



8. FOURTH YEAR SECOND SEMESTER

In the 8th semesters, a student has to register 20 credits with major load in one of the elective courses, for obtaining hands-on training to develop entrepreneurial skill. The complete list of courses for experiential learning is given in first chapter of this book let.

Experiential Learning

8.1 Module - I CROP PRODUCTION

8.1.1 Seed Production Technologies [EPD 401]

3(1+2)

Theory:

Definition of seed, planting value of seed. seed production system in India, Classes of seed, Seed legislation, Seed certification, How to become a seed producer, Agronomical principles of seed production, Genetical principles of seed production, Principles of hybrid seed production of field crops, Seed health management, Harvesting, threshing and drying of seed, Seed Processing, Value addition, Seed priming, Seed packaging and transportation, Seed demand planning cost of seed production, cost benefit ratio, Seed multiplication ratio, seed marketing etc., Seed storage, Maintenance breeding and roguing practices.

Practical

1. Classifications of field crops
2. Agronomical management of seed production
3. Genetic management of seed production
4. Management of seed health
5. Seed harvesting, threshing and drying
6. Seed processing Training
7. Management of seed in store
8. Seed testing
9. Seed packing



10. Value addition
11. Hybrid seed production technologies of important field crops
12. Seed marketing

References:

1. Khare D. and M.S. Bhale (2000) Seed Technology, Scientific Publishers (India)
2. Copeland L.O. Principles of Seed Technology, Burgess Publi.
3. Thomson I.R. An Introduction to Seed Technology Leonard Hill
4. Agrawal R.L. Seed technology Oxford and IBH
5. Tomar HPS Seed Technology Aman Publishers
6. S.V. Singh Minimum seed certification standards
7. Seed science and Technology (1985) ISTA
8. Seed Technology by Mukesh Kumar
9. Seed act (1966)

**8.1.2 Remote Sensing, GIS and Land use Planning [EPD 402]
3(1+2)****Theory:**

Concepts and Definition of RS, Satellites and sensors, Digital Image formation, Image and Keys for visual image interpretation, Introduction of GIS, Software and H/W Requirements for RS and GIS, Digital Image Processing, Formation of FCC and Image classification, Thematic Mapping and Land use planning. Data file organization, Data integration and Formation of Decision Criteria for Land use Plan

Practical

1. EMR Spectrum
2. Visible and NIR bands and spectral resolution
3. Spatial Resolution of different sensors
4. Image, pixel and formation of FCC



5. Digital data acquisition, transfer and storage
6. Visual image interpretation
7. Preparation of land use map using visual image interpretation
8. Data Formats in GIS
9. GIS operations
10. Introduction to RS software
11. Introduction to GIS Software
12. Image formats and Image Importing
13. Image Geo-referencing
14. Digitization and base map preparation
15. Preparing Sub maps
16. Preparation of different land use layers
17. Land use land cover mapping
18. Data entry into GIS tables
19. Data base query and map algebra
20. Analysis of data
21. Preparation of land use plan

References:

1. Richards. 1. A., Remote Sensing Digital Image Analysis: An Introduction, Springer-Verlag, Berlin, (1996).
2. Jensen, 1. R. Introductory Digital Image Processing: A Remote Sensing Perspective. Prentice-Hall, New Jersey, (1990).
3. Burrough. P. A., Principles of Geographical Information Systems for Earth Resources Assessment. Clarendon Press, Oxford, (1986).
4. NRSA, Integrated Mission for Sustainable Development. National Remote Sensing Agency, Hyderabad, (2002).
5. NRSA, National Agricultural Drought Assessment and Monitoring System (NADAMS), NRSA, Hyderabad. 1990.



6. Panda, B. C. (2005) Remote sensing Principles and Applications. Viva Books Pvt. Limited, New Delhi.
7. Steven, M. D. and J. A. Clark (1990) Application of remote sensing in Agriculture, Butterworths, U. K.
8. American society of Photogrammetry (1983) Manual of remote sensing, 2nd ed., R.N. Colweell (Ed), Falls Church, Vs.

8.1.3 Integrated Farming System (EPD 403)

3(1+2)

Theory:

Definition of farming System, Concept of Farming System, Upland Farming System, Lowland Farming System, Rain fed Farming System, Scope of Farming System

Practical: Allied Enterprises

1. Cattle Maintenance
2. Sheep and Goat Rearing
3. Poultry
4. Duck Rearing
5. Piggery
6. Bee Keeping
7. Aquaculture
8. Sericulture
9. Mushroom cultivation
10. Biogas Plant
11. Vermicompost Unit
12. Integration of Enterprises
13. Lowland Farming System
14. Economics

References:

1. Reddy, S.R (2000). Principles of Crop Production.
2. Balasubramaniyan P & Palaniapan S.P. (2001). Principles and Practices of Agronomy.



