

2015 Syllabus
B.Sc. (Agriculture)

III year VI semester

S.No.	Course No.	Course Title	Credit Hours
1.	AGR 304	Principles and practices of cropping and Farming Systems	1+1
2.	AGR 303	Crop Production – II	0+1
3.	SAC 302	Crop and Pesticide Chemistry	2+1
4.	AEX 301	Extension Methodologies and Transfer of Agricultural Technology	1 +1
5.	AEN 302	Pests of Horticultural Crops and their Management	1+1
6.	NST 301	Fundamentals and Applications of nanotechnology	1+0
7.	FPE 301	Post Harvest and Food Engineering	1+1
8.	ENS 301	Environmental Pollution and Management	1+1
9.	HOR 311	Production Technology of Vegetables and Spice crops	2+1
10.	ENG 301	Soft skills for Employability	0+1
	PAT 302	Diseases of Field Crops and Their Management	1+1
12.	PBG 302	Breeding field and Horticultural crops	2+1
13.	NCC 101	National Cadet Corps	Regd. in I Sem
		Total	11+13=24

Unit - I: Cropping System

Cropping systems - Definition - Principles - Concepts - Classification - mono cropping - intensive cropping - cropping systems of India and Tamil Nadu - Interaction between different cropping systems - Cropping system management - Resource management - land, nutrient, water and weed.

Unit - II: Evaluation of Cropping System

Index for evaluation of cropping systems - Land use - yield advantages - Economic evaluation - sustainability.

Unit - III: Farming System

Farming systems - Definition - Principles - Concepts - Enterprises selection and management - interaction between different enterprises with cropping - scope and advantages of Integrated Farming system - Integrated farming system models for different agro eco-systems - interaction between enterprises.

Unit - IV: Evaluation of Farming System

Resource recycling in IFS - Evaluation indicators of integrated farming system - LEIA & HEIA - concepts and principles - Conservation agriculture - principles, concept and scope.

Unit - V: Resource and labour management in farming system

Resource management under constraint situation - Cost reduction strategies in crop production - Non-monetary inputs and low cost technologies - Labour management - farming system and environment.

Practical:

Preparation of cropping scheme - working out input requirements for crops, cropping systems - preparation of calendar of operations for wetland, irrigated upland and dry land cropping system - visit to cropping system experiments - working out indices for evaluation of cropping systems - visit to different units: dairy, goat, poultry, fishery. Mushroom, sericulture and biogas - study on evaluation indicators on farming system - preparation of integrated farming

system models for different eco-systems - on farm field visit - analysis of farming system models.

Theory - Lecture Schedule

1. Cropping system: Definition, Principles and basic concepts.
2. Classification of cropping system - Mono cropping, intensive cropping, multiple cropping, mixed cropping.
3. Major cropping systems prevailing in India and Tamil Nadu for different agro eco systems.
4. Complementary and competitive interaction in different cropping system - light, nutrient, water and weed.
5. Cropping system management : agronomic requirement for crops and cropping system selection of crops and varieties, tillage and land shaping, plant population and crop geometry.
6. Cropping system management: agronomic requirement for crops and cropping system - water management, soil fertility management and plant protection.
7. Indices for evaluation of cropping system - land use, yield advantage and economics.
- 8. Mid Semester Examination.**
9. Farming system: definition, principles and concepts and factors influencing choice and size of enterprises.
10. Scope and advantages of integrated farming system.
11. Allied enterprises for wetland, irrigated upland and dryland - selection and management and their interaction.
12. Resource recycling in integrated farming system.
13. Integrated Farming System evaluation indicators.
14. Integrated farming system - models for wetland, irrigated upland and dryland eco system.
15. Cost reduction technologies and non monetary inputs in integrated farming system.
16. LEIA and HEIA - principles and concepts and Labour management in integrated farming system.
17. Conservation agriculture and environmental impact of integrated farming system.

Practical Schedule:

1. Visit to cropping system experiments in wetland.
2. Visit to cropping system experiments in irrigated upland and dryland.
3. Preparation of cropping scheme for wetland and working out input requirement.
4. Preparation of cropping scheme for irrigated upland and working out input requirement.
5. Calendar of operations for wet land and irrigated upland cropping system.
6. Working out indices for evaluating the cropping system - land use, yield advantage.
7. Working out indices for evaluating the cropping system - Economics, sustainability.
8. Visit to dairy, goat and poultry units.
9. Visit to mushroom unit.
10. Visit to sericulture and biogas unit.
11. Preparation of integrated farming system models : wetland eco-system.
12. Preparation of integrated farming system models : irrigated upland and dryland eco systems.
13. Resource recycling in integrated farming system models of different eco systems.
14. Evaluation of integrated farming system models : wetland eco-system.
15. Evaluation of integrated farming system models : irrigated upland and dryland eco systems.
16. On-farm visit to cropping fields and integrated farming system units.

17. Practical examination.**References:**

- Palaniappan, SP and K. Sivaraman.1996. Cropping systems in the tropics Principles and management. New Age International (P) Ltd., New Delhi.
- Jayanthi, C. Devasenapathy, P and C. Vennila. 2007. Farming Systems. Principles and practices. Satish Serial Publishing House.Delhi.
- S.C. Panda. 2003. Cropping and Farming Systems. Agrobios Publishers. Jodhpur.

Any irrigated dry crop (maize / sorghum / pearl millet / finger millet / cotton / groundnut / sunflower / sesame)

Practical Schedule for Irrigated dry crop (Eg. Maize):

- Ecosystem - Climate and weather - Seasons and varieties of Tamil Nadu
- Selection of field - Main field preparation - seed treatment - Application of manures and fertilizers - Sowing - Weed management and practicing pre- emergence application of herbicides - Thinning and gap filling - Estimation of plant population - Top dressing - Weed management - Water management - Pest management - Observation on nutrient and weeds - Recording growth, yield attributes and yield
- Harvesting, threshing and cleaning the produce - Cost of cultivation and economics

Practical Schedule:

1. Study of ecosystems, climate, weather, seasons and varieties of Tamil Nadu
2. Selection of field for maize cultivation
3. Acquiring skill in seed treatment practices
4. Study and Practice of main field preparation for maize
5. Practicing of application of manures and fertilizers for maize
6. Practicing sowing of maize
7. Acquiring skill in pre-emergence application of herbicides
8. Estimation of plant population and acquiring skill in gap filling and thinning
9. Observation on nutritional deficiency symptoms and corrective measures
10. Study of weeds and weed management in maize
11. Recording growth parameters and assessing dry matter production
12. Study of water management practices for maize
13. Observation of insect pests and diseases and their management
14. Estimation of yield and yield parameters in maize
15. Harvesting, threshing and cleaning of the produce
16. Working out cost of cultivation and economics
17. **Practical Examination**

References:

Ahlawat, I.P.S., Om Prakash and G.S.Saini.2010. Scientific Crop Production in India. Rama Publishing House, Meerut.

Crop Production Guide. 2012. Directorate of Agriculture, Chennai and Tamil Nadu Agricultural University, Coimbatore.

Rajendra Prasad. 2012. Text Book on Field Crop Production, Indian Council of Agrl. Research, New Delhi.

E-References:

www.cimmyt.org

Aim:

To impart knowledge on the chemistry and nutritional significance of various field and horticultural crops so as to include them in the breeding and biofortification programmes towards nutritional security. This course will also impart knowledge on different pesticides, their nature and, mode of action and their fate in soil so as to monitor their effect on the environment

Syllabus - Theory**Unit-I- Chemistry of Agricultural Crops**

Chemical constituents of plants - Proximate and ultimate constituents - Chemical composition and nutritional quality of cereals, pulses, fibre and forage crops. Chemical composition and nutritional quality of oilseeds and sugarcane. Post harvest changes in Sugarcane. Chemistry of fats and oils.

Unit-II- Chemistry of Horticultural Crops, alkaloids and Essential oils

Chemical composition and nutritional quality of fruits, vegetables, spices, condiments, narcotics and beverages. Post harvest changes in fruits. Chemistry of essential oils and alkaloids - Medicinal and aromatic plants.

Unit -III- Pesticide and its Formulations and Insecticides

Pesticides - Definition - Pesticides - classifications-Trends in pesticide use. Pesticide formulations -dusts, wettable powders, emulsifiable concentrate, granules. Insecticides - classification-. Characteristics, Mode of action and use of organochlorine compounds- Organophosphates - Carbamates - Pyrethroids , Botanicals, Microbial Insecticides, Insect Growth Regulators and Newer insecticides.

