LEARNING OUTCOME BASED CURRICULUM FRAMEWORK (LOCF)

FOR

B.Sc. Organic Farming

(A Four Years Degree Program)

(w.e.f. Academic session:2022-23)

"SCHOOL OF NATURAL RESOURCES"

DEPARTMENT OF FORESTRY, WILDLIFE & ENVIRONMENTAL SCIENCES

GURU GHASIDAS VISHWAVIDYALAYA

(A Central University established by the Central University Act.2009 No. 25 of 2009)

BILASPUR-495009, CHHATTISGARH

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Course Structure and Credit Distribution

B.Sc. Organic Farming (4 -Year / 8- Semester) LOCF based Program

Semester	Course Opted	Course Code	Name of the course	Credit	Hour/ week	Marks
I	Core-01	OFUATT1	Introductory Organic Farming Principles	3	3	100
	Core-01 Practical	OFUALT1	Introductory Organic Farming Principles	2	3	100
	Core-02	OFUATT2	Organic Agronomical Practices	3	3	100
	Core-02 Practical	OFUALT1	Organic Agronomical Practices	2	3	100
	Generic Elective (GE)-01	OFUATG1	Nursery Technology	3	3	100
	Practical/Seminar	OFUAlG1	Nursery Technology	2	3	100
	Ability Enhancement Course (AEC-01)	OFUATA1	Drawn from the University Pool	2	-	100
	Skill Enhancement Course(SEC-01)	OFUATL1	Drawn From the University pool	2	-	100
	Extra Curricular Activity-(ECA-01) *Additional Credit Course	OFUATS1	ECA-Extra-curricular activity (Field visit/ NSS/NCC/ *Swachhta*/ Physical Education/ Plantation Activities)	2	-	
	TOTAL			**21**	**18**	**800**
II	Core -03	OFUBTT3	Soil and Water Management	3	3	100
	Core -03 Practical	OFUBLT3	Soil and Water Management	2	3	100
	Core -04	OFUBTT4	Plant Protection and Bio-pesticides	3	3	100
	Core -04 Practical	OFUBLT4	Plant Protection and Bio-pesticides	2	3	100
	Generic Elective (GE)-02	OFUBTG2	Farm Machinery	3	3	100
	Generic	OFUBLG2	Farm Machinery	2	3	100

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	Elective (GE)-02 Practical					
	Ability Enhancement Compulsory (AEC-02)	OFUBTA2	Drawn from the university pool	2	2	100
	Skill Enhancement Course(SEC-02)	OFUBTL2	Drawn From the University pool	2	-	100
	Extracurricular Activity-(ECA-02) *Additional Credit Course	OFUBTS2	ECA-Extracurricular activity(Field visit/ NSS/ Swachhta/ vocational Training/ Sports/ Plantation activities)	2	-	100
	TOTAL			**21**	**20**	**900**

Semester	Course Opted	Course Code	Name of the course	Credit	Hour/ weak	Marks
III	Core -05	OFUCTT5	Orchard Farming	3	3	100
	Core -05 Practical	OFUCLT5	Orchard Farming	2	3	100
	Core -06	OFUCTT6	Organic Farming & Biofertilizers	3	3	100
	Core -06 Practical	OFUCLT6	Organic Farming & Biofertilizers	2	3	100
	Core -07	OFUCTT7	Basics of Plant Genetics and Plant Breeding	3	3	100
	Core -07Practical	OFUCLT7	Basics of Plant Genetics and Plant Breeding	2	3	100
	Generic Elective-(GE)-03	OFUCTG3	Organic Farming Startups and Entrepreneurship	3	3	100
	Generic Elective (GE-3) Practical	OFUCLG3	Organic Farming Startups and Entrepreneurship	2	3	100
	Ability Enhancement Course(AEC-03)	OFUCTA3	Drawn From the University Pool	2	-	100
	Extracurricular Activity-(ECA-03) *Additional Credit Course	OFUCTS3	ECA-Extracurricular activity (Field visit/ NSS/NCC/ *Swachhta*/ Physical Education/ Plantation Activities)	2	-	100
	Total			**24**	**24**	**1000**

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IV	Core -08	OFUDTT8	Biodynamic Farming	3	3	100
	Core - 08Practical	OFUDLT8	Biodynamic Farming	2	3	100
	Core -09	OFUDTT9	Carbon Neutral Farming	3	3	100
	Core -09 Practical	OFUDLT9	Carbon Neutral Farming	2	3	100
	Core -10	OFUDTT10	Urban Farming and Terrace Gardening	3	3	100
	Core -10 Practical	OFUDLT10	Urban Farming and Terrace Gardening	2	3	100
	Generic Elective-(GE)-04	OFUDTG4	Methods of Soil, Plant, Water & Seed Testing	3	3	100
	Generic Elective Practical(GE)-04	OFUDLG4	Methods of Soil, Plant, Water & Seed Testing	2	3	100
	Ability Enhancement Course(AEC-04)	OFUDTA4	Drawn From the University pool	2	-	100
	TOTAL			**22**	**24**	**900**
V	Core -11	OFUETT11	Fundamentals of Agroforestry	3	3	100
	Core -11 Practical	OFUELT11	Fundamentals of Agroforestry	2	3	100
	Core -12	OFUETT12	Floriculture	3	3	100
	Core -12 Practical	OFUELT12	Floriculture	2	3	100
	Core -13	OFUETT13	Residue Management Practices and Manure Production	3	3	100
	Core -13 Practical	OFUELT13	Residue Management Practices and Manure Production	2	3	100
	Discipline Specific Elective DSE-1	OFUETD1	Climatology and Meteorology	3	3	100
	Practical	OFUELD1	Climatology and Meteorology	2	3	100
	OR					
		OFUELD1	Sericulture Technology	3	3	100
	Practical	OFUELD1	Sericulture Technology	2	3	100
	TOTAL			**20**	**24**	**800**

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VI	Core -14	OFUFTT14	Vegetable Farming	3	3	100
	Core -14 Practical	OFUFLT14	Vegetable Farming	2	3	100
	Core -15	OFUFTT15	Medicinal & Aromatic Plants Farming	3	3	100
	Core -15 Practical	OFUFLT15	Medicinal & Aromatic Plants Farming	2	3	100
	Discipline Specific Elective-(DSE-02)	OFUFTD2	Harvesting Organic Produce, Quality Analysis and Improvement	3	3	100
	Practical	OFUFLD2	Harvesting Organic Produce, Quality Analysis and Improvement	2	3	100
	OR					
	Discipline Specific Elective-(DSE-02)	OFUFTD2	Post-Harvest management and Value Addition	3	3	100
	Practical	OFUFLD2	Post-Harvest management and Value Addition	2	3	100
	Ability Enhancement Course (AEC-05)	OFUFTA5	Drawn from the University Pool	2	-	100
	MOOC Course (01)		Online MOOC Course	2-4	-	-
	TOTAL			**17+ 2-4**	**18**	**700**
VII	Core -16	OFUGTT16	Biostatistics	3	3	100
	Core -16 Practical	OFUGLT16	Biostatistics	2	3	100
	Core -17	OFUGTT17	Genetic Engineering and Transgenic Plants	3	3	100
	Core -17 Practical	OFUGLT17	Genetic Engineering and Transgenic Plants	2	3	100
	Core -18	OFUFTT18	Organic Certification	3	3	100
	Core -18 Practical	OFUFLT18	Organic Certification	2	3	100
	Discipline Specific Elective-(DSE-3)	OFUGTD3	Mushroom Technology	3	3	100

