storage.
  26. Palak, basella and chekkurmaniscomposition 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 methods. Manuring and nutrient management – water and weed management -fertigation – nutrient deficiencies - physiological disorders - use of chemical and growth regulators- constraints in production – harvest – yield and storage.
  27. Onion (Aggregatum and Common) -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 methods.
  28. Onion (Aggregatum and common) -manuring and nutrient management – water and weed management -fertigation – nutrient deficiencies - physiological disorders - use of



- chemical and growth regulators- constraints in production - harvest - yield and storage - seed production.
29. Cassava -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 methods.
  30. Cassava -manuring and nutrient management - water and weed management - fertigation - nutrient deficiencies - physiological disorders - use of chemical and growth regulators- constraints in production - harvest - yield and storage.
  31. Sweet potato -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 methods - manuring and nutrient management - water and weed management -fertigation - nutrient deficiencies - physiological disorders - use of chemical and growth regulators- constraints in production - harvest - yield and storage.
  32. Colocasia and Vegetable coleus - 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 methods - manuring and nutrient management - water - use of chemical and growth regulators- constraints in production - harvest - yield and storage.
  33. Amorphophallus -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 methods - manuring and nutrient management - water and weed management -fertigation - nutrient deficiencies - physiological disorders - use of chemical and growth regulators- constraints in production - harvest - yield and storage.
  34. Dioscorea and xanthosoma - 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 methods - manuring and nutrient management - water and weed management -fertigation - nutrient deficiencies - physiological disorders - use of chemical and growth regulators- constraints in production - harvest - yield and storage.

### **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 and chekkurmanis. 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.**

## REFERENCE

### Text Books

1. Bose, T. K, Kabir, J., Maity T. K., Parthasarathy V. A., and Som M. G., 2002. Vegetable Crops Vol. I, II & III NayaProkash, Kolkata
2. Rai, N. and D.S. Yadav, 2005. Advances in Vegetable Production: Research co Book Centre, New Delhi.

3. Veeraraghavathatham. D., M Jawaharlal and SeemanthiniRamdas. 1991. A guide on vegetable culture. A. E. Publication Coimbatore.

### **Further reading**

1. Bailey, L. H 1999. Principles of Vegetable cultivation. Discovery Publishing House, New Delhi. Bishwajit Choudhury . 2003. "Vegetables", International Book Trust, New Delhi.
2. Gopalakrishnan, T.R., 2007. "Vegetable Crops" New India publishing agency, New Delhi.
3. Hazra, P. and M. G., Som. 1999. Technology for vegetable production and improvement, Naya Prokash, Calcutta.
4. James S. Shoemaker and Thomas Smith., 2006. "Culture of Veg., Growing" Asiatic.
5. Neeraj Pratap Singh . 2005. "Basic concepts of vegetable science", International Book distributing co., New Delhi.
6. Nem Pal Sing. A.K. Bhardwaj, K.M. Sing and Abnish Kumar .2004. Modern technology on vegetable production, International book distributing Co., Lucknow.
7. Pranab Hazra, A. Chattopadhyay, K. Karmakar and S. Dutta. 2010. "Modern technology in vegetable production" New India Publishing Agency, New Delhi.
8. Uma Shankar Singh, 2008. "Indian vegetables", Anmol publications Pvt., Ltd., New Delhi.
9. Vishnu Swarup, 2006. Vegetable science and technology in India. Kalyani publishers, 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

### **Web resources**

1. <http://www.informaworld.com/smpp/title~db=all~content=g904622674>
2. <http://www.ces.ncsu.edu/depts/hort/hil/hil-32-a.html>
3. <http://attra.ncat.org/attra-pub/manures.html>
4. <http://ucanr.org/freepubs/docs/8129.pdf>
5. <http://www.agnet.org/library/eb/545/>
6. <http://www.sus-veg-thai.de/>
7. <http://www.amazon.co.uk/Vegetable-Alliums-Production-Science-Horticulture/dp/0851987532>

**Theory:****Unit - I:**

Meteorology - Agricultural Meteorology - Importance and scope in crop production - Co-ordinates of India and Tamil Nadu - Atmosphere - Composition and vertical layers of atmosphere (stratification) - Climate - Weather - Factors affecting climate and weather - Climatic types - Different agricultural seasons of India and Tamil Nadu and climatic characteristics of India.

**Unit - II:**

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 - vapor pressure deficit and its importance - Wind and its effect on crops.

**Unit - III:**

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 - Evaporation - transpiration - Evapotranspiration - PET.

**Unit - IV:**

Agro climatic Zones of India and Tamil Nadu - Agro climatic 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:**

Climate change- climate variability - definition and causes of climate change - Impact of climate change on Agriculture, Forestry, Hydrology, marine and coastal ecosystem

**Practical:**

Observatory - Site selection and layout. Acquiring skill in use of Pyranometers - Sunshine recorder - Maximum, Minimum, Grass minimum and Soil thermometers - Thermograph, Dry and wet bulb thermometers - Hygrograph - Psychrometers - Fortein's barometer - Barograph - Altimeter; Wind vane, Anemometer - Raingauge - Ordinary and self-recording - Dew guage; Automatic weather station - Evaporimeters - Lysimeters, Automatic weather station - Preparation of synoptic charts and crop weather calendars. Rainfall probability analysis. Mapping of Agroclimatic Zones.

### **Theory - 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. **Mid Semester Examination.**
9. Atmospheric pressure, diurnal and seasonal variation - Pressure systems of the world - causes for variation - Isobar - Low, depression, anticyclone, Tornado, hurricane.
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:**

Prasad, Rao, G.S.L.H.V. 2005. Agricultural Meteorology. Kerala Agricultural University, Press, Thrissur.

Mavi, H.S., 1996. Introduction to Agrometeorology, oxford and IBH Publishing Co., New Delhi.

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

**E:References:**

[www.tawn.tnau.ac.in](http://www.tawn.tnau.ac.in)

[www.usbr.gov/pn/agri.met](http://www.usbr.gov/pn/agri.met)

[www.imd.gov.in](http://www.imd.gov.in)

**BIC 101**

**Fundamentals of Biochemistry**

**(2+1)**

**OBJECTIVE**

- To gain basic knowledge of the biomolecules *viz.*, Carbohydrates, Proteins and Lipids - properties, structure and metabolism.
- To learn basics of enzymes

**Theory****UNIT I Carbohydrates**

Carbohydrates - occurrence and classification. Structure of monosaccharides, **oligosaccharides** and polysaccharides. Physical and chemical properties of carbohydrates – optical isomerism,

optical activity, mutarotation, reducing property, reaction with acids and alkalis.

**Glycoconjugates - Glycoproteins and Lectin - structure and significance.**

## **UNIT II Lipids**

Lipids - occurrence and classification. Storage lipids - fatty acids, triacyl glycerol, essential fatty acids, waxes. **Structural lipids - role of lipids in biological membrane - glycolipids** and phospholipids - types and importance; Sterols - basic structure and their importance. Physical and chemical constants of oils. Rancidity of oils.

