SEMESTER VI (NEW)

H/FL 365	Breeding and seed production of ornamental crops	1+1=2
H/VS-364	Seed production in vegetable crops	2+1=3
H/VS -365	Protected cultivation of vegetable crops	1+1=2
H/PHT-362	Processing and value addition of Horticultural crops	1+1=2
H/BIOT-361	Fundamentals of Biotechnology	1+1=2
H/ENTO-364	Nematode of horticultural crops and their management	1+1=1
H/ENTO-365	Apiculture	0+1=1
EXTN-363	Entrepreneurship Development and Communication Skills	1+1=2
H/MIBO-362	Applied microbiology	0+1=1
	Total credits	8+9=17

Course No. : H/VS-365 **Credits :** 2(1+1)
Course title : Protected Cultivation of Vegetable Crops **Semester :** VI

Theory :

Importance and scope, current status, future prospects and problems of protected cultivation. Protected structures, designs and fabrication. Classification of green houses and factors affecting the construction of green house. Environment control in green house viz. Temperature, light, relative humidity (RH), CO_2 enrichment and ventilation or air circulation. Production system and media for protected cultivation. Drip irrigation and fertigation in protected vegetable cultivation. Production of green house Capsicum, Cucumber , Melons, Tomato, Cherry Tomato. Production of vegetables under net houses (Capsicum, Beans, Tomato, Coriander, Methi) and offseason cultivation of vegetables under plastic low tunnels. Disease management and pests management of vegetable crops under protected cultivation. Grading, packaging, transport technology of Vegetables. Constraints in green house vegetable cultivation.

Practical :

Study of types of greenhouses and materials required for construction of the greenhouse Shade house. Study of different types of medias used for planting. Environment control in greenhouse and net house. Practical aspects of production technology of Capsicum, Cucumber, Melons, Tomato, Cherry Tomato. Production of vegetables under net houses (Capsicum, Beans, Tomato, Coriander, Methi). Control of diseases of vegetables crops in greenhouse. Control of pests of Vegetables crops in greenhouse. Grading, packaging, transport technology of Vegetables. Visit to production unit and market of Vegetables.

Books recommended :

1. Proceedings of International seminar on protected cultivation in India held at Bangalore (1997)
2. Greenhouse Operations and management – Paul V. Nelson
3. Protected cultivation of vegetable crops, Balraj Singh, Kalyani Publishers, New Delhi

Lesson Plan - Theory

Lesson No.	Topic	Weightage
1	Importance and scope, current status, future prospects of protected cultivation	5
2	Protected structures, designs and fabrication. Classification of green houses and factors affecting the construction of green house.	10
3-4	Environment control in green house viz. Temperature, light, relative humidity (RH), CO_2 enrichment and ventilation or air circulation.	10

5	Production systems, media for protected cultivation.	10
6	Irrigation and fertigation in protected vegetable cultivation	5
7-10	Production of green house Capsicum, Cucumber, Musk melon, Tomato. Production of vegetables under net houses (Capsicum, Beans, Tomato, Coriander, Methi) and offseason cultivation of vegetables under plastic low tunnels	20
11-12	Disease management of vegetable crops under protected cultivation	10
13-14	Pests management of vegetable crops under protected cultivation	10
15	Grading, packaging, transport technology of Vegetables	10
16	Constraints in green house vegetable cultivation and Recommendations of JOINT AGRESCO for last five years	10

Lesson plan : Practical

Practical No.	Topic
1	Study of types of greenhouses and materials required for construction of the greenhouse and net house.
2	Study of different types of media and its preparation used for planting
3	Environment control in greenhouse and net house
4 - 12	Production technology of Capsicum, Cucumber, Melons, Tomato in green house. Production of vegetables under shade net house (Capsicum, Beans, Tomato, Coriander, Methi)
13	Diseases and pests of vegetables crops in greenhouse
14-15	Grading, packaging, transport technology of Vegetables
16	Visit to production unit and market of Vegetables

Course No. : H/ PHT – 362 **Credits :** 3(1+2)
Course title : Processing And Value Addition In Horticultural Crops **Semester :** VI