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	Practical	OFUGLD3	Mushroom Technology	2	3	100
	OR					
	Discipline Specific Elective-(DSE-3)	OFUGTD3	Apiculture Technology	3	3	100
	Practical	OFUGLD3	Apiculture Technology	2	3	100
	Seminar (S1)	OFUGSS1	Seminar/Experimental learning: NTFP processing, Compost production, Vermi-composting and value addition, Nursery production	2	2	100
	TOTAL			**22**	**26**	**900**
VIII	INTR -1	OFUHEF1	Farming operation Work Experience (Report Writing, Presentation, Viva-Voce)	6		200
	INTR -2	OFUHEF2	Institute and Industrial visit/training (Report Writing, Presentation, Viva-Voce)	6		200
	Dissertation	OFUHDF1	Dissertation writing, Presentation, Viva-Voce	6		200
			TOTAL	**18**		**600**
	The nature of the course in VIII Semester will be field based for learning exposure on agricultural operational/organic farming works through attachment with agriculture department/ Farmers group/ fertilizer industries/ Marketing agencies/NGOs. Institute/ industrial training will be accomplished by the students through visits of nearby farming based Industries / Institutions/ organic certification agencies. Dissertation will be required to inculcate research experience in the students.					
GRAND TOTAL			**165 + 2-4 (MOOC)**			**6500**

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Table 2: Structure of Courses

Semester	Core Courses (19)	GE (4)	DSE (3)	AEC (5)	SEC (2)	Seminar (1)	Dissertation (1)	Internship (3)	Additional Credit Courses (Optional)
I	C1 C2	GE1		AEC1	SEC1				ECA1
II	C3 C4	GE2		AEC2	SEC2				ECA2
III	C5 C6 C7	GE3		AEC3					ECA3
IV	C8 C9 C10	GE4		AEC4					
V	C11 C12 C13		DSE1						
VI	C14 C15		DSE2	AEC5					MOOC
VII	C16 C17 C18		DSE3			Seminar/ Experimental learning			
VIII							Dissertation	Internship1 Internship2	

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B. Sc. Degree in Organic Farming

SEMESTER I

PAPER 1: INTRODUCTORY ORGANIC FARMING PRINCIPLES (CORE-01)

CR: 3+2

Introduction to organic farming, aim, objective, scope and concept, principles and need of organic farming, agencies and institutions related to organic farming, types of organic farming, benefits of organic farming, conventional farming v/s organic farming, scope, potential and present status of organic farming; Chhattisgarh, national and international, essentials for organic farming, farm components for an organic farm.

PRACTICAL:

1. Visit of a farm around Bilaspur (CG) to identify their adopted techniques.
2. Field based experiment for organic farming.
3. Organic Farm Industry visit with the vision to know the comparative study of chemical based production and organic based production system.
4. Identification of types of organic farming.
5. Analysis of organic farming pattern at State, national and international levels.

Suggested Readings:

1. Veeresh G. K. (2011).Organic Farming.Publisher: Foundation Books. ISBN: 9788175968813 https://doi.org/10.1017/UPO9788175968813
2. Reddy S. R. (2017). Principles of Organic Farming. Publisher: Kalayani, ISBN : 9327274474.
3. Rateaver B. (1993). Organic method primer update: A practical explanation: the how and why for the beginner and the experience (Conservation gardening and farming). Publisher: The Rateavers; Special edition, ISBN: 0915966018.
4. Gershuny G. and Martin D. L. (2018). The Rodale Book of Composting, Newly Revised and Updated: Simple Methods to Improve Your Soil, Recycle Waste, Grow Healthier Plants, and Create an Earth-Friendly Garden (Rodale Classics). Publisher: Rodale Books; Updated edition, ISBN: 1635651026.

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PAPER-02: ORGANIC AGRONOMICAL PRACTICES (CORE-02) CR:3+2

Introduction of agriculture, crops, meaning of crop production, classification of crop plants, agronomic classification: cereal, legume, fibre, forage, sugar, oil crops, growing seasons, Crop production methods for rice, wheat, maize, cowpea, Dolichos bean (*Dolichos lablab*), green gram, black gram, pigeon pea, pea.

PRACTICAL

1. Paddy field visit and survey of organic cultivation.
2. Practical approaches of agricultural practices preparation of soil, sowing, adding manure and fertilisers, irrigation, protecting from weeds, harvesting, storage of paddy, wheat and maize
3. Analysis of organic cultivation techniques of leguminous vegetables
4. Cost benefit analysis of organic farming.

Suggested Readings:

1. Reddy S.R. (2014). Principles of Crop Production. Kalyani Publishers, ISBN-10: 9327218582.
2. An Introduction to Agriculture and Agronomy. 2015. http://www.newagepublishers.com/samplechapter/001757
3. Onwueme I. C. and Sinha, T. D. (1999). Field Crop Production in Tropical Africa.Netherlands: CTA, Wageningen, Pp. 1-14.
4. Bassey E. (2019). Fundamental Principles of Crop Production. ISBN; 9781706242604, 1706242603. Publisher: Independently Published
5. Jena, J. and Jena, T. (2020). Glimpses of Crop Production. Publisher: Jain Brothers ISBN: 9788194484646

PAPER-03: NURSERY TECHNOLOGY GE-01 CR: 3+2

Nursery, introduction, objectives and scope, types of nursery, choosing nursery site, design and layout of the nursery, preparation of nursery beds, producing plant from seed, seed handling, dormancy and treatments, methods of sowing, time and season, potting mixtures, transplanting of young seedlings, plant containers, compost and mulches, nutrient and soil management, disease and pest control, sale and marketing.

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PRACTICAL

1. Site selection and its assessment.
2. Preparation of different types of nursery bed
3. Application of seed treatment, seed sowing,
4. Preparation of potting mixtures, application of mulches,
5. Tools and instruments, nursery record
6. Assessment of plantation site, visit of nursery and plantations
7. Marketing management of nursery grown seedlings.

Suggested Readings:

1. Hall K. C. (2003). Manual on nursery practice. Forest Department, Jamaica. E book
2. Pawar P. (2007). Practical Manual of plantation forestry. Scientific publisher, Jodhpur
3. Sharma A. and Singh N. P. (2011). Soil and orchard management. Daya Publishing House, Delhi.
4. Luna R. K. (2006). Plantation forestry in India. International book distributor, Dehradun, India.

PAPER 4. ABILITY ENHANCEMENT COURSE (AEC-01) **CR: 2**

PAPER 5. SKILL ENHANCEMENT COURSE (SEC-01) **CR: 2**

PAPER 6. EXTRA CURRICULAR ACTIVITY (ECA-01) **CR: 2**

SEMESTER II

PAPER- 01. SOIL AND WATER MANAGEMENT (CORE-03) CR: 3+2

Introduction of soil, its formation and properties, plant nutrients, essential nutrients and their role, nutrient uptake phenomenon in plant nutrient cycle, soil tillage, choice of varieties, crop rotation multiple and cropping systems, intercropping in relation to maintenance of soil productivity, sources of nutrients, manures and fertilizers, benefits and drawback of chemical and organic fertilizer, concentrated organic manures, organic preparations, organic amendments and sludges, bio-fertilizers-methods of application, advantages and disadvantages, Standards for organic inputs- fertilizers.