## **UNIT III Proteins and Enzymes**

Amino acids - classification and structure. Essential amino acids. Properties of amino acids - amphoteric nature and isomerism. Classification of proteins based on functions and solubility. Structure of proteins: primary structure, secondary structure, tertiary structure and quaternary structure - **protein folding and denaturation**. Properties and reactions of proteins. Enzymes - Properties, classification and nomenclature. Mechanism of enzyme action. Factors affecting enzyme activity. Enzyme inhibition - Competitive, Non-competitive and Uncompetitive inhibition; **Allosteric enzymes**. Coenzymes, cofactors and isoenzyme.

## **UNIT IV Metabolism**

Carbohydrate metabolism - breakdown of starch by amylases, glycolysis, TCA cycle and pentose phosphate pathway. Respiration - electron transport chain and oxidative phosphorylation. Bioenergetics of glucose. Lipid metabolism - lipases and phospholipases. Beta-oxidation of fatty acids 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.

## **Lecture schedule**

1. Introduction to Biochemistry, Carbohydrates - occurrence and classification R2: 1-4, 66-72.
2. Structure of monosaccharides. R2: 75-82.
3. Structure of oligosaccharides and polysaccharides. R2: 82-90.
4. Physical properties of carbohydrates - Mutarotation, optical activity, isomerism. R2: 73-78.
5. Chemical reactions of carbohydrates. R2: 90-95.



6. Glycoproteins and lectin - structure and significance. R1: 316-321.
7. Lipids - occurrence and classification. R2: 99-100.
8. Storage lipids - Fatty acids and triacyl glycerol. Essential fatty acids, waxes. R2: 101-106.
9. Structural lipids - Glycolipids and phospholipids - types and importance. R2: 107-111.
10. Sterols - basic structure and their importance. R2: 111-114.
11. Physical and chemical constants of oils. Rancidity of oils. R2: 114-119.
12. Amino acids - Classification and structure. R2: 17-21.
13. Properties of amino acids - amphoteric nature, isomerism, essential amino acids. R2: 21-26.
14. Classification of proteins based on function and solubility. R2: 26-31.
15. Structure of protein - Primary, secondary, tertiary and quaternary structure. R2: 31-41.
16. Protein folding, physical and chemical properties of proteins. R2: 41-43, R1: 52-55.
17. **MIDSEMESTER EXAMINATION**
18. Enzymes - Properties, classification and nomenclature. R2: 123-127.
19. Mechanism of enzyme action. R2: 129-131.
20. Factors affecting enzyme activity. R2: 131-136.
21. Enzyme inhibition - competitive, non-competitive, uncompetitive and allosteric enzymes. R2: 136-137, R1: 224-225.
22. Coenzymes, cofactors and isoenzyme. R2: 127-129, 138.
23. Carbohydrate metabolism - breakdown of starch by amylases, Glycolysis - Reactions and bioenergetics. R2:159-164.
24. TCA cycle - Reactions and bioenergetics. R2: 164-168.
25. Pentose phosphate pathway - Reactions . R2: 174-177.
26. Respiration - electron transport chain and oxidative phosphorylation. R2: 170-173.
27. Lipid metabolism - lipases and phospholipases. R2: 205-208.
28. Beta-oxidation of fatty acids and bioenergetics. R2: 208-212.
29. Biosynthesis of fatty acids and triacylglycerol. R2: 213- 220.
30. Transamination, deamination and decarboxylation of amino acids. R2: 224-231.
31. Ammonia assimilating enzymes - GS, GOGAT and GDH. R2: 231-233.
32. Metabolic inter-relationship. R2: 287-289.
33. Secondary metabolites - occurrence, classification and functions of phenolics. R2: 274-276.
34. Occurrence, classification and functions of terpenes and alkaloids. R2: 277-280.

### **Practical**

1. Qualitative analysis of carbohydrates
2. Estimation of starch
3. Estimation of amylose
4. Determination of reducing sugars
5. Qualitative analysis of amino acids
6. Sorenson's formal titration of amino acids
7. Estimation of amino acids by Ninhydrin method
8. Estimation of protein by Biuret method
9. Determination of free fatty acid of an oil
10. Determination of iodine number of an oil
11. Estimation of ascorbic acid by dye method

12. Assay of amylase
13. Estimation of total phenols
- 14. Extraction and estimation of lycopene and carotenoids**
15. Separation of amino acids by paper chromatography
16. Separation of **phenols** by thin layer chromatography
17. Final Practical Examination

### References

1. Berg JM, Tymoczko JL and Stryer L, (2007), Biochemistry, 7<sup>th</sup> Ed. Wiley Eastern Ltd. ISBN:0-7167-8724-5.
2. Thayumanavan, B, Krishnaveni, S and Parvathi, K, (2004), Biochemistry for Agricultural Sciences, Galgotia Publications Pvt Ltd., New Delhi. ISBN :81-7515-459-4.

### Teaching Resources

1. Cox, MM and Nelson, DL. (2011), Principles of Biochemistry, Fourth (Indian edition) Macmillian, Worth Publishers. <http://bcs.whfreeman.com/lehninger6e> - Web links/ Tutorials/ Lecture companion Art
2. Harper's illustrated Biochemistry -<https://freemedebooks.files.wordpress.com/2014/01/harpers-illustrated-biochemistry-28th-edition.pdf>
3. J M Berg, J L Tymoczko and L Stryer , Biochemistry, Sixth Edition - <http://www.irb.hr/users/precali/Znanost.o.Moru/Biokemija/Literatura/Lubert%20Stryer%20-%20Biochemistry.pdf>
4. Sadasivam, S and Manickam, A. (2009), Biochemical Methods, 3<sup>rd</sup> Edn, New Age International.
5. Wilson, K. and Walker, J.M. (2000), Principles and techniques of Practical Biochemistry, 5<sup>th</sup> Edn. - Cambridge University Press.
6. [www.ncbi.nlm.nih.gov](http://www.ncbi.nlm.nih.gov)

**Aim**

To impart basic knowledge on various functions and processes related to crop production, mineral nutrition, plant growth regulators and environmental stresses.

**Syllabus****Unit I: Plant Water Relations**

Importance of Crop Physiology in Agriculture - cell organelle- plasma membrane, chloroplast, mitochondria, peroxisome and vacuole - Structure and role of water -water potential and its components - diffusion - osmosis - imbibition - plasmolysis - Field Capacity and Permanent Wilting Point- Mechanisms of water absorption - Pathways of water movement - Apoplast and symplast - Translocation of water - ascent of sap - mechanisms - Transpiration - significance - structure of stomatal pore- mechanisms of stomatal opening and closing - guttation - antitranspirants

**Unit II: Plant Mineral Nutrition**

Criteria of essentiality - classification of nutrients - macro, micro, mobile, beneficial elements and immobile - mechanism of nutrient uptake- Physiological functions, deficiencies and disorders of macro and micro nutrients - Hidden hunger- Foliar nutrition- root feeding and fertigation - sand culture, hydroponics and aeroponics

**Unit III: Photosynthesis and Respiration**

Light reaction - Photosystems- red drop and Emerson enhancement effect- Photolysis of water and photophosphorylation - Z scheme - Photosynthetic pathways - C<sub>3</sub> and C<sub>4</sub>, CAM - difference between three pathways - Factors affecting photosynthesis- Photorespiration - pathway and its significance - Phloem transport - Munch hypothesis - Phloem loading and unloading - Source and sink strength and their manipulations - Glycolysis - TCA cycle - Oxidative phosphorylation - difference between photo and oxidative phosphorylation - energy budgeting - respiratory quotient