3. Majumdar. P.K. (2000). Principles and Practices of Water Management.
4. Sankaran S. & Mudaliar TVS. (1997). Principles of Agronomy.
5. Singh S.S. (2006). Principles and Practices of Agronomy.
6. Paroda RS. (2003). Sustaining our Food Security.
7. Lenka D. (1999). Irrigation and Drainage.
8. Michael AM (1978). Irrigation: Theory and Practices.
9. Panda SC. (2003). Principles and Practices of Water Management.
10. Panda SC. (2006). Cropping System and Farming System.

8.1.4 Water Management (EPD 404)

4(1+3)

Theory:

Water Resources and Development in India and M P, Methods of Soil Moisture estimation, Crop water Requirement, Water Management of different Crops, Method of Irrigation, Water concept, Objects and approaches, Quality of irrigation water

Practical

1. Determination of Soil Moisture
2. Determination of field capacity and wilting point
3. Calculation of irrigation water requirements
4. Determination of infiltration rate
5. Demonstration of various methods of irrigation
6. Demonstration of fertigation
7. Measurement of discharge rate
8. Study of Soil Moisture Depletion Pattern
9. Operation of sprinkler and drip irrigation system
10. Preparation of water shed harvesting structures

**References:**

1. Reddy, S.R. (2000). Principles of Crop Production.
2. Balasubramaniyan P & Palaniapan S.P. (2001). Principles and Practices of Agronomy.
3. Majumdar, P.K. (2000). Principles and Practices of Water Management.
4. Sankaran S. & Mudaliar TVS. (1997). Principles of Agronomy.
5. Singh S.S. (2006). Principles and Practices of Agronomy.
6. Paroda R.S. (2003). Sustaining our Food Security.
7. Lenka D. (1999). Irrigation and Drainage.
8. Michael AM (1978). Irrigation: Theory and Practices.
9. Panda -SC. (2003). Principles and Practices of Water Management.
10. Panda SC. (2006). Cropping System and Farming System.

8.1.5 Soil Management [EPD 405]**4 (1+3)**

1. Soil and water conservation method, desertification, management and alternate use
2. Area and distribution of problematic soils-acidic, saline, sodic and physically degraded soils: origin and basic concept of problematic soils, factors responsible and their management.
3. The concept of soil quality/soil health, soil resistance and resilience, effects of intensified agro ecosystems on soil quality health. (PSK)

Practical

1. Lime and gypsum requirements of acid soils and sodic soil (PSK)
2. Determination of bulk density of soil (GPT)
3. Determination of hydraulic conductivity of soil (GPT)
4. Determination of infiltration in situ (GPT)
5. Study of soil profile (GPT)
6. Determination of micronutrients and heavy metals in soil and irrigation water (ODS)
7. Determination of available N, P, K in soil (RKT)



8. Determination pH and EC (RKT)
9. Determination of organic carbon (RKT)
10. Estimation of soil loss by multislot divisor
11. Agronomical measures for different slopes /crops construction of gabions and other structures

References:

1. Havlin J.L. Beaton J.L. Tisdale S.L. and Nelson W.L. (2006). Soil Fertility and Fertilizers
2. Agrawal R.R., JSP Yadav and R.N. Gupta, Saline and alkali soils of India- ICAR Publication
3. Chhabra Ranhir. Soil Salinity and water quality, Oxford & IBH Publishing Co. Pvt. Ltd. New Delhi & Calcutta.
4. Gupta S.K. & I.C. Gupta, Management of Saline Soils and Waters, Revised Second Edition. Scientific Publishers, Jodhpur.
5. Jurinak J.I. (1978). Salt-affected Soils, Department of Soil Science & Biometeorology, Utah State University.
6. Nature and property of soils, - 13th Edition, Brady and Weil
7. V.V.Dharunarayan, Soil and water Conservation research in India.

**8.1.6 Management of Post Harvest Insect Pests and Diseases [EPT 402]
3 (1+2)**

Unit I- Storage losses (seed and food) due to insects, mites, rodents, birds and moulds. Important stored grain pests - common names, scientific names, systematic position, host preference, marks of identification, nature of damage, extent of losses, bio-economics.

Unit II- Principles of safe grain storage.

Unit III- Management and safe use of pesticides in stored commodities.

