Integral University, Lucknow

Effective from Session: 2022-23							
Course Code	FSC 501	**Title of the Course**	Tropical Fruit Production	**L**	**T**	**P**	**C**
Year	I	**Semester**	I	2	0	2	
Course Objectives	• Importance of fruit production, major species and varieties of Tropical fruit crops • Knowledge about propagation of fruit crops • Familiar the students about training, pruning and crop regulation of fruit crops. • Knowing the principles and methods of post harvest management.						

Course Outcomes	
CO1	To aware about different species and varieties of fruit crops.
CO2	Students aware about different methods of propagation
CO3	Students also aware about the training, pruning and flowering physiology of fruit crops
CO4	To aware about the different methods of irrigation and nutrient management practices
CO5	To familiarize the students with the important physiological disorders and their management.

Unit No.	**Title of the Unit**	**Content of Unit**	**Contact Hrs.**	**Mapped CO**
1	**Unit-I**	Importance and Background: Importance, origin and distribution, major species, rootstocks and commercial varieties of regional, national and international importance, eco-physiological requirements for Crops Mango, Banana, Guava, Pineapple, Papaya, Avocado, Jackfruit, Annonas, Aonla, Ber, etc.	4	CO1
2	**Unit-II**	Asexual and sexual methods of propagation, planting systems and planting densities, training and pruning methods, rejuvenation, intercropping, nutrient management, water management, fertigation, use of bio-fertilizers, role of bio-regulators, abiotic factors limiting fruit production for Crops Mango, Banana, Guava, Pineapple, Papaya, Avocado, Jackfruit, Annonas, Aonla, Ber, etc.	7	CO2, CO3, CO4
3	**Unit-III**	Physiology of flowering, pollination management, fruit set and development, physiological disorders – causes and remedies, crop regulation, quality improvement by management practices; maturity indices, harvesting, grading, packing, storage and ripening techniques; insect and disease management for Crops Mango, Banana, Guava, Pineapple, Papaya, Avocado, Jackfruit, Annonas, Aonla, Ber, etc.	8	CO5
Practicals:				
		Distinguished features of tropical fruit species, cultivars and rootstocks. Demonstration of planting systems, training and pruning. Hands on practices on pollination and crop regulation. Leaf sampling and nutrient analysis. Physiological disorders-malady diagnosis. Physico-chemical analysis of fruit quality attributes. Field/ Exposure visits to tropical orchards. Project preparation for establishing commercial orchards.	15	CO1, CO2, CO3, CO4, CO5

Reference Books:

- Bartholomew DP, Paull RE and Rohrbach KG. 2002. The Pineapple: Botany, Production, and Uses. CAB International.
- Bose TK, Mitra SK and Sanyal D. 2002. Fruits of India – Tropical and Sub-Tropical.3rd Edn. Naya Udyog, Kolkata.
- Dhillon WS. 2013. Fruit Production in India. Narendra Publ. House, New Delhi.
- Iyer CPA and Kurian RM. 2006. High Density Planting in Tropical Fruits: Principles and Practices. IBDC Publishers, New Delhi.

e-Learning Source:

http://ecoursesonline.iasri.res.in/course/view.php?id=136

https://agritech.tnau.ac.in/horticulture/horti_fruits.html

https://www.science.gov/topicpages/t/tropical+fruit+crop.html

	Course Articulation Matrix: (Mapping of COs with POs and PSOs)																	
PO-PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
CO1	3	2	1	3	3	1	3	1	1	1	3	3	3	3	3			
CO2	2	3	1	2	3	1	2	1	1	1	2	3	3	3	2			
CO3	3	2	1	1	3	1	3	1	1	1	3	3	2	3	3			
CO4	3	2	1	3	3	2	2	1	1	1	1	2	3	3	3			
CO5	3	2	1	3	3	1	3	1	1	1	3	3	3	3	3			

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Integral University, Lucknow

Effective from Session: 2022-23							
Course Code	FSC 503	**Title of the Course**	Propagation and Nursery Management of Fruit Crops	**L**	**T**	**P**	**C**
Year	I	**Semester**	I	2	0	2	
Course Objectives	• To impart knowledge to the students on plant propagation by sexual and asexual method of propagation • To impart knowledge to the students on physiological and anatomical aspects of plant propagation • To impart basic knowledge of nursery management • To know about the micropropagation						

Course Outcomes	
CO1	To study about the different methods of cutting, budding, layering and grafting
CO2	To learn about the Factors influencing seed germination of fruit crops, dormancy, hormonal regulation of seed germination
CO3	The students will be able to know about conventional asexual propagation
CO4	The students will be able to know about principles and concepts of micropropagation
CO5	To study about nursery management practices

Unit No.	**Title of the Unit**	**Content of Unit**	**Contact Hrs.**	**Mapped CO**
1	**Unit-I**	Introduction, understanding cellular basis for propagation, sexual and asexual propagation, apomixis, polyembryony, chimeras. Factors influencing seed germination of fruit crops, dormancy, hormonal regulation of seed germination and seedling growth. Seed quality, treatment, packing, storage, certification and testing.	6	CO1, CO2
2	**Unit-II**	Cutting– methods, rooting of soft and hardwood cuttings under mist and hotbeds. Use of PGR in propagation, Physiological, anatomical and biochemical aspects of root induction in cuttings. Layering – principle and methods. Budding and grafting – principles and methods, establishment and management of bud wood bank. Stock, scion and inter stock relationship – graft incompatibility, physiology of rootstock and top working.	8	CO3
3	**Unit-III**	Micro-propagation – principles and concepts, commercial exploitation in horticultural crops. Techniques – in-vitro clonal propagation, direct organogenesis, embryogenesis, micrografting, meristem culture, genetic fidelity testing. Hardening, packaging and transport of micro-propagules.	7	CO4
4	**Unit-IV**	Nursery – types, structures, components, planning and layout. Nursery management practices for healthy propagule production. Nursery Act, nursery accreditation, import and export of seeds and planting material and quarantine.	6	CO5
Practicals:				
Hands on practices on rooting of dormant and summer cuttings. Anatomical studies in rooting of cutting and graft union. Hands on practices on various methods of budding and grafting. Propagation by layering and stooling. Micropropagation-explant preparation, media preparation, culturing – meristem tip culture, axillary bud culture, micro-grafting, hardening, Visit to commercial tissue culture laboratories and accredited nurseries.			15	CO1, CO2, CO3, CO4, CO5

Reference Books:

- Bose TK, Mitra SK and Sadhu MK. 1991. Propagation of Tropical and Subtropical Horticultural Crops. Naya Prokash, Kolkata.
- Davies FT, Geneve RL and Wilson SB. 2018. Hartmann and Kester's Plant Propagation- Principles and Practices. Pearson, USA/ Prentice Hall of India. New Delhi.
- Gill SS, Bal JS and Sandhu AS. 2016. Raising Fruit Nursery. Kalyani Publishers, New Delhi.
- Jain S and Ishil K. 2003. Micropropagation of Woody Trees and Fruits. Springer.

e-Learning Source:

http://ecoursesonline.iasri.res.in/course/view.php?id=133

https://agritech.tnau.ac.in/horticulture/horti_nursery%20techniques.html

https://egyankosh.ac.in/bitstream/123456789/73070/1/Block-2.pdf

	Course Articulation Matrix: (Mapping of COs with POs and PSOs)																	
PO-PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
CO1	3	3	2	3	3	1	3	1	1	1	3	3	3	3	2			
CO2	2	2	1	2	3	1	2	1	1	1	2	3	3	3	2			
CO3	3	3	2	1	3	1	3	1	1	1	3	3	2	3	2			
CO4	3	2	2	3	3	2	2	1	1	1	1	2	3	3	2			
CO5	3	3	3	1	3	1	3	1	1	1	3	3	3	3	2			

1-Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Integral University, Lucknow

Effective from Session: 2022-23							
Course Code	FSC 513	**Title of the Course**	Minor Fruit Production	**L**	**T**	**P**	**C**
Year	I	**Semester**	I	2	0	2	
Course Objectives	• To import basic knowledge underexploited minor fruit crops. • To impart knowledge to the student about Occurrence, Adoption and General Account of minor fruits • To impart knowledge to the student on Propagation and Cultural Practices • To used knowledge about Post-Harvest Management						