**Unit IV: Growth and Development**

Growth - phases of growth - Factors affecting growth - Hormones- classifications - Biosynthetic pathway and role of auxins - Biosynthetic pathway and role of gibberellins and cytokinins- Biosynthetic pathway and role of ethylene and ABA- Novel and new generation PGR's - Brassinosteroids and salicylic acid - Growth retardants - Commercial uses of PGR's-

Photoperiodism - short, long and day neutral plants - Chailakhyan's theory of flowering-  
Forms of phytochrome - Pr and Pfr - regulation of flowering - Vernalisation - Theories of  
vernalisation - Lysenko and Chailakhyan's theories- Seed germination - physiological and  
biochemical changes - seed dormancy and breaking methods - Senescence and abscission -  
physiological and biochemical changes -Physiology of fruit ripening- climacteric and non-  
climacteric fruits - factors affecting ripening- Manipulations

### **Unit V: Stress Physiology**

Classification of stresses - Physiological changes and adaptations to drought, flooding, high  
and low temperature, salinity and UV radiation - compatible osmolytes - membrane  
properties -- compartmentalization - stress alleviation - Global warming - green house gases  
- physiological effects on crops - Carbon Sequestration

### **Practicals**

Preparation of different types solutions -Measurement of plant water potential by different  
methods - Estimation of photosynthetic pigments- Chlorophylls and Carotenoids -  
Determination of stomatal index and stomatal frequency - Measurement of leaf area by different  
methods Physiological and Nutritional disorders in crops plants -Estimation of chlorophyll  
Stability Index - Estimation of Relative Water Content -Determination of photosynthetic  
efficiency in crop plants - soluble protein - Estimation of Nitrate Reductase activity -Growth  
Analysis - Bioassay of Cytokinin and GA - Estimation of proline -Demonstration of Practical  
applications of PGRs. Field visit for foliar diagnosis

### **Theory lecture schedule**

1. Importance of Crop Physiology in Agriculture - Structure of plasma membrane, chloroplast, mitochondria, peroxisome and vacuole
2. Structure and role of water -water potential and its components - Diffusion - Osmosis - imbibition - Plasmolysis - Field Capacity and Permanent Wilting Point
3. Mechanisms of water absorption - Pathways of water movement - Apoplast and symplast
4. Translocation of water - ascent of sap - mechanisms of xylem transport
5. Transpiration - significance - structure of stomata - mechanisms of stomatal opening and closing - guttation - antitranspirants
6. Mineral nutrition - criteria of essentiality - classification of nutrients - macro, micro, mobile and immobile - mechanism of nutrient uptake

7. Physiological functions and disorders of macro nutrients – Hidden hunger
8. Physiological functions and disorders of micro nutrients
9. Foliar nutrition- root feeding and fertigation – sand culture, hydroponics and aeroponics
10. Light reaction – photolysis of water and photophosphorylation - Z scheme
11. Photosynthetic pathways – C<sub>3</sub> and C<sub>4</sub> cycles
12. CAM pathway – difference between three pathways - Factors affecting photosynthesis.
13. Photorespiration – pathway and its significance
14. Phloem transport – Munch hypothesis - Phloem loading and unloading - Source and sink strength and their manipulations
15. Glycolysis – TCA cycle
16. Oxidative phosphorylation – difference between photo and oxidative phosphorylation – energy budgeting - respiratory quotient
17. Mid Semester Examination
18. Growth – phases of growth – factors affecting growth – Hormones- classifications
19. Biosynthetic pathway and role of auxins
20. Biosynthetic pathway and role of gibberellins and cytokinin
21. Biosynthetic pathway and role of ethylene and ABA
22. Novel growth regulators – Brassinosteroids and salicylic acid – New Generation PGR's
23. Growth retardants and inhibitors -commercial uses of PGR's
24. Photoperiodism - short, long and day neutral plants – Chailakhyan's theory of flowering
25. Forms of phytochrome - Pr and Pfr - regulation of flowering
26. Vernalisation - theories of vernalisation – Lysenko and Chailakhyan's theories
27. Seed germination - physiological and biochemical changes - seed dormancy and breaking methods
28. Senescence and abscission – physiological and biochemical changes
29. Physiology of fruit ripening- climacteric and non climacteric fruits - factors affecting ripening and manipulations

30. Drought - physiological changes - adaptation – compatible osmolytes - alleviation
31. High and low temperature stress – physiological changes - membrane properties - adaptation
32. Salt stress - physiological changes - adaptation – compartmentalization - alleviation
33. Flooding and UV radiation stresses – physiological changes - adaptation
34. Global warming – green house gases --physiological effects on crop productivity- Carbon Sequestration

### **Practicals schedule**

1. Preparation of different types solutions
2. Measurement of plant water potential by different methods
3. Estimation of photosynthetic pigments- chlorophylls and Carotenoids
4. Determination of stomatal index and stomatal frequency
5. Measurement of leaf area by different methods
6. Physiological and Nutritional disorders in crops plants
7. Estimation of chlorophyll Stability Index
8. Estimation of Relative Water Content
9. Determination of photosynthetic efficiency in crop plants – soluble protein
10. Estimation of Nitrate Reductase activity
11. Growth Analysis - LAI, LAD, SLA, SLW, LAR, NAR, RGR, CGR and HI
12. Bioassay of Cytokinin
13. Bioassay of GA
14. Estimation of proline
15. Demonstration of Practical applications of PGRs.
16. Field visit for foliar diagnosis
17. Final Practical Examination

### **Outcome**

Students will come to know basic knowledge on various functions and processes related to crop production, mineral nutrition, plant growth regulators and environmental stresses. In addition, hands on exposure to preparation of solutions, analysis of pigment composition, estimation of growth analytical parameters, diagnosis and correction of nutrient deficiencies, enzyme assays and demonstration of plant growth regulator applications

### **Text books**

1. P. Boominathan, R. Sivakumar, A. Senthil, and D. Vijayalakshmi. 2014. Introduction to Plant Physiology, A.E. Publications. Coimbatore
2. Jain, V.K. 2007. Fundamentals of plant physiology, S.Chand & Company Ltd., New Delhi.
3. Taiz. L. and Zeiger. E., 2010 (Fifth edition). Plant Physiology. Publishers: Sinauer Associates, Inc., Massachusetts, USA.

### **e- books and e-references**

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

**AEC101**

**Principles of Economics**

**(1+1)**

### **Objective**

This course aims to introduce the basic principles of economics including the problem of economic decision - making, laws of economics and macroeconomic concepts.

### **Theory**

#### **Unit 1: Nature and Scope of Economics**

Nature and Scope of economics: Importance, Subject matter: Science Vs. art, Positive science Vs. normative science, Deductive method Vs. inductive method -Definitions of Economics: Wealth, Welfare, Scarcity and Growth - Different economic systems: merits and demerits - Divisions of Economics - Microeconomics and Macroeconomics - Agricultural Economics: Definition and scope - Basic concepts: Goods, Service, Value, Cost, Price, Wealth and Welfare - Wants: Characteristics and classification.