Unit IV- Concept of post harvest diseases, definition, importance with reference to environment and health, principles of plant disease management as



pre-harvest and post-harvest, merits and demerits of biological/phytoextracts in controlling post-harvest diseases.

Unit V- Integrated approach in controlling disease and improving the shelf life of produce, control of aflatoxigenic and mycotoxigenic fungi, application and monitoring for any health hazard, knowledge of Codex Alimentations for each product and commodity.

Practical

1. Study of different storage structures.
2. Identification of pests of stored commodities and their damage.
3. Control of stored grain pests.
4. Role of temperature and moisture in the development of stored grain pests.
5. Detection of insect infestation in storage and estimation of losses.
6. Determination of grain moisture.
7. Preservation of seeds on long term basis.
8. Radiation protection, bag and seed treatment and fumigation of stored commodities.
9. Rodent management in fields, godowns and houses.
10. Isolation characterization and maintenance of pathogens, role of different storage conditions on disease development, application of antagonists against pathogens under *in vivo* conditions.
11. Comparative efficacy of different chemicals, fungicides, phyto-extracts and bio-agents.
12. Visit to grain market, Warehouses of State/FCI, and IGMRI.

References:

1. Cotton, R.T. (1963). Insect Pests of Stored Grain and Products: Identification, Habits and Methods of Control. Burgess Publication Co. Minneapolis.
2. Khare, B.P. (1994). Stored Grain Pests and their Management. Kalyani Publishers, New Delhi.



3. Sharma, Sandeep and Choudhary, A.K. (2008). Storage Pests Management. Mahamaya Publishing House, New Delhi.
4. Pathak, V.N. (1970). Diseases of Fruit Crops and Their Control. IBH Publication, New Delhi.
5. Chaddha, K.L. and Pareek, O.P. (1992). Advances in Horticulture Vol. IV, Malhotra Publishing House, New Delhi.

8.2 Module - II CROP PROTECTION

8.2.1 Integrated Pest Management [EPT 401]

4 (2+2)

Unit - I Introduction, Definition, Principles and Concepts of IPM

Unit - II Various tools of IPM - Cultural, Mechanical, Physical, Biological, Legal and Chemical.

Unit - III IPM in important crops: chickpea, pea, lentil, mustard, bhindi and brinjal

Unit - IV Introduction, Definition, Concept and Components of IDM.

Unit - V Development of IDM - Biological, Chemical, and Cultural disease management.

Unit - VI IDM in important crops: wheat, chickpea, vegetables.

Practical

1. Study of IPM in various crops: pigeonpea, chickpea, mustard, brinjal, lentil, pea and bhindi.
2. Application of biological, cultural, chemical and biocontrol agents and their integration in IDM.
3. Demonstration of IDM in chickpea and vegetables as project work.
4. Visits to IPM villages and demonstration plots.

References:

1. Dhaliwal, G.S. and Arora, R. (2001). Integrated Pest Management: Concepts and Approaches. Kalyani Publishers, New Delhi.
2. Huffaker, C.B. (1980). New Technology of Pest Control. John Wiley & Sons, New York.
3. Metcalf, R.L. and Luckman, W.H. (1982). Introduction to Insect Pest Management. John Wiley & Sons, New York.



4. Smith, E.H. and Pimentel, D. (1978). Pest Control Strategies. Academic Press, New York.
5. Gupta, V.K. and Sharma, R.C. (1995). Integrated Disease Management and Plant Health. Scientific Publishers, Jodhpur.
6. Mayee, C.D., Manoharchary, C., Tilak, K.V.B.R., Mukadam, D.S. and Deshpande, Jayashree (2004). Biotechnological Approaches for the Integrated Management of Crop Diseases. Daya Publishing Houde, New Delhi.
7. Sharma, R.C. and Sharma, J.N. (1995). Integrated Disease Management. Scientific Publishers, Jodhpur.

8.2.2 Management of Post Harvest Insect Pests and Diseases [EPT 402]

3 (1+2)

Unit - I Storage losses (seed and food) due to insects, mites, rodents, birds and moulds. Important stored grain pests - common names, scientific names, systematic position, host preference, marks of identification, nature of damage, extent of losses, bio-economics.

Unit - II Principles of safe grain storage

Unit - III Management and safe use of pesticides in stored commodities.

Unit - IV Concept of post harvest diseases, definition, importance with reference to environment and health, principles of plant disease management as pre-harvest and post-harvest, merits and demerits of biological/phytoextracts in controlling post-harvest diseases.