Course Outcomes	
CO1	Study about the occurrence and distribution of minor fruit crops
CO2	Learn about the propagation of minor fruit crops
CO3	Students are able to know about floral biology
CO4	Study about cultural practices
CO5	Students are able to know about post-harvest management

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO
1	**Unit-I**	Importance – occurrence and distribution, climate adaptation in fragile ecosystem and wastelands. Crops Bael, chironji, fig, passion fruit, jamun, phalsa, karonda, woodapple, cactus pear, khejri, kair, pilu, lasoda, loquat, tamarind, dragon fruit, monkey jack, mahua, khirni, amra, kokum, cape gooseberry, kaphal, persimmon, pistachio, seabuckthorn, hazel nut and other minor fruits of regional importance.	9	CO1
2	**Unit-II**	Traditional cultural practices and recent development in agro-techniques; propagation, botany-floral biology, growth patterns, mode of pollination, fruit set, ripening, fruit quality. Crops Bael, chironji, fig, passion fruit, jamun, phalsa, karonda, woodapple, cactus pear, khejri, kair, pilu, lasoda, loquat, tamarind, dragon fruit, monkey jack, mahua, khirni, amra, kokum, cape gooseberry, kaphal, persimmon, pistachio, seabuckthorn, hazel nut and other minor fruits of regional importance.	9	CO2, CO3, CO4
3	**Unit-III**	Post-harvest management, marketing; minor fruit crops in terms of medicinal and antioxidant values; their uses for edible purpose and in processing industry. Crops Bael, chironji, fig, passion fruit, jamun, phalsa, karonda, woodapple, cactus pear, khejri, kair, pilu, lasoda, loquat, tamarind, dragon fruit, monkey jack, mahua, khirni, amra, kokum, cape gooseberry, kaphal, persimmon, pistachio, seabuckthorn, hazel nut and other minor fruits of regional importance.	9	CO5
Practicals:				
Visits to institutes located in the hot and cold arid regions of the country. Identification of minor fruits plants/ cultivars. Collection of leaves and preparation of herbarium. Allelopathic studies Generating know-how on reproductive biology of minor fruits. Fruit quality attributes and biochemical analysis. Project formulation for establishing commercial orchards in fragile ecosystems.			15	CO1, CO2, CO3, CO4, CO5

Reference Books:

- Ghosh SN, Singh A and Thakur A. 2017. Underutilized Fruit Crops: Importance and Cultivation. Jaya Publication House, New Delhi.
- Krishna H and Sharma RR, 2017. Fruit Production: Minor Fruits. Daya Publishing House, New Delhi.
- Mazumdar BC. 2014. Minor Fruit Crops of India: Tropical and Subtropical. Daya Publication House, New Delhi.
- Nath V, Kumar D, Pandey V and Pandey D. 2008. Fruits for the Future. Satish Serial Publishing House, New Delhi.

e-Learning Source:

https://www.bbau.ac.in/dept/Horticulture/TM/Minor%20Fruit%20crops-Hort-201.pdf

https://www.ishs.org/ishs-article/1241_7

https://content.kopykitab.com/ebooks/2013/11/2267/sample/sample_2267.pdf

Course Articulation Matrix: (Mapping of COs with POs and PSOs)

PO-PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
CO1	3	2	2	1	3	1	3	2	1	2	2	3	3	3	2			
CO2	3	3	3	3	3	1	3	1	2	1	3	3	3	2	2			
CO3	3	1	3	3	3	1	2	1	1	1	2	3	2	3	2			
CO4	3	2	2	3	2	1	3	2	1	1	3	3	3	2	2			
CO5	3	3	2	3	3	1	3	1	1	1	1	3	3	3	2			

1-Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Integral University, Lucknow

Effective from Session: 2022-23							
Course Code	VSC 501	**Title of the Course**	Production of Cool Season Vegetable Crops	**L**	**T**	**P**	**C**
Year	I	**Semester**	I	2	0	2	
Course Objectives	• To know about the importance and historical knowledge of cool season vegetables of bulb and tuber crops. • Familiar with different varieties and cropping systems of different cole crops. • Knowledge of commercial and nutritional importance, origin and distribution of different root crops. • Knowledge of crop protection measure in different crops						

Course Outcomes	
CO1	Students will be able answer about the importance, historical knowledge and production technology of bulb, tuber and cole group crops.
CO2	Can use the knowledge of production of root crops and leafy vegetables.
CO3	By the end of course students will have the idea of production methods of different cool season crops.

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO
1	**Unit-I**	Introduction, commercial and nutritional importance, origin and distribution, botany and taxonomy, area, production, productivity and constraints, soil requirements, climatic factors for yield and quality, commercial varieties/ hybrids, seed rate and seed treatment, raising of nursery, sowing/ planting time and methods, hydroponics and aeroponics, precision farming, cropping system, nutritional including micronutrients and irrigation requirements, intercultural operations, special horticultural practices, weed control, mulching, role of plant growth regulators, physiological disorders, maturity indices, harvesting, yield, post-harvest management (grading, packaging and marketing), pest and disease management and production economics of Bulb and tuber crops—Onion, garlic and potato.	6	CO1, CO2, CO3
2	**Unit-II**	Introduction, commercial and nutritional importance, origin and distribution, botany and taxonomy, area, production, productivity and constraints, soil requirements, climatic factors for yield and quality, commercial varieties/ hybrids, seed rate and seed treatment, raising of nursery, sowing/ planting time and methods, hydroponics and aeroponics, precision farming, cropping system, nutritional including micronutrients and irrigation requirements, intercultural operations, special horticultural practices, weed control, mulching, role of plant growth regulators, physiological disorders, maturity indices, harvesting, yield, post-harvest management (grading, packaging and marketing), pest and disease management and production economics of Cole crops—Cabbage, cauliflower, kohlrabi, broccoli, Brussels sprouts and kale.	6	CO1, CO2, CO3
3	**Unit-III**	Introduction, commercial and nutritional importance, origin and distribution, botany and taxonomy, area, production, productivity and constraints, soil requirements, climatic factors for yield and quality, commercial varieties/ hybrids, seed rate and seed treatment, raising of nursery, sowing/ planting time and methods, hydroponics and aeroponics, precision farming, cropping system, nutritional including micronutrients and irrigation requirements, intercultural operations, special horticultural practices, weed control, mulching, role of plant growth regulators, physiological disorders, maturity indices, harvesting, yield, post-harvest management (grading, packaging and marketing), pest and disease management and production economics of Root crops—Carrot, radish, turnip and beetroot.	6	CO1, CO2, CO3
4	**Unit-IV**	Introduction, commercial and nutritional importance, origin and distribution, botany and taxonomy, area, production, productivity and constraints, soil requirements, climatic factors for yield and quality, commercial varieties/ hybrids, seed rate and seed treatment, raising of nursery, sowing/ planting time and methods, hydroponics and aeroponics, precision farming, cropping system, nutritional including micronutrients and irrigation requirements, intercultural operations, special horticultural practices, weed control, mulching, role of plant growth regulators, physiological disorders, maturity indices, harvesting, yield, post-harvest management (grading, packaging and marketing), pest and disease management and production economics of Peas and beans—Garden peas and broad bean	6	CO1, CO2, CO3
5	**Unit-V**	Introduction, commercial and nutritional importance, origin and distribution, botany and taxonomy, area, production, productivity and constraints, soil requirements, climatic factors for yield and quality, commercial varieties/ hybrids, seed rate and seed treatment, raising of nursery, sowing/ planting time and methods, hydroponics and aeroponics, precision farming, cropping system, nutritional including micronutrients and irrigation requirements, intercultural operations, special horticultural practices, weed control, mulching, role of plant growth regulators, physiological disorders, maturity indices, harvesting, yield, post-harvest management (grading, packaging and marketing), pest and disease management and production economics of Leafy vegetables—Beet leaf, fenugreek, coriander and lettuce.	6	CO1, CO2, CO3
Practicals:				
Scientific raising of nursery and seed treatment; Sowing and transplanting; Description of commercial varieties and hybrids; Demonstration on methods of irrigation, fertilizers and micronutrients application; Mulching practices, weed management; Use of plant growth substances in cool season vegetable crops; Study of nutritional and physiological disorders; Studies on hydroponics, aeroponics and other soilless culture; Identification of important pest and diseases and their control; Preparation of cropping scheme for commercial farms; Visit to commercial farm, greenhouse/polyhouses; Visit to vegetable market; Analysis of benefit to cost ratio.			28	CO1, CO2, CO3 CO4, CO5
Reference Books:				