## **Unit 2: 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 - Indifference curve analysis: Definition and properties of indifference curves and budget line - Demand: Definition, Kinds of demand, Demand schedule, Demand curve, Law of Demand, Determinants of demand, Extension and Contraction of demand Vs. Increase and decrease in demand - Elasticity of Demand: Types, Degrees of price elasticity of demand, Factors influencing elasticity of demand, Importance of elasticity of demand - Standard of Living: Definition, Engel's Law of Family Expenditure - Consumer surplus: Definition and Importance.

## **Unit 3: Theory of Production**

Concept of production - Factors of production - Land: Characteristics of land -Labour: Characteristics of labour, Division of labour, Malthusian and Modern theories 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 - Producer surplus.

## **Unit 4: Exchange and Theory of Distribution**

Exchange and Distribution: Definition - Pricing of factors of production - Marginal productivity theory of distribution - Rent and Quasi rent - Wages: Real wage and money wage - Interest: Pure interest and gross interest - Profit: Meaning of economic profit.

## **Unit 5: Macroeconomic Concepts**

Macroeconomics: Definition and Subject matter - National Income: Concepts - GNP, GDP, NNP, Disposable income and Per capita income - Money: Definition, Types and functions of money - Inflation: Meaning, types of inflation - Public Finance: Meaning, Principles - Public Revenue: Meaning, Classification of taxes - Canons of Taxation - Public expenditure: Principles - Welfare Economics: Meaning, Pareto's optimality.

## **Practical**

Ten principles of economics - Law of Diminishing Marginal Utility - Law of Equi-Marginal Utility - Indifference Curve analysis and consumer equilibrium - Individual and market demand- Measurement of Arc and Point elasticities of demand - own price, income and cross price elasticities of demand - Estimation of Consumer surplus - Law of Diminishing Marginal Returns: Relationship among TPP, APP and MPP - Cost concepts and graphical derivation of cost curves - Estimation of total revenue and profit - Producer surplus



- Supply elasticity - Exchange: Market Structure and Price determination - Theories of Distribution - Computation of National Income - Study of structural changes in the economy - Estimation of Growth Rate - Money: Quantity theory of money - Inflation: Causes and control measures - Estimation of price index - Measures of standard of living - Indices of human development.

### **Theory Schedule**

1. Nature and Scope of economics: Importance, Subject matter: Science Vs. art, Positive science Vs. normative science, Deductive method Vs. inductive method - Different economic systems: merits and demerits.
2. Definitions of Economics - Wealth, Welfare, Scarcity and Growth- Divisions of Economics: Micro economics and Macroeconomics - Agricultural Economics: Definition and scope.
3. Basic concepts - Goods, Services, Use value and Exchange value, Cost, Price, Wealth and Welfare - Wants: Characteristics and Classification of wants.
4. Utility: Definition, Measurement: Cardinal and ordinal utility - Marginal utility - Law of Diminishing Marginal Utility.
5. Law of Equi-marginal Utility: Definition, Assumptions, Limitations and Applications - Indifference curve analysis: Definition and properties of indifference curves and budget line.
6. Demand: Definition, Kinds of demand, Demand schedule, Demand curve, Law of Demand, Determinants of demand - Extension and contraction of demand Vs. Increase and decrease in demand.
7. Elasticity of Demand: Own price, cross price and income elasticities of demand, Degrees of price elasticity of demand, Factors influencing elasticity of demand and Importance of Elasticity of demand.
8. Standard of Living - Definition, Engel's Law of Family Expenditure - Consumer surplus: Definition and Importance.
9. **Mid Semester Examination.**
10. Concept of production - Factors of production - Land and its characteristics.
11. Labour: Characteristics of labour - Division of labour - Malthusian and Modern theories of population.
12. Capital: Characteristics of capital - Capital formation: Phases of capital formation - Entrepreneur: Characteristics and functions of entrepreneur.

13. Supply: Definition, Law of Supply, Factors influencing supply - Elasticity of supply - Producer surplus.
14. Exchange and Distribution: Definition - Pricing of factors of production - Theory of distribution - Marginal productivity theory of distribution - Rent and Quasi rent.
15. Wages: Real wage and money wage - Interest: Pure interest and gross interest - Profit: Meaning of economic profit.
16. Macroeconomics: Definition and Subject matter - National Income: Concepts - GNP, GDP, NNP, Disposable income and Per capita income - Money: Definition, Types and functions of money - Inflation: Meaning and Types of inflation.
17. Public Finance: Meaning, Principles - Public Revenue: Meaning, Classification of taxes - Canons of taxation - Public expenditure: Principles - Welfare Economics: Meaning, Pareto's optimality.

### **Practical Schedule**

1. Elucidation of 10 principles of economics.
2. Exercise on Law of Diminishing Marginal Utility - Exercise on Law of Equi-Marginal Utility.
3. Indifference Curve Analysis: Properties, budget line and consumer equilibrium.
4. Demand schedule - Graphical derivation of individual and market demand - Measurement of Arc and Point elasticities of demand.
5. Estimation of own price, income and cross price elasticities of demand - Estimation of consumer surplus.
6. Law of Diminishing Marginal Returns: Relationship among TPP, APP and MPP.
7. Cost concepts: Total cost, total fixed costs, total variable cost, average costs, marginal costs and Graphical derivation of cost curves - Estimation of total revenue and profit.
8. Supply: Estimation of supply elasticity - Estimation of producer surplus.
9. Market Structure - Characteristic features of different types of Sellers' markets - Perfect competition, monopoly, oligopoly and monopolistic competition - Buyers' Market - Price determination under Perfect completion and Monopoly.
10. Rent: Theories of Rent: Ricardian and Modern theories of rent - Wages: Determination of wages: Marginal productivity theory and Demand and supply theory of wages.
11. Interest: Theories of interest: Keynesian and Modern theories of interest - Profit: Risk - bearing theory of profit.

12. Approaches to computation of National Income - Analysis of Trends in National Income - Study of structural changes in the economy.
13. Estimation of Growth Rate of Population and Food grain production.
14. Money: Quantity theory of money - Inflation: Causes and control measures
15. Consumer price index and Wholesale price index - Estimation of price indices.
16. Measures of standard of living and human development - Human Development Index - Physical Quality of Life Index - Gender Development Index.
17. **Practical Examination.**

### **References**

1. Dewett, K. K. 2004. Modern Economic Theory, Syamlal Charitable Trust, New Delhi.
2. Mankiw, G.N., Principles of Microeconomics, Cengage Learning. Chapter 1.
3. Samuelson, P. 2004. Economics, (18/e), Tata Mc-graw-Hill, New Delhi
4. Seth, M. L. 2005. Principles of Economics, Lakshmi Narain Agarwal Co., Agra. New Delhi.