Introduction to traditional and modern methods of water management, water management techniques in agriculture, horticulture and forestry, effects of soil type, soil texture, and inherent limitations, irrigation management, water management benefits of cover crops, irrigation management, watershed management, smart farming.

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PRACTICAL:

1. Analysis of adopted farming system adopted for water conservation in Chhattisgarh.
2. Determination of water holding capacity of soil, soil moisture and field capacity.
3. Demonstration of Soil tillage operations.
4. Analysis of cropping systems and intercropping pattern of organic farming
5. Soil analysis to understand the correlation with water management practices
6. Identification of fertilizer.
7. Application methods of biofertilizers

Suggested Readings:

1. Singh S. Y. (2021). Soil Fertility and Plant Nutrient Management. Publisher: New India Publishing Agency- Nipa,ISBN: 9789390512270.
2. NPCS Board of Consultants & Engineers (2021). The Complete Book on Organic Farming and Production of Organic Compost. Publisher : Asia Pacific Business Press,ISBN-10 : 8194099528
3. MishraS. R.(2014). Soil and Nutrient Management. Publisher: Discovery Publishing House Pvt Ltd. ISBN: 9789350564578, 9350564572
4. Fawzy Z. F. (2020). Organic Crop Cultivation. Publisher: Excelic Press, ISBN: 9781642243383.
5. Lalitha B.S.,Sannagoudar M.S. & ReddyG.(2011). Enhancing Nutrient Use Efficiency: Concepts,Methods and Management Interventions. New India Publishing Agency (NIPA).
6. Cole G.(2017). Water Conservation and Management. Publisher: Larsen and Keller Education, ISBN-10 : 1635492882.
7. Magdoff F. and Van E. H. (2009). Building Soils for Better Crops, 3rd ed. Sustainable Agriculture research and Education (SARE).

PAPER-02. PLANT PROTECTION AND BIOPESTICIDES (CORE-04)
CR: 3+2

Plant protection- cultural, mechanical methods, botanical pesticides. Plant protection-botanical pesticides, bio-control agents, weed management weedicide, national and international standards for organic inputs- plant protection, disease and pest control by biopesticide of paddy, wheat, maize, pea, market available chemicals, application methods, principles of efficacy, pest and diseases of rice, vegetables and its control methods.

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PRACTICAL:

1. Comparative analysis of impact of cultural and mechanical plant protection practices.
2. Preparation of various types of botanical pesticide.
3. Application of pheromone traps and light traps.
4. Weed management practices by bio pesticide and chemical control analysis.
5. Application of herbicides in field and monitoring.

Suggested Readings:

1. Vincenzo V. (2017). Handbook of Pest Management in Organic Farming. Mediterranean University, Italy, Serge Kreiter, Montpellier SupAgro, France. Publisher: CABI, ISBN: 9781780644998.
2. Zadoks J. C.(2013). Crop Protection in Medieval Agriculture: Studies in pre-modern organic agriculture. ISBN: 9088901872, Publisher : Sidestone Press.
3. Teulon D.A. Plant Protection in Organic Arable and Vegetable Crops – a grower's resource. Publisher: New Zealand Institute for Crop & Food Research. ISBN 0 478 10843 5.
4. Roger B. Y. Organic plant protection: a comprehensive reference on controlling insects and diseases in the garden, orchard and yard without using chemicals / edited by and the editors of Organic gardening and farming magazine. Publisher: Emmaus, Pa.: Rodale Press. ISBN: 0878571108.

PAPER-03. FARM MACHINERY (GE-02) CR: 3+2

Introduction, aim and objectives, tillage; primary tillage equipment's, seedbed refining and leveling equipment, sowing and planting equipment, weeding and intercultural equipment, plant protection equipment, harvesting equipment's for cereals, threshing equipment, forage harvesting and residue handling, rice cultivation machinery, potato planter and harvester, equipments for sugarcane cultivation, estimation of operational cost.

PRACTICAL

1. Introduction to various farm machines and equipment used on the farm.
2. To Measure field efficiency of Farm implements.
3. Study of construction details, adjustments and working of plough.
4. Study of construction details, adjustments and working of disc plough.
5. Study of construction details, adjustments and working of cultivator.
6. Study of different type of mechanical paddy transplants.

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7. Study of different weeding equipment and their uses.
8. Study of sprayers and measurement of nozzle discharge

Suggested readings:

1. Singh T. P. (2017). Farm Machinery. Publisher: PHI learning private limited.
2. Bell B. M. and Rickatson. (2015). Farm Machinery, 6th Edition. ISBN: 9781910456064, 1910456063
3. Kutz M. Handbook of Farm, Dairy and Food Machinery Engineering. ISBN: 9780128148037, Publisher: Elsevier Academic press.
4. Chen G. (2018). Advances in Agricultural Machinery and Technologies. Publisher: CRC Press, ISBN:9781351132381, 1351132385.

PAPER 4. ABILITY ENHANCEMENT COURSE (AEC-02) CR: 2

PAPER 5. SKILL ENHANCEMENT COURSE (SEC-02) CR: 2

PAPER 6. EXTRA CURRICULAR ACTIVITY (ECA-02) CR: 2

SEMESTER-III

PAPER-01. ORCHARD FARMING (CORE-05) CR: 3+2

Orchard management, importance, objectives, merits and demerits, clean cultivation, sod culture, Sod mulch, herbicides and inorganic and organic mulches, tropical, sub-tropical and temperate horticultural systems, competitive and complimentary effect of root and shoot systems, biological efficiency of cropping systems in horticulture, systems of irrigation, soil management, integrated nutrient and pest management, utilization of resources constraints in existing systems, crop model and crop regulation in relation to cropping systems, status of organic horticulture national and international scenario, principles, practices, prospects of organic farming, technological advancements made in organic farming of fruits, Site selection, crop selection, soil preparation, soil solarisation, orchard management and mulching, establishment of orchard, high density and meadow orchad, planting and layout, organic crop production methods of plantation crops, mango, guava, coconut, arecanut, cashew, organic crop production methods- pineapple (*Ananas comosus)*, banana, papaya.

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PRACTICAL:

1. Site selection criteria with reference to types of crops
2. Land preparation and plantation techniques of plantation crops
3. Cultivation practices of mango and guava
4. Cultivation and management methods of papaya and banana
5. Marketing demand and supply analysis of the horticultural crops.