- Bose TK, Kabir J, Maity TK, Parthasarathy VA and Som MG. 2003. Vegetable crops. Vols. I-III. Naya udyog.
- Bose TK, Som MG and Kabir J. (Eds.). 1993. Vegetable crops. Naya prokash.
- Chadha KL and Kalloo G. (Eds.). 1993-94. Advances in horticulture Vols. V-X. Malhotra publ. house.
- Chadha KL. (Ed.). 2002. Hand book of horticulture. ICAR

e-Learning Source:

https://static1.squarespace.com/static/56bb6533c2ea51c6431244f6/t/5c06ba504ae237535a178d32/1543944790735/Fall+Gardening+Workshop_Cool+Season+Crops.pdf

https://btccarsbilaspur.com/production-technology-of-cool-season-crop/

https://www.researchgate.net/publication/364092396_A_Text_Book_of_Cool_Season_Vegetable_Crops

	Course Articulation Matrix: (Mapping of COs with POs and PSOs)																	
PO-PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	2	2	1	3	3	2	1	2	2	2	3	3	2	2	1			
CO2	3	3	3	3	1	1	2	1	3	2	3	2	2	1	2			
CO3	3	2	3	3	3	1	1	1	1	3	3	3	2	1	1			

1-Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Integral University, Lucknow

Effective from Session: 2022-23							
Course Code	STAT 511	**Title of the Course**	Experimental Designs	**L**	**T**	**P**	**C**
Year	I	**Semester**	I	2	0	2	
Course Objectives	• To understand the basic concept and fundamentals of experimental design and its application in agriculture.						

Course Outcomes	
CO1	Students will have basic knowledge of Experiments, designs and analysis of covariance
CO2	Students will have knowledge of Comparative experiments
CO3	The students will be able to prepare their experimental fields on the basis of designs
CO4	Students can have the knowledge of completely Randomized Design, Randomized Block Design and Latin square design and their analysis of variance
CO5	Students can analyze their results according to the designs

Unit No.	**Title of the Unit**	**Content of Unit**	**Contact Hrs.**	**Mapped CO**
1	**Unit-I**	Experiments: Absolute Experiments, Comparative experiments, need for designing of experiments, characteristics of a good design. Treatment, experimental unit, blocks, yield, uniformity trials, size and shape of plots and blocks. Principles of design of experiment: randomization, replication and local control.	4	CO1
2	**Unit-II**	Designs of experiments: Completely Randomized Design, Randomized Block Design and Latin square design and their analysis of variance. factorial design; symmetrical and asymmetrical. Confounding in symmetrical factorial experiments, factorial experiments with control treatment, advantages and disadvantages of confounding.	6	CO2, CO3
3	**Unit-III**	Analysis of covariance for two-way classification (Randomized Block Design). Split plot design: comparison between split-plot design and factorial design, advantages and disadvantages of split plot design. Missing Plot techniques: Analysis of missing plot design (Fisher's Rule), analysis of Randomized Block Design with one missing observation, analysis of Latin Square Design with one missing observation.	5	CO1, CO4
4	**Unit-IV**	Balanced Incomplete Block Design (BIBD), parameters of BIBD, Incidence matrix, Symmetric BIBD, Analysis of BIBD, efficiency of BIBD relative to Randomized Block Design, Response Surfaces.	4	CO5
Practicals:				
Uniformity trial data analysis, formation of plots and blocks, Analysis of data obtained from Completely Randomized Design, Randomized Block Design, Latin Square Design; Analysis of factorial experiments without and with confounding; Analysis with missing data; Split plot designs; Transformation of data; Fitting of response surfaces.			22	CO1, CO2, CO3, CO4, CO5

Reference Books:

- Cochran, W.G. and Cox, G.M. Experimental Design. Asia Publishing House.
- Kempthorne, O. (1965): The Design and Analysis of Experiments. John Wiley.
- Montgomery, D. C. (2008): Design and Analysis of Experiments, John Wiley.
- Goon, A.M., Gupta, M.K. and Dasgupta, B. (2005): Fundamentals of Statistics. Vol. II, 8thEdn. World Press, Kolkata.
- Casella, G, (2008). Statistical Design. Springer.
- Gupta, S.C. and Kapoor, V.K. Latest Revised Edition 2015. Fundamentals of Applied Statistics.

e-Learning Source:

https://iasri.icar.gov.in/

https://www.statisticshowto.com/experimental-design/

	Course Articulation Matrix: (Mapping of COs with POs and PSOs)																
PO-PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	2	3	2	2	2	2	1	1	2	2	1	2	2	2			
CO2	2	3	2	2	2	2	1	1	1	3	1	2	2	2			
CO3	2	3	2	2	2	2	1	1	2	3	1	2	2	2			
CO4	2	3	2	2	2	2	1	1	2	3	1	3	2	2			
CO5	2	3	2	2	2	2	1	1	2	3	1	3	3	2			

1-Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Integral University, Lucknow

Effective from Session: 2022-23							
Course Code	BIOCHEM 505	**Title of the Course**	Techniques in Biochemistry	**L**	**T**	**P**	**C**
Year	I	**Semester**	I	2	0	4	
Course Objectives	• To attain the knowledge and concept of Biomolecules. • To understand the basic concepts and principles of different biochemical techniques. • To understand the applications of different bioanalytical techniques.						

Course Outcomes	
CO1	Understand about the cells and apply the concept of centrifugation.
CO2	Knowledge of classification, principle and application of chromatography.
CO3	Knowledge of principle and application of electrophoresis and blotting techniques
CO4	Understand working principle of spectrophotometer and able to handle different spectrophotometric techniques
CO5	Understand the concept of microscopy and radiations.

Unit No.	**Title of the Unit**	**Content of Unit**	**Contact Hrs.**	**Mapped CO**
1	**Unit-I**	General scheme for purification of biocomponents. Methods of studying cells and organelles, sub cellular fractionation and marker enzymes. Methods for lysis of plant, animal and microbial cells. Ultra-filtration, sonication, freeze drying and fractional precipitation. Principles of centrifugation, concepts of RCF, different types of instruments and rotors, preparative, differential and density gradient centrifugation, analytical ultra-centrifugation, determination of molecular weights and other applications, subcellular fractionation.	6	CO1
2	**Unit-II**	Basic principles, instrumentation, working and applications of partition chromatography, paper, thin layer, ion exchange and affinity chromatography, gel permeation chromatography, HPLC and FPLC.	5	CO2
3	**Unit-III**	Electrophoretic techniques - slab, capillary, 2-D, pulse field, polyacrylamide/agarose gel electrophoresis. Blotting techniques: Western, Southern and Northern blotting- principle and methodology.	5	CO3
4	**Unit-IV**	Fundamental principles of flourescene & phosphorescence, absorption, transmission of light, Beer – Lamberts law, Colorimeter, flame photometry. Principle, instrumentation, working and application of – UV, visible and IR spectroscopy, atomic absorption spectrometry, Nuclear Magnetic Resonance (NMR), Mass spectroscopy - GC-MS, HPLC-MS and LC-MS/MS, Matrix-assisted laser desorption/ionization- Time-of-Flight Mass spectroscopy (MALDI-TOF MS), X-ray crystallography.	6	CO4
5	**Unit-V**	Basic principles, instrumentation and applications of microscopy. Bright field, phase contrast, fluorescence and confocal microscopy. Electron microscope – scanning and transmission electron microscopy. Nature of radioactivity, decay and types of radiation. Radiation hazards and precautions taken while handling radioisotopes. Radiation detection and measurements: Geiger Muller counter, scintillation counter and pulse height analyzer. Application of radioisotopes in biological science- autoradiography.	4	CO5
Practicals:				
Methods for lysis of plant and microbial cells; Centrifugation; Verification of Beer-Lambert's law and determination of absorption coefficients; Paper chromatography – Separation of amino acids and carbohydrates in a mixture; Thin layer chromatography of fatty acids; Column chromatography – Separation of a mixture of proteins and salt using Sephadex column; Electrophoresis. Staining of bacteria – Simple staining, differential staining, staining of spores.			26	CO1, CO2, CO3, CO4, CO5