**Unit I - Introduction to Environmental Science**

Environmental Science – Interrelationship with other sciences - Scope – Concepts - Segments - Global Environmental initiatives and perspectives – Environmental Sustainability – Ecological footprint

**Unit II - Ecology and Ecosystems**

Ecology – Relevance to man - Ecosystem - Components – Terrestrial - Biomes – Forest – Desert - Aquatic – Pond – River – Estuaries – Ocean - Matter cycling - Energy flow – Food Chain, Food Web and Ecological pyramids --Species interactions – Succession

**Unit III- Biodiversity and conservation**

Biodiversity – Types – National and Global Status – Significance – Hotspots - Threats – Conservation – *In-situ* – *Ex-situ* - Biosphere Reserve - National parks and Wildlife Sanctuaries – Botanical Garden

**Unit IV- Natural Resources**

Natural resources – Land – Water – Air – Forest – Minerals – Energy Resources – Renewable - Non-renewable – Status – Degradation – Sustainable Management and Conservations- Resource Extraction

**Unit V- Environmental problems and Protection**

Green House Gases-Global warming- Climate change-Impact on agriculture and other natural resources-Environmental pollution-Introduction to soil, water and air pollution -impact on agriculture and environment

Environmental protection-Global treaties – Conventions – National and state level organizations: TNPCB, CPCB -- Environmental Laws and Acts – Environmental Education

**Practical Schedule:**

1. Environmental Sampling and preservation
2. Assessment of biodiversity in Natural ecosystem
3. Assessment of biodiversity in River ecosystem –
4. Assessment of biodiversity in Pond Ecosystem
5. Biodiversity assessment in different farming systems: organic farm
6. Biodiversity assessment in different farming systems: Conventional farm
7. Water quality analysis: pH, EC and TDS
8. Estimation of Acidity, Alkalinity and Hardness in the water sample
9. Estimation of DO, BOD of water sample
10. Enumeration of *E.coli* in water sample
11. Effect of wastewater irrigation on the germination of agricultural crops (Pot culture test for germination)

12. Estimation of Ammonical ,nitrate nitrogen and phosphorous
13. Estimation of Heavy metals using AAS
14. Assessment of Suspended Particulate Matter (SPM) in the atmosphere
15. Assessing the impact of Suspended Particulate Matter (SPM) on agricultural crops
16. Visit to Contaminated site and Common Effluent Treatment system
17. Practical examination

### **Lecture Schedule**

- 1) Introduction to Environmental Science, Interrelationship with other sciences, Scope, Concepts and Segments
- 2) Global Environmental initiatives and perspectives, Environmental Sustainability and Ecological footprint
- 3) Ecology, its Relevance to man, Ecosystem and its components
- 4) Biomes: Terrestrial (Forest, Desert, etc..) and Aquatic (Pond, River, Estuaries and Ocean)
- 5) Energy flow, Food Chain, Food Web and Ecological pyramids
- 6) Species interactions, adaptations and Succession
- 7) Biogeochemical cycles
- 8) Biodiversity: Types, National and Global Status, importance, Hotspots and Threats
- 9) **Mid Semester Examination**
- 10) Conservation of Biodiversity: *In-situ and Ex-situ* - Biosphere Reserves - National parks, Wildlife Sanctuaries, Botanical Garden, etc..
- 11) Natural and Energy resources: Land, Water, Air, Forest, Minerals, Perpetual, Renewable and Non-renewable
- 12) Present Status of Natural and Energy resources, Resource Extraction, Degradation and Sustainable Management and Conservation.
- 13) Green House Gases-Global warming- Climate change-Impact on agriculture and other natural resources-
- 14) Environmental pollution-Introduction to soil, water and air pollution -impact on agriculture and environment
- 15) Global treaties and Conventions for Environmental Protection
- 16) National and state level organizations: CPCB, TNPCB, etc..
- 17) Environmental Education, Environmental Laws and Acts

### **References:**

1. Tyler Miller and Scot Spoolman. 2009. Living in the Environment (*Concepts, Connections, and Solutions*). Brooks/cole,

Cengage learning publication, Belmont, USA

2. P.D. Sharma, 2009, Ecology and Environment, Rastogi Publications, Meerat, India

**FOR 121**

**Forest Resource Management**

**1+ 1**

**Aim**

To impart knowledge about the basic facts of Forestry as well as agroforestry and familiarize the students with important trees suitable for agroforestry and various agroforestry systems.

**Theory**

## **Unit I -Introduction to Forestry**

Forest - Forestry - Definition, objectives, classification and historical perspectives in India. Role of forest - tangible and intangible benefits. Geographical distribution of world and Indian forests - Forest types - definition and major forest types of India - Forest cover of India as per Forest Survey of India - Definition of Silvics and Silviculture - objectives - its relation with other branches of forestry - International forestry organizations.

## **Unit II Forests and people**

Social forestry - Definition, history, objectives - Components - Farm forestry, Extension forestry, Community forestry, Recreation forestry, Urban forestry - Benefits of social forestry - Important social forestry schemes implemented in India - Definition, origin and evolution of JFM in India - Salient features of JFM - Organisational structure in JFM- Benefit sharing mechanism

## **Unit III - Agroforestry concept and systems**

Land use and land capability classification - Agroforestry - definition and scope - History of agroforestry - Components of agroforestry, benefits and limitations - Overview of global agroforestry - traditional agroforestry practices in Asia and India - Agroforestry system classification - structural, functional, ecological and socio-economic basis

## **Unit IV - Agroforestry tree species and Mensuration**

Important farm grown trees - Silvicultural characters - Regeneration techniques - Tending - Rotation - Yield and Uses of *Tectona grandis*, *Santalum album*, *Casuarina* species, *Eucalyptus* species, *Azadirachta indica*, *Melia dubia*, *Leucaena leucocephala*, *Aibizia lebbeck*, *Acacia nilotica*, *Acacia leucophloea*, *Acacia auriculiformis*, *Ailanthus excelsa*, *Dalbergia sissoo*, *Gmelina arborea* and *Pterocarpus marsupium* - Forest Mensuration - definition, objectives - Diameter, girth and height measurement methods-standard rules governing breast height measurement - Volume estimation in standing and felled trees

## **Unit V - Agroforestry practices**

Agroforestry practices for arid and semi arid regions - Agroforestry for problem soils - salt affected soils, waterlogged areas - Multifunctional agroforestry - green manure, fuel wood and fodder production - agroforestry for soil and water conservation, wasteland development -

Carbon sequestration through agroforestry approaches – Timber transit rules for farm grown trees - National Agroforestry policy, 2014

### **Practical**

Identification of major farm grown tree species and study its uses – Nursery technology of *Tectona grandis*, *Casuarina* species, *Eucalyptus* species, *Azadirachta indica*, *Ailanthus excelsa*, *Melia dubia*, *Leucaena leucocephala*, *Aibizia lebbek*, *Acacia nilotica*, *Acacia leucophloea*, *Dalbergia sissoo*, *Gmelina arborea*, *Santalum album* and *Pterocarpus marsupium* – Tree planting technique - Visit to agroforestry models – Agrisilviculture – Hortisilviculture – Silviculture – Integrated Farming System – Windbreaks and shelterbelts – Industrial wood plantations and contract tree farming – Estimation of volume – Estimation of biomass – Economics of agroforestry.