Unit - V Integrated approach in controlling disease and improving the shelf life of produce, control of aflatoxigenic and mycotoxigenic fungi, application and monitoring for any health hazard, knowledge of Codex Alimentations for each product and commodity.

Practical

1. Study of different storage structures.
2. Identification of pests of stored commodities and their damage.
3. Control of stored grain pests.



4. Role of temperature and moisture in the development of stored grain pests.
5. Detection of insect infestation in storage and estimation of losses.
6. Determination of grain moisture.
7. Preservation of seeds on long term basis.
8. Radiation protection, bag and seed treatment and fumigation of stored commodities.
9. Rodent management in fields, godowns and houses.
10. Isolation characterization and maintenance of pathogens, role of different storage conditions on disease development, application of antagonists against pathogens under *in vivo* conditions.
11. Comparative efficacy of different chemicals, fungicides, phyto-extracts and bio-agents.
12. Visit to grain market, Warehouses of State/FCI, and IGMRI.

References:

1. Cotton, R.T. (1963). Insect Pests of Stored Grain and Products: Identification, Habits and Methods of Control. Burgess Publication Co. Minneapolis.
2. Khare, B.P. (1994). Stored Grain Pests and their Management. Kalyani Publishers, New Delhi.
3. Sharma, Sandeep and Choudhary, A.K. (2008). Storage Pests Management. Mahamaya Publishing House, New Delhi.
4. Pathak, V.N. (1970). Diseases of Fruit Crops and Their Control. IBH Publication, New Delhi.
5. Chaddha, K.L. and Pareek, O.P. (1992). Advances in Horticulture Vol. IV, Malhotra Publishing House, New Delhi.

8.2.3 Non Insect Pests Management [EPT 403]**3 (1+2)**

Introduction, general characteristics, feeding behaviour and management of important non insect pests-

1. Mites: Red Spider mite, stored grain mite.
2. Plant parasitic nematodes: Root Knot, cyst forming, seed gall nematode.
3. Millipedes.
4. Snail and slugs.



5. Rodents: Field and storage species.
6. Birds: Granivorous and fruigevorous.
7. Monkeys: *Rhesus* hanuman langur.
8. Wild boar.
9. Blue bull.
10. Crop raiding elephants.

Practical

1. Identification of non insect pests and their damaging symptoms.
2. Trapping of rodents.
3. Acquaintance of burrow patterns.
4. Visit to warehouses.
5. Visit and survey of villages to know the occurrence & damage of non insect pests of agricultural importance.

References:

1. Gupta, S.K. (1985). Handbook of plant mites of India. Zoological Survey of India, Kolkata.
2. Nair, M.R.G.K. Insects and mites of crops in India. ICAR, New Delhi.
3. Prakash, I. and Mathur, I.P. (1987). Management of Rodent Pests. ICAR, New Delhi.
4. Agrios, G.N. Plant Pathology.
5. Sridhar, S. (2009). Vertebrate Pests in Agriculture - Indian Scenario. Agrobios, Jodhpur.

8.2.4 Pesticides and Plant Protection Equipments [EPT 404]**3 (1+2)****Unit -I** Introduction, principles and utility of sprayers.**Unit - II** General account of plant protection equipments. Classification of machinery manually and power operated, different parts and maintenance of fumigator, granule applicator, dusters, sprayers.



- Unit – III** Classification and formulations of insecticides, mode of action, poisoning and treatment.
- Unit – IV** History and development of chemicals, definition of pesticides and related terms, advantages and disadvantages of chemicals.
- Unit – V** Classification of chemicals (fungicides, bactericides, nematocides and botanicals) used in plant disease control and their characteristics.
- Unit – VI** Formulation and general mode of action and application of different fungicides, phytotoxicity of chemicals.
- Unit – VII** Precautions while using pesticides.

Practical

1. Types of dusters used in plant protection, their mechanism, calibration, maintenance and use.
2. Types of sprayers used in plant protection, their mechanism, calibration, maintenance and use.
3. Fumigation equipments – their mechanism, calibration and use.
4. Application of insecticides, preparation of spray solution, compatibility of insecticides for field use.
5. Listing of insecticides, their available formulations, manufacturers, cost and their recommendations.
6. Precautions and safety measures during handling of pesticides.
7. General recommendations of insecticides for soil insects, defoliators, sucking pests, and internal borers.