Theory :

Importance and scope of fruit and vegetable preservation industry in India, Post harvest losses. Principles and guide lines for processing unit. Principles and methods of preservation viz.,heat, pasteurization, canning and bottling. Preservation by sugar and chemicals. Fruit Beverages. Preparation and preservation of unfermented fruit beverages viz., juices, squash, syrup and cordial etc. Fermented beverages-nira , wine, Cidar. Preparation of jam jelly and marmalade. Preserve ,candied and crystallized fruits. Preservation with salt and vinegar. Preparation of chutneys and sauces/ ketchups. Mushroom processing. Processing of Plantation crops. Spoilage in Processed foods. Quality control of Processed products, Govt. policy on import and export of Processed fruits, food laws. Recommendations of JOINT AGRESCO of last five years.

Practical :

Identification of different equipments required for fruit preservation. Physico chemical analysis of fruits and vegetables. Canning of fruits- mango slices. Canning of vegetables- pea Preparation of fruit juice. Preparation of lemon squash. Preparation of fruit syrup. Preparation of lemon cordial. Preparation of papaya jam. Preparation of guava jelly. Preparation of santra marmalade. Preparation of candies. Preparation of preserves. Preparation of chutneys. Preparation of sauces. Preparation of pickles. Preparation of ready to serve (RTS) drinks. Drying and dehydration of fruits and vegetables. Freezing of fruits and vegetables. Cut out Analysis of processed products. Spoilage of processed products. Pre harvest and post harvest application of chemical substances. Pre cooling, grading and packaging of fruits and vegetables. Types of containers for processing of fruits and vegetables. Visit to commercial processing unit.

Books recommended :

1 R.P.Shrivastava and Sanjeeve Kumar .Fruit and vegetable preservation –principles and practices.
2 Giridhari Lal, Sidhappa and G.L.Tandon (1986) – Fruit and vegetable preservation ICAR, New Delhi.
3 FAO: Fruit and Vegetable processing , International book distributing Co.Lucknow-226 004.
4 Cruess, W.V. Commercial fruit and vegetable products. Mac. Graw- Hill Book Co. New York.
5 Pantastico ERB (1975) Post harvest physiology, handling of tropical & subtropical fruits and vegetables
6 Salunkhe D.K. and Desai B.B.(1984) Post harvest biotechnology of vegetables,Vol 1&2 (RC Press, Inc, Boca Raton, Florida)
7 Weichmann, J (1987) post harvest physiology of vegetables
8 Wills RBH. Post harvest- An introduction to the physiology & handling of fruits and vegetables
9 Ryall and W.T. Pentzer (1974) Handling, Transportation and storage of fruits and vegetable, Vol 1&2
10 Salunkhe D.K. and Bhat- Post harvest physiology, Biotechnology of flowers
11 Post harvest handling of fruits and vegetables by Bal and Sandhu.
12 Post harvest physiology of fruits by S.K.Mitra, CAB International pub. House

Lesson plan - Theory

Lecture No.	Topic	Weightage (%)
1 &2	Importance and scope of fruit and vegetable preservation industry in India, Post harvest losses	05
3	Principles and guide lines for processing unit.	05
4 & 5	Principles and methods of preservation viz.,heat, pasteurization, canning and bottling. Preservation by sugar and chemicals.	05
6 & 7	Fruit Beverages. Preparation and preservation of unfermented fruit beverages viz., juices, squash, syrup and cordial etc.	05
8	Fermented beverages-nira , wine, Cidar	05
9	Preparation of jam jelly and marmalade	05
10	Preserve ,candied and crystallized fruits	05
11	Preservation with salt and vinegar.	05
12	Preparation of chutneys and sauces/ ketchups.	10
13	Mushroom processing.	10
14	Processing of Plantation crops	10
15	Spoilage in Processed foods	10
16	Quality control of Processed products, Govt. policy on import and export of Processed fruits, food laws and Recommendations of JOINT AGRESCO of last five years	10