### **Theory Lecture Schedule**

1. Forests and Forestry - Definition, objectives, classification and historical perspectives in India
2. Role of forests – Tangible and intangible benefits – Geographical distribution of world and Indian forests
3. Forest types – definition and major forest types of India – Forest cover of India – International Forestry organizations - Silvics and Silviculture – definition and objectives – relation with other branches of forestry
4. Definition, history and objectives of social forestry – Components and benefits of social forestry – Important social forestry schemes implemented in India
5. Joint Forest Management – definition, origin, evolution, salient features and organisational structure- benefit sharing mechanism
6. Land use capability classification -Agroforestry – definition, scope and history
7. Agroforestry components – benefits and limitations - Overview of global agroforestry – traditional agroforestry practices in Asia and India
8. Classification of agroforestry systems – structural, functional, ecological and socio-economic basis
9. Silvicultural characters, regeneration techniques, tending, rotation, yield and uses of teak, sandalwood and red sanders
10. Mid semester examination
11. Silvicultural characters, regeneration techniques, tending, rotation, yield and uses of *Casuarina* species, *Eucalyptus* species and *Ailanthus excelsa*



12. Silvicultural characters, regeneration techniques, tending, rotation, yield and uses of *Azadirachta indica*, *Melia dubia*, *Dalbergia sissoo* and *Gmelina arborea*
13. Definition, objectives, scope of Forest Mensuration - Diameter, girth and height measurement methods
14. Standard rules governing breast height measurement - volume estimation of standing and felled trees - measurement of weight and biomass
15. Agroforestry practices for arid, semi arid, salt affected and waterlogged soils
16. Agroforestry practices for fuelwood, fodder production, soil and water conservation and wasteland development - Carbon sequestration through agroforestry approaches
17. Timber transit rules for farm grown trees - National Agroforestry policy, 2014

### **Practical Schedule**

1. Identification of major farm grown tree species and study its uses
2. Nursery technology of Eucalyptus species and Casuarina species
3. Nursery technology of *Azadirachta indica* and *Melia dubia*
4. Nursery technology of *Ailanthus excels* and *Leucaena leucocephala*
5. Nursery technology of *Aibizia lebbek*, *Acacia nilotica* and *Acacia leucophloea*
6. Nursery technology of *Dalbergia sissoo*, *Gmelina arborea* and *Santalum album*
7. Nursery technology of *Pterocarpus marsupium* and *Tectona grandis*
8. Visit to agrisilviculture and silvipasture model
9. Visit to Integrated Farming System
10. Designing an agroforestry model
11. Designing and establishment of wind break and shelter belt
12. Visit to pulpwood / plywood plantations
13. Studies on contract tree farming practices in Tamil Nadu
14. Estimation of volume of standing and felled trees
15. Estimation of tree biomass through various methods
16. Economics of agroforestry - Preparation of bankable projects
17. Final practical examination

### **Outcome / Deliverable**

The students will gain knowledge on concepts of forestry, agroforestry and the important agroforestry systems. The students will learn about the silviculture and nursery technology of important agroforestry tree species.

## Text Books

1. Divya, M.P., K.T.Parthiban, K.Srinivasan, K.Vanangamudi and M.Govinda Rao. 2008. A text book on Social Forestry and Agroforestry. Satish Publishers, Delhi
2. Dwivedi, A.P. 1992. Agroforestry Principles and Practices. oxford & IBH publishing Co., New Delhi
3. Khanna, L. S. 1991. Principles and Practice of Silviculture. Khanna Bandhu, Dehradun.
4. Chaturvedi, A. N and Khanna, L. S. 2000. Forest Mensuration. International Book Distributors, Dehradun.

## Journals

1. Agroforestry Systems, Netherlands
2. International Journal of Agroforestry and Silviculture, International Scholars Journals Publishing Corporation, USA
3. Indian Journal of Agroforestry, CAFRI, Jhansi
4. Agroforestry Today, ICRAF, Nairobi, Kenya
5. Range management and Agroforestry, IGFRI, Jhansi

## E- resources

- [www.worldagroforestry.org](http://www.worldagroforestry.org)
- [www.fao.org/forestry/9469/en](http://www.fao.org/forestry/9469/en)
- [www.global-saf.com](http://www.global-saf.com)
- [www.agroforestry.net.au](http://www.agroforestry.net.au)
- [www.nac.unl.edu/documents/insideagroforestry/vol16issue2.pdf](http://www.nac.unl.edu/documents/insideagroforestry/vol16issue2.pdf)

ENG. 103- DEVELOPMENT EDUCATION (0+1)

(Alternate courses for non-Tamil students)

## Aim:

- Basic principles of learning
- Taxonomy of educational
- Career development and entrepreneurship
- Communication skills

## Lecture Schedule

1. Basic principles of learning. Binary terms viz - growth and development, education - for - life and life - long education, motivation and morale -
2. Occupation and profession, training and education, lateral thinking and convergent thinking, teaching and learning - discussion.
3. Bloom's classification of educational objectives - Cognitive, Affective, Psychomotor domain(s)
4. Career development - opportunity for graduates of agriculture and allied sciences - discussion
5. Success story of a farmer / entrepreneur - factors involved - role - play
6. Brainstorming - Demonstration
7. Simulation - Educational Simulation-Interactive Teaching - Business Simulation - Company's annual report for analysis

8. Interpersonal communication – Transactional communication – ice breaker
9. **MID SEMESTER EXAMINATION**
10. The conduct of a symposium
11. Conferencing – the concept and presentation of a paper
12. Scientific Article Writing and Editing
13. Popular Article Writing, Editing and Blogging
14. Project proposal
15. Project Report – writing
16. Entrepreneur – intrapreneur – Managing an intrapreneur – motivation and entrepreneurship development – planning, monitoring and evaluation.
17. **FINAL PRACTICAL EXAMINATION**

**Text book:**

Sudarsanam.R 1985. “Development Education” Chapter 1,2

**Outcome:**

- Understand the concepts of learning,
- The necessity for Lifelong education,
- Communication skills in terms of career development

**References**

1. Bloom,B.S.Hastings J.T. and Maduas J.F. 1971. Handbook on Formative and Summative Evaluation of Student Learning Mc Graw Hill Pub, New York.
2. Day, A Robert 1993. “How to Write and Publish a Scientific Paper” CUP.
3. Hariharan.S. 1995. “Brainstorming and Interactive Learning” Research Quarterly, ADU, Coimbatore.
4. Krishna Mohan and Meera Banerji, 1990. “Developing Communication Skills”, Macmillan Pub. Co., Ch.6,9,10,13 and 15.
5. Mathew.M. Monipally. 1997. “The craft of Business Letter Writing”. Tata McGraw Hill Pup., Ch. 10 & Appendix – I.
6. Seely John. 1988. “Communicating in Everyday Life”. The Oxford Guide to Writing and Speaking, OUP. P.1-79.
7. Sudarsanam.R 1985. “Development Education” Chapter 1,2.
8. Taneja.R.P. 1991. Dictionary of Education, Anmol Pub., New Delhi, India.
9. Wallace, L.Michael 1998. “Study Skills in English” CUP Unit.4.