References:

1. Chattopadhyay, S.B. (1985). Principles and Procedures of Plant Protection. Oxford & IBH, New Delhi.
2. Gupta, H.C.L. (1999). Insecticides: Toxicology and Uses. Agrotech Publishers, Udaipur.
3. Mathews, G.A. (1979). Pesticides Application Methods. Longman, London.
4. Nene, Y.L. and Thapliyal, P.N. Fungicides in Plant Disease Control. Oxford & IBH, New Delhi.



5. Vyas, S.C. Handbook of Systemic Fungicides. Tata McGraw Hill Publishers, New Delhi.

8.2.5 Nursery Management of Horticultural Crops [EHT 403]

4 (1+3)

Theory:

Importance of plant propagation. Sexual and asexual methods- advantages and disadvantages. Propagation through seeds- seed formation, maturation, dormancy, treatment of breaking dormancy, germination, viability. Vegetative propagation - cuttings, layering, budding and grafting - different methods. Progeny orchards - establishment, maintenance and utilization. Factors affecting rooting - physiological, anatomical, external factors. Root stock production, use of rootstocks for imparting high yield, quality and for tackling specific problems like tree size control. Use of growth regulators in plant propagation, Plant growing structures for propagation - design, construction and maintenance. Care and handling of nursery plants. Rapid production of uniform and good quality planting materials. Plant protection in nurseries - control of pests and diseases. Importance of elite planting materials in crop production with respect to fruit, vegetables & ornamental plants. Fundamental principles and practices to be followed in nursery management. Factors to be considered in the establishment of commercial nurseries in fruit, vegetable & ornamental plants. Green houses, store houses and nursery structures. Techniques of propagation of the above crops. Special treatments for improving germination and rooting. Advances in nursery techniques. Application of mist in the propagation of fruit, vegetable & ornamental. Importance of polythene in the nursery. Packing, storage and transport of nursery plants. Hardening of the nursery plants. Productions of disease free nursery stock and protection of nursery plants from pests and diseases.

Practical

Practice in propagation of plants through seeds, Familiarization with media, implements and containers for plant propagation. Studies on seed testing, certification and storage. Practice in rootstock production, vegetative



propagation methods - cutting, budding, grafting layering etc. separation of propagules. Use of growth regulators for plant propagation. Study of propagation through tissue culture. Studies on preparation of designs and estimates for establishment of plant propagation unit, plant growing structures. Identification of common pests and diseases in nursery plants and their control. Visit to different types of nurseries, selection of site factors to be considered in establishment Familiarization with components of nurseries handling, display and sales of plants cultural practices Estimation of production costs for different kinds of planting materials. Collection of elite seed materials, storage and nursery techniques of fruit, vegetable & ornamental plants. Practice of vegetative propagation methods in the above crops. Practice of potting/ bagging, re-potting etc. packing and transport of nursery materials. Registers to be maintained in a commercial fruit, vegetable & ornamental nursery. Visit to different nurseries (both government and private).

References:

1. Amaenath Veena, Nursery and Landscaping, Jodhpur, Agribios, (2007).
2. Hartmann and Kester, Plant Propagation, Principles and practices, New Delhi, Practice Hall of India. Private Limited. (2002).
3. Sharma, R.R. Propagation of Horticultural Crops Ludhiana, Kalyani Publisher.
4. Shrivastava, S.S. Udyan Nursery, Raipur, Central books Publications.
5. Grewal, H.S. Propagation of Ornamental Plants Ludhiana, Kalyani Publisher.
6. Kumar, Vinod, Nursery and Plantation Practices in Foresty, Jodhpur, Scientific Publisher.
7. Pathak, R.K. Phalvraksha Prawardhan, New Delhi, ICAR.
8. Gill, S.S. BAL, J.S. and Sandhu, A.S. Raising Fruit Nursery, Ludhiana, Kalyani Publisher.



8.2.6 Integrated Farming System [EPD 403]

3(1+2)

Theory:

Definition of farming System, Concept of Farming System, Upland Farming System, Lowland Farming System, Rain fed Farming System, Scope of Farming System

Practical: Allied Enterprises

1. Cattle Maintenance
2. Sheep and Goat Rearing
3. Poultry
4. Duck Rearing
5. Piggery
6. Bee Keeping
7. Aquaculture
8. Sericulture
9. Mushroom cultivation
10. Biogas Plant
11. Vermicompost Unit
12. Integration of Enterprises
13. Lowland Farming System
14. Economics

References:

1. Reddy, S.R (2000). Principles of Crop Production.
2. Balasubramaniyan P & Palaniapan S.P. (2001). Principles and Practices of Agronomy.
3. Majumdar. P.K. (2000). Principles and Practices of Water Management.
4. Sankaran S. & Mudaliar TVS. (1997). Principles of Agronomy.
5. Singh S.S. (2006). Principles and Practices of Agronomy.
6. Paroda RS. (2003). Sustaining our Food Security.
7. Lenka D. (1999). Irrigation and Drainage.
8. Michael AM (1978). Irrigation: Theory and Practices.