Lesson plan - Practical

Practical No.	Practical
1	Identification of different equipments required for fruit preservation.
2	Physico chemical analysis of fruits and vegetables
3	Canning of fruits- mango slices
4	Canning of vegetables- pea
5	Preparation of fruit juice
6	Preparation of lemon squash
7	Preparation of fruit syrup
8	Preparation of lemon cordial
9	Preparation of papaya jam
10	Preparation of guava jelly
11	Preparation of santra marmalade
12	Preparation of candies
13	Preparation of preserves
14	Preparation of chutneys
15	Preparation of sauces
16	Preparation of pickles
17	Preparation of ready to serve (RTS) drinks
18 & 19	Drying and dehydration of fruits and vegetables
20 & 21	Freezing of fruits and vegetables
22&23	Cut out Analysis of processed products
24&25	Spoilage of processed products
26&27	Pre harvest and post harvest application of chemical substances
28&29	Pre cooling, grading and packaging of fruits and vegetables.
30&31	Types of containers for processing of fruits and vegetables.
32	Visit to commercial processing unit

Course No. : H/BIOT-361 **Credits :** 2(1+1)
Course title : Fundamentals of Biotechnology **Semester :** VI

Theory :

History, scope and importance of biotechnology, organogenesis and effect of plant growth regulators, somatic embryogenesis and artificial seeds, callus culture and single cell culture, suspension culture and secondary metabolites, micropropagation, meristem culture and production of disease free plants, anther and pollen culture, embryo culture and embryo rescue technique, somaclonal variation, protoplast isolation and protoplast culture and protoplast fusion, somatic hybridization and cybridization, methods of plant transformation, transgenic plants and their application, molecular markers and their application, cryopreservation.

Practical :

General instructions and laboratory methods, Plant tissue culture laboratory organization, Plant tissue culture laboratory equipments and their uses, Dry Heat and Wet Heat Sterilization methods, Chemical sterilization, Filtration and UV irradiation, Preparation of solutions, Preparation of tissue culture media and their composition, Establishment and maintenance of callus cultures from different explants, sub culture of callus, Production of embryogenic callus, Indirect Organogenesis: Production of shoots and roots from callus, Acclimatization and Hardening, Micropropagation with shoot apex culture in different plants (Banana / Sugarcane), Meristem culture, Virus indexing by ELISA, Anther and pollen culture, Embryo and endosperm culture

Books Recommended :

- Hand Book of Plant Tissue Culture Compiled by A.F. Mascarenhas Published by - Publications and Information Division ICAR, Krishi Anusandhan Bhavan, New Delhi-110012.
- Bhojwani S.S.and Razdan M.K. (1983), Plant tissue culture theory and practice, Elsevier science publishers.
- Hand Book of Plant Tissue Culture Compiled by A.F. Mascarenhas P.No.16 Published by - Publications and Information Division ICAR, Krishi Anusandhan Bhavan, New Delhi-110012.
- Dixon R.N. (1985), Plant cell culture: A practical approach R.L. Press Oxford, Washington.
- Gamborg D.L. and G.C. Phillips (1995) Plant cell tissue culture and organ culture, Narosa Publication House, New Delhi.
- Bhojwani S.S.and Razdan M.K. (1983), Plant tissue culture theory and practice, Elsevier science publishers.
- Experiments in plant Tissue culture IInd Edition. ; John H. Dodds L.W. Roberts. P.No.113 Cambridge University Press Cambridge. (1985)

Lesson plan - Theory

No.	Topic	Sub topics	Marks
1	History, scope and importance of biotechnology	Biotechnology definition, Scientists contribution and applications of biotechnology	6
2	Organogenesis and effect of plant growth regulators	Totipotency, dedifferentiation and re-differentiation, direct and indirect Organogenesis, caulogenesis, rhizogenesis, primordia,	6
3	Effect of plant growth regulators	Effect of plant growth regulators on shooting and rooting, Skoog and Miller hypothesis, auxin to cytokinin ratio	6
4	Callus culture	Callus culture, types of callus and applications of callus culture	7
5	Somatic embryogenesis and artificial seeds	Zygotic and non zygotic embryogenesis, artificial seeds, hydrogels, alginate method, applications and limitation.	7
6	Suspension culture and secondary metabolites	Suspension culture, growth curve, open and closed culture, chemostat, turbidostat, callus culture Vs Suspension culture, secondary metabolites, importance and examples	6
7	Micropropagation	Micropropagation, stages; shooting, rooting; acclimatization and hardening, applications, advantages and disadvantages	6
8	Meristem culture and production of disease free plants	Meristem culture, methods for producing virus free plants, thermotherapy, chemotherapy, micrografting, virus indexing,	6
9	Anther and pollen culture	Anther and pollen culture, production of haploids, technique, advantages and limitations, applications	6
10	Embryo culture and embryo rescue technique	Embryo culture, mature and immature, embryo rescue technique and its applications	6
11	Somaclonal variation	Schemes for obtaining somaclonal variation, factors affecting somaclonal variation, Applications, somaclonal Vs gametoclonal variation	6
12	Protoplast isolation and protoplast culture	Protoplast, protoplast isolation methods-mechanical and enzymatic, viability of protoplast, regeneration of protoplast and culture of protoplasts-liquid culture, liquid droplet, hanging drop, feeder layer, co culturing	6

13	Protoplast fusion, , somatic hybridization and cybridization	Somatic hybridization and Methods of protoplast fusion-Spontaneous, induced, fusogen, sodium nitrate, calcium with high pH, PEG, Electrofusion method, mechanism of fusion, cybridization approaches to achieve cybridization iodoacetate, , gamma or X-rays, enucleation, applications of cybridization, selection, verification and characterization of somatic hybrids.	6
14	Methods of plant transformation, transgenic plants and their application	Transgene, Basic steps of transformation, direct method -agrobacterium and virus mediated, indirect method -electroporation, gene gun, microinjection, silicon carbide, chemical methods	7
15	Molecular markers and their application	Only basics-Definition, different molecular markers-Non PCR and PCR based-RAPD, RFLP,AFLP,STS, Microsatellite, STM,SCAR, Application of molecular markers	7
16	Cryopreservation	Ultra low temperature, cryoprotectans, freezing, storage, thawing, determination of viability	6

Lesson Plan - Practical

Ex. No.	Title
1	General instructions and laboratory methods
2	Plant tissue culture laboratory organization
3	Plant tissue culture laboratory equipments and their uses
4	Dry Heat and Wet Heat Sterilization methods
5	Chemical sterilization, Filtration and UV irradiation
6	Preparation of solutions
7	Preparation of tissue culture media and their composition
8	Establishment and maintenance of callus cultures from different explants, sub culture of callus
9	Production of embryogenic callus
10	Indirect Organogenesis: Production of shoots and roots from callus
11	Acclimatization and Hardening
12	Micropropagation with shoot apex culture in different plants (Banana / Sugarcane)
13	Meristem culture
14	Virus indexing by ELISA
15	Anther and pollen culture
16	Embryo and endosperm culture

12	Vegetable crops: Tomato, Brinjal, Okra, Chilli and Cucurbits etc.	10
13	Tuber and bulb crops: Potato, Sweet potato, Carrot, Radish, and Onion.	5
14	Ornamental crops: Chrysanthemum, Rose, Tuberose, Gladiolus, Carnation and Gerbera.	5
15	Spices: Turmeric, Ginger, Cardamom and Clove.	5
16.	Plantation crops: Banana, Arecanut and Coconut.	5

Lesson plan – Practical

Practical No	Topic
1-2	Methods of sampling.
3-5	Extraction of nematodes from soil and plant parts.
6-7	Counting and estimation of plant parasitic nematodes.
8-10	Nematode killing , fixing and preparation of temporary and permanent mounts.
11-12	Nematicides and their use.
13-16	Collection and preservation of 20 plant species/parts damaged by plant parasitic nematodes.

1. Write procedure of nematode extraction (any one) 10
2. Identification--------
   (damaged parts, collection, material (use) mounting material (use) extraction material (use) charts or photographs of nematodes or morphological parts, nemeticides (do) charts of the females of major
3. Viva
4. Gera – (Meloidogyne, Rolyleuchulus, Heterodera, xiptrineuna.
   Tylenchulus Radopholus)

Course No. : H/ ENTO-365 Credits : 1(0+1)

Course title : Apiculture Semester : VI

Lesson plan – Practical

Lecture No.	Topic
1	Importance and history of apiculture.
2	Studies on different species of bees, morphology and anatomy .
3	Studies on colony organization and life cycle.
4	Bee keeping equipments and social behaviour of bees.
5	Reproduction in bees and queen rearing.
6	Bee pasturage and seasonal management.
7	Economics of bee keeping.
8	Bee enemies and diseases of bees.
9	Role of bees in increasing the productivity of horticultural crops in India- Economy.
10	Bee products and their uses.
11	Recent trends in apiculture.
12	Acquaintance with honey bee species, morphology and structural adaptations.
13	Acquaintance with biology-castes-bee keeping equipments. Bee forage plants.
14&15	Collection and preservation of bee flora, enemies and diseases of bees.
16	Handling of bee colonies and manipulation of honey production.

Course No. : H/EXTN-363 Credits : 2(1+1)
Course title : Entrepreneurship Development and Communication Skills Semester : VI

THEORY:

- Entrepreneur : Meaning, definition, characteristics and role, demands of entrepreneur, identifying potential entrepreneurs.
- Entrepreneurship development - Concept of entrepreneurship, process of entrepreneurship development, motivation and entrepreneurship development, importance of planning, monitoring and follow-up, managing competition, entrepreneurship development programmes.
- Characteristics of Indian Horticultural Processing and Export Industry.
- SWOT analysis, Generation, incubation and commercialization of ideas and innovations.
- Entrepreneurial behavior - Concept, dimensions, factors affecting entrepreneurial behaviour.
- Government schemes and incentives for promotion of entrepreneurship. Government policy on Small and Medium Enterprises (SMEs)/ SSIs.
- Market survey, formulation of project, financial analysis of project.

Communication skills :

- Communication - Meaning and process of communication
- Advertisements - Meaning, types, forms, functions
- Writing Skill : Business letter, Letters of inquiry, quotation orders and tenders, complaints letters

PRACTICAL:

- Conducting market survey to know the demands for different products.
- Preparing advertisements for popularization of products and news writing.
- Preparing project proposals.
- Individual and group presentation, features of oral presentation.
- Evaluation of presentation : evaluation sheet, other strategies to be considered for evaluating a presentation.
- Dyadic communication - Face to face conversation, telephonic conversation, rate of speech, clarity of voice, speaking and listening politeness, telephone etiquettes.
- Meetings - Purpose, procedure, participation, chairmanship, physical arrangements, recording and writing of minutes of meeting.
- Seminar and conferences, regulating speech, physical appearance, body language, posture, eye contact.
- Conducting of mock interviews - testing initiative, team spirit & leadership, group discussion and debates on current topics.

Suggested Readings :

Akhouri, M. M. P., Mishra, S. P. & Sengupta, Rita (1989). Trainers Manual on Developing Entrepreneurial Motivation NIESBUD, New Delhi.

Betty, Gordan, B. (1979).Entrepreneurship, Palying to Win, Taraporewala Bombay. Entrepreneurship Development Institute of India (1987). Developing new Entrepreneurs EDII, Ahmedabad NISIET, Library : 338.93/EDI/87/25104.

Mancuso, Joseph (1974). The Entrepreneurs Handbook Vol. I & II, Artech House Inc. USA.

Patel, V. G. (1987). Entrepreneurship Development Programme in India and its relevant to Developing Countries, Entrepreneurship Development Institute of India, Ahmedabad NISIET, Library: 338.93 (540)/PAT/87/25103.

Sigh, A. K., Lakhan Singh, R. Roy Burman (2006). Dimensions of Agricultural Extension, Aman Publishing House, Meerut.

Lesson Plan

Lecture No.	Course Content	Weightage
1,2,3	• Entrepreneur : Meaning, definition, characteristics and role demands of entrepreneur, identifying potential entrepreneurs	12.5
4,5,6	• Entrepreneurship development - Concept of entrepreneurship, process of entrepreneurship development, motivation and entrepreneurship development, importance of planning, monitoring and follow-up, managing competition, entrepreneurship development programmes	12.5
7,8	• Characteristics of Indian Horticultural Processing and Export Industry.	7.5
9,10	• SWOT analysis, Generation, incubation and commercialization of ideas and innovations	12.5
11,12	• Entrepreneurial behaviour - Concept, dimensions, factors affecting entrepreneurial behaviour.	10.0
13,14	• Government schemes and incentives for promotion of entrepreneurship. Government policy on Small and Medium Enterprises (SMEs)/ SSIs.	12.5
15	• Market survey, formulation of project, financial analysis of project.	7.5
16,17	Communication skills : • Communication - Meaning and process of communication • Advertisements - Meaning, types, forms, functions	12.5
18	• Writing Skill : Business letter, Letters of inquiry, quotation orders and tenders, complaints letters	12.5

Course No. : H/EXTN-363 Credits : 2(1+1)
Course title : Entrepreneurship Development and Communication Skills Semester : VI

THEORY:

- Entrepreneur : Meaning, definition, characteristics and role, demands of entrepreneur, identifying potential entrepreneurs.
- Entrepreneurship development - Concept of entrepreneurship, process of entrepreneurship development, motivation and entrepreneurship development, importance of planning, monitoring and follow-up, managing competition, entrepreneurship development programmes.
- Characteristics of Indian Horticultural Processing and Export Industry.
- SWOT analysis, Generation, incubation and commercialization of ideas and innovations.
- Entrepreneurial behavior - Concept, dimensions, factors affecting entrepreneurial behaviour.
- Government schemes and incentives for promotion of entrepreneurship. Government policy on Small and Medium Enterprises (SMEs)/ SSIs.
- Market survey, formulation of project, financial analysis of project.

Communication skills :

- Communication - Meaning and process of communication
- Advertisements - Meaning, types, forms, functions
- Writing Skill : Business letter, Letters of inquiry, quotation orders and tenders, complaints letters

PRACTICAL:

- Conducting market survey to know the demands for different products.
- Preparing advertisements for popularization of products and news writing.
- Preparing project proposals.
- Individual and group presentation, features of oral presentation.
- Evaluation of presentation : evaluation sheet, other strategies to be considered for evaluating a presentation.
- Dyadic communication - Face to face conversation, telephonic conversation, rate of speech, clarity of voice, speaking and listening politeness, telephone etiquettes.
- Meetings - Purpose, procedure, participation, chairmanship, physical arrangements, recording and writing of minutes of meeting.
- Seminar and conferences, regulating speech, physical appearance, body language, posture, eye contact.
- Conducting of mock interviews - testing initiative, team spirit & leadership, group discussion and debates on current topics.

Suggested Readings :

Akhouri, M. M. P., Mishra, S. P. & Sengupta, Rita (1989). Trainers Manual on Developing Entrepreneurial Motivation NIESBUD, New Delhi.

Course No. : MIBO-362 **Credits : 0+1=1**
Title : Applied Microbiology **Semester : VI**

Practical :

Different biochemical tests for identification of bacterial culture; Enumeration of bacteria : I - Enumeration of bacteria by Stain method. II – Enumeration of bacteria by Most probable number method. III- Enumeration of bacteria by Pour plate method and Spread plate method. Estimation of microbial population of soil. Isolation, identification and maintenance of beneficial soil microorganisms viz., *Azotobacter, Azospirillum, Acetobacter, Rhizobium,* blue green algae, *phosphate* solubilizing bacteria, and cellulose decomposing microbes. Production and application technology of various biofertilizers viz., *Azotobacter, Azospirillum, Acetobacter, Rhizobium,* blue green algae and phosphate solubilizing biofertilizers. Preparation of compost using composting biofertilizers. Production and application technology of *Trichoderma.* Assessment of water quality. Estimation of microbial quality of fruit juices and vegetables.

Exercise schedule (Practical)

Exercise No.	Practical to be covered
1-2	Different biochemical tests to identify bacteria.
3-8	Estimation of microbial population of soil. Isolation, identification and maintenance of beneficial soil microorganisms viz., *Azotobacter, Azospirillum, Acetobacter, Rhizobium,* blue green algae, *phosphate* solubilizing bacteria, and cellulose decomposing microbes.
9-13	Production and application technology of various biofertilizers viz. *Azotobacter, Azospirillum, Acetobacter, Rhizobium,* blue green algae and phosphate solubilizing biofertilizers
14	Preparation of compost using composting biofertilizers.
15	Production and application technology of *Trichoderma.*
16	Assessment of water quality.
17	Estimation of microbial population in fruit juices and vegetables.

Books/ manuals recommended :

1. Laboratory manual of Experimental Microbiology. 1995. R.M. Atlas. Mosby year book Ine. Missouri.
2. Experiment in Microbiology, Plant Pathology and Tissues culture, 1993. K. R. Aneja, Wishwa Prakashan, New Delhi.
3. Microbes in Action. 1995 H.W. Seeley, W.H. Freeman & Co., New York.
4. Microbiology-A Laboratory Manual. 2004. J. G. Cappuccino and N. Sherman. Pearson Education, Patparganj, Delhi.

Course No. :	**H/FL-365**	**Credits :**	**2(1+1)**
Course Title :	**Breeding and Seed Production of Ornamental Crops**	**Semester :**	**VI**

Theory :

History of improvements of ornamental plants, objectives and techniques in ornamental plant breeding. Introduction, selection, hybridization, mutation and biotechnological technique for improvement of ornamental plants. Breeding for disease resistance. Development of promising cultivars of important ornamentals. Role of heterosis and its exploitation, production of FI hybrids and utilization of male sterility, production of open pollinated seed. Harvesting processing and storage of seeds, seed certification.

Practical:

Study of floral biology and pollination in important species and cultivars. Techniques of inducing polyploidy and mutation. Production of pure and hybrid seeds. Harvesting, conditioning and testing of seeds. Practice in seed production methods

Books recommended:

1. Salunke D.K. and B.C. Patil (1987) vegetable and flower seed production.
2. Nema N.P. Principles of seed certification and testing
3. Allard, R.W. (1960). Plant Principles of Plant breeding. Hona Wiley and Sons, New York.
4. Chudhary, R.C. (1984). Introduction to plant breeding Oxford & IBH publishing Co., New Delhi.
5. Singh, B.D. (1987). Plant breeding. Oxford & IBH Pub. Co., New Delhi.
6. Pochlaman, J.M and D. Borthaku (1990) breeding Asian field crops, Oxford and IBH Publ. Co., New Delhi.
7. Choudhary H.K. (1979). Elementary principles of plant breeding. Oxford & IBH Publ. Co., New Delhi.

Lesson Plan - Theory

Periods	Lesson	Weightage of marks
1	History, Scope and important of ornamental of plant breeding	10
2-3	Objectives and techniques in ornamental plant breeding	10
4-9	Introduction, selection, hybridization, mutation and classification of ornamental plant breeding of following crops. Rose, Chrysanthemum, Aster Gladiolus Gerbera, Marigold Gaillardia and carnation.	20
10	Breeding for disease resistance	10
11	Role of heterosis and its exploitation,	10

12	Production of FI hybrids and utilization of male sterility	10
13	Production of open pollinated seed	10
14	Harvesting, processing and storage of seeds	10
15	Seed certification and biotechnological technique improvement of ornamental plants	5
16	Recommendations of Joint Agresco last five years	5

Lesson Plan - Practical

Practical No.	Topic
1-3	Study of floral biology and pollination in important species and cultivars.
4-6	Techniques of inducing polyploidy and mutation.
7-9	Production of pure and hybrid seeds
10-12	Harvesting, conditioning and testing of seeds.
13-16	Practice in seed production methods