**TAM 101 jkpH; ,yf;fpa';fspy; ntshz;ika[k;**

**mwptpay; jkpH;g; gad;ghLk; (0+1)**

bjhy;fhg;gpak; fhl;Lk; Kjw;bghUs;/ fUg;bghUs; - r';f ,yf;fpaj;jpy; ntshz; bjhHpy; El;g';fs; - gjpbdz; fPH;f;fzf;F E}y;fspy; ntshz;ik mwptpay; - gs;S ,yf;fpa';fs;/ VbuGgJ/ ,yf;fpaj;jpy; ntshz; bghwpapay; - njhl;ltpay; - tdtpay; kidapay; - NHypay; ntshz;ikg; gHbkhHpfs; - ,yf;fpak; fhl;Lk; thH;tpay; bewpKiwfs; - ,f;fhy ,yf;fpa';fspy; ntshz;ikr; rpe;jidfs; - gpiHapd;wp vGJk; Kiwfs; - ,yf;fpaj;jpy; bkd;jpwd;fs; - mwptpay; jkpH; tsh;r;rp epiyfs; fiyr;brhy;yhf;fk; - bkhHp bgah;g;ghsh; - Ml;rpj; jkpH; - cHth;fSf;fhd mwptpg;g[fis btspapLjy; - fl;Liur; RUf;fk; vGJjy; - fzpdp cyfpy; jkpH;

**bra;Kiwg; gapw;rpfs;**

1. bjhy;fhg;gpak; fhl;Lk; Kjw;bghUs;/ fUg;bghUs; tHp ntshz; kug[fis mwpyj;
2. r';f ,yf;fpaj;jpy; ntshz; bjhHpy; El;g';fs; - (vl;Lj;bjhif/ gj;Jg;ghl;L)
3. gjpbdz; fPH;f;fzf;F E}y;fspy; ntshz;ik mwptpay;
4. gs;S ,yf;fpa';fs;/ VbuGgJ - cHth; thH;tpay; bewpKiwfSk; ntshz;ikj; bjhHpy; El;g';fSk;
5. ,yf;fpaj;jpy; ntshz; bghwpapay; - njhl;ltpay; - tdtpay; - kidapay; - NHypay;
6. ntshz;ikg; gHbkhHpfs; - cHt[ tpj mwptpay; - ehw;W eLjy; - vU ,Ljy; - ePh;g;ghrdk; - fis nkyhz;ik - gaph;ghJfhg;g[ - mWtil - cHth; rKjhak;
7. ,yf;fpak; fhl;Lk; thH;tpay; bewpKiwfs;
8. ,f;fhy ,yf;fpa';fspy; ntshz;ikr; rpe;jidfs; - ghujp/ ghujpjhrd; gilg;g[fs; - g[Jf;ftpij - rpWfij - g[jpdk;
9. ,ilepiyg; gUtj;njh;t[
10. gpiHapd;wp vGJk; Kiwfs; - vGj;Jg; gpiHfs; - brhw;gpiHfs; - brhw; gphpg;g[g;gpiH - thf;fpag;gpiH - bka;g;g[j; jpUj;jk;
11. ,yf;fpaj;jpy; bkd;jpwd;fs; - jiyikg;gz;g[ - fhy nkyhz;ik

12. MSikg;gz;g[ nkk;ghL – kdpj cwt[j;]jpwd;fs; tsh;j;jy;
13. mwptpay; jkpH; tsh;r;rp epiyfs;/ ntshz; E}y;fs;/ ntshz; ,jH;fs;
14. fiyr;brhy;yhf;fk; - ntshz; fiyr; brhw;fis cUthf;Fk; Kiw – jug;gLj;Jjy; - ,yf;fpa ntshz; fiyr;brhw;fs;/ tl;ihu ntshz;ik tHf;Fr; brhw;fs; - mfuhjapay;
15. bkhHp bgah;g;g[ - Kf;fpa tpjpf; - goepiyfs; - bkhHp bgah;ghshpd; ,d;wpaikahg; gz;g[fs; - ntshz; bra;jpfis bkhHp bgah;j;jy;
16. Ml;rpj; jkpH; - murhizfs; mYtyf; foj';fs; - cHth;fSf;fhd mwptpg;g[f;fis btspapLjy; - fl;Liur; RUf;fk; vGJjy;
17. fzdpp cyfpy; jkpH; - xU';F FwpaPL gapw;Wtpj;jy; - tiyg; g{f;fs; - tpf;fpgPoah – ntshz; bra;jpfisg; gjpntw;wk; bra;jy; - ntshz; bra;jpfis ,izajs tHp mwpjy;

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- fe;jrhkp.,y.br.ntshz;ika[k; gz;ghLk;/ jkpH;ehL ntshz;ikg; gy;fiyf;fHfk;/ nfhak;g[j;J}h;/ 1974
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- FHe;jrhkp.th.br.mwptpay; jkpH;/ ghujp gjpg;gfk;/ brd;id
- kPdhl;rp Re;juk;. kh. kw;Wk; V.,y.tprayl;Rkp jfty; bjhlh;gpy; jkpH; bkhHpg;gad;ghL/ nf.Mh;.v.Mg;brl; gphz;l;/ nfhit – 2002
- kzpnkfiy.k.jkpH; bkhHpj; jl;jpy; ntshz; mwptpaypd; RtLfs;/ njtp gjpg;gfk;/ jpUr;ruphg;gs;sp/ 2002
- ,yf;fpaKk; ntshz;ika[k;/ midj;jpe;jpa mwptpay; jkpH;f; fHfk;/ j";rht{h;:/ 2006
- jkpHhp; kug[r;bry;t';fs;/ cyfj; jkpHuha;r;rp epWtdk;/ brd;id
- re;jpunrfud;/ ,uh/ bkhHpg;ghl; - gilg;ghf;j;jpwd; tsh;j;jy;
- ntshz;fiyr;brhy; ngufuhjp/ jkpH; ehL ntshz;ikg; gy;fiyf;fHfk;/ nfhak;g[j;J}h;/ 2008.
- ghnte;jd;/ ,uh/ jkpHpy; mwptpay; ,jH;fs;/ rhKnty;/ @gp#; fpwpd; gjpg;gfk;/ nfhak;g[j;J}h;
- lhf;l; ,uhjh bry;yg;gd;/ fiyr;brhy;yhf;fk;/ jkpH;g; gy;fiyf;fHfk;/ j";rht{h;

**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 & 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 & 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. **Final Examination.**

## **II Semester**

- 1-3: Motivation of rural and urban youth for formation of SHG (Self Help Groups) in collaboration with Government machineries 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 chulah.
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. Planning 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. Conducing 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. **Final Examination.**

**IV Semester**

1 - 3 : Visit to orphanages and old age homes to look after their needs.

4. Personality development programmes - Building up self confidence in youth.

5 - 7: Teaching NSS volunteers on mediation Yoga and art of healthy living with trained teachers

8 - 9 : 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. **Final Examination.**

- 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.
- For all out door regular activities villages / slums nearby the campus may be selected to avoid transport cost (cycle able distance)
- Special camp activity will be conducted in a village situated within a radius of 15 - 20 KM.

**EVALUATION**

**A. Regular activities**

<b>60 marks</b>	=	I Semester	15 marks
		II Semester	15 marks



III Semester 15 marks

IV Semester 15 marks

(Written test 10 marks - participation in programmes and behavior-5 marks) 80% attendance is mandatory for attending special camp

### **B. Special camp activities**

- a. Attendance in daily activities : 30 marks  
during special camp
- b. Special camp activity report : 5 marks
- c. *Viva - voce* on the 10<sup>th</sup> day : 5 marks  
of the special camp

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**Total** : **40 marks**  
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**PED 101**

**Physical Education**

**0+1**

**Practical**

(17 Practical classes - 2½ hours each class - 17 classes will be converted into 40 practical hours and 2½ hours for evaluation)

### **I Semester (20 Hours)**

Exercises for strength, agility, co-ordination, flexibility, co-operation, vitalcapacity 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 pose (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, flaying 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 given kho, taking a direction, recede, parallel toe method, bullet tow 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/acrobatics, grip, release, swinging, parallel bar exercise, horizontal bar exercise, flic-flac-walk and pyramids.