Suggested Readings:

1. Burrill, T. J. Orchard Cultivation. Publisher: Nabu Press, ISBN: 9781289619411
2. Singh H.P., George V. (2010). Thomas Organic Horticulture: Principles, Practices and Technologies Hardcover. Publisher: Westvill Publishing House, ISBN-10 : 8185873615.
2. Rateaver B. (1993). Organic method primer update: A practical explanation : the how and why for the beginner and the experience (Conservation gardening and farming) . Publishers: The Rateavers; ISBN-10 : 0915966018
3. Denckla T. C. (2003). The Gardener's A-Z Guide to Growing Organic Food. Publishers: Storey Publishing, LLC; Revised edition (January 1, 2003). ISBN-10 : 1580173705
4. Pathak R.K. & Ram, R. (2013). Manual on organic farming in Horticultural crops. 10.13140/2.1.1166.9761. https://www.researchgate.net/publication/265846481_Manual_on_organic_farming_in_Horticultural_crops
5. Chand G, Akhtar N., Kumar S.(2020). Diseases of Fruits and Vegetable Crops: Recent Management Approaches (Innovations in Horticultural Science). Publishers: Apple Academic Press; 1st edition (1 September 2020) ISBN-10 : 1771888369
6. Reddy P. P. (2012).Organic Farming for Sustainable Horticulture. Scientific Publishers, ASIN : B0783H6YRD

PAPER-02. ORGANIC FARMING AND BIOFERTILIZERS (CORE-06)

Concept of organic farming with the production of biofertilizer, biofertilizer's definition, scope, and potential microbes in organic farming, application of biofertilizer's, phosphorus solubilizing bio fertilizers, and microbial activities, biofertilizer formulations, scoping the use of transgenic microorganisms, quality control of biofertilizer, mycorrhizal fungi mass

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production guidelines to establish production unit, biofertilizer's industry and demand, case study on biofertilizer, prospects and challenges for future food utilization in sustainable agricultural, blue green algae, tools and instrument required for microbial production.

PRACTICAL

1. Visit to a biofertilizer production centre.
2. Staining- Simple and differential staining of bacteria. Simple staining – *Bacillussubtilis*, differential staining – *Bacillus* and *E-coli*.
3. Culture media preparation- Nutrient broth, nutrient agar slant, potato dextrose agar.
4. Preparation of various biofertilizer.
5. Marketing and survey for biofertilizer availability.

Suggested Readings:

1. Inamuddin, M., Imran A., Boddula R. And Rezakazemi M. (2021). Biofertilizers: Study and Impact Front Cover. Publisher: John Wiley & Sons. ISBN: 1119724678, 9781119724674.
2. Rakshit, A. Singh V. M., Parihar M., Singh, H. B., Singh A. K. (2021). Biofertilizers: Volume 1: Advances in Bio-inoculants. Publisher Elsevier Science, ISBN: 0128216670, 9780128216675
3. Purohit S. S. (2006). Microbiology Fundamentals and applications. Agrobios publication. ISBN- 9788177542592
4. Dubey R. C. and Maheshwari D. K. (2010). A text book of microbiology. S. Chand & Company Ltd. ISBN- 978-8121925594

PAPER-03. BASICS OF PLANT GENETICS AND PLANT BREEDING (CORE-07)
CR: 3+2

Plant cell: its structure and function. Cell reproduction, mitosis, meiosis and its significance. Nucleus chloroplast and mitochondria. Chromosome its structure and function. Chromosomal aberration. Polyploidy.Linkage and crossing over. Mendel's principles of heredity. Deviation from mendalian inheritance, pleiotropy, threshold characters, co-dominance, chromosome theory of inheritance, gene interaction, multiple alleles. Sex determination-theories, sex linked inheritance and characters. Cytoplasmic inheritance and maternal effects.Chemical basis of heredity. Structure of DNA and its replication, RNA:its structure and function. Mutation and its classification. Plant breeding its aim and objectives, modes of reproduction, methods of breeding, selection types and importance.

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PRACTICAL

1. Preparation of slide showing various stages of mitosis.
2. Preparation of slides showing various stage of meiosis.
3. Testing the viability and germination of pollen grains.
4. Solving the problems based on Mendalian laws, floral morphology.

Suggested Readings:

1. Prasad G. (1998). Introduction to Cytogenetics. Kalyani publishers New Delhi, India
2. Singh P. (2005). Elementary of Genetics. Kalyani publishers Ludhiana, India
3. Acquaah G. (2012). Principles of Plant Genetics and Breeding, 2nd Edition. Wiley-Blackwell
4. Singh B. D. (2014). Fundamentals of Genetics. Kalyani Publishers
5. Gupta P. K. (2015). Cytology, Genetics and Evolution. Rastogi publications,Meerut, India.

PAPER.04. ORGANIC FARMING STARTUPS AND ENTREPRENEURSHIP (GE-03)

CR: 3+2

Organic products start-ups, scope and potential areas for start-ups, funding agencies, food processing and handling, entrepreneurship concept, characteristics, approaches, need for entrepreneurship, traits of an entrepreneur –risk taking, leadership, decision making, planning, organizing, coordinating and marketing, agri-enterprises- stages of establishing enterprise, project identification, step to be considered in setting up an enterprise, feasibility report, product selection, project management and appraisal: market, technical, social, financial analysis, *market management concept planning for marketing target, marketing and competitive strategy, types of entrepreneurs, challenges in organic farming.*

PRACTICAL

1. Industrial visits to learn food processing and handling methods
2. Interview of organic farming entrepreneurs to analyse the risk bearing capacity
3. Analysis of problems related to organic farming marketing with its solution
4. Conceptual project development on organic farming by the students
5. Project planning, appraisal and management analysis

Suggested Readings:

1. Kumar S. A., Poornima S. C., Abraham M. K. and Jayshree K. (2021). Entrepreneurship Development . Publisher: New Age Publishers, ISBN-10 : 8122414346

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2. Wiswall R. (2009).The Organic Farmer's Business Handbook: A Complete Guide to Managing Finances, Crops, and Staff - and Making a Profit. Publishers: Chelsea Green Publishing; Pap/Cdr edition ASIN : B007EDZ2X6
3. Salatin J. (2013). You Can Farm: The Entrepreneur's Guide to Start & Succeed in a Farming Enterprise. Publishers: Polyface, Incorporated; ISBN-10 : 0963810928
4. Uwajeh A. N. Investments: The Easy Guide to Building Wealth with Agricultural Business for Beginners.Publishers: Kindle Edition. ASIN : B01LG5B0NS
5. Nuthall P. L. Farm Business Management: The Human Factor. Publishers: Lincoln University, New Zealand 9781789240733.
(https://www.cabi.org/bookshop/book/9781789240757/)

PAPER -05. ABILITY ENHANCEMENT COURSE (AEC-03) CR: 2

PAPER -6. EXTRA CURRICULAR ACTIVITY (ECA-03) CR: 2

SEMESTER IV

PAPER-01. BIODYNAMIC FARMING (CORE-08) CR: 3+2

Introduction, History, Principle and advantages, biodynamic preparation: crop rotation, Peppering, farm organism, weeds, pests and diseases, Converting a farm to biodynamic, cow horn manure and cow horn silica: preparation, storage and application, preparation, storage and application of jivaamrit, bijaamrit, plant based preparations, panchgaya preparation and application, dasakavya: preparation, storage and application.

PRACTICAL

1. Preparation of cow horn manure and cow horn silica.
2. Compost preparations through plant materials poison preparation, storage and application.
3. Dasagavya: preparation, storage and application.
4. Bijaamrit and jivaamrit preparation, storage and application methods

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Suggested Reading:

1. Selvaraj, N., AnitaB., Anusha B. and Saraswathi G. M. (2006). Organic Horticulture creating a more sustainable farming. Horticultural Research Station, Udhagamandalam.
2. Rudolf S. (2004). What is Biodynamics?Publisher SteinerBooks, 2004 ISBN: 0880109890
3. Waldin M. (2015).Biodynamic Gardening. Publisher: Dorling Kindersley Ltd, ISBN: 0241209331, 9780241209332
4. Masson V., Masson P. andBlais M. (2014). A Biodynamic Manual: Practical Instructions for Farmers and Gardeners.Publisher: Floris Books.ISBN-10: 1782500804

PAPER-02. CARBON NEUTRAL FARMING (CORE-09) CR: 3+2

Basic concept; meaning, objectives, scope- carbon neutral tools, carbon neutral initiatives, policy frame work related to carbon neutral farming, initiatives for carbon neutral farming climate neutral agricultural systems practice for increasing carbon in soils, efficient use of farm inputs assessment are identification low carbon emitting farming system, permanent crop farming, mixed farming, agroforestry and organic farming, case studies of carbon stable farming system in India and world, carbon farming business and enterprise.