UNIT IV - Fungicides ,Rodenticides, Herbicides &PGRs

Fungicides - classification of fungicides -properties, mode of action of inorganic ,organic and systemic fungicides - Rodenticides- Zinc phosphide - Aluminium phosphide - Bromodiolone Herbicides - classification - properties - mode of action of inorganic and organic herbicides like phenoxy compounds, substituted ureas, amides, thiocarbamates, triazines, pyridines, imidazolines and sulphonyl ureas. PGRs -Auxins, Gibberellins, cytokinins,ABA, Ethylene and brassinosteroids

Unit-V-Pesticides and Environment

Insecticide Act and Insecticide Rules - Fate of pesticides in soil- Impact of pesticides on environment

Lecture schedule

1. Proximate and ultimate constituents of plants.
2. Chemical composition and nutritional quality of cereals - Rice, wheat, maize, sorghum, ragi and pearl millet. Synthesis of starch
3. Chemical composition and nutritional quality of pulses - Red gram, blackgram, greengram, cowpea, lablab and soybean-Protein synthesis
4. Chemistry of fibre crops- Cotton, jute, sunhemp and mesta
5. Chemical composition and nutritional quality of forage crops
6. Chemical composition and nutritional quality of oil seed crops - Groundnut, sesame, sunflower, castor, coconut and palm.
7. Chemical composition and nutritional quality of sugar crops- sugarcane and sugar beet - Sucrose synthesis - Post harvest changes in sugarcane
8. Chemistry of fats and oils (Physical, Chemical properties and Analytical constants)
9. Chemical composition and nutritional quality of fruits - Mango, banana, papaya, grapes, guava, sapota, citrus, amla, apple and pomegranate.
10. Chemistry of post harvest changes in fruits.
11. Chemical composition and nutritional quality of vegetables -Tomato, bhendi, brinjal, moringa, gourds and greens.
12. Chemical composition and nutritional quality of cabbage, cauliflower, potato, radish and peas.
13. Chemical composition of spices and condiments - Turmeric, chillies, pepper, ginger, onion, garlic, coriander and fenugreek.
14. Chemical composition of Narcotics - Tobacco, arecanut, cocoa and opium - Beverages - Tea and coffee.
15. Essential oils in aromatic plants- Geranium, eucalyptus

16. Alkaloids in medicinal plants - Cinchona, gloriosa, coleus and aloevera
17. Mid semester examination
18. Pesticides - Definition - Pesticides - classifications-Trends in pesticide use.
19. Pesticide formulations - dusts - wettable powders flowables sprays - manufacture, characteristics and uses.
20. Pesticide formulations – sprays – emulsion concentrates – water soluble liquids-manufacture, characteristics and uses.
21. Pesticide formulations - granules, fumigants and aerosols - Manufacture - Characteristics and uses.
22. Insecticides classification -Characteristics, Mode of action and use of Organochlorines - Lindane and Endosulphan. Characteristics, Mode of action and use of Organophosphates - Phosphamidon, Malathion and Chlorpyrifos, Phorate, Dimethoate, Quinalphos and Profenophos
23. Characteristics, Mode of action and use of Carbamates - Carbaryl, carbofuran, carbosulfan and aldicarb.
24. Characteristics, Mode of action and use of synthetic pyrethroids - Deltamethrin, Fenvalerate, Cypermethrin and Lambdacyclothrin
25. Characteristics, Mode of action and use of Botanicals - nicotine pyrethrum, neem Rotenoids, Insecticide butyl amides - Characteristics, Mode of action and use of Insect Growth Regulators -Novaluron, Buprobasin and GABA inhibitors.
26. Microbial Insecticides - NPV, *Bacillus thuringiensis*, Spinosad and Protozoan insecticides. Characteristics, Mode of action and use of newer insecticides -Neonicotinoids - Imidachloprid, Thiachloprid, Acetamiprid, Flupendiamide, Fipronil, Emamectin, Thiomethoxam, Indoxacarb, Chlorantraniliprole
27. Fungicides - Classification - Inorganics - Characteristics, Mode of action and use of sulfur and copper - Wettable sulphur and Lime sulphur - Bordeaux mixture and copper oxychloride / copper hydroxide.
28. Organic fungicides - Dithiocarbamates - Characteristics, Mode of action and use of Mancozeb, Chlorobenzene and Chlorothalanyl.
29. Systemic fungicides - Characteristics, Mode of action and use of Benomyl, Carbendazim,

Metalaxyl, Quinones, Diclonex, Dicarboximides.-vincozolin

30. Rodenticides - Characteristics, mode of action and use of Zinc phosphide - Aluminium phosphide -Bromodiolone
31. Herbicides - Classification of herbicides - Characteristics, Mode of action and use of 2, 4-D, Sulfonyl ureas - Metsulfuron, Pyrosulfuron, Imidazoline.
32. Characteristics, Mode of action and use of Alachlor, Butachlor, Oxyfluorfen, Fulchloralin, Pendimethalin, Atrazine, Paraquat and Glyphosate. PGRS-Auxins,Gibbrelins,cytokinins,ABA, Ethylene and brassinosteroids
33. Highlights of Insecticide Act -1968 and Insecticide Rules -1971
34. Fate of pesticides in soil-Impact of pesticides on the environment

Practical syllabus

Estimation of moisture, ash, crude protein, P, K and crude fibre in plant samples - Determination of reducing and non-reducing sugars in jaggery —Acid and Saponification value in oils - Estimation of total solids, ascorbic acid, titratable acidity in fruits. Analysis of pesticides - Physical tests - Bulk density, wettability, suspensibility - Chemical test - Acidity &Alkalinity -Estimation of pesticide residues in water, soil and pesticidal calculations Visit to pesticide formulation unit and pesticide testing laboratory

Practical Schedule

1. Sampling, processing and storage of plant materials for chemical analysis
2. Estimation of moisture and ash content
3. Microwave digestion, preparation of di and tri acid extracts of plant samples and Estimation of P and K in triple acid extract
4. Estimation of crude protein
5. Estimation of crude fibre
6. Estimation of reducing and non-reducing sugars in jaggery
7. Estimation of acid value and saponification value in oils
8. .Estimation of total solids, ascorbic acid and titratable acidity in fruit samples
9. Colloquium on-Safe handling and use of pesticide - label - storage - mixing - application methods

10. Determination of bulk density in dust formulation, Wettability and suspensibility test in wettable powder formulations
11. Estimation of emulsion stability in EC formulation
12. Estimation of acidity and alkalinity of pesticides
13. Visit to Pesticide Testing Laboratory
14. Pesticide residue analysis in water
15. Pesticide residue analysis in soil and pesticide requirement calculations
16. Visit to pesticide manufacturing unit
17. Practical Examination

Text books

1. Konard Mengel *et al.*, 2006. Principles of Plant Nutrition. 5th Edition, Springer International.
2. Vasanthi ,D, T.Chitdeshwari, M.R.Latha, C.Sudhalakshmi and A.Vadivel,2014. Text book on Crop and Pesticide Chemistry Pp.310
3. Dhakshinamoorthy, M. 2000. An Introduction to Plant Biochemistry and Chemistry of Crops, Suri Associates, Coimbatore Pp.192
4. Handa, S, K,2004. Principles of Pesticides Chemistry, Agrobios (INDIA), Jodhpur.
5. Roy,N.K, 2002. Chemistry of Pesticides.CBSPublishers &Distributors, New Delhi.

References

1. Brijesh Tiwari and Narpinder Singh. 2012. Pulse Chemistry and Technology. Scientific Publishers, Jodhpur, India.
2. Hand book of Agriculture, 2009. Published by Indian Council of Agricultural Research, New Delhi 110 012.Pp.1583
3. Paul H.Moore and Frederik C.Botha. 2014. Sugarcane : Physiology, Biochemistry and Functional Biology (World Agriculture Series). Amazon Publishers, India.
4. Petra Marschner. 2012. Marschner's mineral nutrition of higher plants. 3rd Edition. ISBN: 978-0-12-384905-2.Elsevier publications.

5. Yash P. Kalra, 1998, Handbook of Reference Methods for Plant Analysis, Taylor & Francis Group, LLC, New York, London
6. Dodia, D.A., I.S.Patel and G.M.Patel. 2010. Botanical Pesticides for Pest Management. Amazon Publishers, India.
7. Gupta, A. 2006. Pesticide Residue in Food commodities. Agrobios Publishers, Jodhpur.
8. Hassall, K.A. 2013. The Chemistry of pesticides, their metabolism, mode of action and uses in crop production. Scientific Publishers, Jodhpur, India.
9. Koul, O., G.S.Dhaliwal, S.Kohar and R.Singh. 2014. Biopesticides in Sustainable Agriculture. Progress and Potential. Amazon Publishers, India.
10. Mac Bean, C. 2013. The Pesticide Manual: A World Compendium. Amazon Publishers, India.
11. Sree Ramulu, U.S. 1979. Chemistry of Insecticides and Fungicides - Oxford and IBM Publishing Co, New Delhi.

e-references

1. www.apo-tokyo.org/OOe-books/AG-12_Leg
2. www.researchgate.net/...Chemical_composition...nutritional.../60b7d52b...
3. www.pulsecanada.com/food...nutrition/composition.../Canadian-Pea-Co...
4. www.wiley.com >... > Food Types > Functional Foods & Nutraceutical
5. www.iipr.res.in/csciences.html
6. www.aiou.edu.pk/FoodSite/Research%20Papers/48.pdf
7. www.plantphysiol.org/content/124/4/1532.full
8. www.amazon.in/Medicinal-Plants-Chemistry-Properties.../1578083958
9. www.tandfonline.com > List of Issues > Table of Contents
10. www.studiauniversitatis.ro/v15/pdf/20-2010/20.../SU20-2-10Caunii.pdf
11. www.fao.org/docrep/t0073e/t0073e01.htm
12. www.pulseaus.com.au/.../Pulses%20Nutritional%20Value%20and%20Th..
13. www.researchgate.net/...Nutritional...oilseeds/.../9fcfd50633dab9e5d7.pdf
14. www.uvm.edu/extension/cropsoil/wp-content/uploads/turner_refining.pdf

15. journals.cambridge.org/article_S0021859600040156
16. www.intechopen.com/.../pesticides-in-the-modern-world-trends-in-pestic...
17. cibrc.nic.in/insecticides_rules.htm
18. www.agcsa.com.au/static/atm_articles/html/3_3c.html
19. www.agf.gov.bc.ca > Agriculture > Pesticide Wise

Outcome:

The students of undergraduate will gain knowledge on chemical composition and nutritional quality of various field and horticultural crops. Proper understanding of chemistry of pesticides will be inculcated among the students. The students will acquire the skills on quality monitoring of crops and pesticides through practices.