## **ATHLETICS**

(a) **Sprint** : Medium start, long start, bunch start, set, pick up, finish, upsweep, downsweep, placement, receiving and exchanging.

(b) **Jumps** : Western roll, belly roll, eastern cut off, fass ferry flop, approach, take off, straddle, hitch-kick, handging, clearance, landing, strides etc.

(c) **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.

(d) **Hurdles** : Finding lead leg, use of lead leg and trial leg, flight, clearing, finish.

Lead up games, advance skills and game for any one of the above games.

## **II Semester (20+ 2 ½ hours)**

Rules and regulations of anyone of the games and athletic events.

Aims and objectiaves of yoga - asanas : ie. padmasana, pujankasana, sarvangasana, chakrasana,dhanurasana, halasana, mayurasana and savasana, asanas for ailments, back pain, arthritis, abdominal problesm, stress, fatiguel, Insomnia, obsity, circulation, hypertension, varicose veins, respiration, heart, digenstion, headaches, depression, addiction and eye problems.

Mental balance and importance - development of concentration suriyanamaskar - advance skills of any one of the games which were taught in the I semester.

## METHOD OF EVALUATION:

- |                                      |          |
|--------------------------------------|----------|
| a. Attendance                        | 60 Marks |
| b. Behavior                          | 10 Marks |
| c. Participation in Sports and Games | 20 Marks |
| d. Final <i>Viva Voce</i>            | 10 Marks |

Marks will be awarded at the end of the IV Semester based on the above method of evaluation procedure. Final class grade chart of each student will be sent to the Dean of concerned colleges of Tamil Nadu Agricultural University.

## **PED 102 - YOGA FOR HUMAN EXCELLENCE (0+1)**

### **Optional course (Two semesters)**

#### **Semester - II**

##### **UNIT - 1: SCIENCE OF ENERGY AND CONSCIOUSNESS**

Who am I? - Energy and Consciousness - Absolute space - Characteristics and capabilities of Absolute space - Magnetism - Universal magnetism and Bio magnetism - Transformation of Universe and Living beings - Sixth sense of human being Genetic centre and functions - Purification of genetic centre imprints in living bodies - Differences in men - Karma Yoga - Cause and Effect system - Duty Consciousness - Love and compassion - Service to humanity - Management techniques - Effective Examination Preparation - Yogasanas for keeping up good health - SKY Yoga types of meditation Part 2: Absolute Space meditation - Five perception centres meditation - Five elements and solar family meditation.

##### **UNIT - 2: YOGA PRACTICES - II**

SKY Yoga meditations Part 2: Absolute Space meditation - Five perception centres meditation - Five elements and solar family meditation - Thought analysis - Moralization of desire - Neutralization of anger- Eradication of worries - Personality development practice - Healthy Body Postures: Salutation to Nature - Asanas: - Thadasana - Ekapathasana - Chakrasana (sideways) - Thirikonasana - Thandasana - Vajrasana - Padmasana - Januseerasana - Pachimothasana - Ustrasana - Bhujangasana - Salabasana - Makkarasana - Artha Pavana Mukthasana - Pavana Mukthasana - Uddhana Padasana - Navasana - Savasana. Chin mudra - Vayu mudra - Sunya mudra - Prithivi mudra - Varuna mudra - Prana mudra - Apana mudra - Apana vayu mudra - Adhi mudra.

**Practical Schedule  
Semester II**

<b>Class</b>	<b>Topic</b>
1	Who am I? - Crown centre meditation- (Thuriyam) - Simplified Physical Exercises Full exercises
2	Energy and Consciousness - Absolute space - Genetic centre meditation Practice - Salutation to Nature
3	Characteristics and capabilities of Absolute space - Magnetism - Absolute Space meditation - Simplified Physical Exercises - Asanas: - Thadasana - Ekapathasana - Chakrasana (sideways) - Thirikonasana
4	Five perception centres meditation - Five perception centres meditation explanation - Thandasana - Vajrasana - Padmasana - Januseerasana - Pachimothasana - Ustrasana - Kayakalpa
5	Five elements and solar family meditation - Five elements and solar family meditation explanation - Salutation to Nature Bhujangasana - Salabasana - Makkarasana - Kayakalpa
6	Universal magnetism and Bio magnetism (Transformation of Universe and Living beings) - Crown centre meditation- (Thuriyam) - Artha Pavana Mukthasana - Pavana Mukthasana - Uddhana Padasana - Navasana - Savasana - Kayakalpa
7	Sixth sense of human being - Genetic centre meditation Practice - Chin mudra - Vayu mudra - Sunya mudra - Prithivi mudra - Varuna mudra - Prana mudra - Apana mudra - Apana vayu mudra - Adhi mudra - Kayakalpa
8	Genetic centre and functions - Purification of genetic centre imprints in living bodies - Absolute Space meditation - Salutation to Nature - Kayakalpa
9	Differences in men - Five perception centres meditation - Simplified Physical Exercises Full exercises - Kayakalpa
10	Karma Yoga - Duty Consciousness - Five elements and solar family meditation - Asanas: - Thadasana - Ekapathasana - Chakrasana (sideways) - Thirikonasana - Thandasana - Vajrasana - Padmasana - Januseerasana - Pachimothasana - Ustrasana - Kayakalpa
11	Cause and Effect system - Crown centre meditation- (Thuriyam) - Bhujangasana - Salabasana - Makkarasana - Kayakalpa
12	Love and compassion - Genetic centre meditation Practice - Artha Pavana Mukthasana - Pavana Mukthasana - Uddhana Padasana - Navasana - Savasana - Kayakalpa
13	Management techniques - (Stress - Emotional - Self - Conflict) - Absolute Space meditation - Salutation to Nature - Kayakalpa
14	Management techniques - (Self identity - Self Monitoring - Group dynamics - Team Management) - Five perception centres meditation - Simplified Physical Exercises Full exercises - Kayakalpa
15	Effective Examination Preparation - Five elements and solar family meditation - Salutation to Nature - Kayakalpa
16	Effective Examination Preparation - Crown centre meditation- (Thuriyam) - Simplified

	Physical Exercises Full exercises - Kayakalpa
17	Final practical Examination

**Outcome :** The course will improve the memory power, concentration in education, improvement of health of the body and main. Hence the students will excel in their career.

### Semester - II

#### Reference books:

- 1) Yoga for modern age - Thathuvagnani Vethathiri Maharishi
- 2) Journey of Consciousness - Thomas Fitzgerald
- 3) Unified force - Thathuvagnani Vethathiri Maharishi
- 4) The History of Universe and living beings - Thathuvagnani Vethathiri Maharishi
- 5) 'The theory of Existence & the Science of Consciousness' - Steven S. Stadler. amazon.com
- 6) Simplified Physical Exercises - Thathuvagnani Vethathiri Maharishi
- 7) Kayakalpam - Thathuvagnani Vethathiri Maharishi
- 8) Sound Health through Yoga - Dr.K. Chandrasekaran,  
Prem Kalyana Publications, Sedapatti
- 9) Light on Yoga - BKS. Iyenger, HarperCollins Publishers,  
New Delhi.
- 10) Yoga for Youth Empowerment - VISION for Wisdom