Course No. :	**H/VS-364**	**Credits :**	**3(2+1)**
Course title :	**Seed Production in vegetable Crops**	**Semester :**	**VI**

Theory :

History of seed industry in India. Definition of seed.. Importance and scope of vegetable seed production in India. Principles of vegetable seed production. Role of temperature, humidity and light in vegetable seed production. Isolation distances in vegetables and agencies of pollination. Methods of seed production of cole crops, root vegetables, solanaceous vegetables, cucurbits, leafy vegetables, bulb crops, leguminous vegetables, okra. Seed testing and purity analysis. Field and seed standards. Seed processing, drying and extraction. Seed act.

Practical :

Study of seed structure, colour size, shape and texture. Field inspection of seed crops. Practices in rouging. Harvesting and seed extraction. Germination and purity analysis. Methods of seed production in cole crops, root vegetables, bulb crops, solanaceous vegetables, cucurbits, leafy vegetables, leguminous vegetables. Seed processing machines. Visit to seed testing laboratory.

Books recommended :

1. Singh, N, Singh, D.K.(2006) :Vegetable seed production technology, IBDC,Lukcnow.
2. Arya Premsingh (2006) : Vegetable seed production principles, Kalyani Publishing, New Delhi.
3. Singh, S.P. (2006) : Seed production of commercial vegetables Agro-tech publishing Academy, Udaipur.
4. Agarwal, R. L. (1980) Seed technology, Oxford and IBH, New Delhi.
5. Nema, N. P. Principles of seed certification and testing
6. Agarwal, P. K. and N. Dadlani (1987). Techniques in seed science and technology. South Asian Publisher, New Delhi.
7. Salunkhe, D. K. and B. C. Patil (1987) Vegetable and flower seed production.
8. Narringlon, J. F. Storage and packaging N. C. C., New Delhi.
9. Padda B. S. and Jarnail Singh. Seed Production of vegetable crops.
10. More T.A., P.B.Kale and B.W.Khule, Vegetable seed production , MSSC, Akola

Lesson plan - Theory

Lecture No.	Topic	Weightage (%)
1	Introduction and history of seed industry in India	5
2	Definition of seed. Differences between grain and seed.	5
3- 4	Importance and scope of vegetable seed production in India.	10
5	Principles of vegetable seed production.	5

6	Role of temperature, humidity and light in vegetable seed production	5
7	Isolation distance in vegetable and agencies of pollination	5
8 - 9	Methods of seed production of Cole crops (Cabbage, Cauliflower, Broccoli)	5
10-11	Methods of seed production of Root vegetables (Radish, Carrot)	5
12-15	Methods of seed production of Solanaceous vegetables (Tomato, Brinjal, Chilli)	5
16-19	Methods of seed production of Cucurbits (Cucumber, Bitter gourd, Bottle gourd, Ridge gourd, Sponge gourd, Watermelon, Muskmelon)	5
20	Methods of seed production of Leafy vegetables (Palak, Methi, Coriander, Amaranthus)	5
21-22	Methods of seed production of Bulb crops (Onion, Garlic)	5
23-26	Methods of seed production of Leguminous vegetables (Peas, Cow pea, Cluster bean, French bean, Dolichos bean)	5
27,28,29	Seed extraction, drying, processing and purity analysis	5
30	Field and seed standards	10
31	Seed legislation	5
32	Recommendations of JOINT AGRESCO for last five years	5

Lesson plan - Practical

Practical No.	Topics
1-2	Study of seed structure, colour, size, shape and texture
3	Field inspection of seed production plot
4	Practices in rouging.
5	Harvesting and seed extraction.
6	Germination and purity analysis.
7	Methods of seed production in Cole crops
8	Methods of seed production in Root vegetables
9	Methods of seed production in Bulb crops
10	Methods of seed production in Solanaceous vegetables
11	Methods of seed production in Cucurbits
12	Methods of seed production in Leafy vegetables
13	Methods of seed production in Leguminous vegetables
14-16	Visit to seed production, processing units and seed testing laboratory