Reference Books:

- Principles and Techniques of Practical Biochemistry by Keith Wilson, John Walker (eds), Cambridge University Press; 5th edition.
- Principles and Techniques of Practical Biochemistry by Wilson, K., Walker, J. (eds.), Cambridge University Press, Cambridge, 2000, 5th edition.
- Lehninger Principles of Biochemistry by David L. Nelson, Michael M. Cox, W. H. Freeman, 6th edition.

e-Learning Source:

	Course Articulation Matrix: (Mapping of COs with POs and PSOs)																
PO-PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO5	PSO6	PSO7
CO1	3	3	1	2	1	2	1	2	1	2	2	3	3	2			
CO2	3	2	1	1	2	2	1	1	1	1	3	3	3	3			
CO3	3	3	2	1	2	1	1	2	2	1	2	2	3	2			
CO4	3	2	1	2	1	1	2	1	1	1	3	3	3	2			
CO5	3	3	1	1	1	1	1	2	1	1	2	2	2	2			

1-Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Integral University, Lucknow

Effective from Session: 2022-23							
Course Code	MCA 512	**Title of the Course**	Information Technology in Agriculture	**L**	**T**	**P**	**C**
Year	I	**Semester**	I	1	0	2	
Course Objectives	• To gain basic knowledge of information technology in agriculture • The aim of improving communication and learning processes between various sectors in agriculture locally, regionally and worldwide • They gain knowledge of weather forecasting to increase the production and productivity of Agriculture • Type of education and Agricultural Journalism • Knowledge of Innovative Information sources.						

Course Outcomes	
CO1	Use of Information and Communication Technology in Agriculture
CO2	Know about crop models concepts & techniques
CO3	Know about computer models for understanding plant processes.
CO4	Knowledge of education and their Characteristics and Agricultural Journalism
CO5	Knowledge of contact methods, Kissan Call center and e-Chaupal.

Unit No.	**Title of the Unit**	**Content of Unit**	**Contact Hrs.**	**Mapped CO**
1	**Unit-I**	Introduction and Applications of e-Agriculture, Introduction to Online Agricultural resources: Consortium for e-resources in Agriculture (CeRA), e-agriculture community, Agriculture: National Portal of India. Agricultural Datasets and Databases: Agricola, Agris. Need of Biological databases in Agricultural Sciences.	4	CO1
2	**Unit-II**	Smartphone Apps in Agriculture for farm advisory, Weather forecasting, types, methods, tools & techniques, Use of ICT in Agriculture, Computer Models for understanding plant processes.	5	CO1, CO3
3	**Unit-III**	Crop models, concepts & techniques, types of crop models, spatial data and their management in GIS; Remote sensing concepts and application in agriculture, Global positioning system (GPS), components and its functions.	5	CO2, CO3
4	**Unit-IV**	Agricultural Journalism – Meaning, Scope and Importance, Sources of news, Kisan call centers, e-chaupal, RRA, PRA tools and techniques KVK, Adopter categories, MANAGE, EEI: extension education institute.	4	CO3, CO4
Practicals:				
Uniformity trial data analysis, formation of plots and blocks, Analysis of data obtained from Completely Randomized Design, Randomized Block Design, Latin Square Design; Analysis of factorial experiments without and with confounding; Analysis with missing data; Split plot designs; Transformation of data; Fitting of response surfaces.			26	CO1, CO2, CO3, CO4, CO5

Reference Books:

- Agri Informatics: An Introduction (Industry Series), by R Chakravarthy, ICFAI University Press.
- E-Agriculture: Concepts and Applications (Agriculture Series), Rahul Gupta (Author), ICFA University Press
- Yadav, D S, Foundations of IT, New Age, Delhi.
- Introduction to Bioinformatics by Teresa Attwood, David Parry-Smith 1st edition; Prentice Hall Publications
- Bioinformatics: A Practical Guide to the Analysis of Genes and Proteins by Andreas D. Baxevanis and B. F. Francis Ouellette (Eds), 2nd Edition; Willey & Sons Publications
- Bioinformatics: Sequence, Structure, and Databanks: A Practical Approach by Des Higgins, Willie Taylor; OUP.
- BIOS Instant Notes in Bioinformatics by Charlie Hodgman, Andrew French, David Westhead, Taylor & Francis publishing; 2 edition

e-Learning Source:

https://iasri.icar.gov.in/

	Course Articulation Matrix: (Mapping of COs with POs and PSOs)																	
PO-PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	3	3	2	1	3	3	1	1	2	3	3	3	3	2	2			
CO2	3	3	3	2	1	3	2	1	3	2	3	3	2	3	2			
CO3	3	3	1	2	2	2	3	1	2	3	3	3	2	3	3			
CO4	3	3	3	2	3	3	2	1	3	2	3	3	3	1	2			
CO5	3	3	2	3	1	3	1	1	2	2	3	3	3	3	2			

1-Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Integral University, Lucknow

Effective from Session: 2018-19							
Course Code	PGS 503 (e-Course)	**Title of the Course**	Intellectual Property and Its Management in Agriculture	**L**	**T**	**P**	**C**
Year	I	**Semester**	I	1	0	0	
Course Objectives	• To understand the knowledge, concept and introduction of Intellectual Property Right regime; TRIPs and various provisions in TRIPS Agreement • To understand the basics of Legislations for the protection of various types of Intellectual Properties • To know the fundamentals of patents, copyrights, geographical indications, designs and layout • To gain the basic concepts of Protection of plant varieties and farmers' rights and bio-diversity protection, Convention on Biological Diversity; International Treaty on Plant Genetic Resources for Food and Agriculture • To study of Licensing of technologies, Material transfer agreements, Research collaboration Agreement, License Agreement						

Course Outcomes	
CO1	Concept of Intellectual Property Right regime; TRIPs and various provisions in TRIPS Agreement
CO2	Knowledge of Legislations for the protection of various types of Intellectual Properties
CO3	Concepts of Protection of plant varieties and farmers' rights and bio-diversity protection, Convention on Biological Diversity; International Treaty on Plant Genetic Resources for Food and Agriculture
CO4	Knowledge of Convention on Biological Diversity; International Treaty on Plant Genetic Resources for Food and Agriculture
CO5	Knowledge of Socio-economic impact, Research collaboration Agreement, License Agreement

Unit No.	**Title of the Unit**	**Content of Unit**	**Contact Hrs.**	**Mapped CO**
1	**Unit-I**	Historical perspectives and need for the introduction of Intellectual Property Right regime; TRIPs and various provisions in TRIPS Agreement; Intellectual Property and Intellectual Property Rights (IPR), benefits of securing IPRs	4	CO1
2	**Unit-II**	Indian Legislations for the protection of various types of Intellectual Properties; Fundamentals of patents, copyrights, geographical indications, designs and layout, trade secrets and traditional knowledge, trademarks.	5	CO2
3	**Unit-III**	Protection of plant varieties and farmers' rights and bio-diversity protection; Protectable subject matters, protection in biotechnology, protection of other biological materials, ownership and period of protection; National Biodiversity protection initiatives; Convention on Biological Diversity; International Treaty on Plant Genetic Resources for Food and Agriculture.	5	CO3, CO4
4	**Unit-IV**	Licensing of technologies, Material transfer agreements, Research collaboration Agreement, License Agreement	4	CO5

Reference Books:

- Erbisch FH and Maredia K.1998. Intellectual Property Rights in Agricultural Biotechnology. CABI.
- Ganguli P. 2001. Intellectual Property Rights: Unleashing Knowledge Economy. McGraw-Hill.
- Intellectual Property Rights: Key to New Wealth Generation. 2001. NRDC and Aesthetic Technologies.
- Ministry of Agriculture, Government of India. 2004. State of Indian Farmer. Vol. V. Technology Generation and IPR Issues. Academic Foundation.
- Rothschild M and Scott N. (Ed.). 2003. Intellectual Property Rights in Animal Breeding and Genetics. CABI.
- Saha R. (Ed.). 2006. Intellectual Property Rights in NAM and Other Developing Countries: A Compendium on Law and Policies. Daya Publ. House.

e-Learning Source:

https://hau.ac.in/public/pages-pdf/1548828324.pdf

	Course Articulation Matrix: (Mapping of COs with POs and PSOs)																	
PO-PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	2	3	3	3	1	1	1	3	3	2	3	3	3	2	2			
CO2	2	3	2	2	1	1	1	1	2	3	1	3	2	2	2			
CO3	3	3	3	3	1	1	2	2	3	3	2	3	2	2	2			
CO4	3	3	2	2	1	1	1	1	2	3	3	3	3	2	2			
CO5	3	3	2	3	1	1	1	3	3	3	3	1	3	3	2			

1-Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Integral University, Lucknow

Effective from Session: 2018-19							
Course Code	PGS 504	**Title of the Course**	Basic Concepts in Laboratory Techniques	**L**	**T**	**P**	**C**
Year	I	**Semester**	I	0	0	2	
Course Objectives	• To understand the basic concepts of safety measures while handling instruments, chemicals, glasswares, etc. in lab • To learn the use of different instruments, chemicals, glasswares, etc. of lab • To learn the preparation of different agrochemical doses in field and pot applications • To learn the preparation of buffers of different strengths and pH values • To learn the preparation of media and methods of sterilization • To understand the seed viability testing, testing of pollen viability						

Course Outcomes	
CO1	Students will have basic knowledge of handling and safety measures of instruments, chemicals, glasswares, etc. in lab before and after use
CO2	Students will have knowledge of usage of different type of lab equipments, instruments, glasswares, plasticwares, etc.
CO3	The students will be able to prepare different agrochemical doses in field and pot applications
CO4	Students can have the knowledge to prepare media, acid and bases of different strengths and buffer solutions
CO5	Students can also perform seed and pollen viability testing

Practicals:

	Contact Hrs.	**Mapped CO**
Safety measures while in Lab; Handling of chemical substances; Use of burettes, pipettes, measuring cylinders, flasks, separatory funnel, condensers, micropipettes and vaccupets; Washing, drying and sterilization of glassware; Drying of solvents/ chemicals; Weighing and preparation of solutions of different strengths and their dilution; Handling techniques of solutions; Preparation of different agro-chemical doses in field and pot applications; Preparation of solutions of acids; Neutralization of acid and bases; Preparation of buffers of different strengths and pH values; Use and handling of microscope, laminar flow, vacuum pumps, viscometer, thermometer, magnetic stirrer, micro-ovens, incubators, sandbath, waterbath, oilbath; Electric wiring and earthing; Preparation of media and methods of sterilization; Seed viability testing, testing of pollen viability; Tissue culture of crop plants; Description of flowering plants in botanical terms in relation to taxonomy.	32	CO1, CO2, CO3, CO4, CO5

Reference Books:

- Furr AK. 2000. CRC Hand Book of Laboratory Safety. CRC Press.
- Gabb MH & Latchem WE. 1968. A Handbook of Laboratory Solutions. Chemical Publ. Co.

e-Learning Source:

https://chem.libretexts.org/Ancillary_Materials/Laboratory_Experiments/Wet_Lab_Experiments/Organic_Chemistry_Labs/Misc/COMMON_LABORATORY_TECHNIQUES

Course Articulation Matrix: (Mapping of COs with POs and PSOs)

PO-PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	2	2	2	2	1	2	1	2	2	2	1	3	2	2	2			
CO2	2	2	2	2	1	2	1	2	1	2	1	3	2	2	2			
CO3	3	3	3	2	1	2	1	2	2	2	1	3	2	2	2			
CO4	3	3	3	2	1	2	1	2	2	2	1	3	2	2	2			
CO5	3	3	3	2	2	2	1	2	2	2	1	3	2	2	2			

1-Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Integral University, Lucknow

Effective from Session: 2022-23							
Course Code	FSC 502	**Title of the Course**	Sub-Tropical and Temperate Fruit Production	**L**	**T**	**P**	**C**
Year	I	**Semester**	II	2	0	2	
Course Objectives	• Importance of fruit production, major species and varieties of Sub Tropical and Temperate fruit crops • Knowledge about different species, rootstock and different methods propagation of Sub Tropical and Temperate fruit crops • Familiar the students about training, pruning and nutrient management of fruit crops • To know about different physiological disorders of fruit crops						

Course Outcomes	
CO1	To make aware about different species, Rootstock and varieties of fruit crops.
CO2	The students will be able to know about different types of propagation methods
CO3	The students also get awareness about the flowering physiology of fruit crops
CO4	To aware the students about the different methods of crop regulation
CO5	To familiarize with the methods of training and pruning.

Unit No.	**Title of the Unit**	**Content of Unit**	**Contact Hrs.**	**Mapped CO**
1	**Unit-I**	Importance and Background: Origin, distribution and importance, major species, rootstocks and commercial varieties of regional, national and international importance, eco-physiological requirements for Crops Citrus, Grapes, Litchi, Pomegranate, Apple, Pear, Peach, Plum, Apricot, Cherries, Berries, Persimmon, Kiwifruit, Nuts- Walnut, Almond, Pecan, etc.	8	CO1
2	**Unit-II**	Propagation, Planting and Orchard Floor Management: Propagation, planting systems and densities, training and pruning, rejuvenation and replanting, intercropping, nutrient management, water management, fertigation, use of bio-fertilizers, role of bio-regulators, abiotic factors limiting fruit production for Crops Citrus, Grapes, Litchi, Pomegranate, Apple, Pear, Peach, Plum, Apricot, Cherries, Berries, Persimmon, Kiwifruit, Nuts- Walnut, Almond, Pecan, etc.	10	CO2, CO4
3	**Unit-III**	Flowering, Fruit-Set and Harvesting: Physiology of flowering, pollination management, fruit set and development, physiological disorders – causes and remedies, crop regulation, quality improvement by management practices; maturity indices, harvesting, grading, packing, storage and ripening techniques; insect and disease management for Crops Citrus, Grapes, Litchi, Pomegranate, Apple, Pear, Peach, Plum, Apricot, Cherries, Berries, Persimmon, Kiwifruit, Nuts- Walnut, Almond, Pecan, etc.	11	CO3, CO4, CO5
Practicals:				
Distinguished features of tropical fruit species, cultivars and rootstocks; Demonstration of planting systems, training and pruning; Hands on practices on pollination and crop regulation; Leaf sampling and nutrient analysis; Physiological disorders-malady diagnosis; Physico-chemical analysis of fruit quality attributes; Field/Exposure visits to subtropical and temperate orchards. Project preparation for establishing commercial orchards.			14	CO1, CO2, CO3, CO4, CO5

Reference Books:

- Chadha KL and Awasthi RP. 2005. The Apple. Malhotra Publishing House, New Delhi.
- Chadha TR. 2011. A Text Book of Temperate Fruits. ICAR, New Delhi
- Childers NF, Morris JR and Sibbett GS. 1995. Modern Fruit Science: Orchard and Small Fruit
- Culture. Horticultural Publications, USA.
- Creasy G and Creasy L. 2018. Grapes. CAB International.
- Davies FS and Albrigo LG. 1994. Citrus. CAB International.
- Dhillon WS. 2013. Fruit Production in India. Narendra Publishing House, New Delhi.
- Jackson D, Thiele G, Looney NE and Morley-Bunker M. 2011. Temperate and Subtropical Fruit Production. CAB International.
- Ladanyia M. 2010. Citrus Fruit: Biology, Technology and Evaluation. Academic Press.
- Layne DR and Bassi D. 2008. The Peach: Botany, Production and Uses. CABI.
- Menzel CM and Waite GK. 2005. Litchi and Longan: Botany, Production and Uses. CAB International.
- Pandey RM and Randey SN. 1996. The Grape in India. ICAR, New Delhi.