AEX 301 Extension Methodologies and Transfer of Agricultural Technology 1+1

Objective

To impart knowledge to the students on different extension methods and approaches used for transfer of agricultural technology. The course will also enable to develop practical skills on preparation of different extension teaching methods.

Theory

Unit I Communication

Communication – meaning, definition, types; Communication models (Aristotle, Shanon-Weaver, Berlo, Schramm, Leagans, Rogers & Shoemaker) – elements and their characteristics; Barriers in communication.

Unit II Extension Teaching Methods

Extension teaching methods – meaning, definition, functions, classification (individual, group, mass contact methods), merits and demerits; Audio aids, Visual aids and Audio-Visual aids – definition, classification, purpose, planning, selection, combination, use; Training – definition, types, training functions of FTC, KVK, EEI, MANAGE, NAARM.

Unit III e-Extension and Agricultural journalism

e-Extension – Community Radio, Internet, cyber cafes, video and teleconferencing, Interactive Multimedia Compact Disk (IMCD), Agri portals, Information Kiosks, Kisan Call Centre (KCC), Mobile phone, Expert System, Village Knowledge Centre (VKC), DEMIC, consultancy clinics, Geographical Information System (GIS); Agricultural journalism (Print media) – definition, principles, importance, ABC of news, types of news.

Unit IV Experiential Learning and Participatory Extension

Experiential Learning (EL) – concept, three types of learning (Scientia, Techne & Praxis), Kolb's Cycle, Participatory Extension Approaches – RRA, PRA & PTD

Unit V Diffusion of Innovations

Diffusion of Innovations – definition, elements; Innovation – definition, attributes; Adoption – meaning, steps in adoption process, adopter categories, factors influencing adoption of innovations; Consequences of innovations.

Practical

Study of communication pattern in State Department of Agriculture; Planning and writing of script for radio, television, print media; Planning and preparation of visual aids - charts, posters, PowerPoint slides and extension literature; Planning and practice in conduct of method demonstration, panel discussion, buzz session; Practicing PRA techniques in a village setting; Practice in handling of still camera, video camera. Study of spread and acceptance of TNAU technologies.

Theory Schedule

1. Communication – meaning, definition, types.
2. Communication models - Aristotle, Shanon-Weaver, Berlo, Schramm, Leagans, Rogers & Shoemaker, elements and their characteristics; Barriers of communication.
3. Extension teaching methods – meaning, definition, function, classification.
4. Individual contact methods – farm and home visit, office call, telephone call, personal letter, observation, result demonstration – merits and demerits.
5. Group contact methods – method demonstration, meeting, lecture, debate, workshop, seminar, forum, conference – merits and demerits.
6. Group contact methods – symposium, panel, brainstorming, buzz session - – merits and demerits.
7. Mass contact methods – campaign, exhibition, Farmers Day, field trips, radio, television – merits and demerits.
8. Mass contact methods – written communication – circular letter, leaflet, folder, pamphlet, newspaper, newsletter - merits and demerits.
- 9. Mid semester Examination.**
10. Audio aids, Visual aids, Audio-Visual aids – definitions, scope, importance, classification, merits and demerits, factors influencing planning and selection, purpose.
11. e-Extension – Community Radio, Internet, cyber cafes, video and teleconferencing, Interactive Multimedia Compact disk (IMCD), Agri portals, Information kiosks, Kisan Call Centre (KCC), Mobile phone, Expert System, Village Knowledge Centre (VKC), DEMIC, consultancy clinics, Geographical Information System (GIS) applications in e-Extension.

12. Agricultural journalism (Print media) – definition, principles, importance, ABC of news, types of news.
13. Training – definition, types, training functions of Farmers Training Centre (FTC), Krishi Vigyan Kendra (KVK), Extension Education Institute (EES), National Institute of Agricultural Extension Management (MANAGE), National Academy of Agricultural Research Management (NAARM).
14. Experiential Learning (EL) – concept, three types of learning (Scientia, Techne & Praxis), Kolb’s Cycle.
15. Participatory Extension Approaches, Meaning, Definition, Importance, Rapid Rural Appraisal (RRA), Participatory Rural Appraisal (PRA) – Resource Mapping, Transect Walk, Matrix ranking, Venn diagram, Seasonal calendar.
16. Diffusion of Innovations – definition, elements; Innovation – definition, attributes. Adoption – meaning, steps in adoption process,
17. Adopter categories, factors influencing adoption of innovations; Consequences of innovations.

Practical schedule

1. Understanding the communication pattern in State Department of Agriculture.
2. Planning and preparation of posters, charts and PowerPoint slides.
3. Planning and preparation of extension literature- leaflet, folder, pamphlet and booklet
4. Practice on conduct of method demonstration in a village.
5. Exercise on conducting panel discussion and buzz session.
6. Practice on script writing for Radio.
7. Practice on script writing for television.
8. Practice on script writing for newspapers.
9. Visit to All India Radio to study their media activities
10. Visit to local press (newspaper agency) to study their media activities
11. Practice on handling of still camera, video camera.
12. Study on applications of Geographical Information System (GIS) in agriculture / e-Extension.
13. Practicing PRA techniques in a village setting.
14. Preparation of interview schedule to study the spread and acceptance of TNAU technologies

15. Visit to village to study the spread and acceptance of TNAU technologies
16. Processing of data and presentation of reports.
17. **Final Practical Examination.**

References

- Ahuja, B.N. 1997. Theory and Practice of Journalism, Surjeet Publications, New Delhi.
- Chauhan Nikulsinh. 2013. Use of ICTs in Agricultural Extension, Biotech Books.
- Janakiram, B. 2007. Training and Development, Wiley India Private limited, New Delhi.
- Lynton Rolf, P and Pareek Udai. 1990. Training for Development, Vistaar Publications, New Delhi.
- Narayanasamy, N. 2009. Participatory Rural Appraisal Principles, Methods and Application, Sage Publications India Pvt. Ltd., New Delhi.
- Pandey, V.C. 2003. Information Communication Technology and Education (The Changing World ICT Governance), Isha Publishers.
- Ray, G.L. 1999. Extension Communication and Management, Naya Prokash, 206, Bidhan Sarani, Calcutta.
- Reddy Adivi, A. 1993. Extension Education, Shree Lakshmi Press, Bapatla, Andhra Pradesh.
- Rishipal. 2011. Training and Development Methods, S.Chand and Co. Ltd., New Delhi.
- Rogers, E.M. 2003. Diffusion of Innovations, The Free Press, New York.

Journals

- Indian Journal of Social Sciences
- Agricultural Extension Review
- Journal of Extension Education - Coimbatore
- Journal of Rural Development
- Yojana

Web resources

- www.i4d.com
- www.panasia.org
- www.joe.org

Aim:

To impart knowledge on distribution, bionomics, symptoms of damage and management strategies of pests of horticultural crops.

Theory**Unit I: Pests of Vegetable Crops**

Distribution, bionomics, symptoms of damage and management strategies of insect and non insect pests of Brinjal, Bhendi, Tomato, Chillies, Onion, Garlic, Moringa, Amaranthus Crucifers, Cucurbits.

Unit II: Pests of Fruit Crops

Distribution, bionomics, symptoms of damage and management strategies of insect and non insect pests of Mango, Citrus, Banana, Guava, Grapevine, Sapota, Pomegranate, Papaya, Aonla, Apple, Pine apple, Custard apple and Jack

Unit III: Pests of Tuber Crops

Distribution, bionomics, symptoms of damage and management strategies of insect and non insect pests of Potato, Sweet potato, Tapioca, Yam and Colocasia

Unit IV: Pests of Spices and Plantation Crops

Distribution, bionomics, symptoms of damage and management strategies of insect and non insect pests of Coconut, Arecanut, Tea, Coffee, Cashew, Cocoa, Betelvine, Ginger, Turmeric, Coriander, Cardamom, Pepper, Curry leaf and Tamarind

Unit V: Pests of Flower Crops, Medicinal Plants, Lawn and Stored products

Distribution, bionomics, symptoms of damage and management strategies of insect and non insect pests of Rose, Jasmine, Crossandra, Chrysanthemum, Tuberose, Cut flowers, Gloriosa, Coleus, Phyllanthus, Aswagantha, Senna, Periwinkle, Lawn and Stored products.

Practical

Identification of symptoms of damage and life stages of important pests of different horticultural crops: vegetables, fruits, spices, tubers, plantation crops, flower crops, medicinal plants, lawn and stored products.

Theory lecture schedule:

Distribution, bionomics, symptoms of damage and management strategies for insects and non-insect pests of

1. Brinjal, Bhendi and Tomato
2. Chillies, Onion, Garlic, Moringa and Amaranthus
3. Crucifers and Cucurbits
4. Mango and Citrus
5. Banana, Guava, Grapevine and Sapota
6. Pomegranate, Papaya and Aonla
7. Apple, Pine apple, Custard apple and Jack
8. Potato, Sweet potato, Tapioca, Yam and Colocasia
9. Midsemester examination
10. Coconut and Arecanut
11. Tea and Coffee
12. Cashew, Cocoa and Betelvine
13. Ginger, Turmeric, Coriander, Cardamom, Pepper, Curry leaf and Tamarind
14. Rose, Jasmine, Crossandra, Chrysanthemum, Tuberose and Cut flowers
15. Gloriosa, Coleus, Phyllanthus, Aswagantha, Senna, Periwinkle and lawn
16. Stored product pests
17. Strategies for stored product pest management

Practical schedule:**Identification of symptoms of damage and life stages of important pests**

1. Pests of Brinjal, Bhendi and Tomato
2. Pests of Chillies, Onion, Garlic, Moringa and Amaranthus
3. Pests of Crucifers and Cucurbits
4. Pests of Mango, Citrus and Sapota
5. Pests of Banana, Grapevine and Guava
6. Pests of Pomegranate, Aonla, Papaya
7. Pests of Jack, Pine apple, Custard apple, Ber and Apple

8. Pests of Potato, Sweet potato, Tapioca, Yam and Colocasia
9. Pests of Coconut and Arecanut
10. Pests of Coffee and Tea
11. Pests of Cashew, Cocoa and Betelvine
12. Pests of Turmeric, Ginger and Coriander
13. Pests of Cardamom, Pepper, Curry leaf and Tamarind
14. Pests of Rose, Jasmine, Crossandra, Chrysanthemum, Tuberose and Cut flowers
15. Pests of Gloriosa, Coleus, Phyllanthus, Aswagantha, Senna and Periwinkle
16. Pests of Lawn and stored products
17. Final Practical Examination

Assignment:

- Collection and submission of 50 pests of horticultural crops
- Rearing of 15 insect pests

Outcome/Deliverables:

The students develop skills for the identification and management of pests of vegetables, fruits, tubers, plantation crops, spices, commercial flowers, medicinal plants, lawn and stored products.

References:

A. Text Book:

1. Muthukrishnan, N., N.Ganapathy, R.Nalini and R.Rajendran.2005. *Pest Management in Horticultural Crops*. New Madura Publishers, Madurai. 325p. {ISBN: 81-902832-0-0}

B. Reference Books:

2. Nair, M.R.G.K.1986. *Insects and mites of crops in India*. Publications and Information Division, ICAR, NewDelhi. 408p.
3. ParvathaReddy.2010. *Insect, Mite and Vertebrate Pests and their Management in Horticultural Crops*. Scientific Publishers, Jodhpur. 384p. {ISBN: 978-81-7233-628-8}
4. David, B.V. and V.V.Ramamurthy.2011. *Elements of Economic Entomology*. Namrutha Publications, Chennai. 386 p. {ISBN: 978-81-921477-0-3}

5. Butani, D.K. and M.G.Jotwani.2013. *Insects in Vegetables*. Daya Publishing House, NewDelhi. 356p.
6. Regupathy,A. and R.Ayyasamy.2013. *A Guide on Crop Pests*. Namrutha Publications, Chennai.368p. {ISBN: 978-81-921477-1-0}

C. Supplementary references:

1. Srivastava, K.P. and D.K.Butani. 2009. *Pest Management in Vegetables* (Vol. I & II). Studium Press (India) Pvt. Ltd., New Delhi . 777p. {ISBN: 978-81-907577-3-7}
2. Ayyar, T.V.R. 1963. *Hand Book of Economics Entomology for South India*. Govt. Press Madras.
3. Sathe,T.V. 2012. *Pests of Ornamental Plants*. Daya Publishing House, New Delhi.199p. {ISBN: 978-81-7035-757-5}

D. Web resources:

1. http://agritech.tnau.ac.in/horticulture/horti_plantprotection_pest.html
2. <http://www.nbaii.res.in/insectpests/pestsearch.php?cropname=Mango>
3. http://www.ncipm.org.in/data_bases.htm
4. ipm.illinois.edu

**NST 301 Fundamentals and Applications of Nanotechnology (1+0) – Revised
24.04.2018**

Objective:

To impart basic knowledge in Nano Science & Technology and its applications in a wide spectrum of disciplines

Outcome:

The course will provide opportunity for UG students to acquire knowledge in the emerging field of Nanotechnology and get motivated to use the innovative tools in any spheres of their specialization

Syllabus

Unit 1: Basics of Nano science (4 lectures) - Introduction to nano science and technology, history, definition, classification of nanomaterials based on origin, dimension - Unique properties of nanomaterials - mechanical, magnetic, thermal, optical and electrical properties

Unit 2: Synthesis of Nanomaterials (3 Lectures): Physical, Chemical and Biological synthesis of nanomaterials

Unit 3: Properties and Characterization of Nanomaterials (4 Lectures): Size (particle size analyzer), morphological (scanning electron microscope and transmission electron microscope), optical (UV-VIS and FT-IR) and structural (XRD) properties of nanomaterials

Unit 4: Application of Nanotechnology (3 Lectures)

Biosensor (principle, component, types, applications) agriculture (nano-fertilizers, herbicides, nano-seed science, nano-pesticides) and food Systems (encapsulation of functional foods, nano-packaging)

Unit V - Application of Nanotechnology (2 Lectures)

Energy, Environment, Health and Nanotoxicology

Lecture schedule

1. Introduction to nano science and technology, history, definition and Moores Law

2. Classification of nanomaterials based on origin and dimension, brief introduction to Quantum Dots, Buckyball, carbon nanotube
3. Unique properties of nanomaterials – physical, chemical and optical properties
4. Physical synthesis (Ball Milling, Types, advantages and disadvantages)
5. Chemical synthesis (Sol-gel method, microwave synthesis, polyol method, electro-spinning)
6. Biological synthesis of nanomaterials using plants and microbes
7. Size (particle size analyzer – Principle, particle size and distribution) and morphology using SEM (scanning electron microscope – Principle, components and applications)
8. Morphological properties using TEM (Transmission electron microscope – Principle, components, applications)
- 9. Mid-Semester Examination**
10. Optical properties using UV-VIS and FT-IR (Principle, components and applications)
11. Structural properties (XRD – Principle, Bragg's law, components, applications) properties of nano-materials
12. Biosensor (principle, component, types, applications – soil, water, early detection of plant diseases and seed quality, food quality)
13. Applications in Agriculture (Nano-fertilizers and seed science)
14. Applications in Agriculture (Nano-herbicides and nano-pesticides)
15. Nano-Food Systems (encapsulation of functional foods, nano-packaging)
16. Nanotechnology applications in Energy and Environment
17. Applications in Health Sciences and Nanotoxicology

References:

1. Subramanian, K. S. K. Gunasekaran, N. Natarajan, C.R. Chinnamuthu, A. Lakshmanan and S. K Rajkishore. 2014. Nanotechnology in Agriculture. New India Publishing House, New Delhi pp. 440 ISBN. 9789383305209
2. **Plant Nanotechnology: Principles and Practices.** 2016. Chittaranjan Kole, D. Sakthi Kumar, Mariya V. Khodakovskaya. (Eds.) Springer-Verlag, New York, USA ISBN 978-3-319-42152-4. 383 p.
3. Nano: The essentials understanding nanoscience and Nano- T.Pradeep - 2009 - Mc Graw Hill.
4. Nanotechnology Applications in Agriculture – C.R. Chinnamuthu, B.Chandrasekaran and C. Ramasamy – 2008.

FPE 301

Post Harvest and Food Engineering

1+1

Unit I: Post harvest losses, moisture content and properties

Post harvest losses – causes and estimates – unit operations of crop processing – moisture content – methods of estimation - engineering properties of grains – mass, volume, density, porosity, sphericity – Thermal properties- applications .

Unit II: Threshing, cleaning and grading

Threshing – threshers for different crops - parts, terminology – operational safety and maintenance - winnowing – manual and power operated winnowers- cleaning, grading and sorting - types of screens - air screen cleaners- construction and operation-care and maintenance –Screen effectiveness-construction and working principles of spiral separator, magnetic separator, specific gravity separator, colour sorter and inclined belt separator.

Unit III: Shelling, drying and storage

Shelling equipments - maize sheller, husker sheller, hand and power operated groundnut decorticator - construction and working – performance evaluation - grain drying – principles - advantages - types - batch and continuous, mixing and non mixing – LSU drier – construction and operation - performance of dryers - storage of food grains – factors affecting storage, traditional and improved methods - modified atmosphere storage.

Unit IV: Cereals, pulses and oilseed processing

Rice processing – Parboiling- traditional and modern methods - , modern rice milling – Size reduction – principles- equipment used- wheat milling – process flow chart – roller flour

mill - construction and operation - pulse milling - wet, dry and CFTRI methods of pulse milling – equipment – construction and operation - oilseed processing – methods and machineries used – ghani, rotary and expeller - filter press – construction and operation – solvent extraction process.

Unit V: Material handling and Food Plant layout

Material handling equipments – bucket elevator, screw conveyor, belt conveyor – construction and operation –Food plant location – selection- layout-types- Food Packaging- requirements- types- Packaging of raw and processed foods.

Practical

Determination of moisture content - study of threshers, winnowers and graders – components, operations, adjustment and performance - determination of efficiency of maize shellers, groundnut decorticators, cleaners and graders, rice milling and pulse milling - experiments on tray and thin layer drier- experiments on screw conveyor and bucket elevator, study of improved grain storage structures – Study of packaging machine – visit to food processing industry.

Theory schedule

1. Post harvest losses – causes and estimates – unit operations of crop processing – moisture content – methods of estimation – direct and indirect methods – wet basis and dry basis.
2. Engineering properties of grains – mass, volume, density, bulk density, true density, porosity, surface area and sphericity– Thermal properties-applications.
3. Threshing – threshers for different crops - parts, terminology - operational safety and maintenance.
4. Winnowing – winnowers- cleaning, grading and sorting- Types of screens - air screen cleaners- construction and operation- screen effectiveness
5. Construction and working principles of spiral separator, magnetic separator, specific gravity separator, colour sorter and inclined belt separator
6. Construction and working of maize sheller, husker sheller, hand and power operated groundnut decorticator -care and maintenance.

7. Grain drying – principles - advantages - types - batch and continuous, mixing and non mixing – LSU drier – construction and operation - heat sources - performance of dryers.
8. Storage of food grains – factors affecting storage, traditional methods - types -bag and bulk storage - CA and MA storage.

9. Mid Semester Examination

10. Rice processing – Parboiling- traditional and modern methods -modern rice milling - layout of modern rice mills.
11. Size reduction – principles- laws in size reduction- equipment used.
12. Wheat milling – process flow chart – roller flour mill - important machineries used in wheat milling – construction and operation.
13. Pulse milling - wet, dry and CFTRI methods of pulse milling – equipment – construction and operation.
14. Oilseed processing – methods and machineries used – ghani, rotary and expeller - filter press – construction and operation – solvent extraction process.
15. Material handling equipments – bucket elevator, screw conveyor, belt conveyor – construction and operation.
16. Introduction to food plant design – selection of plant location - layout – types.
17. Food Packaging – requirements-types- packaging of raw and processed foods..

Practical schedule

1. Determination of moisture content by direct and indirect methods
2. Study of types of thresher and components.
3. Performance evaluation of grain winnower.
4. Performance evaluation of grader.
5. Study of maize sheller / husker sheller for maize.
6. Study of groundnut decorticator.
7. Performance evaluation of cleaner cum grader.
8. Study on paddy parboiling .
9. Study of shelling equipment for paddy .
10. Study of pulse milling equipment.
11. Experiment on tray dryer / thin layer dryer to determine drying characteristics.
12. Performance evaluation of screw conveyor

13. Performance evaluation of bucket elevator
14. Study of improved grain storage structures
15. Study of packaging machine
16. Visit to modern rice mill / oil mill / pulse mill.
17. **Final Practical Examination.**

References

1. Chakraverty,A. 2000. Third Edition. Post Harvest Technology of cereals, pulses and oilseeds. Oxford & IBH publishing & Co. Pvt. Ltd., New Delhi.
2. Sahay. K.M. and Singh,K.K. 1994. Unit operations of Agricultural Processing. Vikas Publishing House Pvt. Ltd. New Delhi.

Web resources

1. www.foodnetbase.com
2. www.fao.org
3. food.oregonstate.edu/security/preserve.html
4. www.postharvest.ucdavis.edu.

ENS 301

Environmental Pollution and Management

1+1

Scope :

It deals with the scientific study of environmental system (air, water, soil land), the inherent or induced changes on organisms and the environmental damages incurred as a result of human interaction with the environment.

Objectives:

- ✓ Imparting basic knowledge about the environment and its allied problems.
- ✓ Developing an attitude of concern for the environment.
- ✓ Motivating the students to participate in environment protection and environment improvement.
- ✓ Acquiring skills to help the concerned individuals in identifying and solving environmental problems and striving to attain harmony with nature.

Unit-I-Pollution in Environment-Introduction-Pollution- Pollutants – Contaminants – Source and types of pollution in Soil-Water-Air-Impact on environment-Pollution Status in India

Unit– II Waste water Management: Waste water – Different types of waste water-pollutants and contaminants-Impact of waste water on ecosystem –Eutrophication – Biomagnification – Water borne diseases –Wastewater treatment methods – Physical, chemical and Biological – General water treatments-Wastewater recycling – Constructed wetlands-Reed bed system - Legislation and standards

Unit-III-Management of polluted soils: Soil pollutants – Sources – Urban and Industrial – Heavy metal – Pesticides – PAH's and PCB's-E-Waste-Fate of pollutants in Soil - Management of soil pollution – Bio and phyto remediation of polluted soil

Unit-IV - Air Pollution and its Management: Air pollutants from industrial and domestic sources – Fate of air pollutants-Air pollution indicators - Monitoring and Control measures – Role of plants in controlling air pollutants-Legislation and Air quality standards - – Noise Pollution – Sources, Effect and Control Measures-Indoor air pollution and control measures

Unit-V- Solid waste management: Solid waste –Sources – Sludge from Industry and farm waste-Characteristics – Environmental problems – Management of sludge and farm wastes – Disposal methods – Sanitary land fills – Incineration – Pyrolysis - Recycling –Energy recovery –Composting – Vermicomposting – Maturity indices assessment-Standards and Legislation

Unit-VI-Environmental standards, Regulation and EIA - Environmental standards-CPCB Norms for discharging industrial effluents to public sewers- CDM and Carbon foot print- Environmental Impact Assessment:Stages of EIA -Monitoring and Auditing – Environmental clearance procedure in India

Lecture Schedule:

1. Introduction-Pollution- Pollutants – Contaminants – Source and types of pollution in Soil-Water-Air-Impact on environment-Pollution Status in India
2. Waste water – Different types of waste water-pollutants and contaminants-Impact of waste water on ecosystem –Eutrophication – Biomagnification – Water borne diseases –
3. Wastewater treatment methods – Physical, chemical and Biological – General water treatments-
4. Wastewater recycling – Constructed wetlands-Reed bed system -Legislation and standards
5. Soil pollutants – Sources – Urban and Industrial – Heavy metal – Pesticides – PAH's and PCB's-E-Waste

6. Fate of pollutants in Soil - Management of soil pollution – Bio and phyto remediation of polluted soil
7. Air pollutants from industrial and domestic sources – Fate of air pollutants-Air pollution indicators – Air pollution episodes-Monitoring and Control measures–
8. Role of plants in controlling air pollutants- Legislation and Air quality standards,
- 9. Mid Semester Examination**
- 10. Noise Pollution, Sources, Effect and Control Measures, Indoor air pollutants and control measures**

11. Solid waste –Sources – Sludge from Industry and farm waste-Characteristics – Environmental problems
12. Management of solid waste, Disposal methods, Sanitary land fills, Incineration, Pyrolysis
13. Recycling –Energy recovery –Composting – Vermicomposting – Maturity indices assessment-Standards and Legislation
14. Environmental standards-CPCB Normsfor discharging industrial effluents to public sewers
15. Environment Impact Assessment,Introduction,Stages of EIA, -Monitoring and Auditing
16. CDM and Carbon foot print
17. Environmental clearance procedure in India

Practical Schedule

1. Sample collection and preservation from contaminated sites.
2. Waste water treatment by physical (column study with vermiculite and activated charcoal) and chemical (Alum treatment)
3. Waste water treatment through constructed wetland system and characterization
4. Estimation of Chlorides, Phosphates in waste water
5. Analysis of Nitrogen in industrial effluent and sludge
6. Collection of PAH's contaminated soils and analysis by GC-MS
7. Biosorption of heavymetal (Cr) by using Water hyacinth and analysis through AAS

8. Pesticide Residue analysis in contaminated water
9. Analysis of SPM in air, Methane and CO₂ in Municipal dumping site
10. Assessing the efficiency of plants to control Indoor air pollutants
11. Analysis of Organic carbon in Sludge and Organic manure
12. Composting and Vermicomposting of farm wastes
13. Energy recovery from wastes
14. Maturity indices of compost- C:N ratio and Phytotoxicity test
15. Maturity indices of compost: starch iodine test and sulphide test
16. Visit to water treatment plant
17. Final practical examination

Reference:

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
- E-Books:** Chiras D.D., 2016. Environmental Science, Tenth Edition. Jones & Bartlett Learning, Burlington, MA. ISBN: 978-1-284-05705-8, 708 Pages

HOR 311

Production technology of vegetables and spice crops

2+1

Theory

Unit I: Scope, Importance and classification of vegetables

Importance of vegetable growing –area and production of vegetables in India and Tamil Nadu- nutritive value of vegetables –classification of vegetables – types of vegetable growing : vegetable production in kitchen garden, roof garden, truck garden, market garden, floating garden, river bed cultivation, garden for vegetable forcing – nursery management – cropping systems in vegetables. Use of growth regulators in vegetables-Protected cultivation of vegetables (tomato ,capsicum and cucumber)

Unit II: Production technology of tropical vegetable crops

Climate and soil – varieties and hybrids – seeds and sowing –raising nursery in protrays – transplanting - nutrient management – irrigation and fertigation – weed management – use of micronutrients -physiological disorders - maturity indices – harvest- Post harvest technology

Crops: Tomato, chilli, brinjal, bhendi, gourds (pumpkin, ash gourd, ribbed gourd, bitter gourd and snake gourd), melons (watermelon and muskmelon) onion, cassava, amaranthus and moringa, sweet potato and yams.

Unit III: Production technology of temperate vegetable crops

Climate and soil – varieties and hybrids – seeds and sowing – transplanting - nutrient management – irrigation and fertigation – weed management – use of micronutrient and growth regulators- physiological disorders - maturity indices and harvest- Post harvest technology

(**Crops:** Cabbage, brussel sprout, cauliflower, broccoli, potato, carrot, radish, beetroot, peas and french beans).

Unit IV: Status of production, scope and crop production techniques of spice crops

Spices- Scope and importance- classification of spices –role of commodity boards - Climate and soil- varieties and related species- propagation, nursery management and planting- training practices- weed and water management- nutrient management–shade regulation- harvest

Crops: Black pepper, cardamom.

Unit V: Crop production techniques in spice crops

Climate and soil- varieties and related species- propagation, nursery management and planting- training and pruning practices- weed and water management- shade regulation- nutrient management including drip and fertigation –harvest- Post harvest technology

Crops: Turmeric, ginger, coriander, clove, nutmeg, vanilla and curry leaf.

Practical

Vegetable crops

Layout of kitchen garden – seed sowing- nursery management– nutrient management – fertigation - practices in use of plant growth regulators - Special horticultural practices in vegetable production - study of maturity indices - protected cultivation - visit to vegetable nursery unit/ /protected cultivation unit.

Spice crops

Black pepper- Description of varieties, study of different shoots, propagation. Cardamom- Description of varieties, propagation, shade management and processing. Coriander and curry leaf- study on varietal identification, seed treatment, sowing and harvest. Clove and nutmeg- Description of varieties, propagation, training, pruning and processing. Turmeric and ginger- description of varieties- propagation- processing and curing. Vanilla- description of varieties- propagation- processing and curing. Visit to spice gardens and commodity boards.

Theory schedule

1. Importance of vegetable growing in India and Tamil Nadu and nutritive value and classification of vegetables.
2. Types of vegetable growing : Vegetable production in nutrition garden, kitchen garden, roof garden, truck garden, market garden, floating garden, river bed cultivation, garden for vegetable forcing
3. Nursery management and cropping systems in vegetable crops
4. Use of growth regulators in vegetables
5. Climate and soil – varieties and hybrids – seeds and sowing – transplanting - nutrient management – irrigation and fertigation – weed management – use of micronutrients - physiological disorders - maturity indices – harvest and yield - pre cooling, grading, packing, and storage of tomato.
6. Climate and soil – varieties and hybrids – seeds and sowing – transplanting - nutrient management – irrigation and fertigation – weed management – use of micronutrients - physiological disorders - maturity indices – harvest and yield - pre cooling, grading, packing, and storage of chilli.
7. Climate and soil – varieties and hybrids – seeds and sowing – transplanting - nutrient management – irrigation and fertigation – weed management – use of micronutrients - physiological disorders - maturity indices – harvest and yield - pre cooling, grading, packing, and storage of brinjal.
8. Climate and soil – varieties and hybrids – seeds and sowing – transplanting - nutrient management – irrigation and fertigation – weed management – use of micronutrients - physiological disorders - maturity indices – harvest and yield- pre cooling, grading, packing, and storage of bhendi
9. Climate and soil – varieties and hybrids – seeds and sowing – transplanting - nutrient management – irrigation and fertigation – weed management – use of micronutrients - physiological disorders - maturity indices – harvest and yield- pre cooling, grading, packing and storage of onion.
10. Climate and soil – varieties and hybrids – seeds and sowing – transplanting - nutrient management – irrigation and fertigation – weed management – use of micronutrients - physiological disorders - maturity indices – harvest and yield- pre cooling, grading, packing,

and storage of gourds (pumpkin and ash gourd,) and melons (water melon and musk melon).

11. Climate and soil – varieties and hybrids – seeds and sowing – transplanting - nutrient management – irrigation and fertigation – weed management – use of micronutrients - physiological disorders - maturity indices – harvest and yield- pre cooling, grading, packing and storage of gourds (ribbed gourd, bitter gourd and snake gourd)
12. Climate and soil – varieties and hybrids – seeds and sowing – transplanting - nutrient management – irrigation and fertigation – weed management – use of micronutrients - physiological disorders - maturity indices – harvest and yield - pre cooling, grading, packing and storage of cassava.
13. Climate and soil – varieties and hybrids – seeds and sowing – transplanting - nutrient management – irrigation and fertigation – weed management – use of micronutrients - physiological disorders - maturity indices – harvest and yield- pre cooling, grading, packing and storage of moringa and amaranthus.
14. Climate and soil – varieties and hybrids – seeds and sowing – transplanting - nutrient management – irrigation and fertigation – weed management – use of micronutrients - physiological disorders - maturity indices – harvest and yield - pre cooling, grading, packing and storage of cabbage – a brief account of brussel sprout.
15. Climate and soil – varieties and hybrids – seeds and sowing – transplanting - nutrient management – irrigation and fertigation – weed management – use of micronutrients - physiological disorders - maturity indices – harvest and yield - pre cooling, grading, packing, and storage of cauliflower- a brief account of broccoli.
16. Climate and soil – varieties and hybrids – seeds and sowing – transplanting - nutrient management – irrigation and fertigation – weed management – use of micronutrients - physiological disorders - maturity indices – harvest and yield- pre cooling, grading, packing and storage of potato, sweet potato and yams.

17. Mid semester examination

18. Climate and soil – varieties and hybrids – seeds and sowing – transplanting - nutrient management – irrigation and fertigation – weed management – use of micronutrients - physiological disorders - maturity indices – harvest and yield - pre cooling, grading, packing and storage of peas

19. Climate and soil – varieties and hybrids – seeds and sowing – transplanting - nutrient management – irrigation and fertigation – weed management – use of micronutrients - physiological disorders - maturity indices – harvest and yield - pre cooling, grading, packing and storage of carrot and radish.
20. Climate and soil – varieties and hybrids – seeds and sowing – transplanting - nutrient management – irrigation and fertigation – weed management – use of micronutrients - physiological disorders - maturity indices – harvest and yield - pre cooling, grading, packing, and storage of beetroot and French beans.
21. Protected cultivation of vegetables (tomato,capsicum and cucumber)
22. Scope and Importance- classification of spices
23. Role of commodity boards
24. Climate and soil- varieties and related species- propagation, nursery management and planting- training and pruning practices of black pepper
25. Weed and water management- growth regulation - shade regulation- nutrient management including drip and fertigation – harvest - yield - post harvest technology of black pepper.
26. Climate and soil- varieties and related species- propagation, nursery management and planting- training and pruning practices- weed and water management- shade regulation- nutrient management including drip and fertigation –harvest-yield- post harvest technology of cardamom.
27. Climate and soil- varieties and related species- propagation, nursery management and planting- weed and water management- inter cropping- nutrient management including drip and fertigation –harvesting and curing of turmeric.
28. Climate and soil- varieties and related species- propagation, rhizome selection and treatment - planting- weed and water management- rotation and mixed cropping –mulching - nutrient management including drip and fertigation –harvest and curing of ginger.
29. Climate and soil- varieties –seeds and sowing- propagation and planting- weed and water management- cropping system- nutrient management including drip and fertigation –harvest of coriander
30. Climate and soil- varieties and related species- propagation, nursery management and planting- training and pruning practices- weed and water management- cropping system nutrient management–harvest of clove.

31. Climate and soil- varieties and related species- propagation, nursery management and planting- training and pruning practices- weed and water management- cropping system- nutrient management–harvest of nutmeg.
32. Climate and soil- varieties and related species- propagation, nursery management and planting- training and pruning practices- weed and water management- shade regulation- nutrient management including drip and fertigation –harvest of vanilla
33. Climate and soil- varieties and related species- propagation, nursery management and planting- training and pruning practices- weed and water management- nutrient management including drip and fertigation –harvest of curry leaf
34. Value addition of important spices (Black pepper, nutmeg, vanilla, Turmeric, ginger)

Practical schedule

1. Layout of kitchen garden and roof garden.
2. Seed treatment and sowing practices in direct sown vegetables
3. Nursery management of transplanted ,bulb and tuber vegetable crops
4. Nutrient management in vegetable crops - fertigation
5. Practices in use of plant growth regulators in vegetable crops
6. Special horticultural practices in vegetable production
7. Study of maturity standards and harvesting of vegetables
8. Protected cultivation of vegetable crops
9. Visit to vegetable nurseries/protected cultivation/gardens.
10. Black pepper- Description of varieties, study of different shoots, propagation
- 12.Cardamom- Description of varieties, propagation, shade management and processing
- 13.Coriander and curry leaf- study on varietal identification, seed treatment, sowing and harvest.
- 14.Clove and nutmeg- Description of varieties, propagation, training, pruning and processing
- 15.Turmeric and ginger- description of varieties- propagation- processing and curing
- 16.Vanilla- description of varieties- propagation- processing and curing
- 17.Visit to spice gardens or commodity boards.
- 18.Practical Examination.

References

- 1 Gopalakrishnan, T.R. 2007. Vegetable Crops. Horticultural Science Series (Series Editor K.V.Peter). New India Publishing Agency.
2. Vishnu Swarup, S. 2012. Vegetable Science and technology in India , Kalyani publisher, New Delhi.
- 3 Veeraragavaththam ,D., M.Jawaharlal and SeemanthiniRamadas 2000 “ A guide on vegetable Culture”
4. Kumar, N. 2014. Introduction to Spices, Plantation, Medicinal and Aromatic crops., IBH Publishing Co. Pvt. Ltd., New Delhi.
- 5.. SandhnaPandey, S.N. Pandey and P.H.Pandy, 2013. Spice crop management and technology, Kalyani publisher, New Delhi.

Journals

1. Indian Horticulture
2. Vegetable Science
3. Indian Journal of Horticulture Science
4. Journal of Horticultural Sciences
5. Acta Horticulturae
6. South Indian Horticulture
7. Hort Science

Web resources

1. [http://www.idosi.org/aejb/1\(1\)08/2.pdf](http://www.idosi.org/aejb/1(1)08/2.pdf)
2. <http://www.academicjournals.org/ajar/PDF/pdf/2009/Sep/Baris>
3. <http://pods.dasnr.okstate.edu>
4. <http://www.avrdc.org>
5. <http://www.ces.ncsu.edu>
6. <http://www.attra.ncat.org/attra-pub//vegetables>
7. <http://www.icar.org.in/dipa/events/ICAR.NEWS/volume-II>

ENG 301

Soft Skills for Employability

0+1

Aim:

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

UNIT I – Introduction to Soft Skills

Soft skills – an introduction – career skills and corporate skills - definitions.

UNIT II – Life Skills

1. Attitude

Attitude - Psychological and sociological definitions – types of attitude - consequences – suggestions to keep good attitude.

2. Emotional Intelligence

Introduction to Emotional Intelligence – four branch model of EQ - five point scale to measure EI – suggestions to improve EI.

3. Interpersonal skills

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

4. Self Development/Empowerment

Self Development - Empowerment - SWOC Analysis - Goal setting based on the principle of SMART – self motivation strategies.

UNIT III Communication Skills

5. Types of Communication

Communication - Basic Communication Model - Verbal and Non-verbal Communication.

Business Communication

Writing memo - short notes – short reports, Agenda , minutes, Business proposals, newspaper advertisement.

6. Group Dynamics

Study of affiliation, participation, goal consciousness – Forming, Storming, Norming –Performing.

7. Kinesics

Definition - personal appearance, posture, gestures, facial expressions, eye contact & movements.

8. MID SEMESTER

UNIT IV – Employability Skills

9. Interview Skills – I

Definitions of interview – two types of interview – preliminary requirements for success – Resume writing – CV writing – Job application – Cover Letter-Specially designed interviews.

10. Interview Skills – II

Telephone interview – Skype interview - Panel Interview - Five stages of interview –how to answer the questions

11. Group Discussion

Definition – contexts – why and how? – techniques and skills.

UNIT V – Corporate Skills

12. Leadership qualities

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

14. Negotiation skills

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

15. Time management

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

16. Stress management

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

17. Final practical Examination

Text book :

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

e-books:

URL : <http://www.citehr.com/28484-hand-book-soft-skills-e-book-doc.html>

URL : <http://promeng.eu/downloads/training-materials/ebooks/soft-skills/advanced-communication-skills.pdf>

Outcome:

The students will acquire a good understanding of attitude formation, of being emotionally Intelligent and there by improve their Interpersonal skills. Knowledge on Self Development, Employability Skills viz., Interview Skills, Group Discussion, Corporate Skills, Leadership qualities, Negotiation skills, Time management and Stress management will enable the students will self reliant when they get in to the world.

Practical Schedule

1. Administration of 25 item questionnaire on Emotional Intelligence and introduction to Soft Skills.
2. Attitude, its types and seven steps to overcome challenged attention.
3. Interpersonal Skills, character traits, formal interpersonal skills and demonstration.
4. Self Development, empowerment and goal setting based on the principle of SMART SWOC analysis.
5. Types of communication viz., verbal and non verbal communication and basic communication model.
6. Writing - writing memo, short notes, short reports, agenda, minutes, business proposals, newspaper advertisement.
7. Group dynamics – the study of affiliation, participation, goal consciousness, forming, storming, norming and performing.
8. Definition of kinesics - personal appearance, posture, gestures, facial expressions, eye contact and movements, observation and explanation of the body language of a public speaker.
9. **MID SEMESTER EXAMINATION.**

10. Mock interview, group interview, telephone interview, skype interview and panel interview - simulation.
11. The techniques and skills of group discussion – group discussion on select topics.
12. Leadership qualities and the basic requirements of being a leader (responsibility, rapport with subordinates, knowledge of the assignment, goal setting, decision making and team work).
13. Goal setting and decision making – exercises.
14. Negotiation skills, functions of negotiation, kinds of negotiation and the phases of the process, rules and steps to improve negotiation skills.
15. Stress management and time management – brainstorming.
16. Teacher student interaction on causes of stress in students life.
17. **FINAL PRACTICAL EXAMINATION**

REFERENCE:

- Alex, *Soft skills Know yourself and know the world*. S. Chand & Co. Publishing House, New Delhi, 2009.
- Beverly Jaeger, *Making Work Work for the Highly Sensitive Person*, Tata McGraw – Hill, USA, 2004.
- Dipali Biswas, *Enhancing Soft Skill*, Shoraff Publishers and Distributors, 2009.
- Gloria. J. Galanes, Kathreine Adams, John. K. and Brillhart, *Effective Group Discussion*, Tata McGraw – Hill, New Delhi, 2004.
- Jagadeesan. G. and Santhanakrishnan, R, *Soft Skills Development*, ICFAI University Press. New Delhi, 2007.
- Martin Avis, *Effective Time Management Skills for Everyone*, Avis Consultancy, London, U.K, 2010.
- Mayer, J.D., Salovey, P and Caruso, D.R, *Models of Emotional Intelligence*, R.J. Shernberg (Ed.). Handbook of Intelligence. Cambridge University Press, Cambridge, 2000.
- Patsy McCarthy and Caroline Hatcher, *Presentation Skill: The Essential Guide for Students*, Sage Publications, CA, 2002.

Peggy Claus, *The Hard Truth about Soft Skills*, Harper Collins Publishers, New York, USA, 2007.

Peter. J. Gosling, *Scientists Guide to Poster Presentations*, Kluwar Academic Pub, N.Y, USA, 2002.

Richard Ellis, *Communication Skills; Step ladders to success for professionals*, Intellect Books, Chicago, USA, 2009.

Robert, A. Day, *How to Write a Scientific Paper*, ELBS, U.K, 2000.

Sarvesh Gulati, *Corporate Soft Skills*, Rupa Publishers, New Delhi, 2006.

Soleman. D, *Working with Emotional Intelligence*, Bloomsbury Publishing, London, 1998.

WEBSITES :

www.softskills.com

www.reportingskills.com

www.writing-skills.com

www.negotiation.com

www.businessballs.com

www.study-habits.com

www.timethoughts.com

THEORY:

UNIT I Diseases of Cereals and Millets

Etiology, symptoms, mode of spread, survival , epidemiology and integrated management of important diseases due to fungi, bacteria, viruses, phytoplasma, phanerogamic parasites and non-parasitic causes of rice, wheat, barley , oats, sorghum, maize, bajra, finger millet, small millets

UNIT II Diseases of Pulses

Etiology, symptoms, mode of spread, survival, epidemiology and integrated management of important diseases of pigeonpea, urdbean, mung bean, chickpea, soybeans, Cowpea , Lab lab and Horse gram

UNIT III Diseases of Oil Seeds

Etiology, symptoms, mode of spread, survival, epidemiology and integrated management of important diseases of groundnut, sesame, sunflower, castor, mustard, Safflower, linseed and jatropa

UNIT IV Diseases of cash crops & storage diseases of grains

Etiology, symptoms, mode of spread, survival , epidemiology and integrated management of important diseases of Cotton, jute, sugarcane, sugar beet, tobacco and mulberry., spoilage of grain during storage and their management.

THEORY

Etiology, symptoms, mode of spread, survival, epidemiology and management of

1. Fungal diseases of rice
2. Bacterial, viral and Phytoplasma diseases of rice.
3. Diseases of wheat, barley and oats
4. Diseases of Sorghum
5. Diseases of Maize and pearl millet
6. Diseases of Ragi (finger millet), small millets
7. Diseases of pulses (pigeonpea, urdbean, mungbean)
8. Diseases of pulses – chickpea, , soybean, cow pea and Lab lab
9. Mid semester examination
10. Diseases of groundnut, gingelly
11. Diseases of sunflower ,safflower and castor
12. Diseases of Mustard , Linseed and jatropa
- 13.

14. Diseases of cotton and jute.
15. Diseases of sugarcane and sugarbeet.
16. Diseases of tobacco and mulberry
17. Spoilage of grains by field fungi and management
18. Fungal spoilage of grains during storage and management.

PRACTICAL

Study of symptoms and host-parasite relationship of:

1. Rice- fungal diseases
2. Rice - Bacterial, viral and phytoplasma diseases.
3. Diseases of wheat, barley and oat
4. Diseases of sorghum
5. Diseases of maize and .pearl millet
6. Diseases of ragi and small millets.
7. Diseases of Pigeonpea, urdbean, mungbean,
8. Diseases of chickpea, soybean, cow pea and lab lab
9. Diseases of groundnut andnd gingelly
10. Diseases of sunflower and castor
11. Diseases of linseed, safflower and Mustard
12. Diseases of cotton and jute.
13. Diseases of sugarcane and sugar beet
14. Diseases of tobacco, mulberry and jatropa
15. Fungal spoilage of grains during storage and management.
16. Field visit and Visit to FCI godowns
17. Practical examination

Note: Students should submit 50 well-pressed diseased specimens.

REFERENCE BOOKS

1. Agrios, G.N. 2008. Plant Pathology, Academic Press, New York.
2. Chaube H.S and Pandhir 2005.Crop diseases and their management .Prentice hall of India Pvt. Ltd. New Delhi
3. Dickson, J.G. 1997. Diseases of field crops, Daya Publishing House, New Delhi.
4. Guptha V.K and Paul V.S 2004. Fungi and Plant diseases.Kalyani Publishers .New Delhi
5. Mehrota, R.S. 1980. Plant Pathology, Tata Mc Grow Mill Pub. Co., New Delhi,
6. Prakasam, V., Valluvaparidasan, V., Raguchander, T. and K.Prabakar. 1997. Field crop diseases, AE Publication, Coimbatore.
7. Rangaswami, G. 2005. Diseases of Crop plants in India. Prentice Hall of India Pvt. Ltd., New Delhi
8. Singh, R.S .1993. Plant Diseases, Oxford &IBH Publication, New Delhi.

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1. Agrios, G.N. 2008. Plant Pathology, Academic Press, New York.
2. Thakur, B.R. 2006. Diseases of field crops and their management
3. Rangasawmi ,G and Mahadevan, A. 1998. Diseases of crop Plants in India, Prentice Hall of India Pvt. Ltd., New Delhi

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1. www.ucmp.berkeley.edu/fungi
2. www.ictv.org
3. www.vivo.library.cornell.edu
4. agridr.in/tnauEAgri/eagri50/PATH272/index.html

PBG 302 Breeding Field and Horticultural Crops (2+1)

Aim

Knowledge about the breeding of field and horticultural crops will be exposed to the students

SYLLABUS FOR THEORY

Unit I: Cereals

Place of origin – putative parents – related wild species – classification – objectives of breeding – methods of breeding – quantity – Quality – stress – conventional – innovative – heterosis breeding – distant hybridization and important varieties in following crops:

Cereals: Rice, Wheat, Grain and fodder Maize, Grain and fodder Sorghum, Pearl millet, Finger millet, Foxtail millet, Kodo millet, Little millet, Proso millet and Barn yard millet.

Unit II: Pulses, Oilseeds and Fibres

Pulses: Redgram , Bengal gram, Greengram, Blackgram, Grain and fodder Cowpea, Soybean, Horsegram and lab-lab ; Oilseeds: Groundnut, Gingelly, Mustard, Castor, Sunflower, Safflower, Niger, Jatropha, Coconut and Oilpalm; Fibres: Cotton, Jute and Mesta

Unit III; Sugars, Starch, Forages, Fumitories, Masticatories and Green manures

Sugars: Sugarcane, Sugar beet; Starch: Potato, Tapioca; Beverages: Coffee and Tea; Fumitories: Tobacco, Masticatories - Betelvine; Forage grasses: Guinea grass, Napier, Pearl millet – Napier, *Cenchrus sp.*, Paragrass; Forage legumes: Lucerne, *Stylosanthes*, Desmanthus, Desmodium, Siratro, Subabul Green manures and green leaf manures: Daincha, Sunnhemp, Tephrosia, Glyricidia, Neem and Pungam

Unit IV: Horticultural crops

Breeding for other sexually propagated horticultural crops-Bhendi, tomato; Breeding for other sexually propagated horticultural crops- Chilli, Brinjal, Papaya; Breeding for other clonally propagated horticultural crops- Banana, Rose, Jasmine

Unit V: Breeding for Biotic and Abiotic stresses and Quality

Breeding for pest and disease resistance - mechanisms of resistance; Breeding for Abiotic stress – drought and cold – salinity and alkalinity- mechanisms of resistance; Breeding for Abiotic stress –mechanisms of resistance; Breeding for quality produce; Ideotype breeding, PPV &FR act, 2001- Plant breeders' right, Farmers right, Biodiversity act, 2002; Germplasm registration.

SYLLABUS FOR PRACTICAL

Observation on floral biology – anthesis and pollination – selfing and crossing techniques – observation on wild species – maintenance of crossing ledger – pedigree record – in following crops.

- ❖ Cereals: Rice, Wheat, Maize, Sorghum, Pearl millet, Finger millet, Little millet, Kodo millet, Barn yard millet, Proso millet and Foxtail millet.
- ❖ Pulses: Redgram and Bengal gram, Green gram, Black gram and Cowpea; Soybean, Horse gram and Lab-lab.
- ❖ Oilseeds: Groundnut, Sesame, Sunflower, Safflower, Niger, Mustard. Castor, Jatropha, Coconut and Oilpalm
- ❖ Fibres: Cotton, Jute and Mesta
- ❖ Sugars: Sugarcane and sugar beet
- ❖ Starch: Potato and tapioca
- ❖ Beverages: coffee and tea
- ❖ Narcotics: Fumitories - tobacco

- ❖ Masticatories : betel vine
- ❖ Forages: Guinea grass, fodder Sorghum, fodder maize fodder pearl millet, Pearl millet – Napier hybrids, *Cenchrus*, Lucerne, fodder cowpea, *Desmanthus*, desmodium, *Stylosanthes*, siratro, subabul
- ❖ Green manures – Daincha, sunnhemp.
- ❖ Other sexually propagated horticultural crops: Chillies, bhendi, brinjal , tomato, papaya
- ❖ Other clonally propagated horticultural crops: Banana, Rose, Jasmine
- ❖ Screening techniques for biotic and abiotic stresses - Parental seed maintenance of hybrids, Field visit to hybrid seed production plots in Rice, Sorghum, Pearl millet, Maize, Cotton and Redgram.

Theory schedule

Place of origin – putative parents – related wild species – classification – objectives of breeding – methods of breeding – quantity – Quality – stress – conventional – innovative – heterosis breeding – distant hybridization and important varieties in following crops:

1. Cereals: Rice.
2. Cereals: Rice.
3. Cereals: Rice.
4. Cereals: Wheat
5. Cereals : Grain and fodder Maize
6. Cereals: Grain and fodder Sorghum, Pearl millet.
7. Cereals: Finger millet, Foxtail millet, Kodo millet, Little millet, Proso millet and Barn yard millet.
8. Pulses: Redgram , Bengal gram
9. Pulses: Greengram, Blackgram, Grain and fodder Cowpea
10. Pulses: Soybean, Horsegram, lab-lab
11. Oilseeds: Groundnut
12. Oilseeds: Gingelly and Mustard
13. Oilseeds: Castor and Sunflower
14. Oilseeds: Safflower, Niger and Jatropha
15. Oilseeds: Coconut and Oilpalm
16. Fibres: Cotton
17. Fibres:Jute, Mesta
18. **Mid Semester Examination.**
19. Sugars: Sugarcane, Sugar beet
20. Starch: Potato, Tapioca

21. Beverages: Coffee and Tea
22. Fumitories: Tobacco, Masticatories - Betelvine
23. Forage grasses: Guinea grass, Napier, Pearl millet – Napier, *Cenchrus sp.*, Paragrass
24. Forage legumes: Lucerne, Stylosanthus, Desmanthus, Desmodium, Siratro, Subabul
25. Green manures and green leaf manures: Daincha, Sunnhemp, Tephrosia, Glyricidia, Neem and Pungam
26. Breeding for other sexually propagated horticultural crops-Bhendi, tomato
27. Breeding for other sexually propagated horticultural crops- chilli, Brinjal, Papaya
28. Breeding for other clonally propagated horticultural crops- Banana, Rose, Jasmine
29. Breeding for pest resistance - mechanisms of resistance
30. Breeding for disease resistance - mechanisms of resistance
31. Breeding for Abiotic stress – drought and cold. – mechanisms of resistance
32. Breeding for Abiotic stress – salinity and alkalinity - mechanisms of resistance
33. Breeding for quality produce.
34. Ideotype breeding, PPV &FR act, 2001- Plant breeders’ right, Farmers right, Biodiversity act, 2002; Germplasm registration.

Final theory examination

Practical schedule

Observation on floral biology – anthesis and pollination – selfing – crossing techniques – observation on wild species – maintenance of crossing ledger – pedigree record – in following crops.

1. Rice
2. Wheat and Maize.
3. Sorghum and Pearl millet. Finger millet, Little millet, Kodo millet, Barn yard millet, proso millet and Foxtail millet.
4. Redgram and Bengal gram
5. Green gram, Black gram and Cowpea; Soybean, Horse gram and Lab-lab.
6. Groundnut, Sesame and Sunflower.
7. Safflower, Niger, Mustard. Castor, Jatropha, Coconut and Oilpalm
8. Cotton, Jute and Mesta.
9. Sugarcane, sugar beet, potato, tapioca, coffee, tea, tobacco and betel vine.
10. Guinea grass, fodder Sorghum, fodder maize, fodder pearl millet, Pearl millet – Napier hybrids, *Cenchrus*.
11. Lucerne, fodder cowpea, *Desmanthus*, desmodium, stylo, siratro, subabul ; Green manures – daincha, sunnhemp.
12. Chillies, bhendi, brinjal , tomato, papaya Banana
13. Rose, Jasmine

14. Screening techniques for biotic stresses
15. Screening techniques for abiotic stresses.
16. Parental seed maintenance of hybrids, Field visit to hybrid seed production plots in Rice, Sorghum, Pearl millet, Maize, Cotton and Redgram.
- 17. Final Practical Examination**

Outcome

The concepts of genetics and plant breeding, methodologies employed for self, cross and vegetatively propagated crops and current trends in plant breeding will be exposed.

References

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- ❖ Phoelman, J.N. and Borthakur, 1969. Breeding Asian field crops Oxford & IBH Publishing Co., New Delhi.
- ❖ Harihar Ram and Hari Govind Singh, 1994. Crop breeding and Genetics. Kalyani Publishers, New Delhi.
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- ❖ N.Kumar.2006. Breeding of horticultural crops- Principles and Practices. New India Publishing Agency. New Delhi
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- ❖ H.H.Ram. 2011. Crop Breeding and Biotechnology. Kalyani Publishers (India)

Further reading

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- ❖ Daniel Sundararaj, D., G. Thulasidas, and M. Stephan Dorairaj. 1997. Introduction to Cytogenetics and Crop improvement. Popular Book Depot, Chennai - 15.
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- ❖ Singh, R.B., R.M. Singh and B.D. Singh, 1984. Advances in Cytogenetics and crop improvement. Kalyani Publishers, New Delhi.

Web resources

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- ❖ www.nbpgr.nic.in
- ❖ www.irri.org

❖ www.icrisat.org