9. Panda SC. (2003). Principles and Practices of Water Management.
10. Panda SC. (2006). Cropping System and Farming System.

8.3 Module - III HORTICULTURE

8.3.1 Commercial Vegetable Production [EHT 401]

3(1+2)

Theory:

Definition of vegetables, Economics, nutritive and aesthetic value of vegetables, Methods of classification, relative merits and demerits, Types of vegetable growing and vegetables forcing structures. Vegetable growing tracts in India with special reference to M.P., Special systems of cultivation in M.P., Production potential of vegetables in M.P., Nutrition- Role of macro and micronutrients, growth regulators in vegetable production. Plant protection- identification and control of important pest and disease, problems of vegetables. Vegetable seed production- General principles, Post harvest handling, grading and marketing of vegetables & physiological disorder of vegetables & their control.

Practical

Familiarization of different varieties of sub-tropical vegetable crops- organic farming of vegetable crops, Seed and soil treatments- preparation of nursery bed, sowing and aftercare- Main field preparation and planting of transplanted and direct sown vegetables- Formation of beds, ridges and furrows, application of manures and basal dressing of fertilizers, gap filling, inter cultural operations, plant protection, harvesting and marketing, preparation of cost of cultivation.

References:

1. Bose, T.K. and Som, M.G. (1990). Vegetable crops in India. Naya Prokash, Calcutta.
2. Das, P.C. (1993). Vegetable crops in India. Kalyani Publishers
3. Hazra, P. and Som, M.G. (1999). Technology for vegetable production and improvement. Naya Prokash, Calcutta.
4. Thamburaj, S. and Singh, N. (2005). Vegetables, tuber crops and spices, ICAR, New Delhi.



8.3.2 Commercial floriculture [EHT 402]

3(1+2)

Theory:

Status and prospects of commercial cultivation of flowers. Varieties, planting systems, spacing, manuring, irrigation, pruning, mulching, plant protection, harvesting, post harvest handling and marketing of major traditional and cut flowers – Aster, Gaillardia, marigold, gomphrena, tuberose, gladiolus, etc. Protected cultivation of rose, gerbera, chrysanthemum etc. general concepts and practices. Commercial cultivation of winter season annuals status and prospects in M.P. planting material production, methods of planting, media components and managements, shade regulation, irrigation, nutrition, plant protection, stage and method of harvest, post harvest handling and marketing. Economics of cultivation.

Practical:

Flower and seed production techniques, cultural practices, propagation and post harvest handling techniques. Visit to commercial production units of marigold, roses, gladiolus, aster, tuberose & gaillardia and other cut flowers. Visit to flower markets and auction centres. Field grown commercial flowers- Hands on training in selection of varieties, propagation methods, cultural operations, harvesting and post harvest handling techniques. Visit to growers fields.

References:

1. Randhawa, G.S. and Mukhopadhyay A. Floriculture in India, New Delhi, Allird Publishers Ltd., (2000).
2. Bose, T.K. and Yadav, L.P. Commercial Flowers, Calcutta, NAYAPRAKASH, (1989).
3. Alexlauric/Victor H. Ried. Floriculture: fundamentals and practices, Jodhpur, AGRO BIOS, (2001).
4. Shrivastava, S.S. Flowers Production Technology, Raipur, Central books House (2003).



5. Panday, B.R. and Rauth, R.L. Bagecho ke Pushp, Jabalpur, J.N.K.V.V. (2006).
6. Prasads and Kumar U.A. Hand book of Floriculture, Jodhpur, AGRO BIOS, (2010).