PRACTICAL

1. Measurement of soil organic matter and soil organic carbon.
2. Measurement of GHG from different farming systems.
3. Measurement of carbon and nitrogen in farm inputs.
4. Determination of carbon stocks in soils of agricultural farms.

Suggested Readings:

1. Bansal M. Basics of organic farming.
2. EIP-AGRI workshop processing towards carbon neutral agriculture.
3. USDA report of carbon farming
4. Global carbon report on carbon reduction and offsets mulching activities effectively carbon neutral.
5. Reddy S. R. Farming system and sustainable agriculture.

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6. Piccolo A. Carbon sequestration in agricultural soils.
7. Fraser R. C. A farmers guide to climate disruption.

PAPER-03. URBAN FARMING AND TERRACE GARDENING (CORE-10)
CR: 3+2

Introduction: concept, aim and significance, benefits; economic, environmental, organic container gardening, garden design, soil composition and soil texture, seed sowing and transplanting, features of organic fertilizers, principles of making liquid organic fertilizers, in house composting: organic matter, kitchen waste composting guidelines, soil management; general soil care, simple crop rotation plan, water and light management, pest management: organic foliar spray,roof and terrace gardening, ecosystem and working of a sustainable organic garden, soil, garden management and maintain, organic farming: a tool of good food good life, suitable crops for urban farming and terrace gardening yields and crop management practices.

PRACTICAL

1. Garden designing with available space.
2. Demonstration to container selection as per the different types of plants.
3. Soil preparation and preparation of potting mix.
4. Seed sowing methods.
5. Preparation of organic fertilizers with the help of kitchen waste.
6. Application of organic fertilizers as per plant requirement.
7. Management practices; pest, plant, soil and water.
8. Survey of urban kitchen gardening.

Suggested Readings:

1. Free e-book 'Organic Urban Farming The Indian Way https://www.udemy.com/course/organic-container-gardening-the-indian-way/
2. George R.(2015). Container Gardening for Absolute Beginners. https://www.amazon.in/Organic-Container-Gardening-Absolute-Beginners-ebook/dp/B010XWRT1M
3. Upadhyaya T. (2021). Secrets of Terrace Gardening: A complete guide to setup and maintain your terrace garden in India, ISBN : 9355267274

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4. Latha A.M. (2016).Steps for starting a low budget organic vegetable Terrace gardenPublisher: green house India publisher, www.amazon.in
5. Toth . J (2014).Gardening: Urban Gardening: Growing Vegetables and Fruit in Heavily Populated Areaswww.amazon.in

PAPER-04. SOIL, WATER AND SEED TESTING (GE-04) CR: 3+2

Soil formation, physio-chemical properties of the soil and its significance, physical chemical properties of the water, water quality test, importance of water testing in agricultural practices, Seed formation, structure, types of seed, seed viability, dormancy, seedling growth parameters, Economically importance of seed testing, instruments for soil, water and plant testing analysis, nitrogen, phosphorus, potash, organic carbon in soil, hardness, nitrate, pH in water, tetrazolium seed viability test.

PRACTICAL

1. Estimation of available soil Potassium by flame photometer method.
2. Estimation of microbial biomass carbon.
3. Estimation of Nitrogen in plant sample.
4. Estimation of pH of Irrigation water.
5. Computation of quality parameters in Irrigation water.
6. Description of seed structures composition and economic importance.
7. Seed and soil health test.
8. Normal seedlings and abnormal seedlings.
9. Washing and cleaning of laboratory glass ware.
10. Equivalent weights and Molecular weights of some important chemical.
11. Unit of measurements and conversions.
12. Physical purity test, Determination of Seed Moisture.
13. Colour changes due to pH change in the presence of pH indicators

Suggested Readings:

1. Gurumurthy P. Practical Manual for Soil, Plant, Water and Seed Testing. Publisher Educreation Publishing.
2. Adepetu J. H. and Nabhan H. and Osinubi A.(1996).Simple soil, water and plant testing techniques for soil resource management. FAO.

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3. Singh D. (2015). Manual on Soil Plant and Water Analysis. Publisher: Westville Publishing House, ISBN-10: 8185873267.

4. Patiram B. (2020). Soil Testing and Analysis: Plant, Water And Pesticide Residues. Publisher : New India Publishing Agency- Nipa.ISBN-10 : 939017547X

PAPER -05. ABILITY ENHANCEMENT COURSE (AEC-04) **CR: 2**

SEMESTER V

PAPER-01. AGROFORESTRY (CORE-11) CR: 3+2

Indian agriculture- structure and constraints. Land use definition, classification and planning. Agroforestry- definition, aims objectives and need. Traditional Agroforestry systems: Taungya system, Shifting cultivation, Wind break, Shelterbelts, Homestead gardens. Alley cropping, high density short rotation plantation systems, silvicultural woodlots/energy plantations. Classification of agroforestry system-structural, Tree architecture, canopy management, Agroforestry systems in different agroclimatic zones, Tree-crop interface. Economics of agroforestry systems. People participation, rural entrepreneurship through agroforestry and industrial linkages.

PRACTICAL

1. Study characteristics of trees/shrubs/grasses for agroforestry.
2. Volume and biomass estimation.
3. Crown measurement, light interception and moisture measurement in agroforestry systems.
4. Litter estimation and nutrient analysis
5. Soil analysis, quantification of fertilizer doses,
6. Annual crops/grass growth measurements and yield

Suggested Readings:

1. Dwivedi A. P. (1992). Agroforestry principles and practices. Oxford and IBH Publication Co., New Delhi.
2. Chundawat D.S. and Gautam S. K. (2010). Textbook of agroforestry.Oxford and IBH publishing co pvt. Ltd.

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3. Nair P. K. R.(1993). An introduction to agroforestry. Kluwer Academic Publishers. 499 p.
4. Huxley P. (1999). Tropical agroforestry. Blackwell Science, Oxford. 371 p.
5. Ramakrishnan P. S. (1992). Shifting agriculture and sustainable development. Man and biosphere series. The Parthenon Publishing Group.

PAPER-02. FLORICULTURE (CORE-12) CR: 3+2

Floriculture: definition, component and importance, Nursery management practices, Identify Plant morphology, different plant varieties and plant families, poly house, net house, propagation techniques of flower, landscape garden, establishment of farm planning and layout different types of landscapes, mulching, planting system and planting densities. Integrated Organic Pest control management of floriculture. Use of growth regulators in horticulture, weed management, types of indoor gardening, Tree based cropping system, identify commercial flowers rose, gerbera, marigold and marketing, project preparation for commercial flowering plant.

PRACTICAL

1. Planning and layout of orchard, tools and implements,
2. Visit of commercial flower production unit.
3. Preparation of nursery beds for sowing of seeds.
4. Land preparation for flowering plants, planting system.
5. Preparation of organic fertilizer mixtures and field application.
6. Preparation and application of growth regulators, maturity standards, harvesting, grading, packaging and storage.

Suggested Readings:

1. Merlo G. (2018). Floriculture and Landscaping. Publisher: Scitus Academics LLC, ISBN 9781681179360
2. Kulkarni B. S. (2016). Floriculture and Landscaping. Agro India Publications
3. Singh J. (2007). Basic Horticulture. Kalyani publishers.
4. Singh A. K. (2020). Textbook of Floriculture And Landscaping. Publisher New India Publishing Agency- Nipa, ISBN; 9386546000.
5. Bal J. S. (2002). Fruit Growing in India. Kalyani publishers
6. Chadha K. L. (2015). Handbook of Horticulture. Jain book Agency.
7. Acquaah G. (2002). Horticulture - Principles and Practices.

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PAPER-03. RESIDUE MANAGEMENT PRACTICES AND MANURE PRODUCTION (CORE-13) CR: 3+2

Introduction Sources, composition and characterization of the solid waste, Economic consideration; Wastes as a wealth and source of income, Planning system, Valorization of organic solid waste, Recycling of organic wastes; Animal feed, composting, anaerobic digestion, rendering, rapid thermophilic digestion, Immobilized enzyme reaction, process, sanitary land filling, Energy recovery, manure production methods, Nadep compost, vermin-compost, Azola production.

PRACTICAL

1. Evaluation of the source of waste.
2. Categorization of wastes in different categories
3. Recycling of wastes in organic manure or any other useful materials
4. Case studies, Field visits, Economic valuation of waste management practices.
5. Vermi compost production.
6. Litter decomposition of different plant species.

Suggested Readings:

1. Pichtel J. (2014). Waste Management Practices. Publisher; CRC press, ISBN; 9781000762648.
2. Sharma C.K.(2022). Solid, Liquid and Hazardous Waste Management. Publisher: Foundation Publishing House, ISBN-1:8195475590.
3. Tabassum B. (2016). Waste Management and Environmental Health. Publisher : Discovery Publishing House Pvt Ltd. ISBN-10 : 9350567776
4. Ramanathan A. L. and Jagbir Singh J. (2019). Solid Waste Management: Present and Future. Publisher: Dreamtech Press, ISBN-10: 9389447925
5. Waldrip, H. M. Pagliari, P. H. and He Z. (2020). Animal Manure: Production, Characteristics, Environmental Concerns, and Management, Volume 67 Print ISBN:9780891183709.

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PAPER-04. CLIMATOLOGY AND METEOROLOGY (DSE-1) CR: 3 + 2

Introduction the atmosphere: origin, composition and structure, isolation and heat budget temperature of the atmosphere, distribution of temperature, air pressure and winds, general circulation of the atmosphere, monsoon, winds, humidity, fog and clouds, precipitation, atmosphere equilibrium: stability and instability, air masses, classification of climate, distribution, climate Change, weather forecasting and analysis, applied climatology, global warming, meteorology: weather and climate, micro-climate, weather elements,solar radiation, nature, properties, solar constant and energy balance, introduction to monsoon, basics of weather forecasting.

PRACTICAL

1. Site selection for agromet observatory, measurement of temperature, measurement of rainfall, measurement of evaporation, measurement of atmospheric pressure, measurement of sunshine duration and solar radiation.
2. Measurement of wind direction and speed and relative humidity.
3. Study of weather forecasting and synoptic chart.
4. Field visits to observe changing pattern adopted by farmer for agriculture due to climate change.

Suggested Readings:

1. Lal D.S. (2011). Climatology. Publisher: Sharda Pustak Bhawan, ISBN-10 : 8186204121
2. Ghadekar S.R. (2008). Textbook of Agro-meteorology. Agromet publishers.
3. Norman D. D. and Malcolm (2007). Farming Systems Development and Soil Conservation FAO. Jain Book Agency.
4. Khan M. K. and Ajmal A. (2008). Crop andforage production using saline waters nam S&T Centre. Jain Book Agency.
5. Singh C. (2012). Modern techniques of raising field crops.Oxford and IBH publishing company, New Delhi.
6. Varshnaya M. C. and Pillai B. (2012). A textbook of agriculture metrology. ICAR, New Delhi Publications.

OR

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SERICULTURE TECHNOLOGY (DSE-01) **CR: 3+2**

Introduction, scope and principle of Sericulture, Silk production in India and other countries and their export and import, types of silk produced in India; host plants of mulberry and non-mulberry silkworms, classification of sericigenous insects. Classification of silkworms based on moultinism, voltinism and geographical distribution; popular silkworm breeds and hybrids of Chhattisgarh, silkworm morphology, silkworm rearing methods, silkworm pest and diseases. Preparation of nursery beds, Selection of materials for cuttings, selection of cutting planting. Selection and grading of sampling, planting System and intercultural operations: - characteristics of sericulture industry, silk reeling, handloom and power loom activities, role of state sericulture department, Central Silk Board, prospects and problems of Sericulture industry for livelihood.

PRACTICAL

1. Sericulture World maps and map of India and Chhattisgarh,
2. Study of life cycle of silkworm: Morphology of egg, larva, pupa and adult. Cocoon characters of popular uni-, bi- and multivoltine races,
3. Identification of different diseased silkworms based on external symptoms.
4. Morphological study of few important cultivars in Chhattisgarh.
5. Preparation of grafting (bud or shoot grafting) or layering (simple layering) drawing and labelling.
6. Identification of different types of weeds, fertilizers, calculation of dosages. Preparation Compost.

Suggested Readings:

1. Kim H. B. (1989). Filature water engineering, Seoul national university press, Republic of Korea.
2. Huang G. R. (1988). Silk reeling, Oxford and IBH publishing co. Pvt. New Delhi.
3. Mahadeveppa D. Halliyal, V.G., Shankar, A.G. And Bhandiwad, R. (2000). Mulberry Silk Reeling Technology, Oxford And IBH Publishing Co. Pvt. Ltd. New Delhi.
4. SonwalkerT. N. (2010). Handbook of Silk Technology, New Age International Pvt., Ltd.
5. Lee Y. W. (1999). Silk Reeling And Testing Manual, FAO Agricultural Services Bulletin No. 136, Rome, Italy.

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6. Akira Nakamura (2000). Fiber Science and Technology. Oxford & IBH Publications, New Delhi.

SEMESTER-VI

PAPER-01. VEGETABLE FARMING (CORE-14) CR 3+2

Introduction to vegetable growing, cultural practices for vegetables, export and import of vegetables, explain general cultural practices used for vegetable production, crop rotation, soils, plant foods, cover crops, cultivation techniques, seed, hybrid seed, storing seed, sowing seed, understanding soils, dealing with soil problems, plant nutrition and feeding, pest, disease & weed control, hydroponic, aeroponic and greenhouse growing, growing selected vegetable varieties, irrigation, harvest & post-harvest, marketing of vegetables, vegetable production methods- okra, amaranthus, cauliflower, cabbage, tomato, solanaceous, cucurbits, spices- pepper, ginger, turmeric, *Amorphophallus paeoniifolius*, drumstick (*Moringa oleifera L.*).

PRACTICAL

1.Site selection and preparation.

2. Cultural practices of cover crops.

3. Planting Vegetables -seed, hybrid seed, storing seed, sowing seed.

4. Cultivation practices of vegetables as per their requirements and plant nutrition management.

6. Pest and weed management practices.

7. Storage and marketing process of vegetables.

Suggested Readings:

1. Jeavons J. and Leler R.(1979). How to Grow More Vegetables. Publisher: Ten Speed Press, ISBN-10 : 0913668990.

2. Coleman E. (2018). The New Organic Grower. Publisher: Chelsea Green Publishing, ISBN-10 : 1603588175.

3. Sowards J. (2021). The First-Time Gardener: Growing Vegetables. Publisher : Cool Springs Press, ISBN-10 : 0760368724.

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4. Matt Rees-Warren M. (2022). Book Review: The Ecological Gardener. https://www.sustainablemarketfarming.com/

PAPER-02. MEDICINAL PLANT & AROMETIC PLANT FARMING (CORE-15)
CR: 3+2

Medicinal diversity in India, Indian Traditional knowledge on medicinal plants: history, scopes, opportunities, Merits and demerits of using herbal products, important medicinal plants viz. *Pepper, Cardamom, Rauwolfia sarpentina, Withania somnifera, Dioscorea, Baladona, Cinchona, Citronellagrass,* khus grass (Vetiver), *Mentha,* Sweet flag (butch), *Ocimum,* Safedmusli, Giloy, soil and climate requirements, export and import potential of medicinal plants, cultivation techniques, value addition and processing techniques,medicinal/herbal garden, National Medicinal Plant Development Board, Medicinal plant conservation area (MPCA).

PRACTICAL

1. Identification of different medicinal and aromatic plants.
2. Collection and processing of medicinal and aromatic plants, processing techniques, storage, packaging.
3. Visit of MPCA, forest area.
4. Application of locally available medicinal plants, interaction with Vaidya and local healers.

Suggested readings:

1. Amritpal Singh Saroya (2018). Textbook of Medicinal and Aromatic Plants. Indian Council of Agriculture Research, New Delhi.
2. Anand Singh Bisht (2019). Hand Book of Medicinal and Aromatic Crops, Brillion Publishing House, New Delhi.
3. N Deepa Devi (2017). A Text Book of Medicinal and Aromatic Crops. Aavishkar Publishers, Distributors, Jaipur

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PAPER-03. HARVESTING ORGANIC PRODUCE, QUALITY ANALYSIS AND IMPROVEMENT (DSE-02) **CR: 3+2**

Harvesting technology; operations – digging, lifting, winnowing, stocking and threshing, timing of harvest, methods of harvest, special techniques, yield collection and management, planning for postharvest quality, crop quality indicators, crop rotation, intercropping, designing cropping system, criteria for seed evaluation, characterization and multiplication, importance of traditional varieties, management of crop purity.

PRACTICAL

1. Harvesting operations digging, lifting, winnowing, stocking and threshing
2. Analysis of crop yield and management.
3. Post harvest techniques of quality management of crops.
4. Crop quality indicators to predict the productivity of soil.

Suggested Reading:

1. Thompson and A. K . (2014) Fruit And Vegetables: Harvesting, Handling And Storage, 2 Volume, Publisher: John Wiley, ISBN: 9781118654040
2. Organic Materials Review Institute, http://www.omri.org/
3. Charles D.J.(2004). Handbook of Herbs and Spices, Volume 2
4. Munnaf M.A. and Mouazen A.M.(2020). Advances in Agronomy.
5. https://www.fao.org/fileadmin/templates/nr/sustainability_pathways/docs/Compilation_techniques_organic_agriculture_rev.pdf

OR

POST-HARVEST MANAGEMENT AND VALUE ADDITION (DSE-02) **CR: 3+2**

Post-harvesting management and its Importance, status of food processing in India, concept of safe food and important food regulations in India, harvesting and post-harvest handling of organic crops, fruits and vegetables ripening process, fruits and vegetables, factors affecting the quality of the post-harvest life and deterioration of harvested crops. Principles and methods of food processing and preservation and its benefits. Methods of storage-pre cooling, pre-storage treatments, low-temperature storage ,controlled atmosphere storage, hypobaric storage, irradiation, and low-cost storage structures, packaging technology.

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PRACTICAL

1. Visit of Mart for identification of different value-added products.
2. Preparation of Pickles, Jam, Jelly, ketchup and Morabba.
3. Drying of fruits, vegetables and flowers.
4. Identification of fresh and aged vegetables and fruits.
5. Visit to cold storage for recording the protocols storage of various fruits and vegetables.
6. Visit to a flower Mandi and record the activities in the Mandi.
7. Visit to a local fruit market and record the activities in the market.

Suggested books

1. Goel K. A., Kumar R. and Mann S. S. (2007). Postharvest Management and Value Addition. *Daya Publishing House*. ISBN- 978-8170354543
2. Rathore N. S., Mathur G. K. and Chasta S.S. (2012). Post-Harvest Management and Processing of Fruits and Vegetables. *The Energy and Resources Institute*. ISBN- 978-8171641154
3. Simson S. P. &Straus M.C. (2010). Post-Harvest Technology of Horticultural Crops. *Oxford*. ISBN- 978-9380179254
4. Kumar P. V. S.& Sudha Vani V. (2020). Post-Harvest Handling and Processing of Plantation Crops. *Notion Press*. ISBN- 9781648501289
5. Arya M. A., Kumar T. and Chandra S.(2020). Practical Manual on Post Harvest Management and Value Addition of Fruits and Vegetables. *Jain Brothers*. ISBN- 978-8194413745

PAPER -04. ABILITY ENHANCEMENT COURSE (AEC-05) **CR: 2**

PAPER-05. MOOC COURSE **CR:2-4**

SEMESTER VII

PAPER: 1. BIOSTATISTICS (CORE-16) **CR: 3 + 2**

Definition and application of statistics, types and source of data, classification and tabulation of data, frequency, distribution, graphical representation of data, (Bar diagram, pie chart, histogram, frequency polygon) measures of central tendency (mean, median, mode) measures of Dispersion (range, standard deviation, Mean deviation, Quartile deviation,

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variance, coefficient of variation), Probability, Test of signification: basic concepts,(Z- Test, X^2-Test, t-Test, F-test,), regression, correlation : (scatter diagram, correlation co-efficient, its properties).

PRACTICAL

1. Histogram, frequency polygon, Bar chart, pie chart.
2. Measures of central tendency: Mean median and mode for raw and grouped data.
3. Construction of frequency distribution table and its graphical representation.
4. Measures of dispersion: Range, mean deviation, quartile deviation and standard deviation for raw and grouped data.
5. Paired't' test, Chi-square test for contingency tables and theoretical ratios
6. Correlation and linear regression.

Suggested Readings:

1. Kenneth N. B. (1998). Introductory Statistics.www.amazon.com
2. Arora P. N. (2003). Biostatistics. Himalayan publishers.
3. Pagano M. and Gauvreau K. (2008). Principles of Biostatistics.Jhon and Wiley Sons Ltd.
4. Chandel S. R. S. (2009). A Hand Book of Agricultural Statistics. Publisher: Anchal Prakhan Mandir.

PAPER-02. GENETIC ENGINEERING AND TRANSGENIC PLANTS (CORE-17)

CR: 3+2

Introduction to genetic engineering, scope of genetic engineering; restriction enzymes and DNA Modifying enzymes, Gene Cloning vectors, gene expression; basics of gene expression various recombinant DNA techniques and their applications, genetically modified (GM) crop plants developed by recombinant DNA (rDNA), genetically modified organisms (GMO), new genetic modification techniques (nGMs), transgenic technology principles of transgene technology, scope of transgenetic technology, gene tagging (T-DNA) tagging and transposon tagging) in gene analysis (identification and isolation of gene), transgenic and gene knockouts technologies - targeted gene replacement, chromosome engineering, gene therapy, strategies of gene delivery, gene replacement/ augmentation, gene correction, gene editing and silencing, transgenic plants.

PRACTICAL

1. Isolation of DNA from plant tissue

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2. Isolation of DNA from animal tissue

3. Agarose gel electrophoresis

4. Effects of antibiotics by gradient method

5. UV induced metagenosis

Suggested readings:

1. Singh G. D. Genetics Engineering of Plants. Publisher: Anmol Publications Pvt Ltd. ISBN: 9788126135998, 9788126135998.
2. Dodds J. H. (2012).Plant Genetic Engineering. Publisher : Cambridge University Press, ISBN-10 : 1107404576, ISBN-13 : 978-1107404571
3. Govil C.M., Aggarwal A. and Sharma J. Plant Biotechnology and Genetic Engineering. Publisher: PHI Learning, ISBN: 9788120353145, 9788120353145.
4. Kumar S., Barone, P. and M. S. (2019).Transgenic Plants. Publisher: Springer Link, ISBN: 978-1-4939-8778-8.
5. T.A.Brown T. A. (2010). Gene Cloning and DNA Analysis, An Introduction. Publiction: Wiley –Blackwell, publication.
6. Primrose, S. B. and Richard M. T. (2009). Principles of Gene Manipulation and Genomics, , Publication; Blackwell Sciectific.

PAPER-03. ORGANIC CERTIFICATION (CORE-18) CR: 3+2

Farm economy: basic concept of economics- demand, supply, economic, viability of a farm. Basic production principles, reducing expenses, ways to increase returns, cost of production system, benefit/ cost ratio, marketing, imports and exports,policies and incentives of organic production, farm inspection and certification: conversion to organic farming, organic earning and national economy, socio economic impacts, procedure of certification of organic products, geo-tagging.

PRACTICAL

1. Estimation of the relationship between demand of supply of organic farm produces
2. Estimation of revenue of farm produces
3. Calculate the cost benefit ratio of organic farming
4. Marketing channels of import and export of organic produces
5. Organic certification process with implementation of policies
6. Socio economic impact assessment with adaptation of organic farming
7. Field visit for Apiculture, Mushroom production, Terrace farming

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Suggested Reading:

1. Gehlot D. (2005). Organic Farming: Standard Accreditation Certification and Inspection. Publishers: Agrobios, ISBN-10: 9788177542370.
2. Ogunbanwo S A. (2012). Organic Certification for Livelihoods Improvement Paperback – Import. Publishers: LAP Lambert Academic Publishing, ISBN-10 : 9783848416332.
3. Vijayan G. (2014). Organic Food Certification and Marketing Strategies. Publishers: AGRIHORTICO ASIN : B00HZI59ZG
4. Yadav A K. Training Manual Certification and Inspection Systems in Organic Farming in India. Government of India Ministry of Agriculture Department of Agriculture and Cooperation. Publishers: National Centre of Organic Farming CGO-II, Kamla Nehru Nagar, Ghaziabad, UP – 201 002.

PAPER-04.MUSHROOM TECHNOLOGY (DSE-03) CR: 3+2

Introduction to mushroom technology; biology of mushrooms; nutritional value, medicinal value of mushrooms, edible mushrooms and cultivation status in India and world, cultivation technology: infrastructure, equipment and substrates in mushroom cultivation, spawn: types, preparation, mushroom bed preparation and factors affecting, compost technology in mushroom production, casing; raw material used for casing, preparation of casing material; important sanitation cultivation, insect - pests management in cultivated mushroom, disease management in cultivated mushroom, value addition of mushroom.

PRACTICAL:

1. Identification of local mushroom Flora and preserved specimens of mushroom.
2. Sterilization of glasswares, equipment, and culture media used in mushroom cultivation.
3. Preparation of culture media: Potato Dextrose medium, Richards medium.
4. Preparation of spawn: Grain spawn, Straw spawn, Sawdust spawn.
5. Preparation of compost and known compost formulations.
6. Identification and management of pests, diseases in Mushroom cultivation.

Suggested Readings:

1. Bahl N.(2008). Handbook on Mushrooms. Publisher: Oxford & IBH publishing Company. ISBN: 9788120413993.

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2. Revathy N.(2020). Mushroom Cultivation. Publisher: Shanlax Publications. ISBN: 978939082735
3. Rana R. S.(2020). Mushroom Cultivation and its Diseases. Publisher: Sankalp Publication. ISBN: 9788194717607

OR

APICULTURE TECHNOLOGY (DSE-03) **CR: 3+2**

Introduction to Apiculture - scope, importance; Apiculture development in India - institutions involved; Species of Honey bees - indigenous, exotic - morphology; Honey - its medicinal properties - application in various fields - other valuable products of honey bees, Bee keeping equipment - introduction to types of bee boxes - BIS standard Tools used in apiculture; Bee flora - importance and rearing - congenial conditions for starting up of apiculture; Honey extraction & handling - Quality control standards - Honey testing kit - Processing of honey; Diseases of Honey Bees - Preventive & Control measures.

PRACTICAL:

1. To study the morphology of local Honey Bee species and their life cycle.
2. To study the detail of honey extraction procedures and quality assessment of Honey samples obtained from local marketing areas.
3. Identification of Bee Flora, their rearing and other importance.
4. To study various Bee keeping equipment's with well labelled diagrams.

Suggested Readings:

1. Mishra R. C. (2013).Prospective in Indian Apiculture. Publisher: Agrobios Publication. ISBN: 9788177541311
2. Nagaraja N. (2014). Honeybees. Publisher: MJP Publishers. ISBN: 9788180940590
3. Mishra R. C. (2013). Honeybees and Their Management in India. Publisher: ICAR, New Delhi. ISBN: 9788171641475

1. SEMINAR (S1)/ EXPERIMENTAL LEARNING CR: 2

SEMESTER - VIII

PAPER 1. FARMING OPERATIONS WORK EXPERIENCE (INTR -1)

CR: 06

29.4.2022

29.04.2022

29.4.2022

Visit to Hi-Tech Nursery, green house, Herbal garden and watersheds. Adopted traditional and modern farming pattern by the villages and crop production. Soil type and adopted cropping pattern and yield calculation. Study the CAT (Catchment area treatment) plan. Use of agricultural farming equipment's instruments. Study the marketing and management of important crops. Methods adopted for the organic manure production.

PAPER 2. INSTITUTES AND INDUSTRIAL VISIT/ TRAINING (INTR-2)

CR: 06

Study the nature of agricultural/ organic product based industries. Raw material- Collection and processing of raw material. Production and management process. Marketing and financial management. Visits of nearby institutions/ organizations.

PAPER 3. DISSERTION **CR: 06**

Students select any topic of research, case study, review of literatures, field study, and experiment on organic farming/ agriculture crop production. Supervisor/ Mentors will be allotted to supervise and guide the students for the dissertation work.

29.4.2022

29.04.2022

29/4

29.4.2022