

आईएफटीएम विश्वविद्यालय, मुरादाबाद, उत्तर प्रदेश
IFTM University, Moradabad, Uttar Pradesh
NAAC ACCREDITED

SCHOOL OF AGRICULTURAL SCIENCES & ENGINEERING
DEPARTMENT OF AGRICULTURAL SCIENCES

MASTER OF SCIENCE AG. HORTICULTURE
(VEGETABLE SCIENCE)

[w.e.f. ACADEMIC SESSION 2021 – 22]

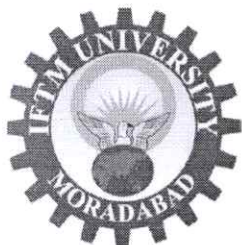
IFTM UNIVERSITY

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CBCS Based Course Structure and Syllabi


of

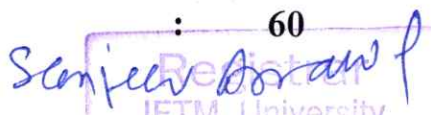
Master of Science Ag. Horticulture (Vegetable Science)

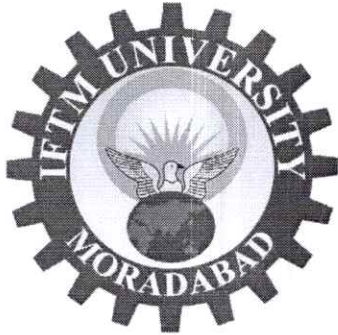
[w.e.f. Academic Session 2021 – 22]

Summary

Programme	:	Master of Science Ag. Horticulture (Vegetable Science)
Programme Level	:	Degree (Post Graduation)
Duration	:	Two Years (Four semesters) Full time
Medium of Instruction	:	English
Minimum Required Attendance	:	75%
Maximum Credits	:	60


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Programme: M.Sc. Ag. Horticulture (Vegetable Science)

Programme Outcomes (POs):

Students completing this course will be able to:

1. Research based subjects such as scientific writing and ethics help students to build research aptitude for local, national, international and global needs.
2. The curriculum of this course lays strong emphasis on in-depth knowledge of theoretical and practical aspects for managing emerging issues in vegetable production by highlighting the usage of in protected cultivation and good agriculture practices in commercial vegetable crops for local and national levels.
3. Seminar based course develop presentation and technical skills in students for national and international platforms.
4. A candidate who possesses a M.Sc. Ag. degree in Horticulture with specialization in Vegetable Science can be benefitted with an enormous number of job profiles under public and private organizations at local, national and international levels.
5. A growing export industry, increasing product demands and advances in horticultural technology is making this an extremely lucrative career for local, national and international prospects.
6. Students can work in a wide range of areas in post harvest industries, agribusiness, crop management, high quality vegetable production units etc at local and national levels.
7. Students can also render their services as a scientist in the field of vegetable sciences at national and international levels.
8. The training institutes welcome such candidates for the posts of training organizers at nationally and internationally.


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9. Students can go for higher degree programs for further research work at national and international.
10. Jobs are being created in sectors, both private and public, in fields such as research and journalism and also within and outside the borders
11. Students may develop as an entrepreneur by producing and processing of vegetables at local and national needs.

Program Specific Outcomes:

After completion of this course Students would be able to

PSO-1: Be equipped with theoretical knowledge, research capability (dissertation work), communication and management skills which, in turn, allow the students to become efficient researchers to start their career in research through Ph.D. & other R & D programmes.

PSO-2: Understand the modern tools and techniques of production of vegetable crops. An education in Olericulture helps the students to understand the basic of practical knowledge of vegetable crop production, improvement and post harvest management.

PSO-3: Be familiar about the principles and practices of crop improvement through different conventional and modern breeding techniques.

PSO-4: Have a firm understanding in the principles and application of the post harvest management of vegetables through processing and value addition.

PSO-5: Have a firm understanding of the basics of the seed production techniques of vegetable crops.


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M. Sc. Ag. Horticulture (Vegetable Science) Effective from Session 2021-22

M.Sc. Ag. Horticulture (Vegetable Science)			
Basic Structure: Distribution of Courses			
S. No.	Type of Course	No. of Courses	Credits
1	Major Course	06	20
2	Minor Course	02	08
3	Supporting Course	01	04
4	Elective Course	02	06
5	Research and Seminar		22

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M. Sc. Ag. Horticulture (Vegetable Science)

Major Courses			
Theory			
1.	MAHV 101	Production Technology of Cool Season Vegetable Crops	3
2.	MAHV 103	Organic Vegetable Production Technology	3
3.	MAHV 104	Protected Cultivation of Vegetable Crops	3
4.	MAHV 201	Production Technology of Warm Season Vegetable Crops	3
5.	MAHV 302	Seed Production Technology of Vegetable Crops	3
6.	MAHV 202	Fundamentals of Processing of Vegetables	3
Practical's			
1.	MAHV 151	Production Technology of Cool Season Vegetable Crops Lab	1
2.	MAHV 251	Production Technology of Warm Season Vegetable Crops Lab	1
Minor Courses			
1.	MAHV 102	Growth and Development of Vegetable Crops	3
2.	MAHV 301	Breeding of Vegetable Crops	3
Practical's			
1.	MAHV 152	Growth and Development of Vegetable Crops Lab	1
2.	MAHV 351	Breeding of Vegetable Crops Lab	1
Supporting Courses			
1.	MMAG 204	Agricultural Statistics and Experimental Designs	3
Practical's			
1.	MMAG 254	Agricultural Statistics and Experimental Designs Lab	1
Elective Courses			
1.	MAHV 203	Elective I	3
2.	MAHV 303	Elective II	3
Research & Seminar			
1	MAHV352	Seminar	1
2	MAHV354	Pre- Dissertation	1
3	MAH 451	Dissertation Work	20

Elective I

S.N.	CODE	Name of Elective
1.	MAHV 203 I	Diseases of Vegetable Crops and Management
2.	MAHV 203 II	Abiotic Stress Management in Vegetable Crops
3.	MAHV203III	Breeding of Self Pollinated Vegetable Crops
4.	MAHV203IV	Hi-Tech Horticulture
5.	MAHV203V	Processing of vegetables
6.	MAHV203VI	Production of Spice Crops
7.	MAHV203VII	True Potato Seed (TPS) Production

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Elective II

S.N.	CODE	Name of Elective
1.	MAHV 303 I	Production Technology of Under Exploited Vegetable Crops
2.	MAHV 303 II	Systematics of Vegetable Crops
3.	MAHV-303 III	Breeding of Cross Pollinated Vegetable Crops
4.	MAHV-303 IV	Seed Production Techniques for Crucifers
5.	MAHV-303V	Post-Harvest Management of Vegetable Crops
6.	MAHV303VI	Biotechnological Approaches in Vegetable Crops
7.	MAHV303VII	Urban Horticulture


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School of Agricultural Sciences & Engineering
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STUDY & EVALUATION SCHEME
M. Sc. Ag. Horticulture (Vegetable Science)

YEAR - I, SEMESTER - I

S.N.	Course Code	Course Name	Periods			EVALUATION SCHEME				Course Total	Credits
			L	T	P	Mid Term Exam		External Exam			
						AS	Total				
Theory											
1.	MAHV 101	Production Technology of Cool Season Vegetable Crops	3	0	0	20	10	30	70	100	3
2.	MAHV 102	Growth and Development of Vegetable Crops	3	0	0	20	10	30	70	100	3
3.	MAHV 103	Organic Vegetable Production Technology	3	0	0	20	10	30	70	100	3
4.	MAHV 104	Protected Cultivation of Vegetable Crops	3	0	0	20	10	30	70	100	3
Practical's / Project											
5.	MAHV 151	Production Technology of Cool Season Vegetable Crops Lab	0	0	2	20	10	30	70	100	1
6.	MAHV 152	Growth and Development of Vegetable Crops Lab	0	0	2	20	10	30	70	100	1
Total			12	0	4	-	-	-	-	600	14

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STUDY & EVALUATION SCHEME
M. Sc. Ag. Horticulture (Vegetable Science)

YEAR – I, SEMESTER – II

S.N.	Course Code	Course Name	Periods			Evaluation Scheme			Course Total	Credits	
			L	T	P	Mid Term Exam		External Exam			
						CT	AS +AT				Total
Theory											
1.	MAHV 201	Production Technology of Warm Season Vegetable Crops	3	0	0	20	10	30	70	100	3
2.	MAHV 202	Fundamentals of Processing of Vegetables	3	0	0	20	10	30	70	100	3
3.	MAHV 203	Elective I	3	0	0	20	10	30	70	100	3
4.	MMAG 204	Agricultural Statistics and Experimental Designs	3	0	0	20	10	30	70	100	3
Practical's / Project											
5.	MAHV 251	Production Technology of Warm Season Vegetable Crops Lab	0	0	2	20	10	30	70	100	1
6.	MMAG 254	Agricultural Statistics and Experimental Designs Lab	0	0	2	20	10	30	70	100	1
Total			12	0	4	-	-	-	-	600	14

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STUDY & EVALUATION SCHEME
M. Sc. Ag. Horticulture (Vegetable Science)

YEAR – II, SEMESTER – III

S.N.	Course Code	Course Name	Periods			Evaluation Scheme				Course Total	Credits
			L	T	P	Mid Term Exam		External Exam			
						CT	AS +AT		Total		
Theory											
1.	MAHV 301	Breeding of Vegetable Crops	3	0	0	20	10	30	70	100	3
2.	MAHV 302	Seed Production Technology of Vegetable Crops	3	0	0	20	10	30	70	100	3
3.	MAHV 303	Elective II	3	0	0	20	10	30	70	100	3
Practical's / Project											
4.	MAHV 351	Breeding of Vegetable Crops Lab	0	0	2	20	10	30	70	100	1
5.	MAHV352	Seminar	0	0	2	-	-	100	-	100	1
6.	MAHV354	Pre- Dissertation	0	0	2	-	-	30	70	100	1
Total			9	0	6	-	-	-	-	600	12

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STUDY & EVALUATION SCHEME

M. Sc. Ag. Horticulture (Vegetable Science)

YEAR - II, SEMESTER - IV

S.N.	Course Code	Course Name	Periods			Evaluation Scheme				Course Total	Credits	
			L	T	P	Mid Term Exam		External Exam				
						CT	AS +AT		Total			
Theory												
-	-	-	-	-	-	-	-	-	-	-	-	-
Practical's / Project												
1.	MAH 451	Dissertation Work	0	0	40	-	-	-	300	300	600	20
Total			-	-	40	-	-	-	-	-	600	20

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 STUDY & EVALUATION SCHEME

M. Sc. Ag. Horticulture (Vegetable Science)

List of Electives

Group - A

Elective I

S.N.	CODE	Name of Elective
1.	MAHV 203 I	Diseases of Vegetable Crops and Management
2.	MAHV 203 II	Abiotic Stress Management in Vegetable Crops
3.	MAHV203III	Breeding of Self Pollinated Vegetable Crops
4.	MAHV203IV	Hi-Tech Horticulture
5.	MAHV203V	Processing of vegetables
6.	MAHV203VI	Production of Spice Crops
7.	MAHV203VII	True Potato Seed (TPS) Production

Group - B

Elective II

S.N.	CODE	Name of Elective
1.	MAHV 303 I	Production Technology of Under Exploited Vegetable Crops
2.	MAHV 303 II	Systematics of Vegetable Crops
3.	MAHV-303 III	Breeding of Cross Pollinated Vegetable Crops
4.	MAHV-303 IV	Seed Production Techniques for Crucifers
5.	MAHV-303V	Post-Harvest Management of Vegetable Crops
6.	MAHV303VI	Biotechnological Approaches in Vegetable Crops
7.	MAHV303VII	Urban Horticulture

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MAHV-101 Production Technology of Cool Season Vegetable Crops L:T:P 3:0:0

Objective: To impart comprehensive knowledge of the scientific production technology of vegetables grown in cool season **for skill development and entrepreneurship.**

Introduction, botany and taxonomy, climatic and soil requirements, commercial varieties/hybrids, sowing/planting times and methods, seed rate and seed treatment, nutritional and irrigation requirements, intercultural operations, weed control, mulching, physiological disorders, harvesting, post-harvest management, plant protection measures and seed production of:

UNIT I

Potato **for better skilling of entrepreneurship.**

UNIT II

Cole crops: cabbage, cauliflower, knoll kohl, sprouting broccoli, Brussels.Sprout **for skill development and entrepreneurship.**

UNIT III

Root crops: carrot, radish, turnip and beetroot **for Entrepreneurship.**

UNIT IV

Bulb crops: onion and garlic **for skill development and Entrepreneurship.**

UNIT V

Peas and broad bean, green leafy cool season vegetables **for Entrepreneurship.**

Course outcomes:

After completion of this course students would be able to

CO1: To understand the taxonomical classification of different cool season vegetable crops **for skill development and employability.**

CO2: Understand the cultivation practices of different cool season vegetables for commercial production **for skill development and Entrepreneurship.**

CO3: Know the general information regarding plant protection and post-harvest management of commercial vegetable crops of cool season **for employability and Entrepreneurship.**

PO-CO Mapping (Please write 3,2,1 wherever required)

me
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Note: 3= Highly correlated, 2= Moderately correlated, 1= Less correlated

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	1	2	2	1	2	1	2	2	1
CO2	1	1	2	1	2	2	1	2	1	1	2
CO3	2	2	1	2	1	1	2	2	2	2	1

CO-Curriculum Enrichment Mapping(Please write 3,2,1 wherever required)

Note: 3= Highly correlated, 2= Moderately correlated, 1= Less correlated


	Skill Development	Employability	Entrepreneurship Development
CO1	3	3	1
CO2	3	1	3
CO3	2	3	3


References:

1. Bose TK & Som MG. (Eds.). 1986. *Vegetable Crops in India*. NayaProkash.
2. Bose TK, Som G & Kabir J. (Eds.). 2002. *Vegetable Crops*. NayaProkash.
3. Bose TK, Som MG & Kabir J. (Eds.). 1993. *Vegetable Crops*. NayaProkash.
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5. Chadha KL & Kallou G. (Eds.). 1993-94. *Advances in Horticulture* Vols.V-X. MalhotraPubl. House.
6. Chadha KL. (Ed.). 2002. *Hand Book of Horticulture*. ICAR.
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MAHVV 151 Production Technology of Cool Season Vegetable Crops Lab L:T:P 0:0:1

List of Experiments:

1. Study of cultural operations (fertilizer application, sowing, mulching, irrigation, weed control) of winter vegetable crops and their economics.
2. Conduction of experiments to demonstrate the role of mineral elements.
3. Study the effect of plant growth substances on cool season vegetables crops
4. Study the herbicides use in cool season vegetable crops
5. Identification and study of different physiological disorders in vegetable crops
6. Preparation of cropping scheme for commercial vegetable farms
7. A visit to commercial greenhouse/ polyhouse.


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MAHV 102 Growth and Development of Vegetable Crops L:T:P3:0:0

Objective: Concepts dealing with the physiological response of crop plants to the environment from the time of seed germination through to reproduction **for skill development and Entrepreneurship.**

UNIT I

Cellular structures and their functions; definition of growth and development, growth analysis and its importance in vegetable production **for skill development.**

UNIT II

Physiology of dormancy and germination of vegetable seeds, tubers and bulbs; Role of auxins, gibberellins, cytokinins and abscisic acid; Application of synthetic hormones, plant growth retardants and inhibitors for various purposes in vegetable crops; Role and mode of action of morphactins, antitranspirants, anti-auxin, ripening retardant and plant stimulants in vegetable crop production **for better skilling of employability and Entrepreneurship.**

UNIT III

Role of light, temperature and photoperiod on growth, development of underground parts, flowering and sex expression in vegetable crops; apical dominance **for better skilling of employability.**

UNIT IV

Physiology of fruit set, fruit development, fruit growth, flower and fruit drop; parthenocarpy in vegetable crops; phototropism, ethylene inhibitors, senescence and abscission; fruit ripening and physiological changes associated with ripening **for better skilling of employability and Entrepreneurship.**

UNIT V

Plant growth regulators in relation to vegetable production; morphogenesis and tissue culture techniques in vegetable crops **for Entrepreneurship development.**

Course outcomes:

On completion of the course students should be able to:

- CO1.** Distinguish key physiological processes underlying the formation of seedlings from seed embryos **for skill development.**
- CO2.** Identify the physiological factors that regulate growth and developmental processes of crop plants, and clearly define their roles **for skill development and Entrepreneurship.**
- CO3.** Evaluate the different strategies used by plants to acquire and utilize resources, and formulate a logical argument of their impact on crop productivity **for better skilling of employability and Entrepreneurship.**


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- CO4.** Recognize the significance of assimilate translocation and patterns of its partitioning in determining crop yield **for skill development and employability.**
- CO5.** Demonstrate clear understanding of crop-environment interaction and its implication on crop growth and yield **for skill development and Entrepreneurship.**
- CO6.** Relate crop physiological processes with agronomic practices used in crop production systems **for skill development.**
- CO7.** Integrate and apply their knowledge of crop physiology for analytical thinking and solving practical problems experienced in agricultural systems **for skill development and employability.**

PO-CO Mapping (Please write 3,2,1 wherever required)

Note: 3= Highly correlated, 2= Moderately correlated, 1= Less correlated

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	1	2	1	2	2	1	1	2	1
CO2	2	1	2	1	2	1	2	2	1	2	2
CO3	1	2	1	2	1	2	1	2	2	1	2
CO4	2	1	2	1	2	2	2	1	1	2	1
CO5	1	2	1	2	1	1	1	2	2	1	2
CO6	2	1	2	1	2	2	1	1	2	2	1
CO7	2	2	1	2	1	1	2	2	1	1	2


CO-Curriculum Enrichment Mapping(Please write 3,2,1 wherever required)

Note: 3= Highly correlated, 2= Moderately correlated, 1= Less correlated

	Skill Development	Employability	Entrepreneurship Development
CO1	3	2	1
CO2	3	2	3
CO3	3	3	3
CO4	3	3	1
CO5	3	2	3
CO6	3	1	2
CO7	3	3	1

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1. Bleasdale JKA. 1984. *Plant Physiology in Relation to Horticulture*. 2nd Ed. MacMillan.
2. Gupta US. (Ed.). 1978. *Crop Physiology*. Oxford & IBH. Krishnamoorti HN. 1981. *Application Plant Growth Substances and Their Uses in Agriculture*. Tata-McGraw Hill.


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3. Peter KV. (Ed.). 2008. *Basics of Horticulture*. New India Publ. Agency.
4. Saini RS, Sharma KD, Dhankhar OP & Kaushik RA. (Eds.). 2001. *Laboratory Manual of Analytical Techniques in Horticulture*. Agrobios.
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- <https://iasri.icar.gov.in/>
- <https://tnau.ac.in/>



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List of Experiments:

1. Preparation of solutions of plant growth substances and their application.
2. Experiments in breaking and induction of dormancy by chemicals.
3. Induction of parthenocarpy and fruit ripening.
4. Application of plant growth substances for improving flower initiation.
5. Changing sex expression in cucurbits and checking flower and fruit drops and improving fruit set in solanaceous vegetables.
6. Growth analysis techniques in vegetable crops.



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MAHV-103

Organic Vegetable Production Technology L:T:P 3:0:0

Objective: To impart knowledge about the cultivation of vegetable using organic inputs and utilizing on farm resources **for better skilling of employability and Entrepreneurship.**

UNIT I

Importance, principles, perspective, concept and component of organic production of vegetable crops **for skill development and Entrepreneurship.**

UNIT II

Organic production of vegetables crops, viz., solanaceous crops, cucurbits, cole crops, root and tuber crops **for employability and Entrepreneurship.**

UNIT III

Managing soil fertility, pests and diseases and weed problems in organic farming system; crop rotation in organic horticulture; processing and quality control for organic foods **for skill development and Entrepreneurship.**

UNIT IV

Methods for enhancing soil fertility, mulching, raising green manure crops. Indigenous methods of compost, Panchagavya, Biodynamics preparation etc. Pest and disease management in organic farming; ITK's in organic farming. Role of botanicals and bio-control agents **for better skilling of employability and Entrepreneurship.**

UNIT V

GAP and GMP- Certification of organic products; organic production and export - opportunity and challenges **for employability and Entrepreneurship.**

Course outcome:

After completion of this course students will be able to

- CO1:** Know different organic inputs for vegetable production **for Entrepreneurship.**
- CO2:** Understand the standard techniques of application of organic input for commercial cultivation of vegetables **for employability and Entrepreneurship.**
- CO3:** Know different mechanical, cultural and biological technologies to replace agro chemicals **for Entrepreneurship.**
- CO4:** Understand the methodology and process of organic certification of organic vegetable produce **for better skilling of employability and Entrepreneurship.**

PO-CO Mapping (Please write 3,2,1 wherever required)

Note: 3= Highly correlated, 2= Moderately correlated, 1= Less correlated


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	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	1	2	2	1	2	1	1	2	1
CO2	2	1	2	1	2	2	1	2	1	1	2
CO3	1	2	1	2	1	1	2	1	2	2	1
CO4	2	1	2	1	2	2	1	2	1	1	2

CO-Curriculum Enrichment Mapping(Please write 3,2,1 wherever required)

Note: 3= Highly correlated, 2= Moderately correlated, 1= Less correlated

	Skill Development	Employability	Entrepreneurship Development
CO1	2	1	3
CO2	2	3	3
CO3	2	1	3
CO4	3	3	3

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1. Dahama AK. 2005. *Organic Farming for Sustainable Agriculture*. 2nd Ed. Agrobios.
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MAHV 104

Protected Cultivation of Vegetable Crops

L:T:P 3:0:0

Objective: Explain the basics of protected cultivation and its significance in crop cultivation. Demonstrate about different types of greenhouse, its design and cost estimation **for employability and Entrepreneurship.**

Crops: Tomato, capsicum, cucumber, melons and lettuce.

UNIT I

Importance and scope of protected cultivation of vegetable crops; principles used in protected cultivation, energy management, low cost structures; training methods; engineering aspects **for skill development and employability.**

UNIT II

Regulatory structures used in protected structures; types of greenhouse/polyhouse/nethouse, hot beds, cold frames, effect of environmental factors, viz. temperature, light, CO₂ and humidity on growth of different vegetables, manipulation of CO₂, light and temperature for vegetable production, fertigation **for employability and Entrepreneurship.**

UNIT III

Nursery raising in protected structures like poly-tunnels, types of benches and containers, different media for growing nursery under cover **for Entrepreneurship.**

UNIT IV

Regulation of flowering and fruiting in vegetable crops, technology for raising tomato, sweet pepper, cucumber and other vegetables in protected structures, training and staking in protected crops, varieties and hybrids for growing vegetables in protected structures **for employability and Entrepreneurship.**

UNIT V

Problem of growing vegetables in protected structures and their remedies, insect and disease management in protected structures; soil-less culture, use of protected structures for seed production **for better skilling of employability and Entrepreneurship.**


Course outcomes:

At the end of the course the student should be able to

CO1: Summarize the scope and importance of greenhouse technology in improving crop production **for skill development.**

CO2: Compare various types of greenhouses, its advantages and cost benefits **for employability and Entrepreneurship.**

CO3: Students are able to successfully growing the different vegetable crops in protected conditions **for Entrepreneurship.**


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PO-CO Mapping (Please write 3,2,1 wherever required)

Note: 3= Highly correlated, 2= Moderately correlated, 1= Less correlated

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	1	1	2	1	2	1	2	2	1
CO2	2	1	2	1	2	2	1	2	1	2	2
CO3	1	2	1	2	1	1	2	1	2	1	1
CO4	2	1	2	1	2	2	1	2	1	2	2
CO5	1	2	1	2	1	1	2	1	2	1	1

CO-Curriculum Enrichment Mapping(Please write 3,2,1 wherever required)

Note: 3= Highly correlated, 2= Moderately correlated, 1= Less correlated

	Skill Development	Employability	Entrepreneurship Development
CO1	3	1	2
CO2	2	3	3
CO3	1	2	3

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MAHV-201 Production Technology of Warm Season Vegetable Crops L:T:P 3:0:0

Objectives: To impart comprehensive knowledge about the scientific production technology of vegetables specially grown in warm season **for skill development and Entrepreneurship.**

Introduction, botany and taxonomy, climatic and soil requirements, commercial varieties/hybrids, sowing/planting times and methods, seed rate and seed treatment, nutritional and irrigation requirements, intercultural operations, weed control, mulching, physiological disorders, harvesting, post-harvest management, plant protection measures, economics of crop production and seed production of: **for better skilling of employability and Entrepreneurship.**

UNIT I

Tomato, eggplant, hot and sweet peppers **for Entrepreneurship.**

UNIT II

Okra, beans, cowpea and clusterbean **for Entrepreneurship.**

UNIT III

Cucurbitaceous crops **for Entrepreneurship.**

UNIT IV

Tapioca and sweet potato **for Entrepreneurship.**

UNIT V

Green leafy warm season vegetables **for Entrepreneurship.**

Outcome: after completion of this course students will be able to

CO1: To understand the taxonomical classification of different cool season vegetable crops **for skill development and employability.**

CO2: Understand the cultivation practices of different warm season vegetables for commercial production **for skill up of Entrepreneurship.**

CO3: Know the general information regarding plant protection and post-harvest management of commercial vegetable crops of warm season **for and employability and Entrepreneurship.**

PO-CO Mapping (Please write 3,2,1 wherever required)

Note: 3= Highly correlated, 2= Moderately correlated, 1= Less correlated

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	1	2	1	2	2	1	2	1	2
CO2	1	2	2	1	2	1	2	2	1	2	1

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CO3	2	1	1	2	1	2	1	1	2	1	2
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CO-Curriculum Enrichment Mapping(Please write 3,2,1 wherever required)

Note: 3= Highly correlated, 2= Moderately correlated, 1= Less correlated

	Skill Development	Employability	Entrepreneurship Development
CO1	3	3	1
CO2	3	2	3
CO3	2	3	3

References:

1. Bose TK & Som MG. (Eds.). 1986. *Vegetable Crops in India*. NayaProkash.
2. Bose TK, Kabir J, Maity TK, Parthasarathy VA & Som MG. 2003. *Vegetable Crops*. Vols. I-III. NayaUdyog.
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MAHV 251 Production Technology of Warm Season Vegetable Crops Lab L:T:P 0:0:1

List of Experiments:

1. To study the cultural operations (fertilizer application, sowing, mulching, irrigation, weed control) of summer vegetable crops and their economics.
2. Study and identification of different physiological disorders and deficiency symptoms of mineral elements.
3. Preparation of cropping schemes for commercial vegetable farm.
4. Laid out the experiments to demonstrate the role of mineral elements.
5. Study the use of plant growth substances regarding the warm season vegetables
6. Study the use of herbicides for controlling the weeds in warm season vegetables
7. Study the procedure and techniques of seed extraction of different warm season vegetables
8. Identification of important pests and diseases and their control.
9. To study the maturity standards (indices) in different vegetable crops
10. To study the economics of production of warm season vegetable crops.


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MAHV202 Fundamentals of Processing of Vegetables L:T:P 3:0:0

Objectives: To educate the students about fundamentals of vegetable processing **for better skilling of employability and Entrepreneurship.**

UNIT I

History of food preservation. Present status and future prospects of vegetable preservation industry in India **for skill and Entrepreneurship development.**

UNIT II

Spoilage of fresh and processed horticultural produce; biochemical changes and enzymes associated with spoilage of horticultural produce; principal spoilage organisms, food poisoning and their control measures, Role of microorganisms in food preservation **for employability and Entrepreneurship.**

UNIT III

Raw materials for processing. Primary and minimal processing; processing equipments; Layout and establishment of processing industry, FPO licence. Importance of hygiene; Plant sanitation **for better skilling of employability and Entrepreneurship.**

UNIT IV

Quality assurance and quality control, TQM, GMP. Food standards – FPO, PFA, etc. Food laws and regulations, Food safety – Hazard analysis and critical control points (HACCP). Labeling and labeling act, nutrition labeling **for skill development and employability.**

UNIT V

Major value added products from vegetables. Utilization of byproducts of vegetable processing industry; Management of waste from processing factory. Investment analysis. Principles and methods of sensory evaluation of fresh and processed vegetables **for Entrepreneurship development.**

Course outcomes:

On successful completion of this course a student will be able to:

CO1: Summarize the history and scope of processing of vegetables **for skill and Entrepreneurship development.**

CO2: Aware about the different quality assurance and control measures of processing of vegetables **for employability and Entrepreneurship.**

CO3: Identify the spoilage in fruits and vegetables and state the reason for the spoilage following safety precautions **for employability and Entrepreneurship.**

CO4: Able to prepare different value added products **for Entrepreneurship development.**

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PO-CO Mapping (Please write 3,2,1 wherever required)

Note: 3= Highly correlated, 2= Moderately correlated, 1= Less correlated

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	1	2	1	2	2	1	1	2	1
CO2	2	1	2	1	2	1	2	2	2	1	2
CO3	1	2	1	2	1	2	1	1	1	2	1
CO4	2	1	2	1	2	1	2	2	2	1	2
CO5	1	2	1	2	1	2	1	1	1	2	1

CO-Curriculum Enrichment Mapping (Please write 3,2,1 wherever required)

Note: 3= Highly correlated, 2= Moderately correlated, 1= Less correlated

	Skill Development	Employability	Entrepreneurship Development
CO1	3	1	3
CO2	2	3	3
CO3	2	3	3
CO4	1	2	3

References:

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MMAG-204

Agricultural Statistics and Experimental Designs

L: T: P 3:0:0

Objective: The main aims of this course are to provide comprehensive knowledge of the basic information of agriculture statistics and experimental design. To provide the scientific basis for the study of the development of economic and social development, planning and decision making in the field of agricultural engineering **for skilling of employability and entrepreneurship.**

Unit I

Presentation of Data: Frequency distributions; graphical presentation of data by histogram, frequency polygon, frequency curve and cumulative frequency curves Measures of Locations and Dispersion: Mean, median, mode and their simple properties (with-out derivation) and calculations of median by graphs; range, mean deviation, standard deviation, standard error, coefficient of variation **for employability and entrepreneurship.**

Unit II

Probability and Distributions: Random distributions; events exhaustive, mutually exclusive and equally likely; definition of probability (with simple exercises); definitions of binomial, Poisson's and normal distributions; and simple properties of the above distributions (without derivation) **for better skilling of employability.**

Unit III

Correlation and Regression: Bivariate data-simple correlation and regression coefficients and their relation; Spearman rank correlation; limits of correlation coefficient; effect of change of origin and scale on correlation coefficient; linear regression and equations of line of regression; association and independence of attributes **for better skilling of employability and entrepreneurship.**

Unit IV

Sampling: Concept of population and sample; random samples; methods of taking a simple random sample. Tests of significance: sampling distribution of mean and standard error; z and t-test (equality of means; paired and unpaired t-test); t-test for comparison of means when variances of two populations differ; Chi- square test for goodness of fit; independence of attributes, and homogeneity of samples; interrelation between t-test and F-Test **for employability in industry.**

Unit V

Experimental Designs: Principles of experimental designs; completely randomized, randomized complete block design (missing plot value in RBD); latin square designs;

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augmented block design; simple factorial experiments including split and strip plot design (mathematical derivations not required); analysis of variance (ANOVA) and its use including estimation of LSD (CD) **for better skilling of employability and entrepreneurship.**

Course Outcomes:

The student is able to

CO1: Understand basic theoretical and applied principles of agricultural statistics needed to enter in agriculture **for skill development.**

CO2: Demonstrate an understanding of the basic concepts of probability and random variables **for better skilling of employability.**

CO3: Understand and interpret the concepts of descriptive statistics from the obtained data **for skill development.**

CO4: Utilize and apply regression and other statistical methods to analyze commodity markets and economic data **for better skilling of employability and entrepreneurship.**

CO5: Gain proficiency in using statistical software for data analysis **for employment and entrepreneurship.**

PO-CO Mapping (Please write 3,2,1 wherever required)

Note: 3= Highly correlated, 2= Moderately correlated, 1= Less correlated

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	1	2	1	2	1	2	1	2	1
CO2	2	1	2	1	2	1	2	1	2	1	2
CO3	1	2	1	2	1	2	1	2	1	2	1
CO4	2	1	2	1	2	1	2	1	2	1	2
CO5	1	2	1	2	1	2	1	2	1	2	1

CO-Curriculum Enrichment Mapping(Please write 3,2,1 wherever required)

Note: 3= Highly correlated, 2= Moderately correlated, 1= Less correlated

	Skill Development	Employability	Entrepreneurship Development
CO1	3	2	1
CO2	3	3	1
CO3	3	2	1
CO4	3	3	3
CO5	2	3	3

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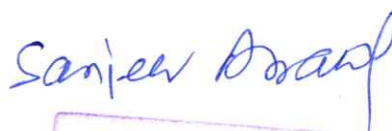
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List of Experiments:

1. Measurement of central tendency and dispersion
2. Standard deviation and standard error
3. Principle uses of χ^2 , F and T- test.
4. Correlation Coefficient, Regression coefficient and Regression equation.
5. Analysis of data generated from completely randomized design, randomized block design.
6. Analysis of data generated from Latin square design, factorial experiments in 2^2 , 2^3 Split plot designs
7. Missing plot techniques.
8. Analysis of covariance.
9. Sampling in field experiments.
10. Analysis of variance (ANOVA).



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MAHV 301

Breeding of Vegetable Crops

L:T:P 3:0:0

Objective: To become students aware of scope of breeding in vegetable crops for conservation of development of area specific variety/hybrids indulging disease resistance to **impart the skill, employability and entrepreneurship.**

Origin, botany, taxonomy, cytogenetics, genetics, breeding objectives, breeding methods (introduction, selection, hybridization, mutation), varieties and varietal characterization, resistance breeding for biotic and abiotic stress, quality improvement, molecular marker, genomics, marker assisted breeding and QTLs, biotechnology and their use in breeding in vegetable crops-Issue of patenting, PPVFR act **for skilling up of employability and entrepreneurship.**

UNIT I

Potato and tomato **for employability and entrepreneurship.**

UNIT II

Eggplant, hot pepper, sweet pepper and okra **for employability and entrepreneurship.**

UNIT III

Peas and beans, amaranth, chenopods and lettuce **for employability and entrepreneurship.**

UNIT IV

Gourds, melons, pumpkins and squashes **for employability and entrepreneurship.**

UNIT V

Cabbage, cauliflower, carrot, beetroot, radish, sweet potato and tapioca **for employability and entrepreneurship.**

Course outcomes:

- CO1:** Students will be able to determine the breeding objectives, selection criteria and methods for improvement of vegetables **for employability and entrepreneurship.**
- CO2:** Students can assess the performance and preserve the genetic resources of vegetables for further breeding use **for entrepreneurship development.**
- CO3:** Students make them clear about protection of varieties and rights of their use for farmer and breeder **for employability and entrepreneurship.**
- CO4:** Students will be able to introduce the new plants or varieties on the basis of its nutritive values, yield potential and disease resistance **for entrepreneurship development.**

PO-CO Mapping (Please write 3,2,1 wherever required)

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Note: 3= Highly correlated, 2= Moderately correlated, 1= Less correlated

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	1	1	2	1	2	2	1	2	1
CO2	1	2	2	2	1	2	1	2	2	1	2
CO3	2	1	1	2	2	1	2	1	1	2	1
CO4	1	2	2	1	1	2	1	2	1	1	2
CO5	2	1	2	2	2	1	2	1	2	2	1

CO-Curriculum Enrichment Mapping (Please write 3,2,1 wherever required)

Note: 3= Highly correlated, 2= Moderately correlated, 1= Less correlated

	Skill Development	Employability	Entrepreneurship Development
CO1	2	3	3
CO2	1	2	3
CO3	1	3	3
CO4	2	1	3

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List of Experiments:

1. Study of selection of desirable plants from breeding population
2. Observations and analysis of various qualitative and quantitative traits in germplasm, hybrids and segregating generations;
3. Study of induction of flowering, phenological characters
4. Study of selfing and crossing techniques in vegetable crops
5. To study the procedure of hybrid seed production of vegetable crops in bulk.
6. To study the screening techniques for insect-pests, disease and environmental stress resistance in above mentioned crops,
7. Demonstration of sib-mating and mixed population; molecular marker techniques to identify useful traits in the vegetable crops and special breeding techniques.
8. A visit to breeding blocks.


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MAHV 302 Seed Production Technology of Vegetable Crops L:T:P 3:0:0

Objective: To make the students aware about new seed polices maintenance of different categories of seeds, their processing and storage **for better skilling of employability and entrepreneurship.**

UNIT I

Definition of seed and its quality, new seed policies; DUS test, scope of vegetable seed industry in India **for skill development and entrepreneurship.**

UNIT II

Genetical and agronomical principles of seed production; methods of seed production; use of growth regulators and chemicals in vegetable seed production; floral biology, pollination, breeding behaviour, seed development and maturation; methods of hybrid seed production **for better skilling of employability and entrepreneurship.**

UNIT III

Categories of seed; maintenance of nucleus, foundation and certified seed; seed certification, seed standards; seed act and law enforcement, plant quarantine and quality control **for employability and entrepreneurship.**

UNIT VI

Physiological maturity, seed harvesting, extraction, curing, drying, grading, seed processing, seed coating and pelleting, packaging (containers/packets), storage and cryopreservation of seeds, synthetic seed technology **for employability and entrepreneurship.**

UNIT V

Agro-techniques for seed production in solanaceous vegetables, cucurbits, leguminous vegetables, cole crops, bulb crops, leafy vegetables, okra, vegetatively propagated vegetables **for skill development and entrepreneurship.**

Course outcomes:

- CO1:** Students will become aware about increased scope of vegetable seed production in seed industry as per new seed polices **for entrepreneurship development.**
- CO2:** Students will be able to the generation system of seeds, certification standards and process **for employability and entrepreneurship.**
- CO3:** Students will become self-reliant in producing own farm seeds for harvesting profuse yield **for skill up of entrepreneurship development.**
- CO4:** Students will be able to determine the requirements of processing and storage of seed **for employability and entrepreneurship.**


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PO-CO Mapping (Please write 3,2,1 wherever required)

Note: 3= Highly correlated, 2= Moderately correlated, 1= Less correlated

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	1	2	1	2	2	1	2	1	2
CO2	2	1	2	1	2	1	2	2	1	2	1
CO3	1	2	1	2	1	2	1	2	2	1	2
CO4	2	1	2	1	2	1	2	1	1	2	1
CO5	1	2	1	2	1	2	1	2	1	2	2

CO-Curriculum Enrichment Mapping(Please write 3,2,1 wherever required)

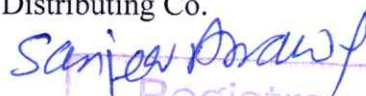
Note: 3= Highly correlated, 2= Moderately correlated, 1= Less correlated

	Skill Development	Employability	Entrepreneurship Development
CO1	2	1	3
CO2	2	3	3
CO3	3	1	3
CO4	2	3	3

References:

1. Agrawal PK & Dadlani M. (Eds.). 1992. *Techniques in Seed Science and Technology*. South Asian Publ.
2. Agrawal RL. (Ed.). 1997. *Seed Technology*. Oxford & IBH.
3. Bendell PE. (Ed.). 1998. *Seed Science and Technology: Indian Forestry Species*. Allied Publ.
4. Fageria MS, Arya PS & Choudhary AK. 2000. *Vegetable Crops: Breeding and Seed Production*. Vol. I. Kalyani.
5. George RAT. 1999. *Vegetable Seed Production*. 2nd Ed. CABI.
6. Kumar JC & Dhaliwal MS. 1990. *Techniques of Developing Hybrids in Vegetable Crops*. Agro Botanical Publ.
7. More TA, Kale PB & Khule BW. 1996. *Vegetable Seed production Technology*. MAHV Varashtra State Seed Corp.
8. Rajan S & Baby L Markose. 2007. *Propagation of Horticultural Crops*. New India Publ. Agency.
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- <http://www.ciks.org/downloads/seeds/4.%20Seed%20Production%20Techniques%20for%20Vegetables.p>

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MAHV-203 (I) Diseases of Vegetable Crops and Management L:T:P3:0:0

Objective: To study major diseases and their management of vegetable crops **for skill development, employability and entrepreneurship.**

Economic Importance, symptoms, cause, disease cycle and integrated management of diseases of crops given below:

Unit I

Chilli (anthracnose, viral disease)

Brinjal (Phomopsis blight, fruit rot, sclerotinia rot, bacterial wilt, root knot) **to provide the skill for employability and entrepreneurship.**

Unit II

Potato (early and late blight, black scurf, common scab, bacterial wilt, viral disease)

Okra (YMV), Colocasia spp. **for employability and entrepreneurship.**

Unit III

Tomato (Damping-off, wilt root knot, late and early blight, viral disease)

Beans (anthracnose, blights, viral disease, rust) **for skill up of employability and entrepreneurship.**

Unit IV

Crucifers (damping-off, downy mildew and black rot)

Onion (yellow dwarf), coconut (root wilt, stem rot) **for employability and entrepreneurship.**

Unit V

Cucurbits (downy mildew, powdery mildew, Fusarium wilt, mosaic) **to provide the skill for employability and entrepreneurship.**

Course outcome

CO1: Students will know diagnosing symptoms, etiology, disease cycle and management of major diseases of vegetable crops **for employability and entrepreneurship.**

CO2: Students will know the diseases of Chilli, Tomato, Potato and Brinjal **for skill development and entrepreneurship.**

CO3: Students will able to manage the Okra, Onion and Beans disease **for better skilling of employability and entrepreneurship.**

CO4: Student will able to manage the diseases of Crucifers **for employability and entrepreneurship.**


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CO5: Students will able to manage the Cucurbits for skill up and entrepreneurship development.

PO-CO Mapping (Please write 3,2,1 wherever required)

Note: 3= Highly correlated, 2= Moderately correlated, 1= Less correlated

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	1	2	2	1	2	1	2	2	1
CO2	2	1	2	1	2	2	1	2	1	2	2
CO3	1	2	2	2	1	1	2	1	2	1	1
CO4	2	1	1	1	2	2	1	2	1	2	2
CO5	1	2	2	2	1	2	2	2	2	1	1

CO-Curriculum Enrichment Mapping(Please write 3,2,1 wherever required)

Note: 3= Highly correlated, 2= Moderately correlated, 1= Less correlated

	Skill Development	Employability	Entrepreneurship Development
CO1	2	3	3
CO2	3	1	3
CO3	3	3	3
CO4	2	3	3
CO5	3	1	3

References:

1. Pathak, V. N. 1980. Diseases of Fruit Crops. Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi.
2. Singh, R.S. 1994. Diseases of Vegetable Crops. Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi.
3. Singh, R.S. 2000. Diseases of Fruit Crops. Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi.
4. Sohi, H. S. 1992. Diseases of Ornamental Plants in India. ICAR, New Delhi.

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- <http://ecoursesonline.iasri.res.in/>
- <https://iasri.icar.gov.in/>
- <http://www.agriglance.com>

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MAHV 203 (II) Abiotic Stress Management in Vegetable Crops L:T:P 3:0:0

Objective: To develop the understanding of growing vegetable crops under abiotic stress and harmful effect of adverse soil conditions on plant growth and development **for skill development, employability and entrepreneurship.**

UNIT I

Environmental stress and its types, soil parameters including pH, classification of vegetable crops based on susceptibility and tolerance to various types of stress; root stock, use of wild species, use of anti-transpirants **for entrepreneurship development.**

UNIT II

Mechanism and measurements of tolerance to drought, water logging, soil salinity, frost and heat stress in vegetable crops **for employability and entrepreneurship.**

UNIT III

Soil-plant-water relations under different stress conditions in vegetable crops production and their management practices **for skill development.**

UNIT IV

Techniques of vegetable growing under water deficit, water logging, salinity and sodicity **for skill development and entrepreneurship.**

UNIT V

Techniques of vegetable growing under high and low temperature conditions, use of chemicals in alleviation of different stresses **for skill development and entrepreneurship.**

Course outcomes:

CO1: Students will understand the use of rootstocks and anti-transparent under stress soil conditions **for entrepreneurship development.**

CO2: Understanding of soil-plant-water relations is used to develop management practices under different stress conditions in vegetable crops production **for skill development.**

CO3: Students can be able to compare techniques of vegetable growing under high and low temperature conditions **for skill development and entrepreneurship.**

PO-CO Mapping (Please write 3,2,1 wherever required)

Note: 3= Highly correlated, 2= Moderately correlated, 1= Less correlated

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	1	2	1	2	2	1	1	2	1
CO2	2	1	1	2	2	1	1	2	2	1	2
CO3	1	2	2	1	1	2	2	1	1	2	1

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CO4	2	1	1	2	2	1	1	2	2	1	2
CO5	1	2	2	1	1	2	2	1	1	2	1

CO-Curriculum Enrichment Mapping (Please write 3,2,1 wherever required)

Note: 3= Highly correlated, 2= Moderately correlated, 1= Less correlated

	Skill Development	Employability	Entrepreneurship Development
CO1	2	1	3
CO2	3	1	2
CO3	3	1	3

References:

1. Dwivedi P & Dwivedi RS. 2005. Physiology of Abiotic stress in Plants. Agrobios.
2. Lerner HR (Ed.). 1999. Plant Responses to Environmental Stresses. Marcel Decker.
3. Maloo SR. 2003. Abiotic Stresses and Crop Productivity. Agrotech Publ. Academy.

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MAHV203III

Breeding of Self Pollinated Vegetable Crops

L: T: P 2:0:0

Objective: The breeding methods that have proved successful with self-pollinated species are: mass selection; pure-line selection; hybridization, with the segregating generations handled by the pedigree method, the bulk method, or by the backcross method; and development of hybrid varieties.

UNIT-I

Centres of origin, plant biodiversity and its conservation. Modes of reproduction, pollination systems and genetics of important vegetable, tuber and spice crops for skill development.

UNIT-II

Self-incompatibility and male sterility, their classification and application in crop improvement. Principles of breeding in self-pollinated crops, pure line selection for skill development and employability.

UNIT-III

Mass selection, heterosis breeding, hybridization, pedigree method, mass pedigree method, bulk method, modified bulk method, single seed descent method and back cross method for skill development and entrepreneurship.

UNIT-IV

Heterosis breeding. Polyploidy breeding. Mutation breeding. Principles of breeding cross pollinated crops, mass selection; recurrent selection, synthetics and composites for skill development.

UNIT-V

Application of biotechnology in crop improvement. Crops: Solanaceous vegetables, Cole crops, cucurbits, bulb crops, tuber crops, leafy vegetables, okra, leguminous vegetables and spice crops for skill development and entrepreneurship.

Course Outcomes:

Students completing this course will be able to:

CO 1: Learn breeding procedures in self and cross pollinated crops for skill development.

CO 2: Understand exploitation of heterosis utilizing male sterility and other methods for skill development and employability.


CO 3: Know about the various population improvement programmes for skill development and entrepreneurship.


CO 4: Study about the fundamentals of mutation, polyploidy and wide hybridization and their role in crop improvement for skill development.

CO 5: Orientation regarding modern molecular approaches likes Marker Assisted Selection for skill development and entrepreneurship.

PO-CO Mapping

Note: 3= highly correlated, 2= moderately correlated, 1= Less correlated


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	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	1	2	1	2	2	1	1	2	1
CO2	2	1	1	2	2	1	1	2	2	1	2
CO3	1	2	2	1	1	2	2	1	1	2	1
CO4	2	1	1	2	2	1	1	2	2	1	2
CO5	1	2	2	1	1	2	2	1	1	2	1

CO-Curriculum Enrichment Mapping

Note: 3= Highly correlated, 2= Moderately correlated, 1= Less correlated

	Skill Development	Employability	Entrepreneurship Development
CO1	3	2	2
CO2	3	3	2
CO3	3	2	3
CO4	3	2	1
CO5	3	2	3

References:

8. Bose TK & Som MG. (Eds.). 1986. *Vegetable Crops in India*. NayaProkash.
9. Bose TK, Som G & Kabir J. (Eds.). 2002. *Vegetable Crops*. NayaProkash.
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12. Chadha KL & Kalloo G. (Eds.). 1993-94. *Advances in Horticulture* Vols.V-X. MalhotraPubl. House.
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MAHV203IV

Hi-Tech Horticulture

L: T: P 2:0:0

Objective: To increase the area, production and productivity of fruits, vegetable, spices, Medicinal and floriculture crops. Introduction of high yielding, disease free and true to type varieties of fruits, vegetable and spices crops through layout of demonstration and minikits in the selected areas.

UNIT-I

Introduction & importance; Nursery management and mechanization; micro propagation of horticultural for skill development.

UNIT-II

Crops; Modern field preparation and planting methods, Protected cultivation: advantages, controlled conditions for skill development.

UNIT-III

Method and techniques, Micro irrigation systems and its components; EC, pH based fertilizer scheduling, canopy management, high density orchard for better skilling and employability.

UNIT-IV

Components of precision farming: Remote sensing, Geographical Information System (GIS), Differential Geo-positioning System (DGPS) for skill development.

UNIT-V

Variable Rate applicator (VRA), application of precision farming in horticultural crops (fruits, vegetables and ornamental crops); mechanized harvesting of produce for skill development.

Course Outcomes:

Students completing this course will be able to:

CO 1: The student will be able to understand different branches of horticulture for skill development.

CO 2: Can demonstrate advanced technologies like training, pruning, etc in horticulture for skill development.

CO3: Deals with soil science and fertility management for horticultural crops for better skilling and employability.

CO4: Analyze the Importance of crop physiology in horticulture for skill development.

CO5: Study of Plant Propagation and Nursery Management for skill development.

PO-CO Mapping

Note: 3= highly correlated, 2= moderately correlated, 1= Less correlated

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	1	2	1	2	2	1	1	2	1
CO2	2	1	1	2	2	1	1	2	2	1	2
CO3	1	2	2	1	1	2	2	1	1	2	1

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CO4	2	1	1	2	2	1	1	2	2	1	2
CO5	1	2	2	1	1	2	2	1	1	2	1

CO-Curriculum Enrichment Mapping

Note: 3= Highly correlated, 2= Moderately correlated, 1= Less correlated

	Skill Development	Employability	Entrepreneurship Development
CO1	3	2	2
CO2	3	2	2
CO3	3	3	2
CO4	3	2	1
CO5	3	2	2

References:

15. Bose TK & Som MG. (Eds.). 1986. *Vegetable Crops in India*. NayaProkash.
16. Bose TK, Som G & Kabir J. (Eds.). 2002. *Vegetable Crops*. NayaProkash.
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Objective: To educate the students about the principles and practices of processing in vegetable crops **and improve the skill, employability and entrepreneurship.**

UNIT I

Present status—Present status and future prospects of vegetable preservation industry in India **knowledge for better employability in industry.**

UNIT II

Spoilage and biochemical changes—Spoilage of fresh and processed vegetable produce; biochemical changes and enzymes associated with spoilage of vegetable produce; Principal spoilage organisms, food poisoning and their control measures; Role of microorganisms in food preservation **for skill development.**

UNIT III

Processing equipments—Raw material for processing; Primary and minimal processing; Processing equipments; Layout and establishment of processing industry; FPO licence; Importance of hygiene; Plant sanitation **to provide employability and entrepreneurship.**

UNIT IV

Quality control—Quality assurance and quality control, TQM, GMP; Food standards FPO, PFA, etc.; Food laws and regulations; Food safety- hazard analysis and critical control points (HACCP); Labelling and labelling act and nutrition labelling **knowledge for better employability in industry.**

UNIT V

Value addition—Major value added vegetable products; Utilization of byproducts of vegetable processing industry; Management of processing industry waste; Investment analysis; Principles and methods of sensory evaluation of fresh and processed vegetables **to provide employability and entrepreneurship.**

Course Outcomes:

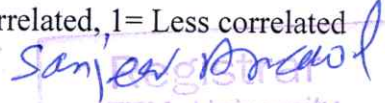
After successful completion of this course, the students are expected to:

1. Appreciate the scope and scenario of vegetable processing in India
2. Acquire knowledge about the processing technology of vegetable crops
3. Adopting processing products of vegetable crops at small or medium scale
4. Adopt processing of vegetable crops as entrepreneur

PO-CO Mapping (Please write 3,2,1 wherever required)

Note: 3= Highly correlated, 2= Moderately correlated, 1= Less correlated


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	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	1	2	1	2	2	1	1	2	1
CO2	2	1	1	2	2	1	1	2	2	1	2
CO3	1	2	2	1	1	2	2	1	1	2	1
CO4	2	1	1	2	2	1	1	2	2	1	2
CO5	1	2	2	1	1	2	2	1	1	2	1

CO-Curriculum Enrichment Mapping(Please write 3,2,1 wherever required)

Note: 3= Highly correlated, 2= Moderately correlated, 1= Less correlated

	Skill Development	Employability	Entrepreneurship Development
CO1	3	1	1
CO2	1	3	3
CO3	1	3	1
CO4	2	3	3
CO5	3	1	2

References:

1. Arthey D and Dennis C. 1996. Vegetable processing. Blackie/ Springer-Verlag.
2. Chadha DS. 2006. The Prevention of food adulteration act. Confed. of Indian Industry.
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MAHV203VI

Production of Spice Crops

L: T: P 2:0:0

Objective: To impart basic knowledge about the importance and production technology of spices grown in India **and improve the skill, employability and entrepreneurship.**

UNIT I

Fruit spices- Black pepper, small cardamom, large cardamom and allspice **to provide employability and entrepreneurship.**

UNIT II

Bud and kernel- Clove and nutmeg **to provide employability and entrepreneurship.**

UNIT III

Underground spices- Turmeric, ginger and garlic **for skill development.**

UNIT IV

Seed spices- Coriander, fenugreek, cumin, fennel, ajowain, dill and celery **to provide employability and entrepreneurship.**

UNIT V

Tree spices- Cinnamon, tamarind, garcinia and vanilla **to provide employability and entrepreneurship.**

Course Outcomes:

After successful completion of this course, the students are expected to:

1. Appreciate the scope and scenario of production of spice crops in India
2. Acquire knowledge about the production technology and processing of spice crops
3. Adopting production of spice crops as entrepreneur

PO-CO Mapping (Please write 3, 2, 1 wherever required)

Note: 3= Highly correlated, 2= Moderately correlated, 1= Less correlated

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	1	2	1	2	2	1	1	2	1
CO2	2	1	1	2	2	1	1	2	2	1	2
CO3	1	2	2	1	1	2	2	1	1	2	1
CO4	2	1	1	2	2	1	1	2	2	1	2
CO5	1	2	2	1	1	2	2	1	1	2	1

CO-Curriculum Enrichment Mapping(Please write 3,2,1 wherever required)

Note: 3= Highly correlated, 2= Moderately correlated, 1= Less correlated

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	Skill Development	Employability	Entrepreneurship Development
CO1	3	1	1
CO2	1	3	3
CO3	1	3	1
CO4	2	3	3
CO5	3	1	2

References:

1. Arya PS. 2003. Spice crops of India. Kalyani.
2. Bhattacharjee SK. 2000. Hand book of aromatic plants. Pointer publications.
3. Bose TK, Mitra SK, Farooqi SK and Sadhu MK. (Eds.). 1999. Tropical horticulture. Vol.I. Naya Prokash.
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Objective: To impart a comprehensive knowledge and skills on quality seed production of vegetable crops **and improve the skill, employability and entrepreneurship.**

UNIT I

Introduction, history, propagation and reproduction—Introduction, definition of seed and its quality, seed morphology, development and maturation; Apomixis and fertilization; Modes of propagation and reproductive behaviour; Pollination mechanisms and sex forms in vegetables; History of vegetable seed production; Status and share of vegetable seeds in seed industry **to provide employability and entrepreneurship.**

UNIT II

Agro-climate and methods of seed production—Agro-climate and its influence on quality seed production; Deterioration of crop varieties, genetical and agronomic principles of vegetable seed production; Methods of seed production, hybrid seeds and techniques of large scale hybrid seed production; Seed village concept **to provide employability and entrepreneurship.**

UNIT III

Seed multiplication and its quality maintenance—Seed multiplication ratios and replacement rates in vegetables; Generation system of seed multiplication; Maintenance and production of nucleus, breeder, foundation, certified/ truthful label seeds; Seed quality and mechanisms of genetic purity testing **for skill development.**

UNIT IV

Seed harvesting, extraction and its processing—Maturity standards; Seed harvesting, curing and extraction; Seed processing, viz., cleaning, drying and treatment of seeds, seed health and quality enhancement, packaging and marketing; Principles of seed storage; Orthodox and recalcitrant seeds; Seed dormancy **to provide employability and entrepreneurship.**

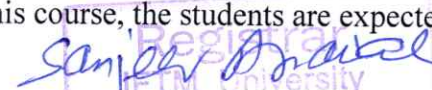
UNIT V

Improved agro-techniques and field and seed standards—Improved agro-techniques; Field and seed standards in important solanaceous, leguminous and cucurbitaceous vegetables, cole crops, leafy vegetables, bulbous and root crops and okra; clonal propagation and multiplication in vegetative propagated crops; Seed plot technique and true potato seed production in potato **to provide employability and entrepreneurship.**

Course Outcomes:

After successful completion of this course, the students are expected to:


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1. Appreciate the scope and scenario of seed production of vegetable crops in India
2. Acquire knowledge about the complete seed production technology, extraction and post-extraction processing of vegetable seeds
3. Adoption of seed production of vegetable crops as entrepreneur

PO-CO Mapping (Please write 3,2,1 wherever required)

Note: 3= Highly correlated, 2= Moderately correlated, 1= Less correlated

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	1	2	1	2	2	1	1	2	1
CO2	2	1	1	2	2	1	1	2	2	1	2
CO3	1	2	2	1	1	2	2	1	1	2	1
CO4	2	1	1	2	2	1	1	2	2	1	2
CO5	1	2	2	1	1	2	2	1	1	2	1

CO-Curriculum Enrichment Mapping(Please write 3,2,1 wherever required)

Note: 3= Highly correlated, 2= Moderately correlated, 1= Less correlated

	Skill Development	Employability	Entrepreneurship Development
CO1	3	1	1
CO2	1	3	3
CO3	1	3	1
CO4	2	3	3
CO5	3	1	2

References:

1. Agrawal RL. (Ed.). 1997. Seed technology. Oxford and IBH.
2. Basra AS. 2000. Hybrid seed production in vegetables. CRC press, Florida, USA.
3. Bench ALR and Sanchez RA. 2004. Handbook of seed physiology. Food products press, NY/ London.
4. Bendell PE. (Eds.). 1998. Seed science and technology: Indian forestry species. Allied Publ.
5. Chakraborty SK, Prakash S, Sharma SP and Dadlani M. 2002. Testing of distinctiveness, uniformity and stability for plant variety protection. IARI, New Delhi
6. Rajan S and Markose BL. 2007. Propagation of horticultural crops. New India publ. agency.



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7. Singh NP, Singh DK, Singh YK and Kumar V. 2006. Vegetable seed production technology. International book distributing Co.

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- <https://tnau.ac.in>
- <https://iasri.icar.gov.in>
- <https://ecourseonline.iasri.res.in>


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MAHV 303 (I) Production Technology of Underexploited Vegetable Crops L:T:P 3:0:0

Objectives: To educate the students about production technology of underexploited vegetable crops **for entrepreneurship development.**

Introduction, botany and taxonomy, climatic and soil requirements, commercial varieties/hybrids, sowing/planting times and methods, seed rate and seed treatment, nutritional and irrigation requirements, intercultural operations, weed control, mulching, physiological disorders, harvesting, post harvest management, plant protection measures and seed production of: **for skill up of employability and entrepreneurship.**

UNIT I

Asparagus, artichoke and leek **for entrepreneurship development.**

UNIT II

Brussels's sprout, Chinese cabbage, broccoli, kale and artichoke **for entrepreneurship development.**

UNIT III

Amaranth, celery, parsley, parsnip, lettuce, rhubarb, spinach, basella, bathua (chenopods) and chekurmanis **for entrepreneurship development.**

UNIT IV

Elephant foot yam, lima bean, winged bean, vegetable pigeon pea, and jack bean and sword bean **for entrepreneurship development.**

UNIT V

Sweet gourd, spine gourd, pointed gourd, Oriental pickling melon and little gourd (kundru) **for entrepreneurship development.**

Course outcomes:

CO1: Introduction, botany and taxonomy, and requirements of underexploited vegetables **for skill development.**

CO2: The students will be well versed with package of practices of underexploited vegetables so as to enhance their production **for skill up of entrepreneurship.**

CO3: Post harvest management, plant protection measures and seed production of underexploited vegetables **for better skilling of employability and entrepreneurship.**

PO-CO Mapping (Please write 3,2,1 wherever required)

Note: 3= Highly correlated, 2= Moderately correlated, 1= Less correlated

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
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CO1	3	2	1	2	2	1	1	2	1	2	1
CO2	2	1	2	1	2	2	1	2	2	1	2
CO3	1	2	2	2	1	2	2	1	2	2	2

CO-Curriculum Enrichment Mapping (Please write 3,2,1 wherever required)

Note: 3= Highly correlated, 2= Moderately correlated, 1= Less correlated

	Skill Development	Employability	Entrepreneurship Development
CO1	3	1	2
CO2	3	1	3
CO3	3	3	3

References:

1. Bhat KL. 2001. *Minor Vegetables - Untapped Potential*. Kalyani.
2. Indira P & Peter KV. 1984. *Unexploited Tropical Vegetables*. Kerala Agricultural University, Kerala.
3. Peter KV. (Ed.). 2007-08. *Underutilized and Underexploited Horticultural Crops*. Vols. I-IV. New India Publ. Agency.
4. Rubatzky VE & Yamaguchi M. (Eds.). 1997. *World Vegetables: Principles, Production and Nutritive Values*. Chapman & Hall
5. Srivastava U, MAHV Vajan RK, Gangopadyay KK, Singh M & Dhillon BS. 2001. *Minimal Descriptors of Agri-Horticultural Crops. Part-II: Vegetable Crops*. NBPGR, New Delhi.

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- <https://tnau.ac.in/>
- <http://ecoursesonline.iasri.res.in/>


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MAHV 303 (II)

Systematic of Vegetable Crops

L:T:P 3:0:0

Objective: To make the students able to classify the vegetables for skill development and employability.

UNIT I

Principles of classification; different methods of classification; salient features of international code of nomenclature of vegetable crops for better skilling of employability.

UNIT II

Origin, history, evolution and distribution of vegetable crops, botanical description of families, genera and species covering various tropical, subtropical and temperate vegetables for better skilling of employability and Entrepreneurship.

UNIT III

Cytological level of various vegetable crops; descriptive keys for important vegetables for skill development and employability.

UNIT IV

Importance of molecular markers in evolution of vegetable crops; molecular markers as an aid in characterization and taxonomy of vegetable crops for skill up of employability and Entrepreneurship.

Course Outcomes:

CO1: Students learn the systematics of naming crops based on different methods of classification for skill development and employability.

CO2: Students would be able to understand the climatic requirement of vegetable crops for their distribution in adaptable climatic zones for employability and Entrepreneurship.

CO3: Students will understand the role of molecular markers in characterization of vegetable crops at cytological level for skill up of employability and Entrepreneurship.

PO-CO Mapping (Please write 3,2,1 wherever required)

Note: 3= Highly correlated, 2= Moderately correlated, 1= Less correlated


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	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	1	2	2	1	2	2	1	2	1	1
CO2	2	2	1	2	2	1	1	2	1	2	2
CO3	1	1	2	1	1	2	2	2	2	2	2
CO4	2	2	1	2	2	1	2	1	1	1	1
CO5	1	1	2	1	1	2	1	2	2	2	2

CO-Curriculum Enrichment Mapping(Please write 3,2,1 wherever required)

Note: 3= Highly correlated, 2= Moderately correlated, 1= Less correlated

	Skill Development	Employability	Entrepreneurship Development
CO1	3	3	1
CO2	2	3	3
CO3	3	3	3

References:

1. Chopra GL. 1968. Angiosperms - Systematics and Life Cycle. S. Nagin
2. Dutta AC. 1986. A Class Book of Botany. Oxford Univ. Press.
3. Pandey BP. 1999. Taxonomy of Angiosperm. S. Chand & Co.
4. Peter KV & Pradeepkumar T. 2008. Genetics and Breeding of Vegetables. (Revised), ICAR.
5. Soule J. 1985. Glossary for Horticultural Crops. John Wiley & Sons.
6. Srivastava U, MAHVajan RK, Gangopadyay KK, Singh M & Dhillon BS.
7. 2001. Minimal Descriptors of Agri-Horticultural Crops. Part-II: Vegetable Crops. NBPGR, New Delhi.
8. Vasistha. 1998. Taxonomy of Angiosperm. Kalyani.
9. Vincent ER & Yamaguchi M. 1997. World Vegetables. 2nd Ed. Chapman & Hall.

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- <https://actascientific.com/ASAG/pdf/ASAG-03-0348.pdf>
- https://www.researchgate.net/publication/227251030_Molecular_markers_Its_application_in_crop_improvement.

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MAHV-303 III Breeding of Cross Pollinated Vegetable Crops L:T:P 3:0:0

Objective: This course enables the students to learn about breeding objectives, methodologies and genetics involved for the improvement of cross pollinated vegetable crops. **for skill development, employability and entrepreneurship.**

UNIT-I

Breeding for Cole crops: Cabbage, cauliflower, broccoli and knolkhol **for skill development.**

UNIT-II

Breeding for Root vegetables: Carrot, beetroot, radish **to provide employability and entrepreneurship.**

UNIT-III

Breeding for Cucurbits: Gourds, melons, pumpkins and squashes **to impart knowledge for better employability in industry.**

UNIT-IV

Breeding for Leafy vegetables: Amaranth, chenopods and palak **for provide employability and entrepreneurship.**

UNIT-V

Breeding for other cross pollinated vegetables: onion, and okra **for skill development.**

Course Outcomes:

Students completing this course will be able to:

CO1: Students will be able to know about the different breeding methods and genetics of major vegetable crops **for skill development.**

CO2: Understand the significance breeding objectives and methodologies for the improvement of cross pollinated vegetable crops **for better employability in industry**

CO3: Provide knowledge of breeding of cole crops and cucurbits **to provide employability and entrepreneurship.**

CO4: Develop the basic knowledge of selection of characters in improvement of root crops, onion and okra as required for market acceptability. **for better employability in industry.**

CO5: Understand the significance of leafy vegetables and their improvement for multi-cut greens and prolonged shelf life **to provide employability and entrepreneurship.**

PO-CO Mapping (Please write 3,2,1 wherever required)

Note: 3= Highly correlated, 2= Moderately correlated, 1= Less correlated

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	1	2	2	1	2	2	1	2	1	1

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CO2	2	2	1	2	2	1	1	2	1	2	2
CO3	1	1	2	1	1	2	2	2	2	2	2
CO4	2	2	1	2	2	1	2	1	1	1	1
CO5	1	1	2	1	1	2	1	2	2	2	2

CO-Curriculum Enrichment Mapping(Please write 3,2,1 wherever required)

Note: 3= Highly correlated, 2= Moderately correlated, 1= Less correlated

	Skill Development	Employability	Entrepreneurship Development
CO1	3	1	1
CO2	1	3	3
CO3	1	3	1
CO4	2	3	3
CO5	3	1	2

References:

1. Kalloo G. 1988. *Vegetable Breeding*. Vols. I-III. CRC Press.
2. Peter KV and Pradeep KT. 2008. *Genetics and Breeding of Vegetables*. ICAR.
3. Rai N and Rai M. 2006. *Heterosis Breeding in Vegetable Crops*. New India Publication Agency.
4. Ram HH. 2005. *Vegetable Breeding-Principles and Practices*. Kalyani Publishers
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MAHV-303 IV Seed Production Techniques for Crucifers L:T:P 3:0:0

Objective: To impart knowledge on principles and practices involved in quality seed production of field crops **for skill development, employability and entrepreneurship.**

UNIT-I

Importance of seed-definition, history and development of seed industry, generation system of seed multiplication – classes of seed, stages of seed multiplication in varieties and hybrids **for skill development.**

UNIT-II

Seed quality – characteristics of quality seeds, factors affecting seed quality and its maintenance. Seed dormancy and viability, Methods to break seed/ bud dormancy of important crucifer plants, factors influencing seed production; Techniques to improve seed germination and seedling vigour **to provide employability and entrepreneurship.**

UNIT-III

Seed multiplication, Agencies involved in seed production at state and national level. Seed certification – control of seed source, field inspection, field counts, field standards **to impart knowledge for better employability in industry.**

UNIT-IV

Genetic purity- Maintenance of genetic purity during seed production. Deterioration of crop varieties— factors and their control, Requirements for hybrid seed production and types of hybrids. Systems and techniques of hybrid seed production, male sterility, self-incompatibility, CHA and EGMS **for provide employability and entrepreneurship.**

UNIT-V

Seed production techniques of important crucifers-mustard, radish, and turnip; Cole crops-cabbage, broccoli, brussels sprouts, kale, and kohlrabi **for skill development, employability and entrepreneurship.**

Course Outcomes:

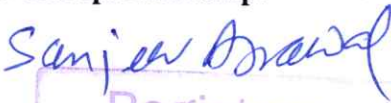
Students completing this course will be able to:

CO1: Students will be able to know generation system of seed multiplication **for skill development.**

CO2: Understand the significance of seed quality factors and techniques usesfor the improvement of seed quality and better germination**for better employability in industry**

CO3: Provide knowledge of seed certification and control of agencies in multiplication of seed**sto provide employability and entrepreneurship.**


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CO4: Develop the basic knowledge of deterioration of crop varieties and maintenance of genetic purity **for better employability in industry.**

CO5: Understand the principles and practices recommended for seed production of various crucifer plants **to provide employability and entrepreneurship.**

PO-CO Mapping (Please write 3,2,1 wherever required)

Note: 3= Highly correlated, 2= Moderately correlated, 1= Less correlated

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	1	2	2	1	2	2	1	2	1	1
CO2	2	2	1	2	2	1	1	2	1	2	2
CO3	1	1	2	1	1	2	2	2	2	2	2
CO4	2	2	1	2	2	1	2	1	1	1	1
CO5	1	1	2	1	1	2	1	2	2	2	2

CO-Curriculum Enrichment Mapping(Please write 3,2,1 wherever required)

Note: 3= Highly correlated, 2= Moderately correlated, 1= Less correlated

	Skill Development	Employability	Entrepreneurship Development
CO1	3	1	1
CO2	1	3	3
CO3	1	3	1
CO4	2	3	3
CO5	3	1	2

References:

1. McDonald MB and Copeland L. 1998. *Seed Production Principles and Practices*. CBS Publishers, New Delhi.
2. Kulkarni GN. 2011. *Principles of Seed Technology*. Kalyani Publishers, New Delhi.
3. Mondal SS, Saha M and Sengupta K. 2009. *Seed Production of Field Crops*. New India Publishing Agency, New Delhi.
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MAHV-303V

Post-Harvest Management of Vegetable Crops L:T:P 3:0:0

Objective: To educate the students about the principles and practices of post-harvest management of vegetables **for skill development, employability and entrepreneurship.**

UNIT-I

Introduction, History and role of post-harvest technology; Present status and future prospects of vegetable preservation industry in India **for skill development.**

UNIT-II

Factors affecting post-harvest life of vegetables, Maturity indices, Ripening and senescence of vegetable crops; Post harvest treatment for quality retention of vegetable crops **to provide employability and entrepreneurship.**

UNIT-III

Post-harvest handling (harvesting, precooling, sorting, grading and packaging) of vegetables, storage systems for vegetables **to impart knowledge for better employability in industry.**

UNIT-IV

Spoilage and biochemical changes—Spoilage of fresh and processed vegetable produce; biochemical changes and enzymes associated with spoilage of vegetable produce; Principal spoilage organisms, food poisoning and their control measures; Role of microorganisms in food preservation **for provide employability and entrepreneurship.**

UNIT-V

Principles and methods of food preservation, Preservation and Processing of fruit and vegetables (canning, dehydration, freezing and value added products). **for skill development.**

Course Outcomes:

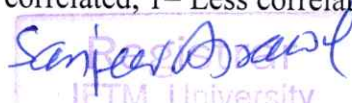
Students completing this course will be able to:

- CO1:** Students will know the importance and scope of post-harvest management of vegetables **for skill development.**
- CO2:** Provide knowledge of harvesting vegetables and factors included for deterioration of vegetables to **provide employability and entrepreneurship.**
- CO3:** Understand the post-harvest handling and storage of vegetables **knowledge for better employability in industry.**
- CO4:** Provide knowledge about spoilage and role of microorganisms in deterioration of post-harvest life of vegetables **for provides employability and entrepreneurship.**
- CO5:** Understand the principles and practices of preservation and processing of vegetables **for skill development.**

PO-CO Mapping (Please write 3,2,1 wherever required)

Note: 3= Highly correlated, 2= Moderately correlated, 1= Less correlated


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	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	1	2	2	1	2	2	1	2	1	1
CO2	2	2	1	2	2	1	1	2	1	2	2
CO3	1	1	2	1	1	2	2	2	2	2	2
CO4	2	2	1	2	2	1	2	1	1	1	1
CO5	1	1	2	1	1	2	1	2	2	2	2

CO-Curriculum Enrichment Mapping (Please write 3,2,1 wherever required)

Note: 3= Highly correlated, 2= Moderately correlated, 1= Less correlated

	Skill Development	Employability	Entrepreneurship Development
CO1	3	1	1
CO2	1	3	3
CO3	1	3	1
CO4	2	3	3
CO5	3	1	2

References:

1. Arthey D and Dennis C. 1996. *Vegetable processing*. Blackie/ Springer-Verlag.
2. Frazier WC and Westhoff DC. 1995. *Food microbiology*. 4th Ed. Tata McGraw Hill.
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- <http://www.uop.edu.pk/ocontents/Lecture%20no%202.pdf>
- <https://ecourseonline.iasri.res.in>

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MAHV303VI Biotechnological Approaches in Vegetable Crops L:T:P 3:0:0

Objective: To impart latest knowledge in biotechnical advancement in vegetable crops and improve the skill, employability and entrepreneurship.

UNIT I

Importance and scope of biotechnology – in vegetable crop improvement. In-vitro culture, micropropagation, anther culture, pollen culture, ovule culture, embryo culture, endosperm culture **for skill development.**

UNIT II

Somatic embryogenesis – somaclonal variation and synthetic seed production, protoplast isolation, culture, manipulation and fusion. Somatic hybrids and Cybrids and their application in vegetable improvement programme **for skill development.**

UNIT III

Blotting techniques, DNA finger printing – Molecular markers/ DNA based markers and role. RFLP, AFLP, RAPD, SSR, SNPs, DNA probes. QTL mapping. MAS and its application in vegetable crop improvement. Allele mining by TILLING and Eco TILLING **to provide employability and entrepreneurship.**

UNIT IV

Plant genetic engineering – Scope and importance, Concepts of cisgenesis, intragenesis and transgenesis. Gene cloning, direct and indirect methods of gene transfer. Role of RNAi based gene silencing in vegetable crop improvement. Biosafety issue, regulatory issues for commercial approval **for skill development.**

UNIT V

Concepts and methods of next generation sequencing (NGS)- Genome sequencing, transcriptomics, proteomics, metabolomics. Genome editing (ZFN, TALENS and CRISPER) **to provide employability and entrepreneurship.**

Course Outcomes:

The student would be expected to learn

1. Different biotechnological tools
2. NGS, genetic engineering

PO-CO Mapping (Please write 3,2,1 wherever required)

Note: 3= Highly correlated, 2= Moderately correlated, 1= Less correlated


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	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	1	2	2	1	2	2	1	2	1	1
CO2	2	2	1	2	2	1	1	2	1	2	2
CO3	1	1	2	1	1	2	2	2	2	2	2
CO4	2	2	1	2	2	1	2	1	1	1	1
CO5	1	1	2	1	1	2	1	2	2	2	2

CO-Curriculum Enrichment Mapping(Please write 3,2,1 wherever required)

Note: 3= Highly correlated, 2= Moderately correlated, 1= Less correlated

	Skill Development	Employability	Entrepreneurship Development
CO1	3	1	1
CO2	1	3	3
CO3	1	3	1
CO4	2	3	3
CO5	3	1	2

References:

1. Agrawal RL. (Ed.). 1997. Seed technology. Oxford and IBH.
2. Basra AS. 2000. Hybrid seed production in vegetables. CRC press, Florida, USA.
3. Bench ALR and Sanchez RA. 2004. Handbook of seed physiology. Food products press, NY/ London.
4. Bendell PE. (Eds.). 1998. Seed science and technology: Indian forestry species. Allied Publ.
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6. Rajan S and Markose BL. 2007. Propagation of horticultural crops. New India publ. agency.
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MAHV303VII

Urban Horticulture

L:T:P 3:0:0

Objective: To update knowledge on the recent trends in the field of landscape designing and developing practical skills **and improve the skill, employability and entrepreneurship.**

UNIT I

Landscape design: Commercial landscape gardening- History, Plant identification and ecology, Materials of garden design, Design making by different garden styles and types. Design principles in ancient and modern landscape. Principles of designing a commercial landscape project. Role of landscaping in environment improvement, ecology conservation (birds, butterflies, animals). Plant wealth for edges, hedges, herbaceous borders, trees, floral beds, water plants, cacti, ferns, palms, etc. **to provide employability and entrepreneurship.**

UNIT II

Site analysis: Assessing site and plants adaptability for different locations, Landscape engineering (Topographical survey and designing concept including GIS,GPS, Remote sensing), special techniques in garden landscaping (Burlapping, waterscaping, xeriscaping, hardscaping, lawn establishment, topiary styles specializing, bioaesthetic planning). **to provide employability and entrepreneurship**

UNIT III

Software in landscaping: Preparation and drawing of site plan, Learning the basics in computer aided design (CAD) for developing a garden landscape plan, Handling soft landscape materials (AUTOCAD and ARCHICAD), GIS as a tool for spatial designing **for skill development.**

UNIT IV


Landscaping for different situations: Contemporary landscaping, Urban landscaping, Environmental landscaping, Industrial and institutional landscaping, Public and private garden making, play ground landscaping, Inventory management, Landscape restoration, Assessing a successful design in site **to provide employability and entrepreneurship.**

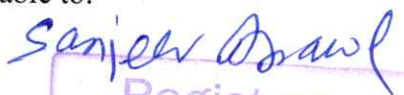
UNIT V

Maintenance: Maintenance of different types of gardens, waste water utilisation, historical and archaeological garden sites, Permissions required for bigger projects, carbon sequestration, carbon credits etc **for skill development.**

Course Outcomes:

Students completing this course will be able to:


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School of Agricultural Sciences & Engineering, IFTM University
M. Sc. Ag. Horticulture (Vegetable Science)

CO1: Understand the basic concepts of Landscape design: Commercial landscape gardening- History, Plant identification and ecology, Materials of garden design, **for skill development.**

CO2: Assessing site and plants adaptability for different locations, Landscape engineering **to provide employability and entrepreneurship.**

CO3: Software in landscaping: Preparation and drawing of site plan, Learning the basics in computer aided design **knowledge for better employability in industry.**

CO4: Understand Landscaping for different situations **for provide employability and entrepreneurship.**

CO5: Understand the concept of Maintenance: Maintenance of different types of gardens **for skill development.**

PO-CO Mapping (Please write 3,2,1 wherever required)

Note: 3= Highly correlated, 2= Moderately correlated, 1= Less correlated

	PO1	PO2	PO3	PO4	PO5
CO1	3	3	1	1	3
CO2	3	3	1	1	1
CO3	1	1	3	1	1
CO4	2	2	3	2	1
CO5	1	3	3	2	1

CO-Curriculum Enrichment Mapping(Please write 3,2,1 wherever required)

Note: 3= Highly correlated, 2= Moderately correlated, 1= Less correlated

	Skill Development	Employability	Entrepreneurship Development
CO1	3	1	1
CO2	1	3	3
CO3	1	3	1
CO4	2	3	3
CO5	3	1	2

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