8.3.3 Nursery Management of Horticultural Crops [EHT 403] 4(1+3)

Theory:

Importance of plant propagation. Sexual and asexual methods- advantages and disadvantages. Propagation through seeds- seed formation, maturation, dormancy, treatment of breaking dormancy, germination, viability. Vegetative propagation - cuttings, layering, budding and grafting - different methods. Progeny orchards - establishment, maintenance and utilization. Factors affecting rooting - physiological, anatomical, external factors. Root stock production, use of rootstocks for imparting high yield, quality and for tackling specific problems like tree size control. Use of growth regulators in plant propagation, Plant growing structures for propagation - design, construction and maintenance. Care and handling of nursery plants. Rapid production of uniform and good quality planting materials. Plant protection in nurseries - control of pests and diseases. Importance of elite planting materials in crop production with respect to fruit, vegetables & ornamental plants. Fundamental principles and practices to be followed in nursery management. Factors to be considered in the establishment of commercial nurseries in fruit vegetable & ornamental plants. Green houses, store houses and nursery structures. Techniques of propagation of the above crops. Special treatments for improving germination and rooting. Advances in nursery techniques. Application of mist in the propagation of fruit, vegetable & ornamental. Importance of polythene in the nursery. Packing, storage and transport of nursery plants. Hardening of the nursery plants. Productions of disease free nursery stock and protection of nursery plants from pests and diseases.

**Practical**

Practice in propagation of plants through seeds, Familiarization with media, implements and containers for plant propagation. Studies on seed testing, certification and storage. Practice in rootstock production, vegetative propagation methods - cutting, budding, grafting layering etc. separation of propagules. Use of growth regulators for plant propagation. Study of propagation through tissue culture. Studies on preparation of designs and estimates for establishment of plant propagation unit, plant growing structures. Identification of common pests and diseases in nursery plants and their control. Visit to different types of nurseries, selection of site - factors to be considered in establishment - Familiarization with components of nurseries - handling, display and sales of plants - cultural practices - Estimation of production costs for different kinds of planting materials. Collection of elite seed materials, storage and nursery techniques of fruit, vegetable & ornamental plants. Practice of vegetative propagation methods in the above crops. Practice of potting/ bagging, re-potting etc. packing and transport of nursery materials. Registers to be maintained in a commercial fruit, vegetable & ornamental nursery. Visit to different nurseries (both government and private).

References:

1. Amaenath Veena, Nursery and Landscaping, Jodhpur, Agribios, (2007).
2. Hartmann and Kester, Plant Propagation, Principles and practices, New Delhi, Practice Hall of India. Private Limited. (2002).
3. Sharma, R.R. Propagation of Horticultural Crops Ludhiana, Kalyani Publisher.
4. Shrivastava, S.S. Udyan Nursery, Raipur, Central books Publications.
5. Grewal, H.S. Propagation of Ornamental Plants Ludhiana, Kalyani Publisher.
6. Kumar, Vinod, Nursery and Plantation Practices in Foresty, Jodhpur, Scientific Publisher.
7. Pathak, R.K. Phalvraksha Prawardhan, New Delhi, ICAR.
8. Gill, S.S. BAL, J.S. and Sandhu, A.S. Raising Front Nursery, Ludhiana, Kalyani Publisher.



8.3.4 Processing and Value addition of horticultural crops [EHT 404] 3(1+2)

Theory:

Post harvest loss assessment of fruits and vegetables in marketing as a surveying and documentation, familiarization of harvesting indices of fruits and vegetables and harvesting devices, measurement of post harvest respiration rate under various situations, exposure to various, storage structures in fruits and vegetables- cold storage, evaporative cool chamber and traditional field storage structures, packaging of various fruits and vegetables in different materials, spray drying of fruit juice powders, freeze drying of fruit and vegetable products, fruit juice concentrates other products from fruits and vegetables like jam, candy, preserve, jelly etc. Losses caused by different mode & their control. Use of preservation and containers. Marketing of by product.

Practical

Preparation of Jam, Jelly, Marmalade Squash, Pickles, Murabba, Candy, Processing and dehydration of Ginger, Tomato Ketchup, Sauce, Tomato powder, Bael Squash & murabba, RTS & other by product of Seasonal fruits & vegetables (Viz.- Potato Chips, Aonla Supari and Papaya - candy)

References:

1. Pantatico, Er. B. (Ed.), (1975). Post harvest Physiology, Handling and Utilization of Tropical and Subtropical Fruits and Vegetables. Westport, AVI Publ. Co., 560 pp.
2. Ryall, A.L. and W.J. Lipton, (1979). Handling, Transportation and Storage of Fruits and Vegetables, Vol. 1, Vegetables and Melons, 2nd ed. Westport, AVI Publ. Co. 588 pp.
3. Salunkhe, D.K., (1975). Storage, Processing and Nutritional Quality of Fruits and Vegetables. Boca Raton, Fl: CRC Press, 166 pp.
4. Major Spices of India- Crop management and Post harvest technology - J.S. Pruthi ICAR New Delhi.
5. Minor Spices and condiments - Crop management and Post harvest technology - J.S. Pruthi, ICAR New Delhi.



6. Preservation of fruits and vegetables. Giridhari Lal, G.S. Siddappa and G.L. Tandon, ICAR, New Delhi.
7. Fruit and vegetable preservation - Principles and Practices by R.P. Shrivastava and Sanjeevkumar. International Book Distributing Co. Lucknow.

8.3.5 Integrated Pest & Disease Management [EPT 401]

4 (2+2)

Unit - I Introduction, Definition, Principles and Concepts of IPM

Unit - II Various tools of IPM - Cultural, Mechanical, Physical, Biological, Legal and Chemical.

Unit - III IPM in important crops: chickpea, pea, lentil, mustard, bhindi and brinjal

Unit - IV Introduction, Definition, Concept and Components of IDM.

Unit - V Development of IDM - Biological, Chemical, and Cultural disease management.

Unit - VI IDM in important crops: wheat, chickpea, vegetables.

Practical

1. Study of IPM in various crops: pigeonpea, chickpea, mustard, brinjal, lentil, pea and bhindi.
2. Application of biological, cultural, chemical and biocontrol agents and their integration in IDM.
3. Demonstration of IDM in chickpea and vegetables as project work.
4. Visits to IPM villages and demonstration plots.

References:

1. Dhaliwal, G.S. and Arora, R. (2001). Integrated Pest Management: Concepts and Approaches. Kalyani Publishers, New Delhi.
2. Huffaker, C.B. (1980). New Technology of Pest Control. John Wiley & Sons, New York.



3. Metcalf, R.L. and Luckman, W.H. (1982). Introduction to Insect Pest Management. John Wiley & Sons, New York.
4. Smith, E.H. and Pimentel, D. (1978). Pest Control Strategies. Academic Press, New York.
5. Gupta, V.K. and Sharma, R.C. (1995). Integrated Disease Management and Plant Health. Scientific Publishers, Jodhpur.
6. Mayee, C.D., Manoharchary, C., Tilak, K.V.B.R., Mukadam, D.S. and Deshpande, Jayashree (2004). Biotechnological Approaches for the Integrated Management of Crop Diseases. Daya Publishing Houde, New Delhi.
7. Sharma, R.C. and Sharma, J.N. (1995). Integrated Disease Management. Scientific Publishers, Jodhpur.

8.3.6 Management of Post Harvest Insect Pests and Diseases [EPT 402] **3 (1+2)**

Unit – I Storage losses (seed and food) due to insects, mites, rodents, birds and moulds. Important stored grain pests - common names, scientific names, systematic position, host preference, marks of identification, nature of damage, extent of losses, bio-economics.

Unit – II Principles of safe grain storage

Unit – III Management and safe use of pesticides in stored commodities.

Unit – IV Concept of post harvest diseases, definition, importance with reference to environment and health, principles of plant disease management as pre-harvest and post-harvest, merits and demerits of biological/phytoextracts in controlling post-harvest diseases.

Unit – V Integrated approach in controlling disease and improving the shelf life of produce, control of aflatoxigenic and mycotoxigenic fungi, application and monitoring for any health hazard, knowledge of Codex Alimentations for each product and commodity.

Practical:

1. Study of different storage structures.
2. Identification of pests of stored commodities and their damage.
3. Control of stored grain pests.



4. Role of temperature and moisture in the development of stored grain pests.
5. Detection of insect infestation in storage and estimation of losses.
6. Determination of grain moisture.
7. Preservation of seeds on long term basis.
8. Radiation protection, bag and seed treatment and fumigation of stored commodities.
9. Rodent management in fields, godowns and houses.
10. Isolation characterization and maintenance of pathogens, role of different storage conditions on disease development, application of antagonists against pathogens under *in vivo* conditions.
11. Comparative efficacy of different chemicals, fungicides, phyto-extracts and bio-agents.
12. Visit to grain market, Warehouses of State/FCI, and IGMRI.

References:

1. Cotton, R.T. (1963). Insect Pests of Stored Grain and Products: Identification, Habits and Methods of Control. Burgess Publication Co. Minneapolis.
2. Khare, B.P. (1994). Stored Grain Pests and their Management. Kalyani Publishers, New Delhi.
3. Sharma, Sandeep and Choudhary, A.K. (2008). Storage Pests Management. Mahamaya Publishing House, New Delhi.
4. Pathak, V.N. (1970). Diseases of Fruit Crops and Their Control. IBH Publication, New Delhi.
5. Chaddha, K.L. and Pareek, O.P. (1992). Advances in Horticulture Vol. IV, Malhotra Publishing House, New Delhi.