e-Learning Source:

https://agricoop.nic.in/sites/default/files/ICAR_9.pdf

https://eternaluniversity.edu.in/docs/SubtropicalandTemperateFruitProduction.pdf

	Course Articulation Matrix: (Mapping of COs with POs and PSOs)																	
PO-PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
CO1	3	2	1	3	3	1	3	1	1	3	3	2	3	2	3			

CO2	2	3	2	2	3	2	2	1	1	1	2	3	3	3	2			
CO3	3	2	1	1	3	1	3	2	1	2	3	3	2	2	3			
CO4	2	2	1	3	3	2	2	1	1	1	1	2	3	3	3			
CO5	3	2	1	3	3	1	3	2	1	1	3	3	3	3	3			

2- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Integral University, Lucknow

Effective from Session: 2022-23							
Course Code	FSC 503	**Title of the Course**	Breeding of Fruit Crops	**L**	**T**	**P**	**C**
Year	I	**Semester**	II	2	0	2	
Course Objectives	• To impart knowledge to the students on sexual and asexual method of propagation • To impart knowledge to the students on breeding systems for fruit crops • To impart basic knowledge of Conventional and Non-Conventional Breeding • To know about the process of mutation						

Course Outcomes	
CO1	To study about the different methods of propagation
CO2	To learn about the breeding systems for fruit crops
CO3	The students will be able to know about different ideotypes for fruit crops
CO4	The students will be able to know about approaches of crop improvement
CO5	To study about biotechnological interventions

Unit No.	**Title of the Unit**	**Content of Unit**	**Contact Hrs.**	**Mapped CO**
1	**Unit-I**	General Concepts and Phenomena: Introduction, understanding cellular basis for propagation, sexual and asexual propagation, apomixis, polyembryony, chimeras. Factors influencing seed germination of fruit crops, dormancy, hormonal regulation of Mango, Banana, Pineapple, Citrus, Grapes, Litchi, Guava, Pomegranate, Papaya, Apple, Pear, Plum, Peach, Apricot, Cherries, Strawberry, Kiwifruit, Nuts	9	CO1, CO2
2	**Unit-II**	Blossom Biology and Breeding Systems: Blossom biology, breeding systems – spontaneous mutations, polyploidy, incompatibility, sterility, parthenocarpy, apomixis, breeding objectives, ideotypes of Mango, Banana, Pineapple, Citrus, Grapes, Litchi, Guava, Pomegranate, Papaya, Apple, Pear, Plum, Peach, Apricot, Cherries, Strawberry, Kiwifruit, Nuts	10	CO2, CO3
3	**Unit-III**	Conventional and Non-Conventional Breeding: Approaches for crop improvement – direct introduction, selection, hybridization, mutation breeding, polyploid breeding, rootstock breeding, improvement of quality traits, resistance breeding for biotic and abiotic stresses, biotechnological interventions, achievements and future thrusts of Mango, Banana, Pineapple, Citrus, Grapes, Litchi, Guava, Pomegranate, Papaya, Apple, Pear, Plum, Peach, Apricot, Cherries, Strawberry, Kiwifruit, Nuts	9	CO4, CO5
Practicals:				
Exercises on bearing habit, floral biology; Pollen viability and fertility studies; Hands on practices in hybridization; Raising and handling of hybrid progenies; Induction of mutations and polyploidy; Evaluation of biometrical traits and quality traits; Screening for resistance against abiotic stresses; Developing breeding programme for specific traits; Visit to research stations working on fruit breeding.			15	CO1, CO2, CO3, CO4, CO5

Reference Books:

- Abraham Z. 2017. Fruit Breeding. Agri-Horti Press, New Delhi.
- Badenes ML and Byrne DH. 2012. Fruit Breeding. Springer Science, New York.
- Dinesh MR. 2015. Fruit Breeding, New India Publishing Agency, New Delhi.
- Ghosh SN, Verma MK and Thakur A. 2018. Temperate Fruit Crop Breeding- Domestication to Cultivar Development. NIPA, New Delhi.
- Hancock JF. 2008. Temperate Fruit Crop Breeding: Germplasm to Genomics. Springer Science, New York.
- Jain SN and Priyadarshan PM. 2009. Breeding Plantation and Tree Crops: Tropical Species. Springer Science, New York.
- Jain S and Priyadarshan PM. 2009. Breeding Plantation and Tree Crops: Temperate Species. Springer Science, New York.
- Janick J and Moore JN. 1996. Fruit Breeding. Vols. I–III. John Wiley & Sons, USA.
- Kumar N. 2014. Breeding of Horticultural Crops:Principles and Practices. NIPA, N. Delhi.
- Moore JN and Janick J. 1983. Methods in Fruit Breeding. Purdue University Press, USA.
- Ray PK. 2002. Breeding Tropical and Subtropical Fruits. Narosa Publ. House, New Delhi.

e-Learning Source:

Course Articulation Matrix: (Mapping of COs with POs and PSOs)

PO-PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
CO1	3	2	2	3	3	2	3	1	2	1	3	3	3	1	2			
CO2	2	2	1	2	3	1	2	1	1	1	2	3	1	3	2			
CO3	3	3	2	1	2	1	3	1	2	1	3	3	2	1	2			
CO4	3	2	2	3	3	2	2	1	1	1	2	2	3	3	2			
CO5	3	3	3	1	3	1	3	1	1	1	3	3	3	3	2			

1-Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Integral University, Lucknow

Effective from Session: 2022-23							
Course Code	FSC 508	**Title of the Course**	Nutrition of Fruit Crops	**L**	**T**	**P**	**C**
Year	I	**Semester**	II	1	0	2	
Course Objectives	• To import basic knowledge essential plant nutrients. • To impart knowledge to the student about process of nutrient uptake from soil to the plant • To impart knowledge to the student on nutrient requirement of fruit crops • To used knowledge about INM						

Course Outcomes	
CO1	To study about the concept and principles of nutrient management
CO2	To learn about the essential plant nutrients
CO3	The students will be able to know about the role of different macro-and micro-nutrients
CO4	The student will be able to know about INM
CO5	Students will be able to know about fertigation

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO
1	**Unit-I**	General Concepts and Principles: Importance and history of nutrition in fruit crops, essential plant nutrients, factors affecting plant nutrition; nutrient uptake and their removal from soil.	3	CO1
2	**Unit-II**	Diagnostics, Estimation and Application: Nutrient requirements, root distribution in fruit crops, soil and foliar application of nutrients in major fruit crops, fertilizer use efficiency. Methods and techniques for evaluating the requirement of macro- and micro-elements, Diagnostic and interpretation techniques including DRIS. Role of different macro-and micro-nutrients, their deficiency and toxicity disorders, corrective measures to overcome deficiency and toxicity disorders.	6	CO2, CO3
3	**Unit-III**	Integrated Nutrient Management (INM): Fertigation in fruit crops, biofertilizers and their use in INM systems.	3	CO4, CO5
		Visual identification of nutrient deficiency symptoms in fruit crops; Identification and application of organic, inorganic and bio-fertilizers; Soil/tissue collection and preparation for macro- and micro-nutrient analysis; Analysis of soil physical and chemical properties- pH, EC, Organic carbon; Determination of N,P,K and other macro- and micronutrients; Fertigation in glasshouse and field grown horticultural crops; Preparation of micro-nutrient solutions, their spray and soil applications.	14	CO1, CO2, CO3, CO4, CO5

Reference Books:

- Atkinson D, Jackson JE and Sharples RO. 1980. Mineral Nutrition of Fruit Trees. Butterworth – Heinemann.
- Bould C, Hewitt EJ and Needham P. 1983. Diagnosis of Mineral Disorders in Plants Vol.1 Principles. Her Majesty's Stationery Office, London.
- Cooke GW. 1972. Fertilizers for maximizing yield. Grenada Publishing Ltd, London.
- Epstein E. 1972. Mineral Nutrition of Plants: Principles and Perspectives. Wiley Eastern Ltd.
- Kanwar JS. 1976. Soil Fertility-Theory and Practice. ICAR, New Delhi.
- Marchner Horst. 1995. Mineral Nutrition of Higher Plants, 2nd Ed. Marschner, Academic Press Inc. San Diego, CA.
- Mengel K and Kirkby EA. 1987. Principles of Plant Nutrition. 4th Ed. International Potash Institute, Worblaufen-Bern, Switzerland.
- Prakash M. 2013. Nutritional Disorders in Fruit Crops: Diagnosis and Management. NIPA, New Delhi.
- Tandon HLS. 1992. Management of Nutrient Interactions in Agriculture. Fertilizer Development and Consultation Organization, New Delhi.
- Westerman RL. 1990. Soil Testing and Plant Analysis, 3rd Ed. Soil Science Society of America, Inc., Madison, WI.
- Yawalkar KS, Agarwal JP and Bokde S. 1972. Manures and Fertilizers. 3rd Ed. Agri Horticultural Publishing House, Nagpur.

e-Learning Source:

https://onlinelibrary.wiley.com/doi/abs/10.1002/9781118060797.ch8

https://www.researchgate.net/publication/277570367_Nutrient_Management_in_Fruit_Crops_Issues_and_Strategies

	Course Articulation Matrix: (Mapping of COs with POs and PSOs)																	
PO-PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
CO1	3	2	2	1	3	1	3	2	1	2	2	3	3	3	2			
CO2	3	3	3	3	3	1	3	1	2	1	3	3	3	2	2			
CO3	3	2	3	3	3	1	2	1	2	1	2	3	2	3	2			
CO4	3	2	2	3	2	1	3	2	1	1	3	3	3	2	2			
CO5	3	3	2	3	3	1	3	1	1	1	1	3	3	3	2			

1-Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Integral University, Lucknow

Effective from Session: 2022-23							
Course Code	VSC 502	**Title of the Course**	Production of Warm Season Vegetable Crops	**L**	**T**	**P**	**C**
Year	I	**Semester**	II	2	0	2	
Course Objectives	• To know about the importance and historical knowledge of warm season vegetables of tuber and leafy crops. • To impart comprehensive knowledge about the scientific production technology of vegetables specially grown in warm season • Knowledge of crop protection measure in different crops						

Course Outcomes	
CO1	To impart basic knowledge about the importance and management of warm season vegetables grown in India.
CO2	Impart knowledge of varietal importance to improve the production and quality of vegetables
CO3	By the end of course students will have the idea of production methods of different warm season crops
CO4	Calculate the agro-chemical doses to control biotic stresses
CO5	Understand the package of practices of crops Identify and control of important physiological disorders

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO
1	**Unit-I**	Introduction, commercial and nutritional importance, origin and distribution, botany and taxonomy, area, production, productivity and constraints, soil requirements, climatic factors for yield and quality, commercial varieties/ hybrids, seed rate and seed treatment, raising of nursery including grafting technique, sowing/ planting time and methods, precision farming, cropping system, nutritional including micronutrients and irrigation requirements, intercultural operations, special horticultural practices namely hydroponics, aeroponics, weed control, mulching, role of plant growth regulators, physiological disorders, maturity indices, harvesting, yield, post-harvest management (grading, packaging and marking), pest and disease management and economics of crops in: Fruit vegetables—Tomato, brinjal, hot pepper, sweet pepper and okra.	6	CO1, CO2, CO3, CO4, CO5
2	**Unit-II**	Introduction, commercial and nutritional importance, origin and distribution, botany and taxonomy, area, production, productivity and constraints, soil requirements, climatic factors for yield and quality, commercial varieties/ hybrids, seed rate and seed treatment, raising of nursery including grafting technique, sowing/ planting time and methods, precision farming, cropping system, nutritional including micronutrients and irrigation requirements, intercultural operations, special horticultural practices namely hydroponics, aeroponics, weed control, mulching, role of plant growth regulators, physiological disorders, maturity indices, harvesting, yield, post-harvest management (grading, packaging and marking), pest and disease management and economics of crops in: Beans—French bean, Indian bean (Sem), cluster bean and cowpea.	6	CO1, CO2, CO3, CO4, CO5
3	**Unit-III**	Introduction, commercial and nutritional importance, origin and distribution, botany and taxonomy, area, production, productivity and constraints, soil requirements, climatic factors for yield and quality, commercial varieties/ hybrids, seed rate and seed treatment, raising of nursery including grafting technique, sowing/ planting time and methods, precision farming, cropping system, nutritional including micronutrients and irrigation requirements, intercultural operations, special horticultural practices namely hydroponics, aeroponics, weed control, mulching, role of plant growth regulators, physiological disorders, maturity indices, harvesting, yield, post-harvest management (grading, packaging and marking), pest and disease management and economics of crops in: Cucurbits—Cucumber, melons, gourds, pumpkin and squashes.	6	CO1, CO2, CO3, CO4, CO5
4	**Unit-IV**	Introduction, commercial and nutritional importance, origin and distribution, botany and taxonomy, area, production, productivity and constraints, soil requirements, climatic factors for yield and quality, commercial varieties/ hybrids, seed rate and seed treatment, raising of nursery including grafting technique, sowing/ planting time and methods, precision farming, cropping system, nutritional including micronutrients and irrigation requirements, intercultural operations, special horticultural practices namely hydroponics, aeroponics, weed control, mulching, role of plant growth regulators, physiological disorders, maturity indices, harvesting, yield, post-harvest management (grading, packaging and marking), pest and disease management and economics of crops in: Tuber crops—Sweet potato, elephant foot yam, tapioca, taro and yam.	6	CO1, CO2, CO3, CO4, CO5
5	**Unit-V**	Introduction, commercial and nutritional importance, origin and distribution, botany and taxonomy, area, production, productivity and constraints, soil requirements, climatic factors for yield and quality, commercial varieties/ hybrids, seed rate and seed treatment, raising of nursery including grafting technique, sowing/ planting time and methods, precision farming, cropping system, nutritional including micronutrients and irrigation requirements, intercultural operations, special horticultural practices namely hydroponics, aeroponics, weed control, mulching, role of plant growth regulators, physiological disorders, maturity indices, harvesting, yield, post-harvest management (grading, packaging and marking), pest and disease management and economics of crops in: Leafy vegetables—Amaranth and drumstick.	6	CO1, CO2, CO3, CO4, CO5
Practicals:				
Scientific raising of nursery and seed treatment; Sowing and transplanting; Description of commercial varieties and hybrids; Demonstration on methods of irrigation, fertilizers and micronutrients application; Mulching practices, weed management;			16	CO1, CO2,

Use of plant growth substances in cool season vegetable crops; Study of nutritional and physiological disorders; Studies on hydroponics, aeroponics and other soilless culture; Identification of important pest and diseases and their control; Preparation of cropping scheme for commercial farms; Visit to commercial farm, greenhouse/polyhouses; Visit to vegetable market; Analysis of benefit to cost ratio.		CO3, CO4, CO5

Reference Books:

- Bose TK, Kabir J, Maity TK, Parthasarathy VA and Som MG. 2003. Vegetable crops. Vols. I-III. Naya udyog.
- Bose TK, Som MG and Kabir J. (Eds.). 1993. Vegetable crops. Naya prokash.
- Chadha KL and Kalloo G. (Eds.). 1993-94. Advances in horticulture Vols. V-X. Malhotra publ. house.
- Chadha KL. (Ed.). 2002. Hand book of horticulture. ICAR.
- Chauhan DVS. (Ed.). 1986. Vegetable production in India. Ram prasad and sons.
- Fageria MS, Choudhary BR and Dhaka RS. 2000. Vegetable crops: production technology. Vol. II. Kalyani.
- Gopalakrishanan TR. 2007. Vegetable crops. New India publ. agency.
- Hazra P and Banerjee MK and Chattopadhyay A. 2012. Varieties of vegetable crops in India,
- (Second edition), Kalyani publishers, Ludhiana, 199 p.
- Hazra P. 2016. Vegetable science. 2ndedn, Kalyani publishers, Ludhiana.
- Hazra P. 2019. Vegetable production and technology. New India publishing agency, New Delhi.
- Hazra P, Chattopadhyay A, Karmakar K and Dutta S. 2011. Modern technology for vegetable
- production, New India publishing agency, New Delhi, 413p
- Rana MK. 2008. Olericulture in India. Kalyani Publishers, New Delhi.
- Rana MK. 2008. Scientific cultivation of vegetables. Kalyani Publishers, New Delhi.
- Rubatzky VE and Yamaguchi M. (Eds.). 1997. World vegetables: principles, production and nutritive values. Chapman and Hall.
- Saini GS. 2001. A text book of oleri and flori culture. Aman publishing house.
- Salunkhe DK and Kadam SS. (Ed.). 1998. Hand book of vegetable science and technology: production, composition, storage and processing. Marcel dekker.
- Shanmugavelu KG., 1989. Production technology of vegetable crops. Oxford and IBH.

e-Learning Source:

	Course Articulation Matrix: (Mapping of COs with POs and PSOs)																	
PO-PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	2	2	2	3	3	2	1	2	2	2	3	3	2	2	1			
CO2	3	3	3	3	1	1	2	1	3	2	3	2	2	3	2			
CO3	3	2	3	3	3	1	2	2	2	3	3	3	2	1	2			
CO4	3	2	2	3	3	2	1	3	3	3	3	3	2	3	2			
CO5	3	2	3	3	3	1	2	2	3	3	3	3	2	1	2			

1-Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Integral University, Lucknow

Effective from Session: 2018-19							
Course Code	PGS 502	**Title of the Course**	Technical Writing and Communications Skills	**L**	**T**	**P**	**C**
Year	I	**Semester**	II	0	0	2	
Course Objectives	• To give knowledge about the various forms of scientific writings • To give knowledge about the various parts of thesis, research communications • To give knowledge about writing of abstracts, summaries, citations etc • To give knowledge about research communications, illustrations, photograph, drawings • To give knowledge about pagination, scientific write ups, editing and proof reading, and writing of review article						

Course Outcomes	
CO1	The students will learn that what are the various forms of scientific writings
CO2	The students will be able to write the various parts of thesis, research communications
CO3	The students will learn how to do writing of abstracts, summaries and what are citations etc
CO4	The students will learn research communications, illustrations, photograph, drawings
CO5	The students will learn pagination, scientific write ups, editing and proof reading, and writing of review article

Title of Experiment	**Contact Hrs.**	**Mapped CO**
Practical: Technical Writing - Various forms of scientific writings- theses, technical papers, reviews, manuals, etc; Various parts of thesis and research communications (title page, authorship contents page, preface, introduction, review of literature, material and methods, experimental results and discussion); Writing of abstracts, summaries, précis, citations etc.; commonly used abbreviations in the theses and research communications; illustrations, photographs and drawings with suitable captions; pagination, numbering of tables and illustrations; Writing of numbers and dates in scientific write-ups; Editing and proof-reading; Writing of a review article. **Communication Skills -** Grammar (Tenses, parts of speech, clauses, punctuation marks); Error analysis (Common errors); Concord; Collocation; Phonetic symbols and transcription; Accentual pattern: Weak forms in connected speech: Participation in group discussion: Facing an interview; presentation of scientific papers.	26	CO1, CO2, CO3, CO4, CO5

Reference Books:

- Wren PC & Martin H. 2006. High School English Grammar and Composition. S. Chand & Co.
- Robert C. (Ed.). 2005. Spoken English: Flourish Your Language. Abhishek.
- Mohan K. 2005. Speaking English Effectively. MacMillan India.
- Sethi J & Dhamija PV. 2004. Course in Phonetics and Spoken English. 2nd Ed. Prentice Hall of India.
- Hornby AS. 2000. Comp. Oxford Advanced Learner's Dictionary of Current English. 6th Ed. Oxford University Press.
- Joseph G. 2000. MLA Handbook for Writers of Research Papers. 5th Ed. Affiliated East-West Press.
- Chicago Manual of Style. 14th Ed. 1996. Prentice Hall of India.
- Collins' Cobuild English Dictionary. 1995. Harper Collins.
- James HS. 1994. Handbook for Technical Writing. NTC Business Books.
- Gordon HM & Walter JA. 1970. Technical Writing. 3rd Ed. Holt, Rinehart & Winston.
- Richard WS. 1969. Technical Writing. Barnes & Noble.

e-Learning Source:

	Course Articulation Matrix: (Mapping of COs with POs and PSOs)																	
PO-PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	3	3	1	2			2		1	1	3	3	2	2	1			
CO2	3	3	1	2		3	2				3	2	2	2	2			
CO3	3	3	1			1	2				3	3	2	2	2			
CO4	3	3	2	3		2	2				3	3	2	2	2			
CO5	3	3	2	3		3	2	1			3	3	2	2	1			

1-Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Integral University, Lucknow

Effective from Session: 2018-19							
Course Code	PGS 505 (e-Course)	**Title of the Course**	Agricultural Research, Research Ethics and Rural Development Programmes	**L**	**T**	**P**	**C**
Year	I	**Semester**	II	1	0	0	
Course Objectives	• To know the objective and principle of extension education • To obtain idea on various development programmes in agriculture and allied area to help farmers. • To enlighten the students about the organization and functioning of agricultural research systems at national and international levels, research ethics, and rural development programmes and policies of Government						

Course Outcomes	
CO1	Students capable, efficient, and self-reliant in character.
CO2	They gain knowledge to help rural families in better appreciation of SWOT in the village.
CO3	They know about to open new opportunities for developing talents and leadership of rural people.
CO4	To provide knowledge and help for better management of farms and increase incomes.
CO5	To promote better social, natural recreational intellectual and spiritual file among the people.

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO
1	**Unit-1**	History of agriculture in brief; Global agricultural research system: need, scope, opportunities; Role in promoting food security, reducing poverty and protecting the environment; National Agricultural Research Systems (NARS) and Regional Agricultural Research Institutions; Consultative Group on International Agricultural Research (CGIAR): International Agricultural Research Centers (IARC), partnership with NARS, role as a partner in the global agricultural research system, strengthening capacities at national and regional levels; International fellowships for scientific mobility.	5	CO1, CO2
2	**Unit-II**	Research ethics: research integrity, research safety in laboratories, welfare of animals used in research, computer ethics, standards and problems in research ethics.	3	CO2, CO3
3	**Unit-III**	Concept and connotations of rural development, rural development policies and strategies. Rural development programmes: Community Development Programme, Intensive Agricultural District Programme, Special group – Area Specific Programme, Integrated Rural Development Programme (IRDP) Panchayati Raj Institutions, Co-operatives, Voluntary Agencies/Non-Governmental Organizations. Critical evaluation of rural development policies and programmes. Constraints in implementation of rural policies and programmes.	5	CO3, CO4, CO5

Reference Books:

- Bhalla GS & Singh G. 2001. Indian Agriculture - Four Decades of Development. Sage Publ.
- Punia MS. Manual on International Research and Research Ethics. CCS, Haryana Agricultural University, Hisar.
- Rao BSV. 2007. Rural Development Strategies and Role of Institutions - Issues, Innovations and Initiatives. Mittal Publ.
- Singh K. 1998. Rural Development - Principles, Policies and Management. Sage Publ..

e-Learning Source:

https://sites.google.com/site/uasdpgs505/course-material-1

	Course Articulation Matrix: (Mapping of COs with POs and PSOs)																	
PO-PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	3	1	2	1	1	3	3	3	2	3	1		1	1	1			
CO2	3	3	3	1	1	3	3	3	2	3	3		2	2	2			
CO3	3	2	1	1	1	2	3	3	2	1	2		1	1	1			
CO4	3	2	2	2	1	3	3	3	2	2	3		1	2	2			
CO5	3	1	1	1	1	2	3	3	2	2	3		3	1	1			

1-Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation