

B.Sc. (Hons.) AGRICULTURE DEGREE PROGRAMME

SEMESTER WISE DISTRIBUTION OF COURSES

SEMESTER I

Sl. No.	Course No.	Course Title	Dept.	Cr. Hr.
1.	AEX 101	Rural Sociology and Educational Psychology	AEX	2+0
2.	AGR 101	Fundamentals of Agronomy	AGR	2+1
3.	HOR 111	Fundamentals of	HOR	2+1
4.	SAC 101	Fundamentals of Soil Science	SAC	2+1
5.	ABE 101	Communication Skills	ENG & AEX	1+1
6.	MDC 101	Farming based livelihood systems	AGR & AEC	2+1
7.	NCC101 / NSS101	National Cadet Corps / National Service Scheme	NCC / NSS	0+1
8.	-	Skill Enhancement course 1	-	0+2
9.	-	Skill Enhancement course 2	-	0+2
10	IFC101	<i>Deeksharambh</i> (Induction cum Foundation course) *	Year Coordinator	0+2*
11.	MAT 101	Introductory mathematics (need based) *	MAT	1+0*
		TOTAL		11+10=21

*Non-Gradual Courses

SEMESTER II

Sl.No.	Course No.	Course Title	Dept.	Cr.Hr.
1.	AEN 101	Fundamentals of Entomology	AEN	2+1
2.	AMP 101	Livestock and Poultry Management	AH	1+1
3.	PAT 101	Fundamentals of Plant Pathology	PAT	2+1
4.	SAC 102	Soil Fertility Management	SAC	2+1
5.	ABE 102	Personality Development	AEX & ENG	1+1
6.	VAC 101	Environmental Studies and Disaster Management	SAC, AGM & AGR	2+1
7.	NCC102/ NSS102	National Cadet Corps / National Service Scheme	NCC / NSS	0+1
8.	-	Skill Enhancement course 3	-	0+2
9.	-	Skill Enhancement course 4	-	0+2
		TOTAL		10+11=21

Summary of credit distributions among different categories of courses (Credit hours)

Sem.	Core Courses (Major and Minor)	Multi-Disciplinary Course (MDC)	Value Added Course (VAC)	Ability Enhancement Course (AEC)	Skill Enhancement Course (SEC)	Internship/ Student READY	Total Credits	Non gradial	Internship
I	11	3 ⁽³⁾	—	1 ⁽⁴⁾ +2 ⁽⁵⁾	4		21	2 ⁽¹⁾ +1 ⁽²⁾	---
II	11	---	3 ⁽⁶⁾	1 ⁽⁴⁾ +2 ⁽⁷⁾	4		21		10 ⁽¹³⁾
Total	22	3	3	6	8		42	3	--

⁽¹⁾ Deeksharambh (Induction-cum-Foundation Course) of 2 credits (2 weeks duration).

⁽²⁾ Mathematics of 1 credit

⁽³⁾ Farming based Livelihood systems

⁽⁴⁾ NCC/NSS

⁽⁵⁾ Communication Skills

⁽⁶⁾ Environmental Studies and Disaster management

⁽⁷⁾ Personality development

⁽¹³⁾ Only for those opting for an exit with UG-Certificate and

Summary of Credit Distributions

Type of courses		Credits
Core courses (Major & Minor/s)	:	22
Common courses (MDC+VAC+AEC)	:	12
Skill Enhancement Courses (SEC)	:	8
Non Gradial	:	3
Total	:	42+3

SKILL ENHANCEMENT COURSES

Sl.No.	Course No.	Course Title	Discipline	Cr.Hr.	Semester
1	SEC 001	Agricultural Waste Management	AGM & SAC	0+2	I/II
2	SEC 002	Biofertilizer and Biopesticide Production	AGM & PAT	0+2	I/II
3	SEC 003	Beneficial Insect Farming	AEN	0+2	I/II
4	SEC 004	Drone Technology	AGR	0+2	I/II
5	SEC 005	Nursery Management	HOR	0+2	I/II
6	SEC 006	Mushroom Production Technology	PAT	0+2	I/II
7	SEC 007	Post Harvest Processing Technology	HOR	0+2	I/II
8	SEC 008	Poultry Production Technology	AH	0+2	I/II
9	SEC 009	Seed Production Technology	SST	0+2	I/II
10	SEC 010	Soil, Plant and Water Testing	SAC	0+2	I/II
11	SEC 011	Surveying and Leveling	AEG	0+2	I/II
12	SEC 012	Vermicompost Production Technology	SAC & AGM	0+2	I/II
13	SEC 013	Video Production	AEX	0+2	I/II
14	SEC 101	Apiculture	AEN	0+2	I/II
15	SEC 102	Computer Programming and Data Structures	COM	0+2	I/II
16	SEC 103	Farm Machinery	AEG	0+2	I/II
17	SEC 104	Installation, Operation and Maintenance of Micro-irrigation System	AEG	0+2	I/II
18	SEC 105	Introduction to Forestry	HOR	0+2	I/II
19	SEC 106	Landscape Gardening	HOR	0+2	I/II
20	SEC 107	Nursery Production in crops	HOR		I/II
21	SEC 108	Orchard Floor Management	HOR	0+2	I/II
22	SEC 109	Packing and Packaging of Horticultural Crops	HOR	0+2	I/II
23	SEC 110	Post-Harvest Management of Horticultural Produce	HOR	0+2	I/II
24	SEC 111	Seed Production Techniques in Vegetable Crops	SST	0+2	I/II
25	SEC 112	Sericulture	AEN	0+2	I/II
26	SEC 113	Turf and Turf Management	HOR	0+2	I/II

B.Sc. (Hons.) Agriculture**FIRST YEAR****I SEMESTER**

Sl. No.	Course No.	Course Title	Discipline	Cr. Hr.
1.	AEX 101	Rural Sociology and Educational Psychology	AEX	2+0
2.	AGR 101	Fundamentals of Agronomy	AGR	2+1
3.	HOR 111	Fundamentals of	HOR	2+1
4.	SAC 101	Fundamentals of Soil Science	SAC	2+1
5.	ABE 101	Communication Skills	AEX & ENG	1+1
6.	MDC 101	Farming based livelihood systems	AGR & AEC	2+1
7.	NCC101 / NSS101	National Cadet Corps I / National Service Scheme I	NCC / NSS	0+1
8.	-	Skill Enhancement Course 1	-	0+2
9.	-	Skill Enhancement Course 2	-	0+2
10	IFC 101	<i>Deeksharambh</i> (Induction cum Foundation course) *	Year Coordinator	0+2*
11.	MAT 101	Introductory Mathematics*	MAT	0+1*
		TOTAL		11+10=21

*Non-Gradual Courses

Course No.	:	AEX 101
Course Title	:	Rural Sociology and Educational Psychology
Credit Hours	:	2+0
Course Category	:	Core Course

Course Learning Rationale / Course Objective (CLR):

The purpose of learning this course is to:

1. To acquire knowledge on basic concepts of rural sociology and educational psychology.
2. To understand the social structure, social stratification and social groups
3. To understand the role of social institutions, social organizations and social control
4. To explore rural leadership and various aspects of educational psychology
5. To gain knowledge on teaching-learning process and basic principles of human behaviour and personality.

Course Learning Outcomes (CLO):

1. Understand the basic concepts related to rural sociology and educational psychology.
2. Assess the forms of social stratification and role of culture, tradition, attributes and social values in rural society
3. Evaluate the role of social institutions and social organizations for the development of society
4. Develop leadership skills
5. Gain expertise on application of educational psychology in Agricultural Extension

THEORY

Unit 1: Rural Sociology, Indian Rural Society, Social Groups, Social Stratification

Sociology and rural sociology: Meaning, definition, scope, importance of rural sociology in Agricultural Extension, and interrelationship between rural sociology and Agricultural Extension. Indian Rural Society: important characteristics, differences and relationship between rural and urban societies. Social Groups: Meaning, definition, classification, factors considered information and organization of groups, motivation in group formation and role of social groups in Agricultural Extension. Social Stratification: Meaning, definition, functions, basis for stratification, forms of social stratification-characteristics and- differences between class and caste system.

Unit 2: Culture, Values, Rural Settlement, Social Institutions and Organisations

Cultural concepts: culture, customs, folkways, mores, taboos, rituals. Traditions: Meaning, definition and their role in Agricultural Extension. Social Values and Attitudes: Meaning, definition, types and role of social values and attitudes in agricultural Extension. Structure of Rural Society and Pattern of Rural settlement. Social Institutions:

Meaning, definition, major institutions in rural society, functions, and their role in agricultural Extension. Social Organizations: Meaning, definition, types of organizations and role of social organizations in agricultural Extension.

Unit 3: Social Interaction, Social Control, Social Change

Social Interaction Process: Associative and Dissociative Social Process. Social Networking: Meaning, types and measurement of social networks. Social Control: Meaning, definition, need of social control and means of social control. Social change: Meaning, definition, nature of social change, dimensions of social change and factors of social change. Migration: Definition, types of Migration, Push and Pull factors of Migration, Migration of Rural youth and its consequences of Agricultural Development.

Unit 4: Psychology and Educational Psychology, Intelligence, Personality

Psychology and educational psychology: Meaning, definition, scope, and importance of educational psychology in Agricultural Extension. Basics of Human behaviour. Intelligence: Meaning, definition, types, factors affecting intelligence and importance of intelligence in Agricultural Extension. Personality: Meaning, definition, types, factors influencing the personality and role of personality in agricultural Extension.

Unit 5: Sensation, Perception, Attention, Motivation, Teaching-Learning Process

Sensation-meaning, definition, process and characteristics, Perception, Attention, Motivation and their application in Farmers setting. Teaching: Learning process: Meaning and definition of teaching, learning, Cognitive, Affective and Psychomotor domains of Learning. Learning experience and learning situation, elements of learning situation and its characteristics. Principles of learning and their implication of teaching.

Theory - Lecture Schedule

1. Sociology and Rural Sociology- Meaning, definition, scope and importance- Interrelationship between rural sociology and Agricultural Extension
2. Indian Rural Society -Characteristics of Indian rural society- Differences and relationships between rural and urban societies- Rationale of understanding the traits of rural society for Effective Extension work
3. Social Groups -Meaning, definition, and classification of social groups - Factors considered in formation and organization of groups
4. Motivation in group formation- Role of social groups in Agricultural Extension - Commodity groups, Farmer Interest Groups and Farmer Producer Companies
5. Social Stratification -Meaning, definition, and functions- Basis of stratification and forms- Differences between class and caste systems- Understanding Social Stratification with respect to Agricultural Extension work
6. Cultural Concepts in Rural Society- Culture: Meaning and definition- Customs, folkways, mores, taboos, rituals, traditions and belief.
7. Cultural traditions and their relevance to extension- Barriers due to cultural norms- Cases of impact of culture on Agricultural practices and Extension work
8. Social Values- Meaning, definition, and types of social values and attitudes- Role in Agricultural Extension

9. Social Institutions in Rural Society- Meaning, definition, and major institutions (family, religion, education, economy, politics) - Functions and roles in Agricultural Extension
10. Social Organizations-Meaning, definition, and types of organizations - Role in agricultural development (e.g., cooperatives, SHGs, Voluntary organisations and NGOs)
11. Social Interaction Processes: Associate - Cooperation, Coordination Accommodation and Assimilation and their role in Extension work.
12. Social interaction Processes: Dissociative-Competition and Conflict- Factors influencing the processes and their role in Extension work
13. Social networking: Meaning, types, Measurement of social network-nodes, edges, cliques, centrality measures - Closeness and betweenness
14. Social Control- Meaning, definition, need for social control - Means of social control: formal and informal
15. Social Change: Meaning and Dimensions- Definition and nature of social change
16. Factors Influencing Social Change- Technological, cultural, economic, political, and environmental factors- Agricultural Extension as a change agent

17. Mid Semester Examination

18. Migration: Definition, types of Migration, Push and Pull factors of Migration, Migration of Rural youth and its consequences of Agricultural Development
19. Psychology and Educational Psychology- Meaning, definition, and scope and importance of educational psychology in Agricultural Extension
20. Basics of Human Behavior - Definition and characteristics of human behavior
21. Factors influencing behavior: biological, psychological, social- Importance of understanding behavior in Agricultural Extension
22. Intelligence: - Meaning, definitions of intelligence-Gardner's multiple intelligences- Types of Intelligence- Factors affecting Intelligence
23. Personality: Meaning, definition, types of Personality, Factors influencing development of personality
24. Sensation-meaning, definition, process and characteristics
25. Perception- Meaning, definition, Principles and factors affecting perception-Errors in Perception
26. Attention- Meaning and types of attention- Span of Attention- Factors influencing Attention
27. Motivation- Concept-Application of Maslow's Hierarchy of Needs -Types of Motivation -Intrinsic and Extrinsic Motivation- Importance and Techniques of motivating farmers. Attitude – Concept – Factors influencing the development of attitude of farmers
28. Cognitive Domain of Learning- Meaning and components of cognitive processes- Bloom's Taxonomy (Cognitive domain)- Importance for adults learning
29. Affective Domain of Learning -Meaning and importance of emotions, values, attitudes in learning. Psychomotor Domain of Learning -Meaning and relevance in skill-based learning.
30. Teaching Learning Process- Definition of Teaching- Principles of Teaching- Steps in Extension Teaching.

31. Meaning of learning experience- Elements and characteristics of learning situations.
32. Principles of Learning- Reinforcement, transfer of learning, feedback, practice- Application of principles of learning in agricultural extension programmes

Suggested Reading:

1. J.B. Chitambar, Introductory rural Sociology
2. Desai, A.R. (1977). *Rural Sociology in India*. Popular Prakashan.
3. Doshi, S.L., & Jain, P.C. (2002). *Rural Sociology*. Rawat Publications.
4. Srinivas, M.N. (1980). *Social Change in Modern India*. Orient Longman.
5. Dahama, O.P., & Bhatnagar, O.P. (2005). *Education and Communication for Development*. Oxford IBH.
6. Beteille, A. (1965). *Caste, Class, and Power: Changing Patterns of Stratification in a Tanjore Village*. University of California Press
7. Santrock, J.W. (2020) - *Educational Psychology*. McGraw-Hill Education.
8. Mangal, S.K. (2011) - *Educational Psychology*. PHI Learning Pvt. Ltd.
9. Gardner, H. (2011) - *Frames of Mind: The Theory of Multiple Intelligences*. Basic Books.
10. Woolfolk, A. (2016) - *Educational Psychology*. Pearson Education.
11. Skinner, B.F. (1954) - *The Science of Learning and the Art of Teaching*. Harvard University Press.
12. Chauhan, S.S. (2009) - *Advanced Educational Psychology*. Vikas Publishing House.
13. Knowles, M. (2015) - *The Adult Learner: The Definitive Classic in Adult Education and Human Resource Development*. Routledge.
14. Bloom, B.S. (1956) - *Taxonomy of Educational Objectives*. Longman.
15. Krathwohl, D.R. (1964) - *Taxonomy of Educational Objectives: Affective Domain*. Longman.
16. Gibson, J.J. (1950) - *The Perception of the Visual World*. Houghton Mifflin.
17. Dave, R.H. (1975) - *Psychomotor Skills in Education*. University of London Press.
18. Anderson, L.W., & Krathwohl, D. (2001) - *A Taxonomy for Learning, Teaching, and Assessing: A Revision of Bloom's Taxonomy*.

Web Resources:

1. Food and Agriculture Organization (FAO): *Extension and Rural Development*
www.fao.org
2. National Institute of Agricultural Extension Management (MANAGE) Resources.
3. National Digital Library of India (NDLI) - Educational Psychology Resources
4. MIT OpenCourseWare - *Introduction to Educational Psychology*

Course No.	:	AGR 101
Course Title	:	Fundamentals of Agronomy
Credit Hours	:	2+1
Course Category	:	Core Course

Course Learning Rationale / Course Objectives (CLR):

1. To impart the basic and fundamental knowledge of Agronomy
2. To impart basic knowledge on crop production practices

Course Learning Outcome (CLO):

1. Understanding the fundamentals of Agronomy
2. Knowing the basics of environmental conditions for crop production activities.
3. Knowledge on Basics of production techniques of field crops.
4. Understanding the agro-climatic zones of the country and the state

THEORY

Unit 1: Agronomy and Soil

Agronomy and its scope: Definition, meaning and scope of Agronomy; art, science and business of crop production, relation of Agronomy with other disciplines of Agricultural Science, field crops and classification, importance, ecology and ecosystem. Growth and development of crops: Definition, Meaning and factors affecting growth and development. Soil: Definition, composition, Texture vs Structure, major soils of India

Unit 2: Tillage and Sowing

Tillage and tilth: Definition, objectives, types, advantages and disadvantages of tillage including conservation tillage. Seeds and sowing: Definitions of crops, variety and seed. Factors affecting crop stands establishment: good quality seed, proper tillage, time of sowing seed rate, depth and methods of sowing: broadcasting, drilling, dibbling, transplanting etc. Crop density and geometry: plant geometry and planting geometry, its effect on growth, yield. After cultivation: Thinning, gap filling and inter cultural operations.

Unit 3: Crop Nutrition

Crop nutrition: Definition of essential nutrients, criteria of essentiality, functional elements, classification of essential nutrients, forms of plant nutrients absorbed by plants, Combined/ uncombined forms. Manures and fertilizers: sources of nutrients – inorganic (fertilizers), organic (manures) and bio-fertilizers; their classification and characteristics, Time and methods of fertilizer application. Green manure and its role in crop production: Definition, objectives types of green manuring, desirable characteristics, advantages and limitations of green manuring. Integrated Nutrient Management (INM): Meaning, different approaches and advantages of INM. Nutrient use efficiency.

Unit 4: Water and Weed Management

Water management: Water resources of the world, India and the state; Soil Moisture constants: Types of soil water: Gravitational water, capillary water, hygroscopic water, Irrigation: definition, importance and methods. Weeds: Definition, Importance and basics of classification of weeds and their control.

Unit 5: Cropping system

Agroclimatic zones of India and the state, cropping systems: Factors affecting cropping systems, major cropping patterns and systems in the country. Sustainable crop production: Definition, importance and practices, natural resources and conservation; pollution and pollutants, Allelopathy: Meaning and importance in crop production, Harvesting and post-harvest operations

Theory - Lecture Schedule

1. Agronomy and its scope: Definition, meaning and scope of Agronomy;
2. Agronomy – as art, science and business of crop production,
3. Relation of Agronomy with other disciplines of Agricultural Sciences
4. Field crops: classification and importance,
5. Ecology and ecosystem. Growth and development of crops: Definition, Meaning
6. Factors affecting crop growth and development
7. Soil: Definition, composition, Texture vs Structure, Major soils of India
8. Tillage and tilth: Definition and objectives, Types of tillage, advantages and disadvantages of tillage
9. Modern concepts of tillage including conservation tillage.
10. Seeds and sowing: Definitions of crops, variety and seed. Factors affecting crop stands establishment: good quality seed, proper tillage,
11. Time of sowing seed rate, depth and methods of sowing: broadcasting, drilling, dibbling, transplanting etc.
12. Crop density and geometry: plant geometry and planting geometry, its effect on growth, yield.
13. After cultivation: Thinning, gap filling and inter cultural operations.
14. Crop nutrition: Definition of essential nutrients, criteria of essentiality, functional elements, classification of essential nutrients, forms of plant nutrients absorbed by plants, Combined/ uncombined forms.
15. Manures and fertilizers: Sources of nutrients - inorganic (fertilizers), organic (manures) and bio-fertilizers; their classification and characteristics,
16. Time and methods of fertilizer application.
17. **Mid Semester Examination**
18. Green manure- role in crop production: Definition, objectives types of green manuring, desirable characteristics, advantages and limitations of green manuring.
19. Integrated Nutrient Management (INM): Meaning, different approaches and advantages of INM. Nutrient use efficiency.

20. Water management: Water resources of the world, India and the state
21. Soil Moisture constants.
22. Types of soil water: gravitational water, capillary water, hygroscopic water,
23. Irrigation: Definition, importance and methods
24. Weeds: Definition, Importance and Harmful effects of weeds
25. Classification of weeds
26. Methods of weed control.
27. Agroclimatic zones of India and the state
28. Cropping systems and Crop rotation: Meanings, Factors affecting cropping systems,
29. Major cropping patterns and systems in the country.
30. Sustainable crop production: Definition, importance and practices, natural resources and conservation;
31. Pollution and pollutants, Allelopathy: Meaning and importance in crop production
32. Harvesting and post-harvest operations

Practical

A visit to Instructional Crop farm and study on field crops, Basic terminologies and units of measurements in agriculture; Identification of crops, seeds, fertilizers, pesticides, Crops and cropping systems in different Agro-climatic zones of the state, Study of some preparatory tillage implements, Study of inter tillage implements, Practice of ploughing / puddling, Study and practice of inter cultivation in field crops, Numerical exercises on calculation of seed, plant population and fertilizer requirement, Study of yield contributing characters and yield estimation of crops, Identification of weeds in different crops, Seed germination and viability test of seed, Practice on time and method of application of manures and fertilizers.

Practical Schedule

1. A visit to Instructional Crop farm to identify and study field crops.
2. Study of some basic terminologies and units of measurements in Agriculture
3. Identification of crops, seeds, fertilizers and pesticides
4. Crops and cropping systems in different Agro-climatic zones of the state.
5. Study of Primary tillage implements.
6. Study of secondary tillage implements.
7. Study of inter tillage implements.
8. Practice of ploughing / puddling
9. Study and practice of inter cultivation in field crops.
10. Numerical exercises on calculation of plant population and seed rate.
11. Seed germination and viability test of seed.
12. Raising nursery for wet land and garden land crops.
13. Numerical exercises on calculation of fertilizer requirement.
14. Practice on time and method of application of manures and fertilizers.

15. Study of yield contributing characters and yield estimation of crops.
16. Identification of weeds in different crops.
17. Final Practical Examination

Suggested Readings:

1. ICAR. 1996. Handbook of Agriculture. Indian Council of Agricultural Research, New Delhi
2. Morachan, Y.B. 1980. Crop Production and Management. Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi.
3. Reddy, S. R. 2008. Principle of Crop Production, Kalyani Publisher, Ludhiana.
4. Reddy Yellamanda T and Shankar Reddy G H. 1995. Principles of Agronomy. Kalyani Publishers, Ludhiana.
5. Sankaran, S. and V.T. Subbiah Mudaliar. 1997. Principles of Agronomy. The Bangalore Printing and Publishing Co. Ltd., Bangalore.
6. Singh, S.S 1998. Principles and Practices of Agronomy. Kalyani Publishers, New Delhi.

Course No.	:	HOR 111
Course Title	:	Fundamentals of
Credit Hours	:	2+1
Course Category	:	Core Course

Course Learning Rationale / Course Objective (CLR):

The purpose of learning this course is to:

1. To provide knowledge on different branches of viz., pomology, olericulture, floriculture and landscaping, spices and medicinal plants
2. To provide knowledge on orchard management, propagation methods, cultural operations and nutrient management of horticultural crops
3. To provide knowledge on different physiological aspects of horticultural crops

Course Learning Outcomes (CLO):

1. Explain the importance, scope, classification of
2. Describe the different methods of propagation
3. Narrate the orchard establishment and management
4. Learn about the canopy management in fruit crops
5. Study the bio regulators, irrigation and fertilizer application in horticultural crops

THEORY

Unit 1: Introduction to

: Its different branches, importance and scope, and botanical classification, soil and climate for horticultural crops.

Unit 2: Plant propagation

Plant propagation: methods and propagation structures, seed dormancy and seed germination, Merits and demerits of sexual and asexual propagation Stock-scion relationship.

Unit 3: Orchard establishment and management

Principles of orchard establishment and management

Unit 4: Canopy management

Principles of orchard establishment, principles and methods of training and pruning of fruit crops, Juvenility and flower bud differentiation, unfruitfulness in horticultural crops, pollination, pollinizers and pollinators, fertilization and parthenocarpy

Unit 5: Bio regulators, irrigation and fertilizer application

Importance of bio regulators in horticultural crops, irrigation and its methods, Fertilizer application in horticultural crops.

Theory - Lecture Schedule

1. Definition and divisions of
2. Importance and scope of
3. Botanical and horticultural classification of horticultural crops
4. Soil and climate for horticultural crops
5. Plant propagation methods in horticultural crops
6. Sexual propagation in horticultural crops
7. Seed dormancy- types and mechanisms
8. Seed dormancy- methods of breaking seed dormancy
9. Seed germination - types of seed germination
10. Asexual propagation - cutting and different methods of cutting in horticultural crops
11. Asexual propagation - budding and different methods of budding in horticultural crops
12. Asexual propagation - layering and different methods of layering in horticultural crops
13. Asexual propagation - grafting and different methods of grafting in horticultural crops
14. Merits and demerits of sexual and asexual propagation
15. Propagation of horticultural crops through specialized plant propagules

16. Stock-scion relationship

17. Mid Semester Examination

18. Orchard and its types
19. Principles of orchard establishment
20. Orchard layout and different planting systems and planting of horticultural crops
21. High density planting in orchards
22. Principles and methods of pruning of fruit crops
23. Principles and methods of training of fruit crops
24. Juvenility and flower bud differentiation
25. Unfruitfulness in horticultural crops - causes and remedies
26. Pollination, pollinizers, pollinators and fertilization in fruit crops
27. Parthenocarpy in horticultural crops
28. Importance of bio regulators in horticultural crops
29. Classification and application of bio regulators in horticultural crops
30. Irrigation and its methods in horticultural crops
31. Classification and application of organic manures and bio-fertilizers in horticultural crops
32. Classification and application of inorganic fertilizers in horticultural crops

Practical

Identification and nomenclature of fruit, Layout of an orchard, pit making and system of planting, Nursery raising techniques of fruit crops, Understanding of plant propagation structures, Propagation through seeds and plant parts, Propagation techniques for horticultural crops, Container, potting mixture, potting and repotting, Training and pruning methods on fruit crops, Preparation of fertilizer mixture and application, Preparation and application of PGR, Layout of different irrigation systems, Maturity studies, harvesting, grading, packaging and storage.

Practical Schedule

1. Identification and nomenclature of fruits
2. Identification and brief description of garden tools
3. Layout of an orchard, pit making and system of planting
4. Nursery raising techniques of fruit crops
5. Understanding of plant propagation structures
6. Propagation of horticultural crops through seeds
7. Propagation of horticultural crops through specialized plant parts
8. Propagation techniques for horticultural crops- layering/cutting
9. Propagation techniques for horticultural crops- budding/grafting
10. Container, potting mixture, potting and repotting
11. Practice of training and pruning methods on fruit crops
12. Preparation of fertilizer mixture and application
13. Preparation and application of PGR
14. Layout of different irrigation systems

15. Maturity studies and harvesting of horticultural crops
16. Grading, packaging and storage of horticultural crops
17. Final Practical Examination

Suggested Readings:

1. Chadha, K.L. 2019. Handbook of (2 Vol., 2nd Rev. Edn.). ICAR.
2. Kumar, N. 2021. Introduction to (9th Edn.). MedTech Science Publications.
3. Misra, K.K. and Kumar, R. 2014. Fundamentals of . Biotech Books.
4. Peter, K.V. 2009. Basic . NIPA.
5. Salunkhe, D.K. and Kadam, S.S. 2013. A Handbook of Fruit Science and Technology. CRC Press.
6. Singh, J. 2020. Basic . Kalyani Publications.
7. Singh, N.P. 2005. Basic Concepts of Fruit Science. IBDC.

Course No.	:	SAC 101
Course Title	:	Fundamentals of soil science
Credit Hours	:	2+1
Course Category	:	Core Course

Course learning Rationale/ course (CLR):

1. To impart knowledge on rocks, minerals, weathering and soil genesis.
2. To impart knowledge on basic soil properties with respect to plant growth
3. To impart knowledge on soil taxonomy, soil survey and soil pollution

Course learning outcomes (CLO):

Experience in knowledge of rock, minerals, weathering and soil genesis

1. To know the soil properties in relation to plant growth and yield
2. To know the soil taxonomy, soil survey methods to classify the soil based on their utility.
3. To learn about soil pollution and their mitigation strategies.

THEORY

Unit 1: Study of origin of earth, rocks, minerals and soil genesis

Soil as a natural body, Pedological and edaphological concepts, Earth's crust; Composition: Formation and classification of Rocks and minerals. Weathering, Soil genesis-soil forming factors and processes. Components of soils; Soil profile.

Unit 2: Soil Physical properties -Texture, Structure, Density, Porosity and Soil colour

Soil physical properties: soil-texture, Particle size analysis, Stoke's Law – assumptions and limitations and significance of soil texture. Soil Structure, classification – types, classes and grades. – formation of soil structure, Factors affecting soil structure, management of soil structure. Soil density and porosity, factors affecting density, importance of bulk density of soil. Soil porosity- definition, types of pores, factors affecting porosity and its importance. Soil colour- causes, measurement- munsell colour chart-factors influencing soil colour- significance

Unit 3: Soil physical properties- consistency, crusting, soil air, temperature and soil water

Soil consistency, soil crusting, compression and compaction, Soil air, composition, gaseous exchange, problem and effect on plant growth. Soil temperature; source, amount and flow of heat in soil; effect on plant growth Soil water Retention and potentials, Soil moisture constants, Movement of soil water, Infiltration, percolation, permeability, conductivity.

Unit 4: Soil chemical and biological properties

Soil reaction – pH, soil acidity and alkalinity, buffering effect of pH on nutrient availability; EC and its impact on plant growth, soil colloids inorganic and organic; silicate clays: constitution and properties; sources of charge; ion exchange, cation and anion exchange capacity, base saturation of soil. Soil organic matter: composition, properties and its influence on soil properties; humic substances – nature and properties.

Unit 5: Soil taxonomy, Soil survey and Soil pollution & its mitigation.

Elementary knowledge of soil taxonomy classification. Soil survey- types and methods, Soil degradation pollution – behaviour of pesticides and inorganic contaminants, prevention and mitigation of soil pollution. Objectives of soil science research institute in India (NBSS and LUP, ISSS, LTFE and NSSTL)

Theory - Lecture Schedule

1. Soil Science- Introduction, importance, branches of soil science, soil definition, pedological and edaphological concepts. Composition of earth crust.
2. Rocks – classification of rocks based on mode of origin and formation – igneous rocks, sedimentary rocks and metamorphic rocks – classification of rocks based on silica content – weatherability of rocks.
3. Minerals – primary, secondary, essential and accessory minerals – primary minerals – quartz, feldspar, micas, pyroxenes, amphiboles and olivines – weatherability of primary minerals. Secondary minerals- non-silicate minerals – P, Ca, Mg, S and micronutrient containing minerals
4. Weathering – types of weathering – physical weathering of rocks – agents of physical weathering and their role - Chemical weathering – solution, hydration, hydrolysis, carbonation, oxidation and reduction, Biological weathering – role of flora and fauna in weathering process.

5. Soil formation – soil forming factors – classification – climate, biosphere, parent material, topography, time and their role in soil formation – catena – definition.
6. Pedogenic processes – basic processes (gains, losses, transformation and translocations) –Fundamental pedogenic processes- eluviation, illuviation, humification, Specific pedogenic processes -calcification, decalcification laterization, podzolisation, gleization, salinization, desalinization, alkalization, dealkalization and pedoturbation.
7. Soil profile – detailed description of a theoretical soil profile – differences between surface soil and sub soil.
8. Soil physical properties – soil texture – definition – various inorganic components in soil and their properties – various textural classes in soil and their properties.
9. Particle size analysis –Stoke's Law – assumptions and limitations – significance of soil texture.
10. Soil structure – classification – types, classes and grades of soil structure – formation of soil structure
11. Factors affecting soil structure, management of soil structure.
12. Density of soil – bulk density and particle density – factors affecting density parameters – importance of bulk density of soil –soil porosity- definition, types of pores, factors affecting porosity and its importance.
13. Soil colour- causes, measurement- munsell colour chart- factors influencing soil colour- significance.
14. Soil consistency – consistence of wet and dry soils – soil crusting – soil plasticity – Atterberg's plastic limits – factors affecting plastic limits – significance of soil consistence.
15. Soil crusting –formation, effect and management. Soil compaction, effect and their management.
16. Soil temperature – sources of heat – heat capacity and conductivity –factors influencing soil temperature – importance of soil temperature on crop growth – management of soil temperature and importance.

17. Mid semester examination

18. Soil air – compositions of atmospheric air and soil air – gaseous exchange – influence of soil air on plant growth, soil properties and nutrient availability – ODR, measurement of oxygen diffusion rate – measures to improve soil aeration.
19. Soil water – forces of soil water retention – pF concept – soil moisture characteristic curves – importance of soil water
20. Soil water potential – components of water potentials – soil moisture constants – field capacity, wilting coefficient, hygroscopic water and saturation – available water and methods for determining soil moisture constants – pressure plate and pressure membrane apparatus.
21. Soil water content – soil water movement – Darcy's Law – saturated, unsaturated and vapour flows – infiltration, percolation and permeability – distribution of water in profile in different soils – soil drainage and its importance.

22. Soil reaction, pH, soil acidity and alkalinity, buffering capacity, effect of pH on nutrient availability, EC and their effect on plant growth.
23. Soil colloids – definition – general properties. Secondary silicate clay minerals –classification based on structure - properties of kaolinite, illite, montmorillonite and chlorite – properties – allophones.
24. Origin of charge in organic and inorganic colloids – negative and positive charges – differences between organic and inorganic soil colloids. Adsorption of ions – types of ion exchange - factors affecting ion exchange capacity of soils
25. Cation and anion exchange capacities of soil – base saturation — importance of Cation Exchange Capacity (CEC) of soils – calculation of base exchange capacity and exchangeable acidity.
26. Soil organic matter – composition – compounds in plant residues – organic matter decomposition, mineralization and immobilization– humus – definition. Importance of soil organic matter and humus – significance of C:N ratio in soil fertility.
27. Soil biology – biomass – flora and fauna – their important characteristics – role of beneficial organisms – Nitrogen fixation, denitrification, solubilization of phosphorus and biological control of plant diseases – promotion of plant growth promoting substances –harmful activities of soil organisms.
28. Soil taxonomy – Keys to soil orders, - criteria at each category of Order suborder, great group, subgroup, family and series – nomenclature according to soil taxonomy
29. Soil survey- types, methods and purpose of soil survey
30. Remote Sensing - principles and basic concepts – sensors and platforms – Aerial and satellite remote sensing – Use of aerial and satellite data in soil resource inventory.
31. Soils of India – major characteristics – potentials and limitations - Objectives of soil science research institute in India (NBSS and LUP, ISSS, LTFE and NSSTL)
32. Soil degradation pollution - behaviour of pesticides and inorganic contaminants, prevention and mitigation of soil pollution.

Practical

Soil analytical techniques- basic concepts. Study of soil forming rocks and minerals. Study of soil profile in the field. Study of soil sampling tools, collection of representative soil sample, its processing and storage. Determination of soil density and porosity. Determination of soil texture by feel and Robinson's pipette Method. Determination of soil colour and soil temperature. Studies of soil moisture content, potential, and water movement in soil. Study of soil structure, water holding capacity and aggregate analysis. Determination of soil pH and electrical conductivity. Determination of soil organic carbon content.

Practical Schedule

1. Soil analytical techniques and concepts. Common laboratory apparatus. Do's and don'ts in a soil chemistry laboratory.

2. Study of rocks and minerals.
3. Study of soil sampling tools, collection of representative soil sample, its processing and storage
4. Study and description of soil profile in the field
5. Determination of bulk density, particle density, per cent porosity.
6. Determination of soil colour and soil compaction
7. Determination of texture by feel method.
8. Determination of soil texture using Robinson's pipette method.
9. Aggregate analysis by wet sieving method.
10. Determination of soil moisture content by gravimetric method, gypsum block and neutron probe method
11. Determination of soil water potential by tensiometer, pressure plate apparatus.
12. Determination of soil moisture constants (Field capacity, water holding capacity and permanent wilting point of soil)
13. Determination of saturated Hydraulic conductivity of soil
14. Determination of infiltration rate of soil
15. Determination of pH and EC of soil
16. Determination of soil organic carbon
17. Final Practical Examination

Suggested Readings:

1. Tisdale, Nelson Werner L, Beaton James D and Havlin John L: Soil Fertility and Fertilizers Samuel: Macmillian Publishing Co., New York.
2. Sehgal,J. A text book of Pedology –concepts and applications- Kalyani publishers,New Delhi.
3. Brady, N.C., 2002. The Nature and Properties of Soils (13th Edition) McMillan Co., New York. Indian Publisher – Eurasia Publishing House (P) Ltd., Ramnagar, New Delhi – 55
4. Dilip Kumar Das. 2004. Introductory Soil Science, Kalyani Publishers, NewDelhi
5. Fundamentals of Soil Science.2009. ISSS Publication, New Delhi.
6. Daji A.J., (1970) A Text Book of Soil Science - Asia Publishing House, Madras.
7. Biswas T.D. and Mukherjee S.K., 1987. Text Book of Soil Science–Tata McGraw Hill Publishing Co. Ltd., New Delhi.
8. Jenny, H. 1941. Factors of Soil Formation - A System of Quantitative Pedology. McGrawHill Book Company INC. NewYork.
9. Joffe, J.S. 1936. The ABC of Soils. Pedology Publication, New Jersey.

Web-Resources:

1. http://www.sciencedirect.com/science?_ob=ArticleURL&_udi=B6V674C837XPuser=2945072 & coverDate=01/31/2005&_rdoc=1&_fmt=high&_orig
2. <http://202.200.144.17/sykc/hjx/content/ckzl/6/2.pdf>

3. http://www.pedosphere.com/volume01/pdf/Section_01.pdf
4. http://waterquality.montana.edu/docs/homeowners/Septic_Drainfield_Soil_Suitability_Presentations/6_Soil_Texture_and_Structure.pdf
5. http://wfrec.ifas.ufl.edu/landscape_/PDFdocuments/SoilProp.pdf
6. [http://www.rootsofpeace.org/assets/Soil%20Testing%20Manual%20V6%20\(Feb%2008\).pdf](http://www.rootsofpeace.org/assets/Soil%20Testing%20Manual%20V6%20(Feb%2008).pdf)
7. <http://www.soils.wisc.edu/courses/SS325/morphology.html>

Course No.	:	ABE 101
Course Title	:	Communication Skills
Credit Hours	:	1+1
Course Category	:	Ability Enhancement Course

Course Learning Rationale / Course Objective (CLR):

- To acquire competence in oral, written and non-verbal communication, develop strong personal and professional communication and demonstrate positive group communication.

Course Learning Outcomes (CLO):

1. Organize and conduct of various group techniques
2. Acquire various Communication skills
3. Develop hard and soft skills
4. Gain knowledge on conflict management
5. Acquire skill on public speaking

THEORY

Unit 1: Communication Process:

The magic of effective communication; Building self-esteem and overcoming fears; Concept, nature and significance of communication process; Meaning,

Unit 2: Communication Types and Models

Types and models of communication; Verbal and non-verbal communication; Linguistic and non-linguistic barriers to communication and reasons behind communication gap/ miscommunication.

Unit 3: Basic Communication Skills:

Listening, Speaking, Reading and Writing Skills; Precis writing/ Abstracting/ Summarizing; Style of technical communication Curriculum vitae/resume writing; Innovative methods to enhance vocabulary , analogy questions.

Unit 4: Listening and Reading Skills:

Definitions, Hearing Vs Listening. Stages of listening process- Types of listening, Speaking skills and types. Reading Skills -Types of reading - Comprehension -Reading comprehension- comprehension skills- Readability index- Guidelines for effective reading.

Unit 5: Structural and Functional Grammar:

Sentence structure, modifiers, connecting words and verbals; phrases and clauses; Case: subjective case, possessive case; objective case; Correct usage of nouns, pronouns and antecedents, adjectives, adverbs and articles; Agreement of verb with the subject: tense, mood, voice; Writing effective sentences; Basic sentence faults.

Theory - Lecture Schedule:

1. The magic of effective communication: Definition of communication- Principles- Functions-Information function - Command and instructive function- Influence or persuasive function and Integrative function - Concepts related to communication (Fidelity Noise, Empathy, Homophily, Heterophily, Propaganda, Publicity and Persuasion)
2. Building self-esteem and overcoming fears: Understanding Confidence and Fear Strategies to build self-esteem and overcome fears-Techniques for Building Confidence- (positive self-talk, practice self-care, build positive relationship, learn from mistakes, practice assertiveness etc.,) Techniques for overcoming fears (focus on preparation, gradual exposure to different communication situations, consistent practice, rehearse out loud etc.,).
3. Communication process-Meaning, Concept, nature (dynamic, social, reciprocal and interdependent) and significance- Elements of communication process and barriers of communication.
4. Communication Types: Verbal - Written communication -oral communication- interpersonal and intrapersonal communication -mass communication- Components of Non-Verbal Communication-Proxemics, Haptics, Gestures, Paralinguistics, Facial expressions, Chronemics Oculistics, Posture, Appearance and Artifacts.
5. Models of communication – Linear model-Aristotle, Lasswells model, Shanon-Weaver, Berlo, Leagans, Rogers & Shoemaker. Interactive model-Schramm, Westley& Maclean. Transactional model-Dance Helical model.
6. Linguistic and non-linguistic barriers to communication- communication gap- Types of communication gap (Vertical gaps, Horizontal gaps, Internal gaps, External gaps, Knowledge gaps, Delivery gaps, Generation gaps). Miscommunication- concept and disadvantages
7. Listening and Speaking: Definitions: Hearing Vs Listening. Stages of listening process- Types of listening (Active listening, passive listening, appreciative,

- critical, Discriminative Listening, Comprehension listening -Selective Listening).
8. Speaking skills (motor perceptive skills and interaction skills) and types (imitative, intensive, responsive, transactional, interpersonal and extensive).

9. Mid Semester Examination

10. Reading Skills -Types of reading (Intensive, extensive, selective, loud, silent, skimming, scanning, - Comprehension -Reading comprehension- comprehension skills- Readability index- Guidelines for effective reading.
11. Writing Skills-Graham's Flow Chart on writing- Types - writing skills for easy reading- Points to be considered in technical writing.
12. Precis writing - Rules for making a precis-guidelines - Styles of technical communication: Assertive Style- Aggressive Style- Passive-Aggressive Style- Submissive Style- Manipulative Style- Abstracting and Summarizing.
13. Curriculum vitae/resume writing; Difference between resume and curriculum vitae. Tips for writing Curriculum vitae/resume writing.
14. Innovative methods to enhance vocabulary (reading extensively, playing word game, listening to podcast, use of mnemonics, practice using new words).
15. Analogy questions: (power of reasoning and ability to think concisely and accurately) for writing farm related contents, Sentence structure Modifiers, connecting words and verbals for effective extension literature writing.
16. Phrases and clauses: Use of phrases and clauses for extension communication (Poster, leaflets and folders). Case: subjective case, possessive case; objective case; Correct usage of nouns, pronouns and antecedents, adjectives, adverbs and articles for extension communication (for agricultural columns in dailies and farm magazines).
17. Agreement of verb with the subject: tense, mood, voice in extension communication. Writing effective sentences- Basic sentence faults to be avoided while writing for farmers.

Practical

Listening and note taking; Writing skills: precis writing, summarizing and abstracting; Reading and comprehension (written and oral) of general and technical articles; Micro-presentations and Impromptu Presentations: Feedback on presentations; Stage manners: grooming, body language, voice modulation, speed; Group discussions; Public speaking exercises; vocabulary building exercises; Interview Techniques; organization of events.

Practical Schedule

1. Practicing Listening and note taking methods
2. Practicing Writing Skills- Precis writing
3. Practicing Summarizing and Abstracting
4. Practicing Reading and Comprehension
5. Writing popular and technical articles
6. Practicing micro presentations - I
7. Practicing micro presentations- II
8. Impromptu presentations

9. Analysing the feedback of presentations
10. Stage manners (grooming, body language, voice modulation and speed: Practicing as individual)
11. Stage manners (grooming, body language, voice modulation and speed: Practicing as Groups)
12. Practicing group discussion -I
13. Public speaking Techniques (Practicing)
14. Practising vocabulary building exercise
15. Practice of resume writing and techniques of Interviewing
16. Exercise on organising events
17. Final Practical Examination

Suggested Readings:

1. Allport, G. W. 1937. Personality: A Psychological Interpretation. Holt, New York.
2. Brown Michele and GylesBrandreth. 1994. How to Interview and be Interviewed. Sheldon Press, London.
3. Carnegie Dale. 1997. The Quick and Easy Way to Effective Speaking. Pocket Books, New York.
4. Francis Peter, S. J. 2012. Soft Skills and Professional Communication. Tata McGraw Hill, New Delhi.
5. Kumar, S. and PushpaLata. 2011. Communication Skills. Oxford University Press.
6. Neuliep James, W. 2003. Intercultural Communication A Contextual Approach. Houghton Mifflin Co Boston.
7. Pease, Allan. 1998. Body Language. Sudha Publications, Delhi.
8. Raman, M. and Singh, P. 2000. Business Communication. Oxford University Press.
9. Seely, J. 2013. Oxford Guide to Effective Writing and Speaking. Oxford University Press.
10. Thomson, A. J. and Martinet, A. V. 1977. A Practical English Grammar. Oxford University.

Course No.	:	MDC 101
Course Title	:	Farming based livelihood systems
Credit Hours	:	2+1
Course Category	:	Multidisciplinary Course

Course Learning Rationale / Course Objectives (CLR)

1. To make the students aware about farming-based livelihood systems in agriculture
2. To disseminate the knowledge and skill how farming-based systems can be a source of livelihood

Course Learning Outcome

1. Understanding the farming based livelihood systems
2. Knowing the basics of farming systems and livelihood enterprises.
3. Knowledge on Basics of livelihood models and programmes in the country.

Theory

Unit I: Livelihood systems

Status of agriculture in India and different states, Income of farmers and rural people in India. Livelihood-Definition, concept and livelihood pattern in urban and rural areas. Different indicators to study livelihood systems. Agricultural livelihood systems (ALS): Meaning, approaches and framework.

Unit II: Farming systems

Definition of farming systems and farming based livelihood systems. Prevalent Farming systems in India contributing to livelihood. Types of traditional and modern farming systems. Components of farming system/ farming-based livelihood systems

Unit III: Livelihood enterprises

Crops and cropping systems, Livestock (Dairy, Piggery, Goatry, Poultry, Duckery etc.), Horticultural crops, Agro-forestry systems, Aqua culture Duck/Poultry cum Fish, Dairy cum Fish, Piggery cum Fish etc., Small-, medium- and large- enterprises including value chains and secondary enterprises as livelihood components for farmers.

Unit IV: Livelihood models

Factors affecting integration of various enterprises of farming for livelihood. Feasibility of different farming systems for different agro-climatic zones, Commercial farming-based livelihood models by NABARD, ICAR and other organizations across the country, Case studies on different livelihood enterprises associated with the farming. Risk and success factors in farming-based livelihood systems,

Unit V: Livelihood programmes

Schemes and programs by Central and State Government, Public and Private organizations involved in promotion of farming-based livelihood opportunities. Role of farming-based livelihood enterprises in 21st Century in view of circular economy, green economy, climate change, digitalization and changing life style.

Lecture schedule

1. Status of agriculture in India and different states, Income of farmers and rural people in India
2. Livelihood-Definition, concept and livelihood pattern in urban and rural areas
3. Different indicators to study livelihood systems.
4. Different indicators to study livelihood systems
5. Different indicators to study livelihood systems
6. Different indicators to study livelihood systems
7. Agricultural livelihood systems (ALS): Meaning, approaches and framework
8. Definition of farming systems and farming based livelihood systems
9. Prevalent Farming systems in India contributing to livelihood.
10. Types of traditional and modern farming systems.
11. Components of farming system/ farming-based livelihood systems – I
12. Components of farming system/ farming-based livelihood systems – II
13. Components of farming system/ farming-based livelihood systems – III
14. Crops and cropping systems
15. Livestock - Dairy, Piggery, Goatry
16. Livestock - Poultry, Duckery etc.

17. MID SEMESTER EXAMINATION

18. Aqua culture, Duck/Poultry cum Fish, Dairy cum Fish, Piggery cum Fish etc
19. Horticultural crops Agro-forestry systems
20. Small-, medium- and large- enterprises including value chains and secondary enterprises as livelihood components for farmers.
21. Factors affecting integration of various enterprises of farming for livelihood.
22. Feasibility of different farming systems for different agro-climatic zones,
23. Feasibility of different farming systems for different agro-climatic zones,
24. Commercial farming-based livelihood models by NABARD, ICAR and other organizations across the country
25. Risk and success factors in farming-based livelihood systems
26. Case studies on different livelihood enterprises associated with the farming
27. Case studies on different livelihood enterprises associated with the farming
28. Case studies on different livelihood enterprises associated with the farming
29. Schemes and programs by Central and State Government
30. Public and Private organizations involved in promotion of farming-based livelihood opportunities
31. Role of farming-based livelihood enterprises in 21st Century in view of circular economy, green economy, climate change, digitalization and changing lifestyle.
32. Role of farming-based livelihood enterprises in 21st Century in view of circular economy, green economy, climate change, digitalization and changing life style

Practical

Survey of farming systems and agricultural based livelihood enterprises - Study of components of important farming based livelihood models/ systems in different agro-climatic zones - Study of production and profitability of crop based, livestock based, processing based and integrated farming based livelihood models - Field visit of innovative farming system models - Visit of Agri-based enterprises and their functional

aspects for integration of production, processing and distribution sectors and Study of agri-enterprises involved in industry and service sectors (Value Chain Models) - Learning about concept of project formulation on farming-based livelihood systems along with cost and profit analysis - Case study of Start-Ups in agri-sectors.

Practical schedule

1. Farming system scenarios in India and different states
2. Study of resource recycling in farming system models – Wet land
3. Study of resource recycling in farming system models – Garden land
4. Study of resource recycling in farming system models – Dry land
5. Study of production and profitability in farming system models – Wet land
6. Study of production and profitability in farming system models – Garden land
7. Study of production and profitability in farming system models – Dry land
8. Study of Value-Added Products
9. Visit to Agro based processing industries
10. Field visit to Wetland IFS to note down resource recycling and profitability
11. Field visit to Garden land IFS to note down resource recycling and profitability
12. Field visit to Dry land IFS to note down resource recycling and profitability
13. Study of Industrial agricultural and service sectors (Value Chain Models)
14. Calculation of different indicators – Cropping system
15. Calculation of different indicators – Farming system
16. Project formulation for IFS
17. **FINAL PRACTICAL EXAMINATION**

Suggested Readings

1. Ashley, C. and Carney, D. 1999. Sustainable Livelihoods: Lessons from Early Experience; Department for International Development: London, UK; Volume 7. [Google Scholar]
2. Agarwal, A. and Narain, S. 1989. Towards Green Villages: A strategy for Environmentally, Sound and Participatory Rural Development, Center for Science and Environment, New Delhi, India
3. Carloni, A. 2001. Global Farming Systems Study: Challenges and Priorities to 2030 – Regional Analysis: Sub-Saharan Africa, Consultation Document, FAO, Rome, Italy
4. Dixon, J. and A. Gulliver with D. Gibbon. 2001. Farming Systems and Poverty: Improving Farmers' Livelihoods in a Changing World. FAO & World Bank, Rome, Italy & Washington, DC, USA
5. Evenson, R.E. 2000. Agricultural Productivity and Production in Developing Countries'. In FAO, The State of Food and Agriculture, FAO, Rome, Italy

6. Livelihood Improvement of Underprivileged Farming Community: Some Experiences from Vaishali, Samastipur, Darbhanga and Munger Districts of Bihar by B. P. Bhatt, Abhay Kumar, P.K. Thakur, AmitavaDeyUjjwal Kumar, Sanjeev Kumar, B.K. Jha, Lokendra Kumar, K. N. Pathak, A. Hassan, S. K. Singh, K. K. Singh and K. M. Singh ICAR Research Complex for Eastern Region ICAR Parisar, P.O. Bihar Veterinary School, Patna - 800 014, Bihar
7. Panwar et al. 2020. Integrated Farming System models for Agricultural Diversification, Enhanced Income and employment, Indian Council of Agricultural Research, New Delhi.
8. Reddy, S.R. 2016. Farming System and Sustainable Agriculture, Kalyani Publishers, New Delhi.
9. Singh, J.P., et al. 2015. Region Specific Integrated Farming System Models, ICAR-Indian Institute of Farming Systems Research, Modipuram.
10. Walia, S. S. and Walia, U. S. 2020. Farming System and Sustainable Agriculture, Scientific Publishers, Jodhpur, Rajasthan.

Course No.	:	NCC 101
Course Title	:	National Cadet Corps I
Credit Hours	:	0+1
Course Category	:	Ability Enhancement Course

Course Learning Rationale / Course Objectives (CLR)

1. To develop qualities of character, courage, comradeship, discipline, leadership, secular outlook, spirit of adventure and sportsmanship and the ideals of selfless service among the youth to make them useful citizen.
2. To create a human resource of organized trained and motivated youth to provide leadership in all walks of life including the Armed Forces and be always available for the service of the nation.

Course Learning Outcome (CLO)

1. Creating a pool of selfless and responsible citizen.
2. Developing a human resource of organized trained and motivated youth.
3. Motivating youth for making career in Armed Forces.

Practical/Awareness activities

- Aims, objectives, organization of NCC and NCC song. DG's cardinals of discipline.
- Drill- aim, general words of command, attention, stands at ease, stand easy and turning.

- Sizing, numbering, forming in three ranks, open and close order march, and dressing.
- Saluting at the halt, getting on parade, dismissing, and falling out.
- Marching, length of pace, and time of marching in quick/slow time and halt. Side pace, pace forward and to the rear. Turning on the march and wheeling. Saluting on the march.
- Marking time, forward march, and halt. Changing step, formation of squad and squad drill.
- Command and control, organization, badges of rank, honors, and awards
- Nation Building- cultural heritage, religions, traditions, and customs of India. National integration. Values and ethics, perception, communication, motivation, decision making, discipline and duties of good citizens. Leadership traits, types of leadership. Character/ personality development. Civil defense organization, types of emergencies, firefighting, protection. Maintenance of essential services, disaster management, aid during development projects.
- Basics of social service, weaker sections of society and their needs, NGO's and their contribution, contribution of youth towards social welfare and family planning.
- Structure and function of human body, diet and exercise, hygiene and sanitation. Preventable diseases including AIDS, safe blood donation, first aid, physical and mental health. Adventure activities. Basic principles of ecology, environmental conservation, pollution and its control.

Practical Schedule

1. Aims, objectives, organization of NCC and NCC song. DG's cardinals of discipline.
2. Drill - aim, general words of command, attention, stands at ease, stand easy and turning.
3. Sizing, numbering, forming in three ranks, open and close order march, and dressing.
4. Saluting at the halt, getting on parade, dismissing, and falling out.
5. Marching, length of pace, and time of marching in quick/slow time and halt. Side pace, pace forward and to the rear. Turning on the march and wheeling. Saluting on the march.
6. Marking time, forward march, and halt. Changing step, formation of squad and squad drill.
7. Command and control, organization, badges of rank, honors, and awards
8. Nation Building - cultural heritage, religions, traditions, and customs of India.
9. National integration.
10. Values and ethics, perception, communication, motivation, decision making, discipline and duties of good citizens.
11. Leadership traits, types of leadership. Character/ personality development.
12. Civil defense organization, types of emergencies, fire fighting, protection.
13. Maintenance of essential services, disaster management, aid during development projects.

14. Basics of social service, weaker sections of society and their needs, NGO's and their contribution, contribution of youth towards social welfare and family planning.
15. Structure and function of human body, diet and exercise, hygiene and sanitation. Preventable diseases including AIDS, safe blood donation, first aid, physical and mental health.
16. Adventure activities. Basic principles of ecology, environmental conservation, pollution and its control.
17. Final Practical Examination

Course No	:	NSS 101
Course Title	:	National Service Scheme I
Credit Hours	:	0+1
Course Category	:	Ability Enhancement Course

Syllabus Practical

1. Introduction and Basic Components of NSS
2. Orientation: History, Objectives, Principles, Symbol, Badge; Regular Programs under NSS.
3. Organizational structure of NSS, Code of conduct for NSS volunteers, Points to be considered by NSS Volunteers' awareness about Health.
4. NSS program activities. Concept of regular activities, Special camping, Day camps, Basis of adoption of village/slums, conducting survey, Analysing Guiding financial patterns of scheme, Youth program/schemes of GOI, Coordination with different agencies and maintenance of diary. Understanding youth. Definition, Profile, Categories, Issues and Challenges of youth; and Opportunities for youth who is agent of the social change.
5. Community mobilization. Mapping of community stakeholders, Designing the message as per problems and their culture; Identifying methods of mobilization involving youth-adult partnership. Social harmony and National integration.
6. Indian history and culture, role of youth in nation building, Conflict resolution and peace building. Volunteerism and Shramdaan. Indian tradition of volunteerism, its need, importance, motivation and constraints; Shaman as part of volunteerism.
7. Citizenship, Constitution, and Human rights. Basic features of constitution of India, Fundamental rights and duties, Human rights, Consumer awareness and rights and Right to information. Family and Society. Concept of family, Community (PRIs and other community-based organizations) and Society.

Practical Schedule

1. Introduction to NSS – Historical roots, aims, philosophy, and the guiding motto.
2. Understanding NSS Emblem and Awards – Significance of the badge, symbol, and recognitions.

3. Objectives and Principles of NSS – Key values and principles that guide all activities.
4. Regular NSS Programs – Categories, purpose, and methods of implementation.
5. NSS Organizational Structure – Overview of hierarchy at national, state, university, and institutional levels.
6. Volunteer Code of Conduct – Discipline, ethical behavior, and responsibilities expected from volunteers.
7. Volunteer Health Awareness – Importance of hygiene, mental wellness, and public health engagement.
8. NSS Activity Planning – Structuring and planning regular and special NSS events.
9. Special Camping Program – Purpose, annual themes, and field-level execution.
10. Day Camps and Community Visits – Short-term field programs and awareness drives.
11. Adopting Villages/Slums – Framework for selection, engagement, and impact creation.
12. Conducting Field Surveys – Techniques to assess socio-economic status and document findings.
13. Youth-Oriented Government Schemes – Introduction to major youth development programs and how to access them.
14. NSS Diary Maintenance – Documenting participation, reflections, and progress.
15. Career Guidance & Counselling via NSS – Creating student support and mentorship groups.
16. Campus Cleanliness and Environment Campaigns – Organizing tree planting, plastic-free drives, and clean-up initiatives.

17. Final Practical Examination

Besides the above, NSS volunteers will attend work during important occasions like Convocation, Farmers Day, Sports meet and other University / School functions. NSS Volunteers will attend one special camp in the selected village for a duration of 7 days and undertake various activities based on the need of that village. For all out door regular activities villages / slums nearby the campus may be selected to avoid transport cost (cycle able distance) Special camp activity will be conducted in a village situated within a radius of 15 – 20 KM.

Course No.	:	IFC 101
Course Title	:	<i>Deeksharambh</i>
Credit Hours	:	0+2
Course Category	:	Induction cum Foundation Course (non-gradual)

Course Learning Rationale / Course Objective (CLR):

1. To give a broad view and application areas of the subject of study
2. Helping students from different backgrounds for cultural Integration

3. Knowing about the operational framework of academic process in university
4. Instilling life and social skills, leadership qualities, team working spirit
5. Developing social awareness, ethics and values, creativity
6. Helping students to identify the traditional values and indigenous cultures along with diverse potentialities both in indigenous and developed scenario

Activities

The details of activities/ schedules will be decided by the university / School:

1. Discussions on operational framework of academic process in School, as well as interactions with Dean, Professor education, Co-ordinator, Warden, Staff advisor and research co-ordinator of the School
2. Creating awareness on the subject of study, and the traditional values and indigenous cultures along with diverse potentialities both in indigenous and developed scenario
3. Familiarizing various Departments of the Institute, and interaction with Heads and faculties of the Department.
4. Interaction with alumni, business leaders, perspective employers, progressive farmers, outstanding achievers in related fields, and people with inspiring life experiences
5. Group activities to identify the strength and weakness of students (with expert advice for their improvement) as well as to create a platform for students to learn from each other's life experiences
6. Field visits to related research fields/ establishments
7. Sessions on personality development (instilling life and social skills, social awareness, ethics and values, team work, leadership, *etc.*) and communication skills

Course No	:	MAT 101
Course Title	:	Introductory Mathematics
Credit Hours	:	0+1
Course Category	:	Non-gradual

Course Learning Rationale / Course Objective (CLR):

The purpose of learning this course is to:

1. To provide preliminary Knowledge of Mathematics for students

Course Learning Outcomes (CLO):

1. Integrated product of function and define matrices and determination.
2. Acquire interest to utilise calculus in agriculture
3. Apply the Knowledge gained in the designing field.

THEORY

Unit 1: Algebra

Progressions- Arithmetic, Geometric and Harmonic Progressions. Matrices: Definition of Matrices, Addition, Subtraction, Multiplication, Transpose and Inverse up to 3rd order by adjoint method, Properties of determinants up to 3rd order and their evaluation.

Unit 2: Ordinary Differential Calculus

Definition - Differentiation of function using first principle, Derivatives of sum, difference, product and quotient of two functions, Methods, Increasing and Decreasing Functions. Application of Differentiation- Growth rate, Average Cost, and Marginal cost, Marginal Cost, Marginal Revenue.

Unit 3: Partial Differential Calculus

Partial differentiation: Homogeneous function, Euler's theorem, Maxima and Minima of the functions of the form $y = f(x)$ and $y = f(x_1, x_2)$.

Unit 4: Integral Calculus

Integration - Definite and Indefinite Integrals-Methods- Integration by substitution, Integration by parts. Area under simple well-known curves.

Unit 5: Mathematical Models

Agricultural systems - Mathematical models - classification of mathematical models- Fitting of Linear, quadratic and exponential models to experimental data.

Practical Schedule

1. Introduction to Matrix, Differential Calculus - ODE, PDE and Mathematics in Agriculture
2. Simple problems in Arithmetic, Geometric and Harmonic Progressions.
3. Problems in Addition, Subtraction, Multiplication and Transpose of a matrix
4. Problems in determinants and inverse up to 3rd order by adjoint method.
5. Problems in differentiation of x^n , e^x , $\sin x$ & $\cos x$, derivatives of sum, difference.
6. Derivatives of product, quotient of two functions and differentiation of functions of functions.
7. Simple problem based on Logarithmic differentiation and differentiation by substitution method.
8. Application - Growth rate, Average Cost, and Marginal cost, Marginal Cost, Marginal Revenue.
9. Simple Problem - Partial differentiation: Homogeneous function, Euler's theorem.
10. Problems in Maxima and Minima of the functions of the form $y=f(x)$.
11. Problems in Maxima and Minima of the functions of the form $y = f(x_1, x_2)$.
12. Problems in integration of simple functions Definite Integral
13. Problems in product of two functions using integration by parts Integration by substitution method
14. Application - Problems in Area under simple well-known curves
15. Problems in fitting linear models to experimental data.
16. Problems in fitting Quadratic models and Exponential models to experimental data

17. Final Practical Examination

Suggested readings:

1. Mehta, B. C. and G. M. K. Madnani, 2014, Mathematics for Economists, Sultan Chand & Sons, New Delhi.
2. Kailasam.C, Pangayar Selvi. R and Vasanthi. R, 2010dinar, Applied Mathematics, Agrobios (India), Jodhpur.
3. James Stewart and Barhara Frank, Calculus, 2008, International Thomson Publishers, Singapore.
4. Duraipandian, 2007, Calculus and Analytical Geometry, Emerald Publishers, Chennai.
5. Ranganathan.C.R. 2006, A First Course in Mathematical Models of Population Growth (with MATLAB programs), Associated publishing company, New Delhi.
6. Manickavasagam Pillai, T. K and Natarajan, T. 2004. Calculus, Viswanathan Publications, Madras.

II SEMESTER

Sl.No.	Course No.	Course Title	Discipline	Cr.Hr.
1.	AEN 101	Fundamentals of Entomology	AEN	2+1
2.	AMP 101	Livestock and Poultry Management	AH	1+1
3.	PAT 101	Fundamentals of Plant Pathology	PAT	2+1
4.	SAC 102	Soil Fertility Management	SAC	2+1
5.	ABE 102	Personality Development	AEX & ENG	1+1
6.	VAC 101	Environmental Studies and Disaster Management	SAC, AGM & AGR	2+1
7.	NCC102/ NSS102	National Cadet Corps II / National Service Scheme II	NCC / NSS	0+1
8.	-	Skill Enhancement Course 3	-	0+2
9.	-	Skill Enhancement Course 4	-	0+2
		TOTAL		10+11=21

Course No	:	AEN 101
Course Title	:	Fundamentals of Entomology
Credit Hours	:	2+1
Course Category	:	Core Course

Course Learning Rationale / Course Objective (CLR):

1. To know the history of entomology, classification of insects and their relationship with other arthropods
2. To study the various morphological characters of class Insecta and their importance for classification of insects
3. To get an idea about the different physiological systems of insects and their role in growth, development and communications of insects
4. To study the characteristics of commonly observed insect orders and their economically important families

Course Learning Outcomes (CLO):

1. Understand the outline of Entomology and classification of insects in relation to other arthropods
2. Identify the various morphological characters and their importance for classification of insects
3. Explain the major physiological systems of insects and their functions in growth, development and communication
4. Recognize key insect orders characters and understand the economically important insect families

THEORY

Unit 1: History and importance

History of Entomology in India. Major points related to dominance of Insects in Animal kingdom. Classification of phylum Arthropoda up to classes. Relationship of class Insects with other classes of Arthropoda.

Unit 2: Morphology

Structure and functions of insect cuticle and molting. Body segmentation. Structure of head, thorax and abdomen. Structure and modifications of insect antennae, mouth parts, legs, Wing venation, modifications and wing coupling apparatus.

Unit 3: Anatomy and physiology

Structure and functions of digestive, circulatory, excretory, respiratory, nervous, secretory (Endocrine) and reproductive system, in insects. Types of reproduction in insects. Metamorphosis and diapause in insects. Types of larvae and pupae. Major sensory organs.

Unit 4: Insect ecology

Introduction, environment and its components. Effect of abiotic factors and biotic factors. Categories of pests. Surveillance and forecasting.

Unit 5: Insect systematics

Taxonomy – importance, history and development and binomial nomenclature. Definitions of biotype, Sub-species, Species, Genus, Family and Order. Classification of class Insecta up to Orders, basic groups of present day insects with special emphasis to orders and families of Agricultural importance like Orthoptera: Acrididae, Tettigoniidae, Gryllidae, Gryllotalpidae; Dictyoptera: Mantidae, Blattidae; Odonata; Isoptera: Termitidae; Thysanoptera: Thripidae; Hemiptera: Pentatomidae, Coreidae, Cimicidae, Pyrrhocoridae, Lygaeidae, Cicadellidae, Delphacidae, Aphididae, Coccidae, Lophophidae, Aleurodidae, Pseudococcidae; Neuroptera: Chrysopidae; Lepidoptera: Pieridae, Papilionidae, Noctuidae, Sphingidae, Pyralidae, Gelechiidae, Arctiidae, Saturniidae, Bombycidae; Coleoptera: Coccinellidae, Chrysomelidae, Cerambycidae, Curculionidae, Bruchidae, Scarabaeidae; Hymenoptera: Tenthredinidae, Apidae, Trichogrammatidae, Ichneumonidae, Braconidae, Chalcididae; Diptera: Cecidomyiidae, Tachinidae, Agromyziidae, Culicidae, Muscidae, Tephritidae.

Theory - Lecture schedule

1. History of Entomology in India – classification of phylum arthropoda with classes - relationship with other members of Arthropoda.
2. Insect dominance - structural, morphological and physiological factors responsible for dominance.
3. Insect body wall - its structure and function, cuticular appendages.
4. Moulting process in insects.
5. Structure of insect head and its appendages.
6. Structure of insect thorax and its appendages.
7. Structure of insect abdomen and its appendages.
8. Digestive system - structure of alimentary canal and its modifications in certain groups. Digestive enzymes, digestion and absorption of nutrients.
9. Circulatory system in insects - haemocoel and dorsal vessel - circulation of blood - composition of haemolymph - haemocytes and their functions.
10. Excretory system in insects - malpighian tubules - accessory excretory organs and physiology of excretion
11. Respiratory system in insects - structure of trachea - tracheoles - types of respiratory system - types of spiracles - respiration in aquatic and endoparasitic insects.
12. Nervous system in insects - structure of neuron – types of nervous systems.
13. Conduction of nerve impulses - axonic and synaptic transmissions.
14. Exocrine and endocrine glands and their function - effect on metamorphosis and reproduction
15. Male and female reproductive systems in insects – structure and modifications. Spermatogenesis and Oogenesis

16. Types of reproduction - oviparous, viviparous, paedogenesis, polyembryony, ovoviporous and parthenogenesis.

17. Mid Semester Examination

18. Metamorphosis and diapause in insects. Immature stages of insects
19. Structure of sense organs - types of sensilla - photoreceptors; chemoreceptors and mechanoreceptors
20. Definition of insect ecology and introduction to environment and its components
21. Effect of abiotic factors- temp, moist, humidity, RF, light and air on the population of insects
22. Effect of biotic factors- food competition, biotic potential and environmental resistance on the population of insects
23. Categories of pests, ETL, EIL, surveillance and forecasting
24. Taxonomy, importance, history and development of insects.
25. Classification and nomenclature of insects. Definition of biotype, sub species, species, genus, family and order
26. Distinguishing characters of Agricultural important orders and family of Orthoptera: Acrididae, Tettigoniidae, Gryllidae, Gryllotalpidae; Dictyoptera: Mantidae, Blattidae; Odonata
27. Isoptera: Termitidae; Thysanoptera: Thripidae
28. Hemiptera: Pentatomidae, Coreidae, Cimicidae, Pyrrhocoridae, Lygaeidae, Cicadellidae, Delphacidae, Aphididae, Coccidae, Lophophidae, Aleurodidae, Pseudococcidae; Neuroptera: Chrysopidae
29. Lepidoptera: Pieridae, Papilionidae, Noctuidae, Sphingidae, Pyralidae, Gelechiidae, Arctiidae, Saturniidae, Bombycidae
30. Coleoptera: Coccinellidae, Chrysomelidae, Cerambycidae, Curculionidae, Bruchidae, Scarabaeidae
31. Hymenoptera: Tenthredinidae, Apidae. Trichogrammatidae, Ichneumonidae, Braconidae, Chalcididae
32. Diptera: Cecidomyiidae, Tachinidae, Agromyziidae, Culicidae, Muscidae, Tephritidae

Practical

Methods of collection and preservation of insects including immature stages; External features of Grasshopper/Blister beetle; Types of insect antennae, mouthparts and legs; Wing venation, types of wings and wing coupling apparatus. Abdomen and its appendages. Types of insect egg, larvae and pupae; Dissection of digestive system in insects (Grasshopper); Study of characters of orders Odonata, Orthoptera, Dictyoptera, Phasmida, Psocoptera, Dermaptera, Isoptera, Thysanoptera, Hemiptera, Lepidoptera, Neuroptera, Coleoptera, Hymenoptera, Diptera and their families of agricultural importance. Insecticides and their formulations. Pesticide appliances and their maintenance. Sampling techniques for estimation of insect population and damage.

Practical Schedule

1. Collection and preservation of insects including immature stages of insects
2. Observations on external features of grasshopper / blister beetle
3. Types of insect head and antennae
4. Types of mouth parts in insects
5. Types of insect legs and wings, Insect abdomen and its appendages
6. Types of immature stages of insects.
7. Dissection of digestive system in insect (Grasshopper)
8. Study of characters of Orders of Odonata, Dictyoptera (Mantidae, Blattidae) and Orthoptera (Acrididae, Tettigoniidae, Gryllidae, Gryllotalpidae)
9. Study of characters of Orders of Phasmida, Psocoptera, Dermaptera, Isoptera (Termitidae) and Thysanoptera (Thripidae)
10. Study of characters of Orders of Hemiptera (Pentatomidae, Coreidae, Cimicidae, Pyrrhocoridae, Lygaeidae, Cicadellidae, Delphacidae, Aphididae, Coccidae, Lophophidae, Aleurodidae, Pseudococcidae, Tingidae, Diaspididae, Kerridae, Membracidae, Miridae, Cicadidae)
11. Study of characters of Orders of Lepidoptera (Pieridae, Papilionidae, Lycaenidae, Hesperidae, Cochlidiidae, Noctuidae, Sphingidae, Pyralidae, Gelechiidae, Arctiidae, Nymphalidae, Lymantriidae, Saturniidae, Bombycidae, Plutellidae)
12. Study of characters of Orders of Coleoptera (Coccinellidae, Chrysomelidae, Cerambycidae, Curculionidae, Bruchidae, Scarabaeidae, Apionidae, Melolonthidae, Anobiidae, Bostrychidae, Meloidae, Buprestidae)
13. Study of characters of Orders of Hymenoptera (Tenthredinidae, Apidae, Trichogrammatidae, Ichneumonidae, Braconidae, Chalcididae, Sphecidae, Vespidae, Formicidae, Xylocopidae, Bethyidae, Agaonidae)
14. Study of characters of Orders of Diptera (Cecidomyiidae, Tachinidae, Agromyziidae, Culicidae, Muscidae, Tephritidae, Syrphidae) and Neuroptera (Chrysopidae, Myrmeleontidae, Ascalaphidae)
15. Insecticides and their formulations- Pesticide appliances and their maintenance
16. Sampling techniques for estimation of insect population and damage
17. Final Practical Examination

Suggested Readings:

1. Borror, D. J., D. M. DeLong and C.A. Triple Horn. 1976. An introduction to the study of insects (IV Edition). Holt, Rinehart and Winston, New York, London and Sydney.
2. Chapman R.F.1974. Insect Structure and Function, ELBS publishers, New Delhi.
3. Odum, E. P. and G. W. Barrett. 2017. Fundamentals of Ecology. Cengage India Private Limited. Uttar Pradesh.
4. Richards O.W. and R.G. Davies 1977. Imm's General Text Book of Entomology Vol.I and II. Chapman and Hall Publication, London.

Course No.	:	AMP 101
Course Title	:	Livestock And Poultry Management
Credit Hours	:	1+1
Course Category	:	Core Course

Course Learning Rationale / Course Objective (CLR):

The purpose of learning this course is:

1. The course aims to impart knowledge and adequate understanding of the importance of livestock and poultry Industry in the National economy.
2. Provide basic knowledge to the students about scientific livestock and poultry rearing practices.
3. To familiarize with different livestock breeds in relation to various agro climatic zones, enabling to choose appropriate breeds for their utility.
4. To disseminate information on scientific feeding using locally available feed components in order to save the farming expenditure
5. Entrepreneurship development through Livestock / Poultry and Integrated Farming System

Course Learning Outcomes (CLO):

1. Understand the role of livestock and poultry in the national economy and its significance in agriculture.
2. Comprehend the principles of livestock and poultry management, including housing, reproduction, nutrition, and disease control.
3. Develop skills in handling, identification, feeding, and breeding strategies for livestock and poultry.
4. Analyse scientific feeding methods, ration formulation, and efficient utilization of feed resources.
5. Apply practical knowledge in livestock and poultry farm operations, including farm layout planning, record keeping, disease prevention, and economic analysis.

THEORY

Unit 1: Introduction

Role of livestock in the national economy- Common nomenclatures used in livestock and poultry- Important Indian and exotic breeds of cattle, buffalo, sheep, goat, swine, and poultry- Various systems of livestock rearing - Extensive- Semi intensive- Intensive and mixed, diversified, specialized and Integrated Farming.

Unit 2: Reproduction in Livestock and Poultry

Reproduction in cattle- Oestrus Cycle- Artificial Insemination- Embryo Transfer Technology - Incubation, hatching and brooding of chicks.

Unit 3: Housing and General Management Practices

Housing principles- Systems of housing- Space requirements for different species of livestock and poultry- Management of calves, growing heifers, and milch animals.- Management of sheep, goat, and swine -Management of broilers, growers and layers.

Unit 4: Nutrition and Feeding Management

Digestion in livestock and poultry- Proximate principles of feed- Nutrients and their functions- Classification of feedstuffs - Feed ingredients for livestock and poultry ration- Feed supplements and feed additives- Feeding of livestock and poultry.

Unit 5: Health Management and Disease Control

Introduction to livestock and poultry diseases - Prevention and control of important diseases of livestock and poultry.

Theory - Lecture Schedule

1. Role of livestock in the national economy
2. Common nomenclatures used in livestock and poultry management
3. Important Indian and exotic breeds of cattle, buffalo, sheep, goat, swine, and poultry
4. Various systems of Livestock Production: Extensive, Semi-Intensive, Intensive, Mixed, diversified, specialized and Integrated Farming.
5. Reproduction in cattle – Oestrus cycle
6. Artificial Insemination & Embryo Transfer Technology in cattle
7. Incubation, hatching, and brooding in chicks
8. Housing principles, systems of housing and space requirements for different species of livestock and poultry

9. Mid Semester Examination

10. Management of calves, growing heifers, and milch animals
11. Management of sheep, goat, and swine
12. Management of broilers, growers and layers
13. Digestion in livestock and poultry, proximate principles of feed
14. Nutrients and their functions, classification of feedstuffs
15. Feed ingredients, feed supplements, feed additives & feeding of livestock and poultry
16. Introduction to livestock and poultry diseases
17. Disease prevention and control (including vaccination)

Practical

External parts of cattle, buffalo, sheep, goat, swine and poultry. Handling and restraining of livestock. Identification methods of cattle. Judging of dairy cattle. Culling of livestock and poultry. Planning and layout of housing for different types of livestock. Computation of rations for livestock. Identification of livestock and poultry feed ingredients. Clean milk production, milking methods. Hatchery operations, incubation

and hatching equipment. Management of chicks, growers and layers. Debeaking, dusting and vaccination. Economics of cattle, buffalo, sheep, goat, swine and poultry production, Visit to IDF and IPF to study breeds of livestock and poultry and daily routine farm operations and farm records.

Practical Schedule

1. Study of external parts of cattle, buffalo, sheep, goat, swine, and poultry.
2. Handling and restraining techniques for cattle.
3. Identification methods of farm animals and poultry.
4. Judging of dairy cattle and layer birds.
5. Culling of livestock and poultry.
6. Planning and layout of housing for different types of livestock.
7. Computation of rations for livestock based on nutrient requirements.
8. Identification of livestock and poultry feed ingredients.
9. Clean milk production – hygienic practices and different milking methods.
10. Dehorning and castration of livestock
11. Hatchery operations – incubation and hatching equipment
12. Brooding management of chicks.
13. Debeaking and vaccination in poultry.
14. Economics of cattle, buffalo, sheep and goat production.
15. Economics of Swine and Poultry production
16. Visit to livestock and poultry farms.
17. Final Practical Examination

Suggested Readings:

1. Banerjee, G.C. 2010. The Text Book of Animal Husbandry. Oxford Book Company, Calcutta.
2. Gopalakrishnan, C.A., and Lal, D.M.M., 1992. Livestock and Poultry Enterprises for Rural Development. Vikas Publications Private Limited, GHAZIABAD, Uttar Pradesh.
3. Kadirvel, R., and Balakrishnan, V., 1998. Hand Book of Poultry Nutrition. Madras Veterinary School, TANUVAS, Chennai.
4. Prabakaran, R., 1998. Commercial Chicken Production. Publisher P.Saranya, 5/2, Ramalingam Street, Seven Wells, Chennai.
5. Radostitis. O.M., Gray, C.C., Blood,D.C.and Hinchcliff,K.W. 2000. A text book of the diseases of Cattle, Sheep, Pigs, Goats and Horses. IX edition, Book Power WB Saunders, London.

Course No.	:	PAT 101
Course Title	:	Fundamentals of Plant Pathology
Credit Hours	:	2+1
Course Category	:	Core Course

Course Learning Rationale / Course Objective (CLR):

The purpose of learning this course is:

1. To understand the general concepts and classification of plant diseases
2. To elaborate the process of disease development
3. To get knowledge of general characteristics of protozoa, chromista, fungi, bacteria, virus, and other microorganisms causing plant diseases
4. To know various plant disease management principles and practices

Course Learning Outcomes (CLO):

1. Acquaint the concepts, classification and types of parasitism of plant diseases
2. Comprehend the role of pathogens in pathogenesis
3. Cognize the general characters, taxonomy and symptoms produced by protozoa, chromista, fungi, bacteria, mollicutes, viruses, viroids, algae and phanerogamic parasites.
4. Understand the epidemiology and fundamental principles and practices of plant disease management for effective disease control.

THEORY

Unit 1: Introduction to Plant Pathology

Importance of plant diseases- Definition –objectives of Plant Pathology-History of Plant Pathology - Causes and classification of plant diseases - Koch's postulates- Types of parasitism- Pathogenesis – Disease cycle - Spread and survival of plant pathogens. General characters of Protozoa, Chromista and Fungi - Reproduction in Protozoa, Chromista and Fungi - Symptoms caused by Protozoa, Chromista and Fungi

Unit 2: General characters and taxonomy of *Protozoa*, *Chromista* and *Fungi*

Taxonomy and classification of *Eukaryotes*- Major characteristic features of Kingdom Protozoa, Chromista and Fungi - Classification of Kingdom – *Protozoa* – General characters and diseases caused by Fungi like *Protozoa* (*Plasmodiophora*; *Spongospora*), Life cycle of *Plasmodiophora* - *Flagellate Protozoa* (*Phytomonas*) - Classification of Kingdom -***Chromista***- General characters and symptoms produced by *Oomycetes* (*Pythium*, *Phytophthora Albugo*, *Sclerospora*, *Peronospora*, *Pseudoperonospora*, *Bremia* and *Plasmopara*), Life cycle of *Pythium* and *Plasmopara*- Classification of Kingdom – *Fungi* – General characters and symptoms produced by Phylum *Chytridiomycota* (*Synchytrium*) and *Zygomycota* (*Rhizopus* and *Mucor*)

Unit 3: General characters and taxonomy of *Fungi* - *Ascomycota* and *Basidiomycota*

General characters of Phylum *Ascomycota* -Taxonomic characters and symptoms produced by *Taphrinomycetes* (*Taphrina*), *Dothidiomycetes* (*Capnodium*, *Cercospora*, *Macrophomina*, *Helminthosporium*, *Alternaria* and *Venturia*); *Eurotiomycetes* (*Aspergillus*, *Penicillium*); *Leotiomycetes* (*Erysiphe*, *Uncinula*, *Leveillula* and *Phyllactinia*), Life cycle of Powdery Mildew Fungi; *Sordariomycetes* (*Claviceps*, *Fusarium*, *Verticillium*, *Colletotrichum*, and *Pyricularia*), Life cycle of *Claviceps*. General characters of Phylum *Basidiomycota*- Life cycle of rust fungi – Taxonomic characters and symptoms caused by *Pucciniomycetes* (*Puccinia*, *Uromyces*, *Hemileia*, *Melampsora*, *Phragmidium*), Life cycle of Rust fungi (*Puccinia*); *Ustilaginomycetes* (*Sporisorium*, *Ustilago*, *Tolyposporium*, *Urocystis*); *Exobasidiomycetes* (*Exobasidium* and *Tilletia*); *Agaricomycetes* – Edible and Poisonous mushroom - Taxonomic characters and symptoms caused by *Ganoderma*, *Rhizoctonia* and *Sclerotium*

Unit 4: Bacteria, Viruses, Viroids, Algae and Phanerogamic parasite

Classification of bacteria - general characters and symptoms of phytopathogenic bacteria –Pathogenesis- Mode of entry, survival and spread - General characters and symptoms of *Candidatus* Phytoplasma, Fastidious vascular bacteria, *Spiroplasma*, Viruses Viroids, Algae and Phanerogamic parasites.

Unit 5: Principles of Plant Disease Management

Role of weather factors in plant disease development– survey and assessment Principles and methods of plant disease management Avoidance - Exclusion - Eradication and Protection – chemical, host plant resistance & biological methods – Integrated disease management.

Theory - Lecture Schedule

1. Plant diseases – Significance and history of Plant Pathology (Prevost, Tillet, Anton de Bary, J. G.Kuhn, Millardet, Woronin, Brefeld, Biffen, E.C. Stakman, E.J. Butler, B.B. Mundkur, J.F. Dastur, K.C. Mehta and T.N. Sadasivan).
2. Causes of Plant diseases – Infectious and non – infectious diseases- Biotic agents- Protozoa, Chromista, Fungi, Bacteria, *Candidatus* Phytoplasma, Fastidious vascular bacteria, *Spiroplasma*, Virus, Viroids, Algae and Phanerogamic parasites.
3. Classification of plant diseases- Koch's Postulate.
4. Types of parasitism –parasite, saprophyte, facultative saprophyte, facultative parasite, obligate parasite, biotrophs, hemibiotrophs, perthotrophs, necrotrophs, and symbiosis.
5. Pathogenesis – Development of disease in plants - Disease cycle- Disease triangle.
6. Spread and survival of plant pathogens.
7. Animate agents- Eukaryotes & Prokaryotes- General characters of Protozoa, Chromista and Fungi- Somatic Characters - Resting structures.
8. Asexual and sexual reproduction in Protozoa, Chromista and Fungi.
9. Symptoms caused by Protozoa, Chromista and Fungi.

10. Taxonomy and classification of *Eukaryotes*- – Key to Kingdom, phylum, Sub-Phyla, Classes, Orders and Families. Major characteristic features of Kingdom Protozoa, Chromista and Fungi.
11. Classification of **Kingdom – Protozoa** –Fungi like Protozoa - General characters - Example genus *Plasmodiophora* and *Spongospora* -Life cycle of *Plasmodiophora* – Important characters and diseases caused by *Flagellate Protozoa* – Example Genus *Phytomonas*.
12. Classification of **Kingdom -Chromista-** General Characters of **Oomycota-** Classification- Important Characters of Class **Oomycetes** -Taxonomic characters and symptoms produced by the Genus *Pythium*, *Phytophthora* *Albugo*, *Sclerospora*, *Peronospora*, *Pseudoperonospora*, *Bremia* and *Plasmopara* - Life cycle of *Pythium* and *Plasmopara*.
13. Classification of **Kingdom – Fungi** – General characters – Important Characters of Phylum **Chytridiomycota** – Taxonomic characters and symptoms produced by *Synchytrium* - General characters of Phylum *Zygomycota* - Taxonomic characters and symptoms produced by *Rhizopus* and *Mucor*.
14. Classification of **Kingdom – Fungi** – General characters of Phylum **Ascomycota-** Classification- Important characters of class **Taphrinomycetes** – Taxonomic characters and symptoms produced by *Taphrina* - Important characters of class **Dothidiomycetes** – Taxonomic characters and symptoms produced by *Capnodium*, *Cercospora*, (*Mycosphaerella*), *Macrophomina*, *Helminthosporium* (*Cochliobolus*), *Alternaria* (*Lewia*) and *Venturia* -Life cycle of *Venturia*.
15. Important characters of class **Eurotiomycetes** –Classification- Taxonomic characters and symptoms produced by *Aspergillus* (*Eurotium*), *Penicillium* (*Talaromyces*) - Important characters of class **Leotiomycetes** – Classification- Taxonomic characters and symptoms produced by *Erysiphe*, *Uncinula*, *Leveillula* and *Phyllactinia* - Life cycle of powdery mildew fungi- Important characters of class **Pezizomycetes** – Taxonomic characters of *Morchella* and *Gyromitra*.
16. Important characters of class **Sordariomycetes** – Classification - Taxonomic characters and symptoms produced by *Claviceps*, *Colletotrichum* (*Glomerella*), *Fusarium* (*Gibberella*), *Chaetomium*, *Verticillium*, *Pestalotia* (*Pestalospaeria*) and *Pyricularia* (*Magnaporthe*) - Life cycle of *Claviceps*.
17. **Mid Semester Examination**
18. Classification of Kingdom – *Fungi* – Classification - General characters of Phylum **Basidiomycota-** Types of mycelia, Basidium, Basidiospores and Basidioma.
19. Important characters of class **Pucciniomycetes** - Classification - General characters and life cycle of rust fungi – Taxonomic characters and symptoms caused by *Puccinia*, *Uromyces*, *Hemileia*, *Melampsora* and *Phragmidium*- Life cycle of *Puccinia*.
20. Important characters of class **Ustilaginomycetes** – Classification- Taxonomic characters and symptoms caused by *Sporisorium*, *Ustilago*, *Tolyposporium*, *Urocystis* - Important characters of class **Exobasidiomycetes** - Taxonomic characters and symptoms caused by *Exobasidium* and *Tilletia*.
21. Important characters of class **Agaricomycetes** – Edible and Poisonous mushroom - Important taxonomic characters of *Agaricus*, *Pleurotus*, *Volvariella*, *Lentinus*

- and *Calocybe* - Taxonomic characters and symptoms caused by *Ganoderma*, *Rhizoctonia* (*Thanetophorus*) and *Sclerotium* (*Agroathelium*).
22. Classification and general characters of phytopathogenic bacteria - Mode of entry and symptoms produced by *Xanthomonas*, *Ralstonia*, *Erwinia*, *Pectobacterium*, *Rhizobium* (*Agrobacterium*), *Corynebacterium* (*Clavibacter*) and *Streptomyces*.
 23. General characters and symptoms produced by *Candidatus* Phytoplasma, Spiroplasma and Fastidious vascular bacteria.
 24. General characters of Virus – Morphology, structure and multiplication of plant virus – Symptoms and transmission of plant viruses.
 25. Important characters and symptoms of Viroid (Potato spindle tuber, coconut cadang cadang), Algal (*Cephaleuros*) and Phanerogamic parasites- Abiotic diseases - Difference between biotic and abiotic disease.
 26. Epidemiology - Role of weather factors in plant disease development.
 27. Disease surveillance and assessment.
 28. Principles of crop disease management - Avoidance - Exclusion- plant quarantine – domestic, international and embargo - Phytosanitary certificate.
 29. Principles of crop disease management - Eradication - Different methods of eradication of plant diseases.
 30. Principles of crop disease management - Protection – chemical methods of protection - Fungicides – ideal characters- formulations and adjuvants - Contact and systemic fungicides – Antibiotics - Phytotoxicity of fungicides.
 31. Principles of crop disease management – Immunization - Host plant resistance – Definition – Types of resistance - Structural and biochemical defense in plants. - Resistant varieties
 32. Biological methods - Mechanism -Important biocontrol agents (*Trichoderma* spp., *Pseudomonas fluorescens*, *Bacillus subtilis*) – Methods of application - Integrated Disease Management (IDM)

Practical

Study of the microscope; Acquaintance with laboratory material and equipment; Study of different plant disease symptoms; Microscopic examination of general structure of fungi; Simple staining of bacteria: Direct and indirect staining, Gram staining of bacteria; Microscopic examination of fungal diseased specimen; Microscopic examination of bacterial diseased specimen; Preparation of culture media; Isolation of plant pathogens: Fungi, bacteria and viruses; Purification of plant pathogens; Study on plant disease diagnosis: Koch's Postulates, Characteristics, formulation, methods of application and calculation on fungicides.

Practical Schedule

1. Study of the microscope and acquaintance with laboratory equipment's.
2. Study of symptoms of protozoan, chromistian and fungal diseases.
3. Study of symptoms of bacterial, phytoplasmal and fastidious vascular bacterial diseases.
4. Study of symptoms of viral, viroid, algal and phanerogamic parasitic diseases.
5. Detection and diagnosis of plant diseases.

6. Survey and assessment of plant diseases.
7. General structures of *Protozoa*, *Chromista* and *Fungi* from the diseased specimen- Preparation of temporary mount and microscopic examination of fungal diseases.
8. Gram staining of bacteria.
9. Preparation of culture media.
10. Isolation of plant pathogens – Fungi and bacteria.
11. Purification of plant pathogens – Fungi and bacteria.
12. Demonstration of Koch's Postulates.
13. Study of various groups of fungicides and preparation of Bordeaux mixture and Bordeaux paste.
14. Methods of application of fungicides and calculation of spray fluid.
15. Pre immunization technique in crop disease management
16. Botanicals in plant disease management
17. Final Practical Examination

Assignment: Students should submit 50 well preserved diseased specimens in 3 instalments during the semester.

Suggested Readings:

1. Richard Oliver, 2024. Agrios's Plant Pathology. Academic Press, New York.
2. Alexopoulos, C.J., Mims, C.W. and Blackwell, M. 2010 Introductory Mycology. John Wiley and Sons Ltd., N. York.
3. Alice D and Jeyalakshmi C 2018. Plant Pathology. A.E Publications, Coimbatore.
4. Ravichandra, N.C. 2013. Fundamentals of Plant Pathology, PHI Learning Private Limited, New Delhi
5. Dube, H.C. 2009. A textbook of Fungi, Bacteria and Viruses, Vikas Publishing House P. Ltd, New Delhi.
6. Mehrotra, R.S. and Aneja, K.R. 1990. An Introduction to Mycology, Wiley E.Ltd. New Delhi.
7. Mandahar, C.L. 1987. Introduction to Plant Viruses, Chand and Co., Pvt. Ltd., New Delhi.
8. Hull, R. 2002. Mathews' Plant Virology (4th Edition), Academic Press Inc., London. 1001 pp.
9. Janse J.D 2005 Phytobacteriology- Principles and Practice, CABI Publishing, UK.

Web-resources:

1. www.mycobank.org
2. www.mycology.net
3. www.bspp.org.uk
4. www.ictv.org
5. www.bibo.library.cornell.edu
6. www.apsnet.org

Course No.	:	SAC 102
Course Title	:	Soil Fertility Management
Credit Hours	:	2+1
Course Category	:	Core Course

Course Learning Rationale/ Course objective (CLR):

The purpose of learning this course is:

1. To provide a comprehensive knowledge of soil fertility, plant nutrition, fertilizers, and nutrient management

Course Learning Outcomes (CLO):

After the completion of this course, the student will be able to

1. Develop knowledge of soil fertility, plant nutrition, nutrient transport, and the chemistry of nutrients. Identify the roles, deficiencies, and toxicities of essential nutrients.
2. Gain expertise in evaluating soil fertility, soil testing, plant analysis, and rapid tissue tests. Understand critical nutrient levels and forms in soil.
3. Learn about manures, fertilizers, and nutrient management approaches. Study fertilizer classification, composition, properties, and methods to improve nutrient use efficiency.

THEORY

Unit 1: Introduction to Soil Fertility and Plant Nutrition

History of soil fertility and plant nutrition. Criteria of essentiality. Forms of nutrients in soil. Role, deficiency and toxicity symptoms of essential plant nutrients, Mechanisms of nutrient transport to plants, factors affecting nutrient availability to plants.

Unit 2: Chemistry of soil nutrients

Chemistry of macro and micronutrients.

Unit 3: Soil fertility evaluation and Manures

Soil fertility evaluation, Soil testing. Critical levels of different nutrients in soil. plant analysis, rapid plant tissue tests. Indicator plants. Introduction and importance of manures and fertilizers. Preparation and properties of major manures (FYM, Compost, Vermicompost, Green manuring, Oilcakes).

Unit 4: Fertilizers and Soil amendments

Chemical fertilizers: classification, composition and properties of major fertilizers, secondary and micronutrient fertilizers, Complex fertilizers. Customised fertilisers, water soluble fertilizers nano fertilizers. Soil amendments, Fertilizer Storage, Fertilizer Control Order.

Unit 5: Fertilizer recommendation, Carbon sequestration and Carbon Trading

Fertilizer recommendation approaches. Integrated nutrient management. Methods of fertilizer recommendations to crops. Factor influencing nutrient use efficiency (NUE), methods of application under rainfed and irrigated conditions. STCR/ RTNM/ IPNS, Carbon sequestration and Carbon Trading.

Theory – Lecture Schedule

1. History of soil fertility and plant nutrition, soil fertility and productivity. Criteria of essentiality. Essential and beneficial plant nutrients.
2. Roles, deficiencies and toxicity symptoms of Nitrogen, Phosphorus and Potassium and their corrective measures.
3. Roles, deficiencies and toxicity symptoms of Calcium, Magnesium, Sulphur and micronutrients.
4. Mechanisms of nutrient transport to plant
5. Factors affecting nutrient availability to plants.
6. Sources, forms, mobility, transformation, fixation, losses and availability of nitrogen in soil
7. Sources, forms, mobility, transformation, fixation, losses and availability of phosphorus in soil
8. Sources, forms, mobility, transformation, fixation, losses and availability of potassium in soil
9. Sources, forms, mobility, transformation, fixation, losses and availability of calcium, magnesium and sulphur in soil
10. Sources, forms, mobility, transformation, fixation, losses and availability of micronutrients in soil
11. Concepts and approaches of soil fertility evaluations- Liebig's Law, Mitscherlich's law, Bray's nutrient mobility concept. Inductive and deductive approaches. Isotopic and crop logging technique.
12. Soil fertility evaluation; Soil testing, critical levels of different nutrients in soil, Plant analysis, rapid plant tissue tests. Indicator plants
13. Introduction and importance of manures and fertilizers.
14. Methods of preparation of bulky organic manures, concentrated organic manures (oil cakes), green manures and green leaf manures.
15. Composting techniques- Aerobic and anaerobic (Bangalore & Coimbatore method), enriched FYM
16. Vermicomposting. Composting of organic wastes - Sugarcane trash and coir waste.

17. Mid Semester Examination

18. Definition and classification of N, P and K fertilizers. N fertilizers- composition and properties of Urea, ammonium sulphate, ammonium nitrate and CAN.
19. Manufacture of urea and ammonium sulphate.
20. P fertilizers- composition and properties of Rock phosphate, bone meal, basic slag, single super phosphate, diammonium phosphate and triple super phosphate
21. Manufacturing of SSP and DAP.

22. K fertilizers- composition and properties of MOP and SOP- manufacturing of MOP and SOP
23. Complex fertilizers- definition, manufacture of ammonium phosphate, nitrophosphate and N,P,K complexes. Micronutrient fertilizers
24. Customised fertilisers, water soluble fertilizers nano fertilizers
25. Fertilizer Storage, Fertilizer Control Order
26. Fertilizer recommendation approaches - IARI method, Critical level approaches, Agronomic approaches, DRIS and STCR.
27. Integrated nutrient management
28. Methods of fertilizer recommendations to crops
29. Factors affecting nutrient use efficiency
30. Methods of application under rainfed and irrigated conditions
31. STCR/RTNM/IPNS
32. Carbon sequestration and Carbon Trading

Practical

Introduction of analytical instruments and their principles, calibration and applications of Colorimetry and flame photometry; Estimation of alkaline hydrolysable N in soils; Estimation of soil extractable P in soils; Estimation of exchangeable K in soils; Estimation of exchangeable Ca and Mg in soils; Estimation of soil extractable S in soils; Estimation of DTPA extractable Zn in soils; Estimation of N in plants; Estimation of P in plants; Estimation of K in plants; Estimation of S in plants.

Practical Schedule

1. Introduction to analytical instruments. Calibration and applications of Colorimetry and Nephelometry
2. Calibration and applications of Flame photometry and AAS
3. Estimation of available N status in soil
4. Estimation of available P status in soil
5. Estimation of available K status in soil
6. Estimation of available S status in soil
7. Estimation of exchangeable Ca and Mg in soil
8. Estimation of DTPA extractable micronutrients in soil
9. Preparation of di and tri acid extract of plant samples and estimation of N content in plant sample
10. Estimation of P and K content in plant sample
11. Estimation of S content in plant sample
12. Estimation of N in Urea
13. Estimation of N in ammonium nitrate
14. Estimation of water-soluble P in SSP
15. Estimation of K in KCl and K_2SO_4
16. Colloquium on soil testing laboratories and Soil test-based fertilizer prescriptions
17. Final Practical Examination

Suggested Readings:

1. Soil Fertility and Nutrient Management by S. S. Singh, Kalyani Publishers
2. Soil Fertility and Fertilizers by Samuel L. Tisdale, Werner L. Nelson and James D. Beaton, Macmillan Publishing Company, New York
3. The nature and Properties of Soils by Harry O. Buckman and Nyle C
4. Chopra, S. L., Kanwar, J. S. and Rakshit, A. 2013. Analytical Agricultural Chemistry, Kalyani Publishers Ludhiana.
5. Das, D. K. 2011. Introductory Soil Science (3rd Edition), Kalyani publisher, Ludhiana (India).
6. Gupta, P. K. 2009. Soil, Plant, Water and Fertilizer Analysis (2nd Edition), Agrobios, Jodhpur (India).
7. Indian Society of Soil Science (ISSS) 2002. Fundamentals of Soil Science, IARI, New Delhi.
8. Mariakulandai. A. and T.S. Manickam. Chemistry of manures and fertilizers. Asia publishing house, New Delhi.
9. Mengel, K. and E.A. Kirkby. 1987. Principles of Plant Nutrition, 4th ed. International Potash Institute, Worblaufen-Bern, Switzerland.

Course No.	:	ABE 102
Course Title	:	Personality Development
Credit Hours	:	1+1
Course Category	:	Ability Enhancement Course

Course Learning Rationale / Course Objective (CLR):

1. To understand the concept of personality and its types
2. To gain knowledge about motivation, attitude and intelligence
3. To know about personality development and team building
4. To assess learning styles of students
5. To learn about the conflict management techniques

Course Learning Outcomes (CLO):

1. Understand group dynamics
2. Acquire various personality traits
3. Develop organizational behaviour.
4. Develop skill on Measurement of intelligence.
5. Acquire skill on personality analysis

THEORY

Unit 1: Personality & Determinants of personality

Personality Definition, Nature of personality, theories of personality and its types. The humanistic approach - Maslow's self-actualization theory, shaping of personality, Determinants of personality, Myers-Briggs Typology Indicator, Locus of control and performance, Type A and Type B Behaviours, personality and Organizational Behaviour.

Unit 2: Individual behavior, Perception and Attribution

Foundations of individual behavior and factors influencing individual behavior, Models of individual behavior, Perception and attributes and factors affecting perception, Attribution theory and case studies on Perception and Attribution.

Unit 3: Learning & organizational behavior

Learning: Meaning and definition, theories and principles of learning, Learning and organizational behavior, Learning and training, learning feedback. Attitude and values.

Unit 4: Intelligence & its measurements

Intelligence- types of Intelligence, theories of intelligence, measurements of intelligence, factors influencing intelligence, intelligence and Organizational behavior, emotional intelligence.

Unit 5: Motivation, Teamwork and group dynamics

Motivation- theories and principles, Teamwork and group dynamics.

Theory – Lecture Schedule

1. Personality- Meaning, Definition, Nature of personality, theories of personality - Biological personality, Psychoanalytic, Humanistic, Trait perspective and Behaviourist theories. Personality types – Sheldon, Galen, Pavlov –Extrovert, Introvert and Ambivert.
2. The humanistic approach - Maslow's self-actualization theory. Shaping of personality - stages of shaping - Freud, Erikson, and Piaget's theories.
3. Determinants of personality - Myers-Briggs Typology Indicator -Locus of control and performance, Type A and Type B Behaviours
4. Personality and organizational behavior: Personality-Importance of inherited and acquired characteristics. Organizational behaviour-Meaning and definition. Personality traits in organizational behaviour -OCEAN- (Openness to experience, conscientiousness, extroversion, agreeableness and neuroticism)
5. Foundations of individual behavior – Motivation, Ability, Role perception, Situational factors (MARS) and factors influencing individual behavior - personal factors, environmental factors and organisational factors.
6. Models of individual behavior – Rational and Emotional Model, Behaviouristic and Humanistic Model, Economic and Self-Actualizing Model and Theory X and Theory Y.

7. Perception – meaning, definition, stages and attributes of perception, Perceptual process, factors affecting perception.
8. Fritz Heider Attribution theory, Jones & Davis Correspondent Inference Theory and case studies on Perception and Attribution

9. Mid Semester Examination

10. Learning- Meaning and definition, theories (Classical and Operant Conditioning Theory) and principles of learning – Learning and Organizational Behaviour - Behaviorism, Cognitivism, Connectivism, Constructivism, and Humanism.
11. Learning and training – meaning, definition, Learning vs training. Learning feedback (Focus on learning, Be timely: Be constructive: Encourage action, Provide further help, Focus on learning goals, Provide prompt feedback)
12. Attitude and values - meaning, definition, importance – types of values - Attitude Vs Values
13. Intelligence- meaning, definition, types of Intelligence - Abstract, Concrete and Social Intelligence, theories of intelligence (Spearman's Two factor Theory of Intelligence, Thurstone's Theory of Intelligence and Gardner's Theory of Multiple Intelligences)
14. Measurement of intelligence - Binet Test, Wechsler Scales. Factors influencing intelligence.
15. Intelligence and Organizational behavior - Key aspects of intelligence in organization, emotional intelligence –Pillars of emotional intelligence (self-awareness, self-regulation, motivation, empathy and social skills)
16. Motivation theories - Maslow's needs hierarchy, Alderfer's ERG theory, McClelland's achievement motivation and Herzberg's two-factor theory and principles of motivation.
17. Teamwork and Group dynamics – Meaning, Definition, team building, and group dynamics – Meaning, Definition and key elements of group dynamics (roles, norms, relationships, and communication).

Practical

MBTI personality analysis, Learning Styles and Strategies, Motivational needs, Firo-B, Interpersonal Communication, Teamwork and team building, Group Dynamics, Win-win game, Conflict Management, Leadership styles, Case studies on Personality and Organizational Behavior.

Practical Schedule

1. Exercise on MBTI personality analysis
2. Assessing the Learning Styles through Barsch and Kolb Inventories
3. Exercise on applying Learning Strategies
4. Assessing the Motivational needs in an Organization
5. Exercise on assessing motivation using online tools
6. Assessing individual's interpersonal needs- Firo-B (Fundamental Interpersonal Relations Orientation-Behavior)

7. Exercise on Effective Interpersonal Communication in an organization
8. Exercise on Teamwork
9. Exercise on Team building
10. Exercise on Group Dynamics
11. Exercise on Win-win game
12. Exercise on Conflict Management
13. Assessing the Leadership styles and its significance in Organization
14. Assessing the Emotional Intelligence
15. Case studies on Personality and its influence in Organization
16. Case studies on Organizational Behavior
17. **Final Practical Examination**

Suggested Reading:

1. Andrews, Sudhir. 1988. How to Succeed at Interviews. 21st (rep.) New Delhi. Tata McGraw-Hill.
2. Heller, Robert. 2002. Effective Leadership. Essential Manager series. Dk Publishing.
3. Hindle, Tim. 2003. Reducing Stress. Essential Manager series. Dk Publishing.
4. Kumar, Pravesh. 2005. All about Self- Motivation. New Delhi. Goodwill Publishing House
- Lucas, Stephen. 2001. Art of Public Speaking. New Delhi. Tata - Mc-Graw Hill.
5. Mile, D.J. 2004. Power of Positive Thinking. Delhi. Rohan Book Company.
6. Smith, B. 2004. Body Language. Delhi: Rohan Book Company.
7. Shaffer, D. R. 2009. Social and Personality Development (6th Edition). Belmont, CA: Wadsworth

Course No.	:	VAC 101
Course Title	:	Environmental Studies and Disaster Management
Credit Hours	:	2+1
Course Category	:	Value Added Course

Course Learning Rationale / Course Objectives (CLR):

1. To expose and acquire knowledge on the environment
2. To study the environmental stress effects
3. To gain the state-of-the-art - skill and expertise on management of disasters

Course Learning Outcome (CLO):

1. To understand the environmental stress
2. To understand the disaster effects.
3. To know the effect of environmental stress on disaster management

THEORY

Unit 1: Introduction to Environment - Environmental studies

Definition, scope and importance – Multidisciplinary nature of environmental studies – Segments of Environment-Spheres of Earth - Lithosphere - Hydrosphere - Atmosphere - Different layers of atmosphere.

Unit 2: Natural Resources

Classification - Forest resources. Water resources. Mineral resources Food resources. Energy resources. Land resources. Soil resources. Ecosystems: Concept of an ecosystem - Structure and function of an ecosystem-Energy flowing the ecosystem. Bio diversity and its conservation: Introduction, definition, types. Bio geographical classification of India. Importance and Value of biodiversity. Biodiversity hotspots. Threats and Conservation of biodiversity.

Unit 3: Environmental Pollution

Definition, cause, effects and control measures of: a. Air pollution. b. Water pollution. c. Soil pollution. d. Marine pollution. e. Noise pollution. f. Thermal pollution. Light pollution. Solid Waste Management: Classification of solid wastes and management methods, Composting, Incineration, Pyrolysis, Biogas production, Causes, effects and control measures of urban and industrial wastes.

Unit 4: Social Issues and the Environment

Urban problems related to energy. Water conservation, rain water harvesting, watershed management. Environmental ethics: Issues and possible solutions, climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Environment Protection Act. Air (Prevention and Control of Pollution) Act. Water (Prevention and control of Pollution) Act. Wildlife Protection Act. Forest Conservation Act. Human Population and the Environment: Environment and human health: Human Rights, Value Education. Women and Child Welfare. Role of Information Technology in Environment and human health.

Unit 5: Disaster management

Disaster definition - Types - Natural Disasters - Floods, drought, cyclone, earthquakes, landslides, avalanches, volcanic eruptions, Heat and cold waves. Man Made Disasters: Nuclear disasters, chemical disasters, biological disasters, building fire, coalfire, forest fire, oil fire, road accidents, rail accidents, air accidents, sea accidents. International and National strategy for disaster reduction. Concept of disaster management, national disaster management framework; financial arrangements; role of NGOs, community-based organizations and media in disaster management. Central, state, district and local administration in disaster control; Armed forces in disaster response;

Police and other organizations in disaster management.

Theory - Lecture schedule

1. Introduction to Environment - Environmental studies: Definition, scope and importance – Multidisciplinary nature of environmental studies
2. Segments of Environment-Spheres of Earth - Lithosphere - Hydrosphere - Atmosphere - Different layers of atmosphere.
3. Natural Resources: Classification of Forest, water and mineral resources
4. Natural Resources: Classification of food, energy resources and soil and resources
5. Ecosystems: Concept of an ecosystem - Structure and function of an ecosystem-
6. Energy flow in the ecosystem.
7. Bio diversity and its conservation: Introduction, definition, types.
8. Biogeographical classification of India.
9. Importance and Value of biodiversity; Biodiversity hotspots.
10. Threats and Conservation of biodiversity.
11. Environmental Pollution: Definition, cause and effects
12. Control measures of Air pollution, water pollution, soil pollution.
13. Control measures of Marine pollution, noise pollution, thermal pollution and light pollution.
14. Solid Waste Management: Classification of solid wastes and management methods, Composting, Incineration, Pyrolysis, Biogas production, Causes, effects and control measures of urban and industrial wastes.
15. Social Issues and the Environment: Urban problems related to energy.
16. Water conservation, rain water harvesting, watershed management.

17. Mid Semester Examination

18. Environmental ethics: Issues and possible solutions, climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust.
19. Environment Protection Act. Air (Prevention and Control of Pollution) Act.
20. Water (Prevention and control of Pollution) Act.
21. Wildlife Protection Act. Forest Conservation Act.
22. Human Population and the Environment: Environment and human health: Human Rights, Value Education. Women and Child Welfare. Role of Information Technology in Environment and human health. Disaster management:
23. Disaster definition and Types
24. Natural Disasters - Floods, drought, cyclone,
25. Earthquakes, landslides, avalanches, volcanic eruptions,
26. Heat and cold waves.
27. Man Made Disasters: Nuclear disasters, chemical disasters, biological disasters,
28. Building fire, coalfire, forest fire, oil fire, road accidents, rail accidents, air accidents, sea accidents.

29. International and National strategy for disaster reduction.
30. Concept of disaster management, national disaster management framework; financial arrangements;
31. Role of NGOs, community-based organizations and media in disaster management. Central, state, district and local administration in disaster control;
32. Armed forces in disaster response; Police and other organizations in disaster management.

Practical

Visit to a local area to document environmental assets river/forest /grassland /hill / mountain. Energy: Biogas production from organic wastes. Visit to wind mill / hydro power / solar power generation units. Biodiversity assessment in farming system. Floral and faunal diversity assessment in polluted and unpolluted system. Visit to local polluted site- Urban/Rural/Industrial/Agricultural to study of common plants, insects and birds. Environmental sampling and preservation. Water quality analysis: pH, EC and TDS. Estimation of Acidity, Alkalinity. Estimation of water hardness. Estimation of DO and BOD in water samples. Estimation of COD in water samples. Enumeration of *E. coli* in water sample. Assessment of Suspended Particulate Matter (SPM). Study of simple ecosystem – Visit to pond/river/hills. Visit to areas affected by natural disaster.

Practical Schedule

1. Visit to a local area to document environmental assets river / forest / grassland / hill / mountain.
2. Study of Energy: Biogas production from organic wastes.
3. Visit to wind mill / hydro power / solar power units
4. Biodiversity assessment in farming system.
5. Floral and faunal diversity assessment in polluted and unpolluted system.
6. Visit to local polluted site-Urban/Rural/Industrial/Agricultural to study of common plants, insects and birds.
7. Environmental sampling and preservation.
8. Water quality analysis: pH, EC and TDS.
9. Estimation of Acidity, Alkalinity.
10. Estimation of water hardness.
11. Estimation of DO and BOD in water samples.
12. Estimation of COD in water samples.
13. Enumeration of *E. coli* in water sample.
14. Assessment of Suspended Particulate Matter (SPM).
15. Study of simple ecosystem – Visit to pond/river/hills.
16. Visit to areas affected by natural disaster.
17. **Final Practical Examination**

Suggested Readings:

1. De, A.K. 2010. Environmental chemistry. Published by New Age International Publishers, New Delhi. ISBN:13-9788122426175.384pp
2. Dhar Chakrabarti, P.G. 2011. Disaster management - India's risk management

policy frame work sand key challenges. Published by Centre for Social Markets (India), Bangalore.36 pp.

3. Erach Bharucha, Text book for Environmental studies. University Grants Commission, New Delhi
4. Parthiban, K.T. Vennila, Prasanthrajan, S., Umesh, M. and Kanna, S. 2023. Forest, Environment, Biodiversity and Sustainable development. Narendra Publishing House, New Delhi, India. (In Press).
5. Prasanthrajan M. and Mahendran, P.P. 2008. A text book on Ecology and Environmental Science. ISBN 81-8321-104-6. Agrotech Publishing Academy, Udaipur - 313 002. First Edition: 2008
6. Prasanthrajan M. 2018. Objective environmental studies and disaster management. ISBN 9789387893825. Scientific publishers, Jodhpur, India. Pp. 146.
7. Sharma, P.D. 2009. Ecology and Environment, Rastogi Publications, Meerut, India
8. Tyler Miller and Scot Spoolman. 2009. Living in the Environment (Concepts, Connections, and Solutions). Brooks/cole, Cengage learning publication, Belmont, USA.

Course No.	:	NCC 102
Course Title	:	National Cadet Corps II
Credit Hours	:	0+1
Course Category	:	Ability Enhancement Course

Course Learning Rationale / Course Objectives (CLR):

The purpose of learning this course is:

1. To develop qualities of character, courage, comradeship, discipline, leadership, secular outlook, spirit of adventure and sportsmanship and the ideals of selfless service among the youth to make them useful citizen.
2. To create a human resource of organized trained and motivated youth to provide leadership in all walks of life including the Armed Forces and be always available for the service of the nation.

Course Learning Outcome (CLO):

1. Creating a pool of selfless and responsible citizen.
2. Developing a human resource of organized trained and motivated youth.
3. Motivating youth for making career in Armed Forces.

Practical/Awareness activities:

- Arms Drill-Attention, stand at ease, stand easy. Getting on parade. Dismissing and falling out. Ground/take up arms, examine arms. Shoulder from the order and vice-versa, present from the order and vice-versa. Saluting at the shoulder

at the halt and on the march. Short/ long trail from the order and vice- versa. Guard mounting, guard of honor, Platoon/Coy Drill.

- Characteristics of rifle (.22/.303/SLR), ammunition, fire power, stripping, assembling, care, cleaning, and sight setting. Loading, cocking, and unloading. The lying position and holding.
- Trigger control and firing a shot. Range Procedure and safety precautions. Aiming and alteration of sight. Theory of groups and snap shooting. Firing at moving targets. Miniature range firing. Characteristics of Carbine and LMG.
- Introduction to map, scales, and conventional signs. Topographical forms and technical terms.
- The grid system. Relief, contours, and gradients. Cardinal points and finding north. Types of bearings and use of service protractor. Prismatic compass and its use. Setting a map, finding north and own position. Map to ground and ground to map. Knots and lashings, Camouflage and concealment, Explosives and IEDs.
- Field defenses obstacles, mines and mine lying. Bridging, waterman ship. Field water supplies, tracks and their construction. Judging distance. Description of ground and indication of landmarks. Recognition and description of target. Observation and concealment. Field signals. Section formations. Fire control orders. Fire and movement. Movement with/without arms. Section battle drill. Types of communication, media, latest trends and developments.

Practical Schedule:

1. Arms Drill-Attention, stand at ease, stand easy. Getting on parade. Dismissing and falling out. Ground/take up arms, examine arms.
2. Shoulder from the order and vice-versa, present from the order and vice-versa. Saluting at the shoulder at the halt and on the march. Short/ long trail from the order and vice- versa.
3. Guard mounting, guard of honor, Platoon/Coy Drill.
4. Characteristics of rifle (.22/.303/SLR), ammunition, fire power, stripping, assembling, care, cleaning, and sight setting. Loading, cocking, and unloading. The lying position and holding.
5. Trigger control and firing a shot. Range Procedure and safety precautions. Aiming and alteration of sight. Theory of groups and snap shooting. Firing at moving targets. Miniature range firing.
6. Characteristics of Carbine and LMG.
7. Introduction to map, scales, and conventional signs. Topographical forms and technical terms.
8. The grid system. Relief, contours, and gradients. Cardinal points and finding north. Types of bearings and use of service protractor.
9. Prismatic compass and its use. Setting a map, finding north and own position. Map to ground and ground to map.
10. Knots and lashings, Camouflage and concealment, Explosives and IEDs.
11. Field defenses obstacles, mines and mine lying.
12. Bridging, waterman ship. Field water supplies, tracks and their construction.

13. Judging distance.
14. Description of ground and indication of landmarks. Recognition and description of target. Observation and concealment. Field signals. Section formations.
15. Fire control orders. Fire and movement. Movement with/without arms. Section battle drill.
16. Types of communication, media, latest trends and developments.

17. Final Practical Examination

Apart from the above-mentioned activities the cadets will take part Republic Day Parade, Independence Day Parade, Puducherry Liberation Day Parade, various camps, Social Services and Community Development activities etc.

Note: As per government guidelines, for getting B and C certificate in NCC, minimum years of requirement is 2 and 3 years along with 1-2 annual camps. The enrolled NCC Cadets are required to participate in NCC activities during their 2nd and 3rd years, as assigned by the ANO/1(P) Naval Unit NCC.

Course No.	:	NSS 102
Course Title	:	National Service Scheme II
Credit Hours	:	0+1
Course Category	:	Ability Enhancement Course

Syllabus practical

1. Introduction and Basic Components of NSS
2. Orientation: History, Objectives, Principles, Symbol, Badge; Regular Programs under NSS.
3. Organizational structure of NSS, Code of conduct for NSS volunteers, Points to be considered by NSS Volunteers' awareness about Health.
4. NSS program activities. Concept of regular activities, Special camping, Day camps, Basis of adoption of village/slums, conducting survey, Analysing Guiding financial patterns of scheme, Youth program/schemes of GOI, Coordination with different agencies and maintenance of diary. Understanding youth. Definition, Profile, Categories, Issues and Challenges of youth; and Opportunities for youth who is agent of the social change.
5. Community mobilization. Mapping of community stakeholders, Designing the message as per problems and their culture; Identifying methods of mobilization involving youth-adult partnership. Social harmony and National integration.
6. Indian history and culture, role of youth in nation building, Conflict resolution and peace building. Volunteerism and Shramdaan. Indian tradition of volunteerism, its need, importance, motivation and constraints; Shaman as part of volunteerism.
7. Citizenship, Constitution, and Human rights. Basic features of constitution of India, Fundamental rights and duties, Human rights, Consumer awareness and

rights and Right to information. Family and Society. Concept of family, Community (PRIs and other community-based organizations) and Society.

Practical Schedule

1. Understanding Youth – Profiles, roles, categories, and current challenges faced by youth.
2. Youth as Change Agents – Involving youth in community development and transformation.
3. Community Stakeholder Analysis – Mapping local influencers and institutions for collaborative projects.
4. Cultural Context in Communication – Designing awareness content that aligns with local traditions and practices.
5. Building Youth-Adult Partnerships – Co-working methods for sustainable change.
6. Social Harmony Initiatives – Campaigns to promote equality, inclusiveness, and peace.
7. Fostering National Integration – Activities that cultivate patriotism and communal unity.
8. India's Cultural and Traditional Heritage – Understanding and respecting India's historical richness.
9. Youth and Nation Building – Encouraging active citizenship and civic responsibility.
10. Conflict Resolution and Peacebuilding – Training in communication, empathy, and negotiation.
11. Volunteerism and Shramdaan – Origin, relevance, and application in the Indian context.
12. Boosting Volunteer Motivation – Understanding and addressing barriers to volunteerism.
13. Indian Constitution and Civic Duties – Fundamental rights, duties, and democratic values.
14. Role of Family, PRIs, and Society – Contributions of family structures, local governance, and community-based organizations.
15. Consumer and Human Rights Education – Awareness on rights, responsibilities, and legal remedies.
16. Final Evaluation and Review – Assessment based on participation, record-keeping, and understanding.
17. **Final Practical Examination**

Besides the above, NSS volunteers will attend work during important occasions like Convocation, Farmers Day, Sports meet and other University / School functions. NSS Volunteers will attend one special camp in the selected village for a duration of 7 days and undertake various activities based on the need of that village. For all out door regular activities villages / slums nearby the campus may be selected to avoid transport cost (cycle able distance) Special camp activity will be conducted in a village situated within a radius of 15 – 20 KM.

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SKILL ENHANCEMENT COURSES (SEC)

Sl.No.	Course No.	Course Title	Discipline	Cr.Hr.	Semester
1	SEC 001	Agricultural Waste Management	AGM & SAC	0+2	I/II
2	SEC 002	Biofertilizer and Biopesticide Production	AGM & PAT	0+2	I/II
3	SEC 003	Beneficial Insect Farming	AEN	0+2	I/II
4	SEC 004	Drone Technology	AGR	0+2	I/II
5	SEC 005	Nursery Management	HOR	0+2	I/II
6	SEC 006	Mushroom Production Technology	PAT	0+2	I/II
7	SEC 007	Post Harvest Processing Technology	PHT	0+2	I/II
8	SEC 008	Poultry Production Technology	AH	0+2	I/II
9	SEC 009	Seed Production Technology	SST	0+2	I/II
10	SEC 010	Soil, Plant and Water Testing	SAC	0+2	I/II
11	SEC 011	Surveying and Leveling	AEG	0+2	I/II
12	SEC 012	Vermicompost Production Technology	SAC & AGM	0+2	I/II
13	SEC 013	Video Production	AEX	0+2	I/II
14	SEC 101	Apiculture	AEN	0+2	I/II
15	SEC 102	Computer Programming and Data Structures	COM	0+2	I/II
16	SEC 103	Farm Machinery	AEG	0+2	I/II
17	SEC 104	Installation, Operation and Maintenance of Micro-irrigation System	AEG	0+2	I/II
18	SEC 105	Introduction to Forestry	HOR	0+2	I/II
19	SEC 106	Landscape Gardening	HOR	0+2	I/II
20	SEC 107	Nursery Production in Crops	HOR	0+2	I/II
21	SEC 108	Orchard Floor Management	HOR	0+2	I/II
22	SEC 109	Packing and Packaging of Horticultural Crops	HOR	0+2	I/II
23	SEC 110	Post-Harvest Management of Horticultural Produce	PHT	0+2	I/II
24	SEC 111	Seed Production Techniques in Vegetable Crops	SST	0+2	I/II
25	SEC 112	Sericulture	AEN	0+2	I/II
26	SEC 113	Turf and Turf Management	HOR	0+2	I/II

Course No.	:	SEC 001
Course Title	:	Agricultural Waste Management
Credit Hours	:	0+2
Course Category	:	Skill Enhancement Course

Course Learning Rationale / Course Objective (CLR):

1. The courses may be offered as module of complementing courses to help the student to achieve skill in a specific area of his interest.
2. For the prospect of local employment and entrepreneurship development.

Course Learning Outcomes (CLO):

1. To impart knowledge on various aspects of biowastes and agricultural wastes for managing as organic amendments in agricultural production system.
2. To develop skills on various methods of conversion of decomposable wastes into organic manures.

Practical

Organic waste and its use: Introduction to agricultural waste management, type of wastes, and sources of agriculture waste. Visit of different agriculture waste management units, Collection, transport, sorting, treatment, storage and utilization of Agriculture Wastes, Preparation of Organic Manures from agriculture Wastes, Production of compost by aerobic and anaerobic methods from agriculture waste, Enriched compost production from agriculture waste, Production of Vermicompost from agriculture wastes, Production of enrich vermicompost from agriculture waste. Biogas Production Technology: Biogas Production from Agriculture waste and utilization of slurry, Production of enriched biogas slurry, Collection and preparation agricultural waste sample for analysis, Quality analysis (N, P and K) of manure, compost, vermicompost and biogas slurry. Collection and preparation agricultural waste sample for analysis. Quality analysis (N, P and K) of manure, compost, vermicompost and biogas slurry. Recommended doses and application of manure, compost, vermicompost and biogas slurry for major crops and others.

Practical Schedule

- 1,2. Introduction – agricultural wastes – source segregation methods -methods of collection and storage of agricultural wastes
- 3,4. Different agricultural production systems – types of wastes generated – quantification and classification of wastes – methods of waste processing -reporting
- 5,6. Visit to a Landfill site – Study about volume, size and Chemical reduction techniques -leachate treatment facilities

- 7,8. Visit to a Landfill site – assessment of pollution problems - Garbage to Green – Converting landfills to parks
- 9,10. Composting –principles - factors affecting composting- different methods of composting-aerobic - windrow compost preparation - aerated static pile composting
- 11,12. Other methods of composting – preparation of different types of compost – Sheet composting –In vessel composting – biodynamic composting - pipe composting
- 13,14. Preparation of compost by trench method- NADEP compost - anaerobic composting –merits- demerits. Use of microorganisms in composting - Microbial composts –EM compost - Preparation of Coir pith compost - production technologies.
- 15,16. Preparation of Vermi compost - mass multiplication of earthworms- indoor vermicomposting (small scale). Outdoor vermicomposting (commercial scale) - insitu vermicomposting.

17. Mid Semester Examination

- 18,19. Rapid thermo chemical processing of agricultural wastes- Pyrolysis -Biochar production by the process of pyrolysis from organic waste.
- 20,21. Biogas plants – different types – designs – visit to nearby biogas production unit and study the operation and production of biogas –advantages – disadvantages - prepare lay out plan
- 22,23. Use of agricultural wastes in preparation of bio fertilizers. Value addition of products - enriched manures - production with biotic and abiotic components
- 24,25. Quality parameters of organic manures and specifications - procedure for collection of manure samples- solid and liquid manures.
- 26,27. Liquid organic manures- vermiwash, compost tea, biogas slurry- preparation – enrichment and uses – Other uses of agricultural wastes
- 28,29. Evaluation of compost maturity - maturity indices of compost
Determinations - C:N ratio, temperature, colour, odour moisture content, pH, EC and nutrient contents (N, P, K, Ca, Mg, Fe, Mn, Zn, Cu),
- 30,31. Rapid test for assessing microbial load, detection of pathogens and hazardous heavy metals (Ni, Pb, Cd, As, Hg)
Compost stability test-microbial respiration of CO₂ – (germination test)
- 32,33. Preparation of project proposal and work plan for establishing commercial organic manures, production unit- report preparation.

34. Final Practical Examination

Suggested Readings:

1. Ashworth, G.S. and Azevedo, P. 2009. Agricultural Wastes. Nova Science Publishers.
2. Cheng, H. H (ed.). 1990. Pesticides in the Soil Environment: Processes, Impacts, and Modeling. SSSA-ASA, Inc., Madison, WI.

3. Das, P.C. 1993. Manures and Fertilizers. Kalyani Publishers, New Delhi.
4. Gupta P.K. 2006. Vermi composting for Sustainable Agriculture. Published by AGROBIOS (India) Jodhpur
5. Powers, J. F. and Dick, W.P. 2000. Land Application of Agricultural, Industrial, and Municipal By-products. SSSA-ASA, Inc., Madison, WI
6. Ramachandra T.V. 2006. Soil and Groundwater Pollution from Agricultural Activities. Commonwealth of Learning, Canada and Indian Institute of Science, Bangalore
7. Rattan Lal (ed).2001. Soil carbon sequestration and the greenhouse effect. SSSA Special publication number 57, SSSA Inc. Madison, WI
8. Sharma, A.K. 2005. Biofertilizers for Sustainable Agriculture. Published by AGROBIOS(India) Jodhpur
9. Stoffella, P. J. and Khan, B.A (ed.). 2001. Compost Utilization in Horticultural Cropping Systems. Lewis Publishers, Boca Raton, FL
10. Tandon, H.L.S. 1992. Fertilizers, Organic Manures, Recyclable Wastes and Biofertilizers. Fertilizer Development and Consultation Organization.
11. Tandon, H.L.S. 1993. Methods of Analysis of Soils, Plants, Waters and Fertilizers. Fertilizer Development and Consultation Organization.143p.
12. Yawalkar, K.S., Agrawal, J.P. and Bokde,S. 1981. Manures and Fertilizers.
13. Bhatnagar, R.K. and Palta, R.K. (2002). Vermiculture and vermicomposting. Kalyani Publishers, Ludhiana.
14. Publishers, Ludhiana.
15. Clive A. Edwards, Norman Q. Arancon, and Rhonda L. Sherman (2011). Vermiculture Technology: Earthworms, Organic Wastes, and Environmental Management". CRC Press.
16. M. Devender Reddy, Mandapati Roja, Ch. Deepthi (2019). Agricultural Waste Management. Kalyani Publishers, Delhi.
17. Thelma Bosso (2016). Agricultural Waste Management. Callisto Publishers, U.K.
18. Vir Singh, Poonam Gusain, Meenakshi Arya (2018). Agro Waste Management, SSDN Publishers.

Web -References:

1. <http://www.eartheasy.com>
2. <http://www.composting council.org>
3. <http://www.Epa.gov/compost>

Course No.	:	SEC 002
Course Title	:	Biofertilizer and Biopesticide production
Credit Hours	:	0+2
Course Category	:	Skill Enhancement Course

Course Learning Rationale / Course Objective (CLR):

To enable students to gain knowledge and hands-on-experience in bioinoculant and biopesticide production technology and establish a commercial unit.

Course Learning Outcomes (CLO):

Knowledge and hands-on-experience in use bioinoculants and biopesticide production techniques and establish a commercial unit.

Practical Schedule

1. Biofertilizers - types, production and demand in India; Importance and contribution of biofertilizers in Agriculture and allied sectors. Facilities and equipments required for laboratory scale, pilot scale and large scale biofertilizer production (liquid and carrier) –principles and specifications.
2. Isolation, purification and characterization of nitrogenous biofertilizers – Rhizobium, Azospirillum, Azotobacter and Gluconoacetobacter.
3. Isolation, purification and characterization of nitrogenous biofertilizers – Azotobacter and Gluconoacetobacter.
4. Isolation, purification and characterization of phosphate solubilizing bacteria.
5. Isolation, purification and characterization of zinc solubilizing and potassium releasing bacteria.
6. Isolation, purification and characterization of plant growth promoting bacteria - Pink Pigmented Facultative Methylophiles (PPFM) and screening of PPFM.
7. Preparation of medium and carrier material for large scale production.
8. Mass production of nitrogenous based bio-fertilizers (Rhizobium and Azospirillum).
9. Mass production of nitrogenous based bio-fertilizers (Azotobacter and Gluconoacetobacter).
10. Mass production of phosphate solubilizing bacteria.
11. Mass production of zinc solubilizer and potassium releasing bacteria.
12. Mass production of PPFM
13. Isolation of AM spores from soil and morphological characterization of AM spores. Selection of efficient AM fungi by plant infection tests.
14. Mass Production of Arbuscular Mycorrhizal (AM) Fungal Biofertilizer
15. Mass production of Azolla and BGA.

16. BIS standards / Fertilizer Control Order – Specifications and quality control measures for various biofertilizers.

17. Mid Semester Examination

18. Storage and preservation of various microbial cultures. Shelf life and storage of biofertilizers.
19. Constraints in mass production of various biofertilizers. Study of plant response to biofertilizers- visit to biofertilizer inoculated fields
20. Formulation development for production of fixed quantity of various biofertilizers.
21. Biofertilizers - Organic certification – processes to be followed – Agencies for Certification.
22. Exposure to advanced techniques in biofertilizer production - Tangential Flow Filtration, lyophilized cells production and automatic packing unit.
23. Economics of biofertilizer production.
24. Calculation of commercial production cost – fixed cost- cost of building, equipments and glasswares and variable cost - raw materials, maintenance, labour cost etc.,
25. Preparation of culture Media for the isolation of biocontrol agents.
26. Isolation of biocontrol agents - *Trichoderma asperellum*, *Metarhizium*, *Pseudomonas fluorescens* and *Bacillus subtilis*.
27. Assessing the in vitro antagonistic activity of biocontrol agents.
28. Mass multiplication of fungal biocontrol agents - *Trichoderma asperellum* and *Metarhizium*.
29. Mass multiplication of bacterial biocontrol agents - *Pseudomonas fluorescens* and *Bacillus subtilis*.
30. Quality control standards and shelf-life evaluation of biocontrol Agents.
31. Visit to commercial biofertilizer and biocontrol production unit.
32. Identification of botanicals for pest management.
33. Identification of entomopathogenic microorganisms infected cadavers in field condition. Mass production of entomopathogens

34. Final Practical Examination

Suggested Readings:

1. Motsara, M.R., Bhattacharyya, P., and Beena Srivastava. 2004. Biofertilizer Technology, Marketing and Usage – A source book- Cum -Glossary
2. Somani L.L., 2011. Biofertilizers: Commercial Production Technology and Quality Control Publishers:
3. NIIR 2012. The Complete Technology Book on Biofertilizer and Organic Farming NIIR Project Consultancy Services, New Delhi. P. 608. (ISBN: 9789381039076)
4. Reeta Khosla 2017. Biofertilizers and Biocontrol Agents for Organic Farming, Publishers: Kojo press. (ISBN-10: 8192756793, ISBN-13: 978-8192756790)
5. Agrawal, R.L. 1996. Seed Technology, Oxford & IBH Publishing Co., New Delhi.

6. Bhaskaran, M. A. Bharathi, K. Vanangamudi, N. Natarajan, P. Natesan, R. Jerlin and K. Prabakar. 2003. Principles of seed production. Kaisher Graphics, Coimbatore.
7. Copeland LO & McDonald MB. 2001. Principles of Seed Science and Technology. 4th Ed. Chapman & Hall.
8. Singhal NC. 2003. Hybrid Seed Production in Field Crops. Kalyani Publishers, New Delhi.
9. Vanangamudi, K. 2014. Seed Science and Technology. An Illustrated Text Book. New India Publishing Agency, New Delhi.
10. Kennedy, J.S and Zadda Kavitha. 2006. Manual on commercial Production of biocontrol agents. Department of Agricultural Entomology, TNAU, Coimbatore. 156p.
11. Gautam, R.D. 1994. Biological Pest Suppression. Westville Publishing House, New Delhi. 221 p

Course No.	:	SEC 003
Course Title	:	Beneficial Insect Farming
Credit Hours	:	0+2
Course Category	:	Skill Enhancement Course

Course Learning Rationale / Course Objective (CLR):

1. To enhance the skill in the apiculture, sericulture and lac culture
2. To study the mass production techniques of predators and parasitoids

Course Learning Outcomes (CLO):

1. Develop practical skills in the rearing of beneficial insects
2. Demonstrate knowledge and ability in mass production of biological control agents such as predators and parasitoids

Practical

Honey bee species, castes of bees. Beekeeping appliances and seasonal management, bee enemies and disease. Bee pasturage, bee foraging and communication. Insect pests and diseases of honey bee. Practicing and handling of honey bee colonies. Capturing techniques of wild bee colonies Beekeeping products. Mulberry cultivation, mulberry varieties and methods of harvesting and preservation of leaves. Types of silkworm, voltinism and biology of silkworm. Rearing appliances of mulberry silkworm and methods of disinfection. Rearing, mounting and harvesting of cocoons. Pest and diseases of silkworm, management. Species of lac insect, morphology, biology, host plant, lac production – seed lac, button lac, shellac, lac- products. Identification of major parasitoids and predators commonly being used in biological control. Insect orders bearing predators and parasitoids used in pest control and their mass multiplication

techniques. Important species of pollinator, weed killers and scavengers with their importance. Visit to research and training institutions devoted to beekeeping, sericulture, lac culture and natural enemies.

Practical Schedule

1. Identification, morphology and structural adaptations in honey bees
2. Different species of honey bees
3. Types of bee hive, bee keeping appliances and seasonal management
4. Rearing of queen, worker and drone cell and colony organization
5. Bee enemies and diseases
6. Apiary management tactics, bee pasturage, bee foraging and communication
7. Practicing and handling of honey bee colonies
8. Capturing techniques of wild bee colonies
9. Beekeeping products – extraction of honey bee products
10. Morphology and botanical aspects of mulberry plants
11. Mulberry cultivation - mulberry nursery bed preparation – methods of planting
- pruning methods – leaf / shoot harvest– preservation of leaves
12. Pests and diseases of mulberry
13. Morphology and biology of different species of silkworm
14. Voltinism and silkworm breeds
15. Silkworm rearing requirements - rearing house and appliances
16. Disinfectants- Practicing the disinfection methods in rearing house, larval rearing and grainage

17. Mid Semester Examination

18. Grainage technology
19. Methods of rearing – chawki and late age silkworm rearing
20. Mounting, harvesting and marketing of cocoon
21. Post cocoon technology and rearing techniques of non mulberry silkworm
22. Pests and diseases of mulberry silkworm
23. Lac insects, biology, host plant, strains, cultivation and their management
24. Pests of lac, extraction of lac and their products
25. Identification of different types of parasitoids
26. Identification of different types of predators
27. Mass production techniques of parasitoids
28. Mass production techniques of predators
29. Identification of weed killers, pollinators, scavengers and soil builders
30. Visit to apiculture unit
31. Visit to sericulture unit and mulberry field
32. Visit to grainage centre and silk reeling/weaving centre
33. Visit to bio control laboratory

34. Final Practical Examination

Suggested Readings:

1. Dandin, S. B., J. Jayaswal and K. Giridhar. 2003. Hand book of Sericulture Technologies. Central Silk Board, Bangalore.
2. David, B. V. and V. V. Ramamurthy. 2016. Elements of Economic Entomology, Namrutha Publications, Chennai.
3. Ganga, G. and J. Sulochana Chetty. 2022. An Introduction to Sericulture. Oxford and IBH publication, New Delhi.
4. Mishra, R. C. 1995. Honeybees and their management in India. ICAR, Everest Press, New Delhi.
5. Sailesh chattopadhyay. 2011. Introduction to lac and lac culture. Birsa Agricultural University, Ranchi.
6. Singh, T. and B. Saratchandra. 2004. Principles and techniques of silkworm seed production. Discovery publishing house, New Delhi.

Course No.	:	SEC 004
Course Title	:	Drone Technology
Credit Hours	:	0+2
Course Category	:	Skill Enhancement Course

Course Learning Rationale / Course Objective (CLR):

1. To provide basic knowledge on drone components, regulations, and safe operation in agriculture.
2. To develop practical skills in flying, spraying, monitoring, maintenance, and data handling of agricultural drones.

Course Learning Outcome (CLO):

1. Students will be able to operate agricultural drones safely and effectively for spraying and monitoring.
2. Students will acquire skills in drone maintenance, minor repair, and data usage in farm applications.

Practical

Agricultural drones - Types, structure and components; DGCA regulations and safety protocols; drone parts and their functions; Standard Operating Procedures (SOP), Battery charging, Simulator, Manual flight training, Emergency handling, Mapping agricultural fields using GPS and software, Mission planning; crop monitoring - RGB, NDVI, thermal imaging; Camera calibration for crop imaging; image processing; NDVI, biotic and abiotic stress monitoring; drone spraying, Cost benefit analysis and case studies.

Practical Schedule

1. Introduction to agricultural drones: Types, structure, and components
2. DGCA regulations and safety protocols for drone operation
3. Identification of drone parts and their functions
4. Standard Operating Procedures (SOP) for safe drone handling
5. Battery care, handling, charging, and safety
6. Simulator training for basic flight skills
7. Pre-flight checklist and operational SOPs
8. Manual flight training: take-off, landing, hovering
9. Emergency handling: return-to-home, signal loss, low battery situations
10. Mapping agricultural fields using GPS and software
11. Mission planning for field spraying and data capture
12. Basics of aerial crop monitoring: RGB, NDVI, thermal imaging
13. Camera calibration and drone setup for crop imaging
14. Capturing crop images for health monitoring using drones
15. Image downloading and data transfer SOP
16. Introduction to NDVI and plant health indices
17. **Mid Semester Examination**
18. Image processing and interpretation for crop vigour and stress
19. Use of drone imagery to detect pest/disease hotspots
20. Weed and crop health mapping using RGB cameras
21. Planning site-specific spraying missions using imagery
22. Loading pesticide/fertilizer in spraying drone & calibration
23. Aerial spraying operation: demonstration
24. SOPs for drone cleaning, safety, and chemical tank maintenance
25. Troubleshooting common drone issues: software & hardware; Minor repairs: propeller, ESC, wiring, GPS, arm replacement
26. Crop stress monitoring using multispectral/thermal sensors
27. Monitoring irrigation status using aerial imagery
28. Recording and interpreting field variability using drone data
29. Cost-benefit analysis of drone operations vs conventional methods
30. Case studies: Real-world use of drones in agriculture
31. Preparation of financial project proposal
32. Visit to drone research lab or institute
33. Visit to nearby drone based company / entrepreneur / agri-tech startup
34. **Final Practical Examination**

Suggested Readings:

1. Singh, R.K. *et al.*, 2021. *Drones in Agriculture: Emerging Applications and Issues*. CRC Press.
2. Zhang and Qin, 2015. *Precision Agriculture Technology for Crop Farming*. CRC Press.
3. Fahlstrom, Paul G., Gleason and Thomas J., 2012. *Introduction to UAV Systems*. Wiley.

4. Lillesand, Thomas, Kiefer, Ralph W., and Chipman, Jonathan, 2014. *Remote Sensing and Image Interpretation*. Wiley.
5. Pix4D Tutorials: <https://support.pix4d.com>
6. DGCA India Drone Rules Portal: <https://dgca.gov.in>

Course No.	:	SEC 005
Course Title	:	Nursery Management
Credit Hours	:	0+2
Course Category	:	Skill Enhancement Course

Course learning Rationale / Course Objective (CLR):

The purpose of learning this course is to:

- To impart hands-on skills and competencies for the scientific establishment, operation and management of horticultural nurseries with a focus on plant propagation, nursery practices, infrastructure, record keeping and entrepreneurship development.

Course Learning Outcomes (CLO):

1. Demonstrate technical knowledge of plant propagation methods used in nursery production.
2. Operate nursery tools, manage growing media and maintain propagation structures.
3. Monitor and manage irrigation, nutrition, pests and diseases in nursery plants.
4. Maintain nursery records and comply with plant certification standards.
5. Plan, budget and propose viable nursery business models and entrepreneurship projects.

Practical

Horticultural nursery management, starting with familiarization of nursery tools, layout design, and soil sterilization. It progresses to seed extraction, treatment, and sowing, as well as raising seedlings in pro-trays and polybags. Nursery raising under protected structures, identification and maintenance of mother plants, and various propagation techniques such as vegetative propagation, budding, and grafting. Nursery irrigation, fertilization, and pest management, along with record-keeping, nursery calendar preparation, and entrepreneurship planning. Visits to commercial and institutional nurseries, training in advanced techniques, and understanding quality standards and certification protocols. Market surveys, cost analysis and preparation of a nursery business model.

Practical Schedule

1. Familiarization with nursery tools, implements and containers.
2. Layout design and planning of a horticultural nursery unit.

3. Soil sterilization techniques and preparation of nursery beds.
4. Preparation and mixing of potting media using various components.
5. Seed extraction, treatment and sowing in nursery beds. Raising seedlings in pro-trays and polybags.
6. Nursery raising under protected structures (polyhouse, net house, shade net).
7. Identification and maintenance of mother plants for propagation.
8. Vegetative propagation using softwood, hardwood and semi-hardwood cuttings.
9. Practice of mound, serpentine and air layering techniques.
10. Budding techniques: T-budding, patch budding and ring budding.
11. Grafting techniques: wedge, softwood, approach and epicotyl grafting.
12. Use of plant growth regulators in propagation techniques.
13. Nursery irrigation techniques: manual, drip and sprinkler methods.
14. Fertilizer and nutrient application through fertigation in nursery conditions.
15. Identification and correction of nutrient deficiency symptoms in nursery plants.
16. Weed management techniques in containerized and bed nurseries.

17. Mid Semester Examination

18. Identification and management of common pests in nursery plants.
19. Identification and management of common diseases in nursery plants.
20. Preparation and application of biofertilizers and biopesticides.
21. Packing, labelling and transportation techniques of nursery plants.
22. Maintenance of nursery records, registers and inventory management.
23. Preparation of nursery calendar and routine work schedule.
24. Construction and maintenance of mist chambers and shade structures.
25. Media recycling and hygienic disposal of diseased materials.
26. Visit to a commercial nursery unit to study operational practices.
27. Visit to a government or institutional nursery and interaction with nursery managers.
28. Indexing and maintenance of virus-free nursery stock.
29. Training in mini-cutting techniques and care of graft union healing.
30. Identification of physiological disorders in nursery plants.
31. Management of physiological disorders in nursery plants
32. Understanding quality standards and plant certification protocols.
33. Cost analysis and budgeting of nursery establishment and operations.

34. Final Practical Examination.

Course No.	:	SEC 006
Course Title	:	Mushroom Production Technology
Credit Hours	:	0+2
Course Category	:	Skill Enhancement Course

Course Learning Rationale / Course Objective (CLR):

1. To understand different types of mushrooms (edible and poisonous)
2. To acquaint with spawn production and cultivation techniques of Oyster, milky, paddy straw and button mushrooms
3. To comprehend the processing, value addition and cost of mushroom cultivation and value addition

Course Learning Outcomes (CLO):

1. Acquaint the morphology of mushroom and identification of edible and poisonous mushrooms
2. Understand oyster, milky, paddy straw and button mushrooms cropping and biotic and abiotic problems in mushroom cultivation
3. Expertise in biodegradation of agrowastes, processing, project preparation and cost analysis

Practical

Different types of mushrooms, Morphology - Edible and poisonous type - edible mushrooms-*Pleurotus*, *Agaricus*, *Volvariella* and *Calocybe* – nutritional values - and pharmacological values-preparation of culture media- pure culture techniques- sterilizing techniques-media - glassware - maintenance of culture. Mother spawn production-type of spawn - Multiplication of bed spawn – Substrates for mushroom cultivation and their preparation -mushroom cultivation techniques for *Pleurotus* and *Calocybe*- maintenance of spawn running and cropping room-harvest-packing and storage- pests, diseases and weed mould, abiotic disorders – management strategies. Substrates for mushroom cultivation and their preparation - cultivation techniques for *Agaricus* and *Volvariella*-maintenance of spawn running and cropping room-harvest-packing and storage- pests, diseases and weed mould, abiotic disorders – management strategies. Post harvest technology of *Agaricus*, *Pleurotus*, *Calocybe* and *Volvariella* – methods of preservation – Drying: solar, cabinet, fluidized bed and freeze drying – Packing methods - Controlled atmospheric storage- modified atmospheric storage and canning – Cost analysis. Biodegradation of coir pith - cost estimation- Mushroom recipes of *Agaricus*, *Pleurotus*, *Calocybe* and *Volvariella* - Cooking methods- value added products – instant food mixes –Cost analysis. Project preparation- principles of mushroom farm enterprise management – cost estimation.

Practical Schedule

1. General characters of mushrooms, edible and poisonous mushrooms and morphological characters of *Agaricus*, *Calocybe*, *Pleurotus*, *Volvariella* and

2. Equipment's, instruments and essentials for mushroom cultivation and Sterilization Techniques
3. Preparation of culture media
4. Pure culture techniques in mushroom
5. Mother spawn production techniques of oyster, milky and button mushroom: Quality of spawn, spawn contaminants and their management
6. Bed spawn production techniques of oyster, milky and button mushroom: Quality of spawn, spawn contaminants and their management
7. Visit to commercial mushroom spawn production lab
8. Oyster mushroom cultivation: Spawn running room, cropping room requirement and Substrate preparation
9. Oyster mushroom cultivation: Bed preparation, cropping, harvesting and storing
10. Oyster mushroom cultivation: Pest, disease, competitor and abiotic disorders and their management
11. Visit to commercial oyster mushroom farm
12. Milky mushroom cultivation: Spawn running room, cropping room requirement and Substrate preparation
13. Milky mushroom cultivation: Bed preparation, casing cropping, harvesting and storing
14. Milky mushroom cultivation: Pest, disease, competitor and abiotic disorders and their management
15. Visit to commercial milky mushroom farm
16. Paddy straw mushroom: Preparation of mother spawn and bed spawn
17. **Mid Semester Examination**
18. Paddy straw mushroom: Bed preparation and cropping
19. Paddy straw mushroom cultivation: Pest, disease, competitor and abiotic disorders and their management
20. Button Mushroom cultivation: Compost Preparation
21. Button Mushroom cultivation: Spawning, Casing and Cropping
22. Button mushroom cultivation: Pest, disease, competitor and abiotic disorders and their management
23. Button mushroom cultivation: Pest, disease, competitor and abiotic disorders and their management
24. Visit to commercial button mushroom farm
25. Post Harvest Processing of mushrooms
26. Mushroom value-added products and recipes
27. Biodegradation of agrowastes using mushroom spawn: Spent mushroom – composting and their use
28. Mushroom as a component in Integrated Farming System (IFS)
29. Visit to Uzhavar sandai, markets and observing the marketing pattern of mushroom
30. Project preparation on mushroom spawn production and cost estimation
31. Project preparation on oyster mushroom production and cost estimation

32. Project preparation on milky mushroom production and cost estimation
33. Project preparation on button mushroom production and cost estimation
34. Final Practical Examination

Suggested Readings:

1. Agarwal, R.K. and C.L.Jandaik.1986. Mushroom cultivation in India. Indian Mushroom Growers Association, Solan, Himachal Pradesh.p-83.
2. Bahl, N.1988. Hand book of Mushroom II Edn. Oxford & IBM Publishing Co. New Delhi.
3. Marimuthu, T., A.S Krishnamoorthy, K.Sivaprakasam and R.Jeyarajan, 1989. Oyster Mushroom Production. The Vijay Books. Sivakasi, India.P.57.
4. Krishnamoorthy A.S, Marimuthu, T., and S. Nakkeran . 2005. Mushroom Biotechnology, The Vijay Books. Sivakasi, India., Pub.ODL, TNAU, Cbe-3
5. Pathak,V.N. Nagendra Yadav and Maneekas Gaur.2000.Mushroom production and processing Technology. Agribios (India) Ltd., New Delhi

Web-References:

1. www.mushroomcouncil.com/grow/grow.html
2. www.krishniworld.com/html/mushroom.html
3. www.gmushrooms.com/pots.html
4. www.mushworld.com/home/
5. www.mushroomcouncil.org

Course No.	:	SEC 007
Course Title	:	Post Harvest Processing Technology
Credit Hours	:	0+2
Course Category	:	Skill Enhancement Course

Course Learning Rationale / Course Objective (CLR):

The purposed of learning this course is to:

1. Gain basic knowledge on the use of various equipments and machineries in the food processing industry.
2. Understand on various properties of cereals, pulses, nuts and oil seeds and fruits and vegetables.
3. Know the process of grains, animal foods and fruits and vegetables.
4. Learn about food adulteration.

Course Learning Outcomes (CLO):

1. Provide practical knowledge on the use of appropriate processing equipments in setting up a food processing business.

2. Hands on experience in milling and oil extraction techniques of cereals, millets and pulses and oil seeds.
3. Describe the reduction techniques of anti-nutritional factors from grains.
4. Analysis and identify the food adulterants in common foods.

Practical

Study on various equipments and machineries used in food processing industry - Physical characteristics of grains - Parboiling and Milling of grains - Cooking quality of cereals - Extruded products - Unit operations for oil extraction from nuts and oil seeds - Removal of anti-nutritional factors - Properties of milk - Flavoured milk - Processing of ice cream and khoa - Grading and quality evaluation of egg - Tenderization on meat cookery - Detection of food adulteration - Mechanical drying and Osmotic dehydration of commercially important fruits and vegetables - Rehydration ratio of dehydrated foods - Refrigeration & Freezing of fruits and vegetables - Development of products from fruits and vegetables waste - Pectin extraction technique - Determination of pectin strength - Fermented fruit beverage (RTS and Squash) - Preparation of different concentration of sugar syrups - Preparation and quality evaluation of jam, jelly, marmalade, preserve, candied, crystallized and glazed fruits - Canning of fruits and vegetables - Preparation of fermented products (Sauerkraut).

Practical Schedule

1. Demonstration of various equipments and machineries used in food processing industry.
2. Physical characteristics of grains (cereals and pulses).
3. Parboiling of paddy.
4. Milling characteristics of paddy grains.
5. Cooking quality of cereals.
6. Preparation of extruded products.
7. Pulse milling.
8. Cooking quality of pulses.
9. Unit operations for oil extraction from nuts and oil seeds.
10. Removal of anti-nutritional compounds from selected pulses and oilseeds.
11. Determination of properties of milk.
12. Preparation of flavoured milk.
13. Processing of ice cream (different types) and khoa.
14. Grading and quality evaluation of egg.
15. Effect of tenderization on meat cookery.
16. Experiments on detection of food adulteration.
17. Mid semester examination
18. Mechanical drying of commercially important fruits and vegetables.
19. Osmotic dehydration of fruits and vegetables.
20. Determination of rehydration ratio of dehydrated foods.
21. Preservation of food by low temperature - Refrigeration of fruits and vegetables.

22. Preservation of food by low temperature - Freezing of fruits and vegetables.
23. Development of products from fruits and vegetables waste.
24. Pectin extraction from fruit pulp and determination of pectin strength in fruit extracts.
25. Preparation and quality evaluation of non-fermented fruit beverage (RTS and Squash).
26. Preparation of different concentration of sugar syrups.
27. Preparation and quality evaluation of jam, jelly and marmalade from various fruits.
28. Preparation and quality evaluation of preserves.
29. Preparation and quality evaluation of candied, crystallized and glazed fruits.
30. Canning of fruits and vegetables.
31. Preparation of fermented products (Sauerkraut).
32. Visit to modern rice mill / grain processing units.
33. Visit to food processing/ dairy industry

34. Final Practical Examinations

Suggested Readings:

1. Srilakshmi, B. 2005. Food Science. New Age International (P) Ltd., Publishers, New Delhi.
2. N. Shakuntala Manay and M. Shadaksharaswamy. 2001. Foods facts and principles. New Age International (P) Limited, Publishers New Delhi.
3. Dr. Banshi D Shukia, Dr. Prabhat K Srivastava, Er. Ram K Gupta.1992. Oilseeds Processing Technology. Central Institute of Agricultural Engineering, Nabi Bagh, Berasia Road, Bhopal - 462 018, India
4. Dennis R. Heldman, University of Missouri. 1995. Food Science. Springer Science+Business MediaNew York.
5. Srilakshmi. B. 2015. Nutrition Science. New Age International Pvt. Ltd. New Delhi
6. Kader A A. 2002. Postharvest technology of horticultural crops. 3rd edn, University of California, Agricultural and Natural Resources.
7. Srivastava R P and Kumar Sanjeev. 2019. Fruit and Vegetable Preservation – Principles and Practices. CBS Publishers and Distributors Pvt Ltd.

Course No.	:	SEC 008
Course Title	:	Poultry Production Technology
Credit Hours	:	0+2
Course Category	:	Skill Enhancement Course

Course Learning Rationale / Course Objective (CLR):

1. To educate students about the current status of the poultry industry and the issues confronted by the poultry producers.
2. To provide opportunity for the students to learn about all aspects of the commercial broiler production.
3. To provide practical information on poultry management
4. To acquire hands on training for establishing a small-scale commercial poultry enterprise that open avenues for self employment.

Course Learning Outcome (CLO):

1. The students gain knowledge in basic concepts of scientific rearing of poultry.
2. Imparts fundamental knowledge on poultry farming with current trends in the industry.
3. Develop hands-on-skills in poultry farm operations such as brooding, litter management, feeding, vaccination and Disease control
4. Provides exposure and train students in entrepreneurial aspects of poultry farming

Practical

Introduction – Poultry Industry in India - Selection of farm site and poultry strains- Systems of rearing and housing – construction of poultry house - cleaning and disinfection of poultry house and equipment- poultry farm equipment- Preparation of brooder house – Brooding- Litter management- Feeding management- Feed ingredients - Disease management and Vaccination schedule – Summer management - Technical standards - Farm records - Integration- Poultry farm Economics - Dressing of chicken — Visit to poultry farms / Institutions / sales outlets

Practical Schedule

1. Poultry Industry in India.
2. Selection of farm site.
3. Selection of chicks.
4. Systems of poultry rearing.
5. Housing for poultry.
6. Cleaning and disinfection of poultry house and equipments.
7. Identification of poultry farm equipment.
8. Preparation of brooder house to receive the chicks.
9. Management at the time of arrival of chicks
10. Brooding of chicks.

11. Litter management.
12. Types of feeds
13. Feed formulations
14. Feeding management
15. Identification of poultry feed ingredients.
16. Disease management
17. Mid Semester Examination
18. Vaccination of birds.
19. Summer management of birds.
20. Technical standards in commercial poultry production.
21. Measures of efficiency in poultry production.
22. Poultry farm integration.
23. Rodent and pest management
24. Maintenance of farm records.
25. Demonstration of dressing of chicken.
26. Sale of chicken, billing and accounting
27. Economics of poultry production
28. Customer care and keeping up the business relations
29. Problems faced during rearing and sales
30. Farm visit I
31. Institution visit
32. Visit to butcher shop / retail shop
33. Feedback by students
34. Final Practical Examination

Suggested Readings:

1. Jagdish Prasad, 2016. Poultry Production and Management, Kalyani Publishers. Darya Ganj, New Delhi-2.
2. Sudhakar Dwivedi, Mourp Dolma and Pawan Kumar Sharma 2016. Broiler Production: Economics and marketing. New Delhi publishers.
3. Manoj Kumar Rai, 2011. Handbook of Poultry, Oxford Book Company.
4. Rajeshwar prasad, 2010. Poultry Management. Alfa publishers.
5. Sharma.R.P., R.N.Chatterjee, S.V.Ramarao and S.R.Sharma, 2008. Poultry Production in India, ICAR Publications, New Delhi.

Course No.	:	SEC 009
Course Title	:	Seed Production Technology
Credit Hours	:	0+2
Course Category	:	Skill Enhancement Course

Practical

Scope and importance of seed industry and seed production - Cereals, pulses, oilseeds, cotton and commercially important vegetable crops-principles and practices of seed production - Generation system of seed multiplication - Pollination behaviour - Tools employed in hybrid seed production - Designing of Planting ratio and Border rows - Physical and genetic contaminants – isolation distance. Planning of seed production - season and land selection - Assessment of seed source and seed selection - pre sowing seed invigouration treatments - Dormancy breaking treatments - Seed priming - pelleting - polymer coating. Practicing nursery and main field preparation - Practicing the sowing of seeds in the nursery – pro-tray nursery - management. Main field preparation - layout - formation of beds - transplanting - fertilizer and nutrient management - weed management - irrigation management - special cultural practices – pest and disease management - identification and removal of off-types and volunteer plants -Practicing hybridization techniques (emasculation and pollination and detasseling) - Identification of physiological disorders and management - Exposure visit to seed certification department - Seed certification procedures - Registration and sowing report - Field inspection – Field counting – Seed yield assessment-Visit to seed production plots. Pre-harvest sanitation spray - identification of physiological and harvestable maturity indices - Harvesting methods - Post harvest verification - Kapas sorting, cob sorting and pod verification - Threshing / extraction of seeds - Processing sequence - Seed drying - Seed cleaning - Grading - Pre-storage seed treatment - Seed packing - Seed storage -Visit to seed processing unit and seed storage godown and learning sanitation measures. Economics of variety and hybrid seed production (cost benefit ratio) - Visit to private seed industry. Seed sampling procedure and submission of samples - Seed testing procedure - Estimation of seed moisture - Physical purity analysis - Germination test - Visit to grow out test field and DNA finger printing laboratory for genetic purity assessment - Visit to seed retail shop - Seed marketing - Project preparation.

Practical Schedule

1. Scope and importance of seed industry and seed production - Cereals, pulses, oilseeds, cotton and commercially important vegetable crops.
2. Principles and practices of seed production.
3. Generation system of seed multiplication.
4. Pollination behaviour - tools employed in hybrid seed production.
5. Designing of planting ratio and border rows - Physical and genetic contaminants - Isolation distance.
6. Planning of seed production - season and land selection - assessment of seed source and seed selection.
7. Pre sowing seed invigouration treatments - Dormancy breaking treatments - Seed priming - pelleting - polymer coating.
8. Practicing nursery preparation - Practicing sowing of seeds in the nursery - protray nursery management.

9. Main field preparation - layout - formation of beds – transplanting.
10. Fertilizer and nutrient management.
11. Weed and Irrigation management.
12. Special cultural practices – Practicing hybridization techniques (Emasculation and pollination and detasseling).
13. Pest and disease management.
14. Identification and removal of off-types and volunteer plants.
15. Identification of physiological disorders and management.
16. Exposure visit to seed certification department and Visit to seed production plots
- Seed certification procedures - Registration and sowing report - Field inspection
- Field counting - Seed yield assessment-.

17. Mid Semester Examination

18. Pre-harvest sanitation spray - Identification of physiological and harvestable maturity indices - harvesting methods.
19. Post-harvest verification - Kapas sorting, cob sorting and pod verification.
20. Threshing / extraction of seeds.
21. Seed Drying – principles, moisture equilibrium – Types of drying - Seed driers - types.
22. Seed processing - principle - importance - seed cleaning, grading and upgrading – equipments.
23. Visit to seed processing unit.
24. Seed sampling procedure and submission of samples.
25. Seed testing - Estimation of seed moisture.
26. Seed testing - Physical purity analysis.
27. Seed testing - Germination test.
28. Visit to grow out test field and DNA finger printing laboratory for genetic purity assessment.
29. Pre-storage seed treatment and Seed packing.
30. Seed storage - principles - factors affecting seed longevity during storage - Seed storage godown and learning sanitation measures.
31. Economics of variety and hybrid seed production (cost benefit ratio) and Seed Production Planning.
32. Visit to private seed industry
33. Visit to retail seed shop - Seed marketing. Project preparation

34. Final Practical Examination

Suggested Readings:

1. Agrawal, R.L. 2019. Seed Technology. Oxford & IBH Publishing Company Pvt. Ltd., New Delhi.
2. Hebblethwaite, P. D. 1980. Seed Production. Butterworth Heinemann Ltd., London, UK.
3. Joshi, A. K. and Singh, B. D. 2004. Seed Science and Technology. Kalyani Publishers, New Delhi.

4. Kulkarni, G. N. 2011. Principles of Seed Technology. Kalyani Publishers, New Delhi.
5. McDonald, M.B. and Copeland, L. 1998. Seed Production Principles and Practices. CBS Publishers, New Delhi.
6. Mondal, S.S., Saha, M. and Sengupta, K. 2009. Seed Production of Field Crops. New India 1326 Publishing Agency, New Delhi.
7. Sen, S. and Ghosh, N. 2010. Seed Science and Technology. Kalyani Publishers, New Delhi.
8. Singhal, N. C. 2010. Seed Science and Technology. Kalyani Publishers, New Delhi.

Course No.	:	SEC 010
Course Title	:	Soil, Plant and Water Testing
Credit Hours	:	0+2
Course Category	:	Skill Enhancement Course

Course Learning Rationale/ Course objective (CLR):

The purpose of learning this course is;

1. To impart the knowledge of Soil, Plant and Water testing to the students.

Course Learning Outcomes (CLO):

After the completion of this course, the student

1. will have the skill of testing the different parameters of soil, plant and water.
2. will be specialist in rapid test of plant tissue

Practical

Standardization of solutions and reagents, collection and preparation of soil samples, estimation of soil physical and chemical properties – Soil densities, texture, pH, EC, organic carbon, macro and micronutrients, CEC and exchangeable cations in soil. Fertilizer calculation and recommendation. Plant sampling and sample preparation for analysis, digestion of plant material and estimation of macro and micro nutrients in plant. Rapid plant tissue test for N, P and K. Water sampling - Determination of EC, pH, cations (Ca, Mg, Na, K) and anions (CO₃, HCO₃, Cl, SO₄) in irrigation water and computation of salt and classification of water sample as per different methods.

Practical Schedule

- 1,2. Principles of analytical chemistry: Analytical techniques, concepts of gravimetry, concepts of titrimetry (volumetric). Instruments used in soil, plant, water, analysis: pH meter, EC meter, Spectrophotometer, Flame photometer, Atomic Absorption, Spectrophotometer (AAS).

- 3,4. Standardization of solutions and reagents. Collection and preparation of soil, plant and water samples.
- 5,6. Determination of soil bulk density, particle density and porosity. Determination of soil texture by feel method and hydrometer method.
- 7,8. Estimation of pH and EC in soil and saturation paste extract. Determination of CEC and exchangeable cations in soil.
- 9,10. Estimation of cations and anions in saturation paste extract.
- 11,12. Determination of organic carbon and available nitrogen in soil.
- 13,14. Determination of available phosphorus, potassium and sulphur in soil.
- 15,16. Determination of available DTPA extractable Zn, Fe, Mn and Cu and hot water-soluble boron in soil.

17. Mid Semester Examination

- 18,19. Estimation of lime and gypsum requirement of a problem soil.
- 20,21. Fertilizer recommendation – calculations. Estimation of nitrogen content in plant.
- 22,23. Estimation of phosphorus, potassium, calcium, magnesium and sulphur nutrient content in plant.
- 24,25. Estimation of micronutrients content in plant. Rapid plant tissue test for N, P and K
- 26,27. Determination of pH, EC, Ca and Mg in irrigation water
- 28,29. Determination of Na, K, CO₃ and HCO₃ in irrigation water.
- 30,31. Determination of Cl, SO₄ and boron in irrigation water.
- 32,33. Classification of irrigation water using different approaches. Computation of salt in water sample.

34. Final Practical Examination

Suggested Readings:

1. M.L. Jackson 1973. Soil Chemical Analysis, Prentice Hall of India Pvt. Ltd., New Delhi.
2. H.L.S. Tandon 1990. Methods of Analysis of soil, plant, water and fertilizers, FDCO, New Delhi.
3. P. K. Gupta 1999-2000. Soil, Plant, Water and Fertilizer Analysis, AgroBotanica, Bikaner
4. Richards, L.A. (1954). Diagnosis and improvement of saline and alkali soils. USDA Hand book No. 60, Washington, DC USA.
5. Black, C.A. 1965. Agronomy Monograph. Methods of Soil Analysis. Part 1. Physical and Mineralogical properties including Statistics of Measurement and Sampling. Wiley, New York.
6. Hesse, P.R. 1971. A Text book of Soil Chemical Analysis. John Murray (Publishers) Ltd. London
7. Motsara, M.R and R.N. Roy.2008. Guide to laboratory establishment for plant nutrient analysis. Food and Agriculture organization of the United Nations.Rome.pp.220 (also available online)
8. Piper, C.S 1942. Soil and plant analysis: Inter science Publishers, New York.

Course No.	:	SEC 011
Course Title	:	Surveying and Leveling
Credit hours	:	0+2
Course category	:	Skill Enhancement Course

Course Learning Rationale/Course Objective (CLR):

1. To develop practical skills in measuring distances, angles, and elevations using chain and dumpy level for basic surveying tasks.
2. To train students in conducting field surveys such as chain surveying, compass surveying, and leveling for preparation of plans and profiles.
3. To enhance accuracy and interpretation skills in recording, reducing, and plotting survey data manually.

Course Learning Outcomes (CLO):

1. Apply skills in using basic surveying instruments and analyze data.
2. Apply skills to conduct traverse survey and to find the area
3. Apply the knowledge of levelling in different operations in civil engineering projects.
4. Summarize the principles and purpose of basic levelling in surveying.
5. Use total station in the field of civil engineering land survey

Practical

Introduction- Surveying instruments; chains, tapes, cross staff and their types and its uses. Chain Surveying- Ranging and Chaining of Survey lines. Field work and Plotting of Chain survey Compass Surveying- Prismatic Compass& Surveyor compass Uses, Bearings, Local attraction, Fieldwork & Plotting. Levelling- General principle. Types of levels and their temporary and permanent adjustments. Methods of levelling. Reduction of levels. Total station-general commands used- instrument preparation and setting- reading distances and angles, Measurement of distances and coordinates of given points, using Total station, Measurement of altitudes of given elevated points, using total station.

Practical Schedule

1. Study of survey instruments – Folding and unfolding the chain – Roles of Leader and Follower
2. Methods of chaining on level ground – Methods of chaining on sloping ground
3. Procedure for entering records in the field book
4. Study of conventional symbols used in surveying
5. Direct and indirect measurement in surveying using a chain
6. Chain and cross-staff surveying – Linear measurements – Plotting and calculating areas
7. Area computation using the Mid Ordinate Method
8. Area computation using the Average Ordinate Method
9. Area computation using Simpson’s Rule

10. Area computation using the Trapezoidal Rule
11. Area computation using the co-ordinate method
12. Volume computation using the Trapezoidal Rule
13. Volume computation using the Prismoidal Rule
14. Study of compass surveying – Temporary adjustment of a prismatic compass
15. Compass surveying – Bearing observation and angle computation
16. Compass surveying – Measurement of included angles

17. Mid Semester Examination

18. Compass surveying – local attractions of bearing
19. Study of plane table surveying – Accessories and procedure for setting up a plane table at a station
20. Plane table surveying using the Radiation Method
21. Plane table surveying using the Intersection Method
22. Plane table surveying using the Traversing Method
23. Study of leveling instruments – adjustments of a dumpy level
24. Study of Simple and differential leveling
25. Determination of elevation difference using a dumpy level – Rise and Fall Method
26. Determination of elevation difference using a dumpy level – Height of Collimation Method
27. Preparation of a contour map
28. Measurement of farm pond volume
29. Area measurement using GPS
30. Total Station – Operation, setting up, and taking measurements
31. Preparation of a School survey map using chain and dumpy level
32. Pre leveling of paddy field through dumpy level
33. Field visit to a project site

34. Final Practical Examination

Suggested Readings:

1. Surveying and Levelling N.N. Basak. Mcgraw hill publications
2. A Textbook of Surveying and Levelling, R. Agor, Standard Book House.
3. Surveying: Theory and Practice by James M. Anderson, Edward M. Mikhail, Tata McGraw Hill.

Course No.	:	SEC 012
Course Title	:	Vermicompost production technology
Credit Hours	:	0+2
Course category	:	Skill Enhancement Course

Course learning Rationale/ Course Objectives (CLR):

1. To impart hands-on-experience training in vermicompost production technologies
2. To train the students for establishing the vermicompost production unit, certification procedures and marketing

Course Learning Outcome (CLO):

1. Acquiring knowledge and skill in establishment of vermicompost unit
2. Understanding the vermicompost production technologies
3. Gaining knowledge on organic input certification procedures and marketing

Practical

Visit to vermicompost unit; Earth worm - selection, biology, Selection of suitable site and establishment of vermicompost unit; Preparation of organic waste; Vermicomposting – Process, post harvest handling; Physico-chemical properties assessment, certification and marketing of vermicompost.

Practical schedule

1. Importance of organic waste management
2. Vermicomposting – Definition, concept, history and environmental advantages
3. Visit to vermi compost production unit
4. Role of earthworms in decomposition and nutrient recycling
5. Market potential of vermicompost and scope for rural employment,
6. Government initiatives and policies for scaling up vermicompost production unit
7. Classification of earthworms and selection of suitable species for composting
8. Ideal environmental conditions, biology and production cycle of earth worms
9. Procurement and maintenance of earthworms
10. Common predators of earthworms and their management
11. Study on types and suitability of biodegradable waste required for vermicomposting
12. Study on green and brown materials balance, moisture content and CN ratio of feed stock
13. Acquiring skill in Sourcing and storage and pre-treatment of organic waste
14. Physico-chemical analysis of feedstock
15. Acquiring skill in site selection for vermicompost unit
16. Study on required tools and equipment for vermicomposting

17. Mid Semester Examination

18. Acquiring skill in planning of lay out construction of vermicompost unit
19. Acquiring skill in cost estimation and budgeting of vermicomposting
20. Acquiring skill in layering of vermibed and inoculation of earthworms
21. Acquiring skill in maintenance of safety and hygiene measures in vermicompost unit
22. Acquiring skill in monitoring the decomposition stages and assessing the compost maturity
23. Acquiring skill in monitoring the decomposition stages and assessing the compost maturity
24. Acquiring skill in documentation of production process of vermicompost
25. Acquiring skill in separation of worms from matured compost
26. Acquiring skill in manual and mechanical harvesting of vermicompost
27. Acquiring skill in cleaning and reusing compost beds
28. Estimating the yield of vermicompost
29. Acquiring skill in post-harvest handling, labelling and branding vermicompost
30. Study on value added and by-products of vermicompost
31. Physico-chemical analysis of vermicompost and vermiwash
32. Carrying out organic input certification procedures
33. Acquiring skill in marketing of vermicompost and earthworms

34. Final Practical Examination

Suggested Readings:

1. Sathe, T.V. Vermiculture and Organic Farming. Days Publishing House, New Delhi.
2. Vaishali Badwaik, 2025. Textbook on vermiculture and vermicomposting, Bhumi Publishing, India.
3. Yashwant B.Patne. Textbook on vermiculture and vermicomposting, Prabhakar Publication, India.
4. Sohan Singh Walia and Tarmanpreet Kaur, 2024. Earthworms and vermicomposting-Species, Procedures and Application, Springer Nature.

Course No.	:	SEC 013
Course Title	:	Video Production
Credit Hours	:	0+2
Course category	:	Skill Enhancement Course

Course learning Rationale/ Course Objectives (CLR):

To impart skill in video production to the students by providing hands on experience through exposing technologies.

Course Learning Outcome (CLO):

1. Skill in handling video camera and shooting videos
2. Skill in editing the audio and video using softwares
3. Practice in script writing
4. Skill in application of Open Board Casting Software

Practical Schedule

1. Exposure visit to video production centre / Educational Media Centre to understand different types of camera and camera support system
2. Familiarisation of video camera, parts of video camera and other accessories. Handling of camera support system
3. Basic handling of video camera
4. Practicing video camera with white balance
5. Practicing, Composition, Focusing, Zooming and Shooting
6. Practicing different camera positions- long shot, medium shot, close up, zoom, tilting and panning
7. Lighting techniques and moods
8. Familiarising with drone camera and its parts
9. Exposure on Drone Technology Centres to study its operation
10. Different types of video scripts – basic production script, story board script, camera script
11. Planning script for five minutes video programme
12. Script for documentary production and drama – story board
13. Care and maintenance of camera
14. Exposure on audio recording equipments
15. Exposure on Audio editing softwares
16. Practicing - Installing of video and audio software into desktop computer
17. **Midsemester examination**
18. Sound – audio recording, voice dubbing and audio mixing
19. Familiarizing of open source softwares for video & audio editing
20. Video editing using smart phones
21. Synchronising the audio in video editing smart phones
22. Familiarising in exporting final output in mobile
23. Creating videos using images and text, designing of video titles using adobe photoshop
24. Familiarising voice recording techniques using smart phones
25. Advance techniques of exporting final video for different formats and sizes
26. Video editing techniques – video libraries and graphic libraries
27. Video and audio online and offline editing
28. Non-linear programme editing& Methods of off line video editing
29. Advanced techniques of - cut – mix - editing
30. Using Graphics and animation in video production

31. Application of open-source software – Gimp, Blender
32. Applications of Open Board Casting Software (OBS), Google sketchup
33. Presentation of produced program
34. Final Practical Examination

Suggested readings:

1. Jim Owens and Gerald Millerson.2008. Video Production Handbook, Focal Press, USA.
2. Wallace Jackson. 2015. "Android Studio New Media Fundamentals: Content Production of Digital Audio/Video, Illustration and 3D Animation" Apress, USA.
3. News Editing - Bruce II. Westley
4. Radio and TV Journalism- Jan R Hakemulder, PP Singh, Fay AC DE Jonge
5. Radio and TV Journalism – K.M. Srivastava

Course No.	:	SEC 101
Course Title	:	Apiculture
Credit Hours	:	0+2
Course Category	:	Skill Enhancement Course

Course Learning Rationale / Course Objective (CLR):

The purpose of learning this course is:

1. To enhance the skill on honey bee rearing
2. To know about the seasonal management of honey bees
3. To study the capturing and rearing techniques in stingless bee
4. To know about the extraction and processing of honey bee products

Course Learning Outcomes (CLO):

1. Acquire practical skills in honey bee colony establishment and maintenance
2. Understand and apply seasonal management practices for honey bee colonies
3. Understand rearing techniques specific to stingless bees
4. Demonstrate techniques for the extraction, processing and handling of bee products

Practical

Identification, morphology and structural adaptations in honey bees. Different species of honey bees. Bee keeping appliances and types of bee hive. Rearing of queen, worker, drone cell and colony organization and queen rearing techniques. Establishment of apiary unit -Seasonal management of honey bee colonies. General apiary management practices. Practicing and handling of honey bee colonies- Indian bees and Italian bees.

Bee behaviour -Bee pasturage, foraging and communication. Bee enemies and diseases and their management. Bee keeping products - Extraction of bee products - Processing and storage of honey. Honey bee nutrition - Evaluation of artificial food supplements. Honey bee as bioindicator. Migratory beekeeping. Biology, colony organization of stingless bee - Different types of hive for domestication - Capturing and rearing technique -Extraction of honey from stingless bee. Quality control of honey bee products. Case studies of beekeeping in crops. Marketing -Value addition of bee products and medicinal properties. Capturing technique of wild bee colonies. Visit to apiculture unit, honey processing unit and quality control unit.

Practical Schedule

1. Identification, morphology and structural adaptations in honey bees.
2. Different species of honey bees
3. Bee keeping appliances
4. Types of bee hives
5. Rearing of queen, worker, drone cell and colony organization
6. Queen rearing techniques and artificial queen bee insemination
7. Establishment of apiary unit
8. Seasonal management of honey bee colonies - Summer
9. Seasonal management of honey bee colonies - Monsoon and winter
10. General apiary management practices
11. Practicing and handling of honey bee colonies- Indian bees
12. Practicing and handling of honey bee colonies- Italian bees
13. Bee behaviour - bee pasturage
14. Bee behaviour - bee foraging and bee communication
15. Bee enemies and their management
16. Bee diseases and their management
17. Mid Semester Examination
18. Bee keeping products - extraction of bee products
19. Processing and storage of honey
20. Honey bee nutrition and evaluation of artificial food supplements
21. Honey bee as bioindicator
22. Migratory beekeeping
23. Biology, colony organization of stingless bee
24. Different types of hive for domestication of stingless bee
25. Capturing and rearing technique of stingless bee
26. Extraction of honey from stingless bee
27. Quality control of honey bee products
28. Case studies of beekeeping in crops
29. Marketing of honey bee products
30. Value addition of bee products and medicinal properties
31. Capturing technique of wild bee colonies
32. Visit to apiculture unit

33. Visit to honey processing unit and quality control unit

34. Final Practical Examination

Suggested Readings:

1. Abrol, D. P. 2019. Beekeeping- A compressive guide to bees and beekeeping. Scientific Publishers, India.
2. David, B. V. and V. V. Ramamurthy. 2016. Elements of Economic Entomology, Namrutha Publications, Chennai.
3. Mishra, R. C. 1995. Honeybees and their management in India. ICAR, Everest Press, New Delhi.

Course No.	:	SEC 102
Course Title	:	Computer Programming and Data Structures
Credit Hours	:	0+2
Course Category	:	Skill Enhancement Course

Course Learning Rationale / Course Objective (CLR):

The purpose of learning this course is to: understand fundamental data structures, algorithm design and analysis, applying data structures to solve problems, developing programming skills, learn about searching and sorting techniques.

Course Learning Outcomes (CLO):

Ability to analyze algorithms, skill in selecting appropriate data structures, proficiency in implementing data structures, improved problem solving skills, understanding of abstract data types, familiarity with searching and sorting algorithms, ability to design and implement solutions using data structures.

Practical

Introduction To High Level Languages; Structure Programming, C Programming, A Simple C Programming, Execution Of A 'C' Program, Program And Instruction; Familiarizing With C Ide Code: Blocks; Building An Executable Version Of C Program; Study Of Different Operators Such As Arithmetic, Relational, Logical, Assignment, Increment And Decrement, Conditional, Bitwise And Special Operators, Precedence Of Arithmetic Operators; Debugging A C Program; Developing And Executing Simple Programs; Creating Programs Using Decision Making Statements Such As If, Go To And Switch; Developing Program Using Loop Statements While, Do And For; Using Nested Control Structures; Familiarizing With One And Two Dimensional Arrays; Using String Functions; Creating User Defined Functions; Developing Structures And Union; Using Local, Global And External Variables; Using Pointers; Developing Linked Lists In C Language; Inserting An Item In Linked List; Deleting An Item In Linked List; Implementing Stacks; Implementing Push/Pop Functions; Creating Queues, Insertion/Deletion In Queues.

Practical Schedule

1. Introduction to high level languages;
2. Structure programming,
3. C programming, a simple c programming, execution of a 'c' program, program and instruction; familiarizing with c ide code::blocks; building an executable version of c program;
4. Study of different operators such as arithmetic, relational,
5. Logical, assignment,
6. Increment and decrement,
7. Conditional,
8. Bitwise and special operators,
9. Precedence of arithmetic operators;
10. Debugging a c program;
11. Developing and executing simple programs;
12. Creating programs using decision making statements such as if,
13. Go to
14. Switch;
15. Developing program using loop statements while, do
16. For

17. Mid semester examination

18. Using nested control structures;
19. Familiarizing with one and two dimensional arrays;
20. Using string functions;
21. Creating user defined functions;
22. Developing structures and union;
23. Using local, global and external variables;
24. Using pointers;
25. Developing linked lists in c language;
26. Inserting an item in linked list;
27. Deleting an item in linked list;
28. Implementing stacks;
29. Implementing push functions;
30. Implementing pop functions;
31. Creating queues,
32. Insertion in queues
33. Deletion in queues

34. Final Practical Examination

Suggested Readings:

1. Subrat Kumar Mahapatra, Prasannajit Mishra and Jayashankar Pradhan. Introductory Agri-Informatics, Third Edition, Jain Brothers, 2024

2. LibreOffice Community, Getting Started Guide 24.8, LibreOffice Documentation Team, 2024
3. GNOME Library Help
4. Michael J Crawley. The R Book, Second Edition. John Wiley, 2013
5. Brian S, Everitt and Torsten Hothorn. A Handbook of Statistical Analyses Using R, Second Edition. 2009, Chapman and Hall/CRC
6. Stuart Russell And Peter Norvig. Artificial Intelligence - A Modern Approach, Fourth Edition. Pearson Education, 2020

Course No.	:	SEC 103
Course Title	:	Farm Machinery
Credit Hours	:	0+2
Course Category	:	Skill Enhancement Course

Course Learning Rationale / Course Objective (CLR):

1. To familiarize students with various makes, models, and functional systems of agricultural tractors.
2. To provide practical skills in conducting pre-operational checks and routine maintenance of tractors.
3. To train students in the safe operation and driving of tractors and power tillers under field conditions.
4. To develop the ability to hitch, de-hitch, and adjust primary and secondary tillage implements.
5. To enable students to understand and perform various ploughing methods and field pattern operations.
6. To provide hands-on experience in the calibration and operation of seed drills and sprayers.

Course Learning Outcomes (CLO):

1. Identify various makes and models of tractors and understand their functional systems.
2. Perform pre-start maintenance checks and follow safety procedures.
3. Operate tractors and adjust both primary and secondary tillage implements.
4. Hitch and de-hitch mounted and trailed implements effectively.
5. Drive tractors with trollies in forward and reverse directions safely.
6. Operate and calibrate different types of sprayers.

Practical

Familiarization with different makes and models of agricultural tractors. Identification of various functional systems including air supply, fuel, cooling,

transmission, steering and hydraulic systems. Maintenance points to be checked before starting a tractor. Familiarization with controls on a tractor. Safety rules and precautions to be observed while driving a tractor. Practice of driving a tractor and with tillage tools (Primary/Secondary tillage implements) and their adjustment in the field. Field patterns while operating a tillage implement. Hitching and de-hitching of mounted and trailed type implements to the tractor. Practice for driving of a trailed type of trolley: forward and in reverse direction. Familiarization with different types of sprayers. Operation of tractor operated boom and orchard sprayers. Calibration of a sprayer. Nozzle spacing on a boom, pressure setting of a nozzle. Use of Pick Positioner. Use of drones for spraying. Familiarization with tractor operated tree pruners.

Practical Schedule

1. Familiarization with different makes and models of agricultural tractors.
2. Study of air supply and fuel systems in tractors.
3. Study of cooling system components and their maintenance.
4. Understanding the transmission and steering systems in tractors.
5. Introduction to the hydraulic systems used in tractors.
6. Performing maintenance checks before starting a tractor.
7. Hands-on training with tractor controls and dashboard functions.
8. Safety rules and precautions for operating a tractor.
9. Practical session on basic forward driving of a tractor in the field.
10. Practice of driving in both forward and reverse directions.
11. Introduction to primary tillage implements – types and applications.
12. Introduction to secondary tillage implements – functions and adjustments.
13. Demonstration of different methods of ploughing.
14. Adjusting tillage implements according to field conditions.
15. Practice on field patterns during tillage operations.
16. Training on hitching and de-hitching mounted implements.
17. **Mid Semester Examination**
18. Hitching and field adjustment of the Mouldboard (MB) plough.
19. Hitching and field adjustment of the Disc plough.
20. Field operation and hitching of secondary tillage implements – harrows and cultivators.
21. Hitching and adjustment of rotavator in the field.
22. Study of seed drills – calibration, hitching, and field adjustments.
23. Driving practice with a power tiller.
24. Study and operation of intercultural equipment – dry land, wet land, and power weeder.
25. Demonstration field clearance equipments
26. Practical session on attaching and detaching trailed implements.
27. Driving practice with a trailed trolley in the forward direction.
28. Driving a tractor with a trolley in reverse – steering and maneuvering techniques.

29. Overview of different types of agricultural sprayers.
30. Identification of components and operation of power sprayers.
31. Introduction to sprayer calibration – principles and procedures.
32. Practical calibration of a sprayer using water and measurement tools.
33. Field demonstration of drone-based spraying and data collection.

34. Final Practical Examination

Suggested Readings:

1. Sahay Jagdishwar. Elements of Agricultural Engineering.
2. Kepner R A, Bainer R and Barger E L. Principles of Farm Machinery.
3. Michael A M and Ojha T P. Principles of Agricultural Engineering.
4. Culpin C. Farm Machinery.
5. Rodichev V and Rodicheva G. Tractors and Automobiles.

Course No.	:	SEC 104
Course Title	:	Installation, Operation and Maintenance of Micro Irrigation Systems
Credit Hours	:	0+2
Course Category	:	Skill Enhancement Course

Course Learning Rationale / Course Objective (CLR):

1. To impart hands-on training on the design, installation, and maintenance of micro irrigation systems.
2. To familiarize students with different components of drip and sprinkler systems.
3. To develop skills in the operation, fertigation, chemigation, automation, and troubleshooting in micro irrigation.
4. To equip students to analyze water quality, soil moisture, crop water needs, and uniformity of water application.
5. To introduce IoT and automation techniques in modern irrigation practices.

Course Learning Outcomes (CLO):

1. Identify and install various components of micro irrigation systems (drip and sprinkler).
2. Operate and maintain micro irrigation and fertigation systems effectively.
3. Evaluate the performance and uniformity of irrigation systems.
4. Implement automated irrigation using sensors, solenoid valves, and timing devices.
5. Estimate the cost economics and perform field visits to assess real-time installations.

Practical

Micro irrigation system installation: installation of filters and fertigation equipment; installation of main and sub mains; Laying of laterals, Punching of laterals, and fixing the emitters, operation of micro irrigation system; Maintenance of micro irrigation system; Filter cleaning, maintenance of fertigation equipment, chemical treatment, sub main and lateral bi-wall flushing, Introduction to automated irrigation system in open field and green houses – sensors for soil moisture, temperature, light control devices, timing devices, fertigation system, solenoid devices, remote controlled valve system

Practical Schedule

1. Introduction to micro irrigation and its scope
2. Fundamentals of fluid mechanics and their application in micro irrigation
3. Acquaintance with different components of a micro irrigation system
4. Installation of micro irrigation system (Both drip and sprinkler) – main, submain, lateral and emitters, riser and sprinkler head
5. Water quality analysis for drip irrigation system
6. Operation of the micro irrigation system
7. Determination of pump requirement and selection
8. Design of a drip irrigation system in the field
9. Hydraulics of drip irrigation system
10. Computation of crop water requirement
11. Installation and operation of fertigation equipment
12. Study and maintenance of different filters (screen, sand, disc, etc.)
13. Maintenance of micro irrigation system
14. Chemigation treatment in drip irrigation system
15. Design of sprinkler irrigation system
16. Hydraulics of sprinkler irrigation system

17. Mid Semester Examination

18. Determination of uniformity coefficient of drip irrigation system
19. Determination of uniformity coefficient of sprinkler irrigation system
20. Performance evaluation of installed micro irrigation system
21. In-situ measurement of soil moisture using sensors
22. Determination of hydraulic conductivity of soil
23. Determination of wetting pattern in drip irrigation system
24. Measurement of soil moisture using tensiometer
25. Determination of soil moisture characteristic curve
26. Determination of upward flux using tensiometer
27. Study of components of an automated irrigation system
28. Operation of automated micro irrigation systems in open fields and greenhouses
29. IoT-based irrigation system operation: solenoid valve and timing device setup
30. Different methods of automation in irrigation systems

31. Cost economics of micro irrigation system
32. Visit to a micro irrigation system in a farmer's field or institutional farm
33. Visit to an automated irrigation system in a greenhouse (or industry exposure)

34. Final Practical Examination

Suggested Readings:

1. Biswas, R.K. 2015. Drip and Sprinkler Irrigation. New India Publishing Agency.
2. Goyal, M.R. 2016. Micro Irrigation Management Technological Advances and Their Applications - Innovations and Challenges in Micro Irrigation. CRC Press.
3. James, L.G. 1993. Principles of Farm Irrigation System Design. Krieger publishing Company, Malabar, Florida.
4. Mane, M.S. and Ayare, B. L. 2019. Principles of Sprinkler Irrigation. Jain Brothers, N. Delhi, 4th edn.
5. Mane M.S and Ayare, B. L. 2019. Principles of Drip Irrigation. Jain Brothers, New Delhi.

Course No.	:	SEC 105
Course Title	:	Introduction to Forestry
Credit Hours	:	0+2
Course Category	:	Skill Enhancement Course

Course Learning Rationale / Course Objective (CLR):

The purpose of learning this course is to:

1. Impart practical knowledge on identification, propagation and management of farm-grown trees.
2. Develop skills related to nursery practices, measurement techniques and forestry-based industries.
3. Familiarize students with wood and non-wood forest products and their commercial applications.

Course Learning Outcomes (CLO):

1. Identify major farm-grown tree species, seeds and seedlings.
2. Select suitable nursery sites and perform layout and propagation techniques.
3. Apply methods for measuring height, diameter and estimating volume of standing trees.
4. Recognize wood and non-wood forest products.
5. Understand the processing and marketing aspects of forestry-based industries.
6. Visit and analyze agroforestry plantations and related industries for hands-on exposure.

Practical

Identification of important farm grown trees, tree seeds and seedlings. Site selection for tree nursery and layout of nursery. Propagation methods, plantation establishment, plantation management, pest and diseases management and harvesting for various wood-based industries. Height measurement, diameter measurement and Volume estimation in trees - Identification of wood and non - wood forest products - Visit to Agroforestry plantations. Visit to Pulp and Paper, Matchwood, Energy, plywood industries to study the production, processing and marketing.

Practical Schedule

1. Introduction to forestry tools and safety procedures in field practices.
2. Identification of important farm-grown tree species common to Tamil Nadu (e.g., *Melia dubia*, *Ailanthus excelsa*, *Casuarina equisetifolia*, *Tectona grandis*).
3. Identification of tree seeds: morphology, dormancy, viability tests.
4. Identification of seedlings in early nursery stages: monocots vs. dicots, morphology.
5. Criteria for selecting a suitable nursery site: soil, water, slope, proximity.
6. Layout and planning of nursery beds, mist chambers and shade nets.
7. Seed propagation techniques: pre-treatment, sowing, watering, germination care.
8. Asexual propagation: budding, grafting, air layering and stem cuttings.
9. Nursery practices for commonly grown multipurpose trees in agroforestry systems.
10. Techniques of plantation establishment: site preparation, spacing, pit digging.
11. Irrigation methods in forestry nurseries and plantations: basin, drip and furrow methods.
12. Practices in plantation management: thinning, pruning, weeding, mulching.
13. Identification and diagnosis of common insect pests and diseases in forest trees.
14. Integrated Pest Management (IPM) in tree plantations: biological and chemical controls.
15. Methods of harvesting trees for different uses: saw-timber, pulp, poles, biomass.
16. Measurement of tree height by shadow method and single pole method.
17. **Mid Semester Examination**
18. Measurement of tree height using hypsometer.
19. Diameter measurement using calipers and diameter tapes.
20. Volume estimation of standing trees using volume tables and formulas, and felled trees by sectional method.
21. Identification of wood forest products: teak, rosewood, sandalwood, eucalyptus, acacia.
22. Visit to local timber depots to observe grading, seasoning and auction procedures.
23. Identification of non-wood forest products (NWFPs): gums, resins, honey and medicinal plants.

24. Study of collection, processing and packaging of NWFPs.
25. Visit to Agroforestry Research Station – demonstration of species trials and intercropping systems.
26. Visit to State Forest Nursery – practical exposure to large-scale nursery operations.
27. Visit to TNPL (Tamil Nadu Newsprint and Papers Limited), Karur – paper production from wood and agro-residues.
28. Visit to Plywood/Matchwood Industry at Sivakasi – understanding wood processing and grading.
29. Visit to Casuarina Energy Plantation (Delta region) – energy plantation management and economics.
30. Visit to FC&RI, Mettupalayam
31. Analysis of marketing channels for timber and NWFPs – mandis, FPCs, cooperatives.
32. Data collection from plantation visits and exercises in record-keeping.
33. Compilation of nursery and plantation logs – sample record formats for forest department.

34. Final Practical Examination

Suggested Readings:

1. Chundawat, D.S. & Gautam, S.K. (2017). Textbook of Agroforestry. Oxford and IBH Publishing.
2. Tiwari, K.M. (1992). Social Forestry. APH Publishing Corporation, New Delhi.
3. Dhiman, R.C. (2010). Forestry Principles and Applications. Kalyani Publishers.
4. Dwivedi, A.P. (2003). Forest Management. International Book Distributing Co., Lucknow.
5. Tewari, D.N. (2008). A Monograph on Non-Wood Forest Products of India. International Book Distributors.

Course No.	:	SEC 106
Course Title	:	Landscape Gardening
Credit Hours	:	0+2
Course Category	:	Skill Enhancement Course

Course Learning Rationale / Course Objective (CLR):

1. To explain the fundamental principles and elements of landscape design, including balance, proportion and unity, and how to apply these concepts in creating aesthetic and functional landscapes.

2. To identify various ornamental plants, trees, shrubs, and ground covers, and select the most appropriate species based on climate, soil, and aesthetic needs.
3. To design and plan the layout of gardens, including hardscape features like pathways, walls, and water bodies, ensuring a harmonious and sustainable landscape.
4. To maintain different landscape features, including proper irrigation, pruning, fertilization, pest control, and seasonal adjustments for plants and garden structures.

Course Learning Outcomes (CLO):

1. Identify and classify various ornamental plants, trees, shrubs, and ground covers used in landscape gardening.
2. Demonstrate the ability to design basic landscape plans for home gardens, public parks, and institutional spaces using principles of design and aesthetics.
3. Gain practical skills in site preparation, planting techniques, and maintenance of different landscape features such as lawns, hedges, borders, and water bodies.
4. Select appropriate landscaping styles (formal, informal, modern, etc.) based on location, climate, and intended function.

Practical

Identification and use of garden tools and equipment. Study of growth characters, identification and classification of ornamental trees, shrubs, climbers, ground covers and indoor plants. Making and maintenance of edge, hedge and topiary. Establishment and maintenance of a lawn. Bonsai making. Art principles of landscaping. Formal and informal gardens. Planning, designing and establishment of garden features. Landscape design process: Landscape drafting tools. Dimensioning, graphic symbols and notations. Site analysis and landscape designing of residential, public buildings and religious places.

Practical Schedule

1. Study of garden tools and equipment's used in landscape architecture.
2. Study of graphic language and use of drawing equipments in Landscape architecture
3. Study of graphic symbols and notations used in landscape designing.
4. Identification and classification of avenue trees.
5. Identification and classification of shrubs.
6. Identification and classification of annuals.
7. Identification and classification of pot plants.
8. Identification and classification of climbers and ground covers
9. Study of various features of an ornamental garden with suitable plants and identification of plants for each feature.
10. Study and designing of different styles of gardens, Study and designing of gardens based on different themes.
11. Study of making and maintenance of edges.
12. Study of making and maintenance of hedges and topiary.

13. Art of trophy and carpet beds.
14. Identification of indoor plants and their maintenance.
15. Identification of outdoor plants and their maintenance.
16. Identification of lawn grasses.
17. **Mid Semester Examination**
18. Methods of establishment of lawn grasses.
19. Maintenance of lawn grasses.
20. Practices on horticultural crafts – bonsai.
21. Practices on horticultural crafts terrarium
22. Practices on flower arrangements.
23. Practices on horticultural crafts Vegetable and fruit carving.
24. Identification of different living components - their form, size, shape, texture flowering and their beauty and utility in the garden.
25. Identification of different non- living components - their form, size, shape, texture flowering and their beauty and utility in the garden.
26. Study about site analysis and preparation of bubble graph.
27. Principles of landscape drawing and fundamentals of manual drawing. Preparation and practices on manual drawing and budget preparation.
28. Fundamentals of designing garden – Plan view, elevation and perspective diagram.
29. Computer aided landscape designing.
30. Preparation of landscape plan for residential, bungalow, Institute and Industry gardens.
31. Preparation of landscape plan for public buildings and religious places.
32. Preparation of landscape plan for roads and roundabouts.
33. Visit to community parks and Institutional gardens.
34. **Final Practical Examination.**

Suggested Readings:

1. Floriculture in India: Randhawa. G. S. and A. Mukhopadhyay. 2010. Allied publishers Pvt. Ltd. New Delhi.
2. Introductory Ornamental and Landscape Gardening: Rajaneesh Singh and Brijendra Kumar Singh. 2020, Bio-Green Books.
3. Landscape Gardening: Sudhir Pradhan. 2018. Scientific Publishers India.
4. Principles of Landscape Architecture: Pragnya shree Mishra and Bhi Masen Naik. 2022. New India Publishing Agency.
5. Principles of Landscape Gardening: Y. Chandrasekhar and Hernia Naik B. 2020. ICAR.

Course No.	:	SEC 107
Course Title	:	Nursery Production in crops
Credit Hours	:	0+2
Course Category	:	Skill Enhancement Course

Course Learning Rationale / Course Objective (CLR):

1. Understand the basic principles and significance of nursery production in .
2. Acquire skills in the selection and preparation of nursery sites and materials.
3. Develop proficiency in propagation techniques (sexual and asexual) for horticultural crops.
4. Learn nursery management practices including irrigation, fertilization, pest/disease control, and hardening.
5. Gain experience in marketing and economic evaluation of nursery enterprises.

Course Learning Outcomes (CLO):

1. Identify suitable sites and design layout plans for horticultural nurseries.
2. Propagate horticultural plants using appropriate techniques (seed, grafting, budding, layering, etc.).
3. Manage nursery activities effectively including media preparation, potting, and transplanting.
4. Diagnose and manage nursery pests and diseases using IPM practices.
5. Prepare and evaluate a small-scale nursery business plan with basic cost-benefit analysis.

Practical

Layout of model nursery, Tools and equipment-identification and application. Different methods of breaking seed dormancy stratification, scarification and use of plant growth regulators. Extraction and storage of healthy seeds, seed bed preparation, Identification and raising of rootstocks for different fruit plants, soil solarization, preparation of potting mixtures. Selection of healthy scion wood, practices in different methods of plant propagation like cutting, layering, budding and grafting in fruit plants. Micropropagation-explant preparation, media preparation, culturing–meristem tip culture, axillary bud culture, micro-grafting and hardening of plants. Nursery management practices i.e. weed control, irrigation, nutrition, removal of sprouts etc. Protection of nursery plants against adverse climatic conditions. Protected structures. Diagnosis and control of important diseases and pests in the nursery, lifting and packing of nursery plants, Visit to commercial tissue culture laboratories and accredited nurseries.

Practical Schedule

1. Introduction to nursery production: scope, importance, and types.
2. Selection and layout planning of a nursery site.
3. Identification and use of nursery tools, equipment, and materials.
4. Soil sterilization techniques: solarization, steam, and chemical treatments.

5. Preparation of nursery beds: flat, raised, and sunken beds.
6. Preparation and sterilization of potting media (soil, sand, compost, cocopeat, etc.).
7. Seed treatment and sowing techniques for horticultural crops.
8. Germination testing and seedling assessment.
9. Pricking and transplanting of seedlings.
10. Preparation and use of nursery containers: polybags, trays, pots.
11. Propagation by cuttings: softwood, semi-hardwood, and hardwood.
12. Preparation and application of rooting hormones.
13. Budding techniques: T-budding and patch budding.
14. Grafting methods: wedge, whip, cleft, and approach grafting.
15. Layering methods: simple, mound, serpentine, and air layering.
16. Collection and preparation of scion and rootstock materials.

17. Mid Semester Examination

18. Micropropagation: explant selection and sterilization.
19. Micropropagation: preparation of tissue culture media (Murashige and Skoog).
20. Identification of nursery pests and beneficial insects.
21. Nursery pest management: biological, chemical, and cultural approaches.
22. Diagnosis and management of nursery diseases.
23. Weed management practices in nurseries.
24. Irrigation systems: hand watering, drip, and sprinkler methods.
25. Nutrient management: composting and fertilizer application.
26. Hardening and acclimatization of nursery seedlings. Potting and repotting of nursery plants.
27. Labelling, tagging, and record-keeping in nursery operations.
28. Packaging and transportation of nursery plants.
29. Nursery layout design: drawing and interpretation.
30. Educational visit to a commercial or government nursery.
31. Project planning: establishment of a small model nursery unit.
32. Economic analysis: cost estimation, pricing, and profitability.
33. Preparation of a nursery business or entrepreneurship plan.

34. Final Practical Examination.

Suggested Readings:

1. Chaitanya, K. (2021). Orchard Management. In Recent Advances in Sapota Production and Post-Harvest Management (pp. 117–126). New Delhi Publishers.
2. Bose, T.K., Mitra, S.K., & Sadhu, M.K. (1991). Propagation of Tropical and Subtropical Horticultural Crops. In Propagation of Horticultural Plants (pp. 1–250). Naya Prokash.

Course No.	:	SEC 108
Course Title	:	Orchard Floor Management
Credit Hours	:	0+2
Course Category	:	Skill Enhancement Course

Course Learning Rationale / Course Objective (CLR):

The purpose of learning this course is to:

1. To provide knowledge on layout of different systems of orchards and fruit nutrition garden
2. To provide knowledge on soil management practices in orchard
3. To provide knowledge on layout of various irrigation systems
4. To provide knowledge on application of manure and fertilizers and use of organic manures in orchard

Course Learning Outcomes (CLO):

1. Explain the different systems of orchards and fruit nutrition garden
2. Analysis the soil management practices in orchard
3. Learn about the various irrigation systems in orchard
4. Narrate application of manure and fertilizers and use of organic manures in orchard

Practical

Layout of different systems of orchards and Fruit Nutrition Garden. Soil management practices: clean cultivation, sod culture, sod mulch, intercropping, cover cropping and mixed cropping. Use of mulch materials: organic and inorganic, moisture conservation and weed control. Layout of various irrigation systems, surface irrigation: Flood system, basin system, modified basin system, furrow method, sub-surface irrigation systems: drip irrigation and its components, overhead irrigation: sprinkler system, fertigation, Different methods of application of manure and fertilizers, use of organic manures, Biofertilizers, Green manuring and bio-agents. Visit to orchards of Progressive fruit growers.

Practical Schedule

1. Planning and layout of different systems of orchards
2. Planning and layout of fruit nutrition garden
3. Planting and lay out of different planting systems of orchard
4. Records maintenance in orchard
5. Studies on clean cultivation in orchard
6. Studies on sod culture in orchard
7. Studies on sod mulch in orchard
8. Studies on intercropping in orchard
9. Studies on cover cropping in orchard

10. Studies on mixed cropping in orchard
11. Study of organic mulches in orchard
12. Study of inorganic mulches in orchard
13. Soil management in relation to soil organisms
14. Nutrient uptake
15. Study of moisture conservation methods and observations on soil moisture contents under mulches
16. Observations on weed growth under different systems of management

17. Mid Semester Examination

18. Weed management in orchard
19. Use of different weedicides in orchard
20. Layout, components and use of flood system of irrigation in the orchard
21. Layout, components and use of basin system of irrigation in the orchard
22. Layout, components and use of modified basin system of irrigation in the orchard
23. Layout, components and use of furrow method of irrigation in orchard
24. Layout, components and use of drip system of irrigation in orchard
25. Layout, components and use of modified basin system of irrigation the orchard
26. Layout, components and use of sprinkler system of irrigation in orchard
27. Layout, components and use of fertigation system in orchard
28. Different methods of application of manure and fertilizers in orchard
29. Classification and application of organic manures in orchard
30. Classification and application of biofertilizers in orchard
31. Use of green manures in orchard
32. Use of bio-agents in orchard
33. Visit to orchards of progressive fruit growers

34. Final Practical Examination

Suggested Readings:

1. Kumar, 1990. Introduction to Crops. Rajalakshmi Publications, Nagercoil, Tamilnadu.
2. Palaniappan, S.P. and Sivaraman, K. 1996. Cropping Systems in the Tropics. New age International (P) Ltd., New Delhi.
3. Shanmugavelu, K.G.1989. Production Technology of Fruit Crops. Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi.
4. Dhillon, W.S. and Bhatt. 2011. Fruit Tree Physiology. Narendra Publishing House, New Delhi.
5. Mazumdar, B.C. 2004. Principles and Methods of Orchard Establishment. Daya Publishing House, New Delhi.
6. Pradeep Kumar, T., B. Suma, Jyothi Bhaskar and K.N. Satheson. 2008. Management of Horticultural Crops. New India Publishing Agency, New Delhi.

7. Mazumdar. B.C. 2004. Orchard Irrigation and Soil Management Practices. Daya Publishing Agency, New Delhi. Daya Publishing Agency, New Delhi.

Course No.	:	SEC 109
Course Title	:	Packing and Packaging of Horticultural Crops
Credit Hours	:	0+2
Course Category	:	Skill Enhancement Course

Course Learning Rationale / Course Objective (CLR):

The purposed of learning this course is to:

1. Understand basic knowledge of different packaging materials and their properties for horticultural produce.
2. Gain knowledge on different type of damages occurring in horticultural crops.
3. Understand the modern packaging techniques for horticultural produce.

Course Learning Outcomes (CLO):

1. Provide practical knowledge on selecting and using appropriate packaging materials for horticultural crops during transportation and storage.
2. Describe the different type of damages occurring to horticultural crops and their management.
3. Provide ability to use appropriate modern packaging techniques for shelflife improvement of horticultural crops.

Practical

Different packaging and cushioning materials used for horticultural produce. Packaging technology for retail marketing- vacuum, shrink-wrap, cling pack. Concept of active and passive packaging. Important physical parameters of different packaging materials. Determination of gas permeability and water vapour permeability of packaging materials. Designing of retail packaging boxes. Different type of damages occurring in horticultural crops during transportation. Packaging technology for domestic and export of commercial horticultural crops. Controlled and modified atmospheric packaging for shelf-life enhancement. Visit to commercial pack house. Visit to fruits and vegetables market.

Practical Schedule

1. Studies on different packaging and cushioning materials used for fruits.
2. Studies on different packaging and cushioning materials used for vegetables.
3. Studies on different packaging and cushioning materials used for roots and tuber crops.
4. Vacuum packaging technology for fruits and vegetables.

5. Shrink wrapping techniques for fruits and vegetables.
6. Cling packing techniques for fruits and vegetables.
7. Active and passive packaging technologies for fruits and vegetables.
8. Studies on important physical parameters of different packaging materials.
9. Determination of gas permeability of packaging materials.
10. Determination of water vapour permeability of packaging materials.
11. Studies on designing of retail packaging boxes.
12. Different types of damages occurring in fruits during transportation.
13. Different types of damage occurring in vegetables during transportation.
14. Different types of damage occurring in roots and tuber crops during transportation
15. Pre-packaging techniques for fruits.
16. Pre-packaging techniques for vegetables.

17. Mid Semester Examination

18. Pre-packaging techniques for roots and tuber crops.
19. Edible waxing of fruits.
20. Edible waxing of vegetables
21. Edible waxing of root and tuber crops.
22. Bottling of fruits and vegetables.
23. Canning of fruits and vegetables.
24. Minimal processing of fruits and vegetables.
25. Consumer and transport packaging for fruits and vegetables.
26. Controlled atmospheric packaging of fruits for shelf life extension.
27. Controlled atmospheric packaging of vegetables for shelf life extension.
28. Controlled atmospheric packaging of roots and tuber crops for shelf life extension
29. Modified atmospheric packaging of fruits for shelf life extension.
30. Modified atmospheric packaging of vegetables for shelf life extension.
31. Modified atmospheric packaging of root and tuber crops for shelf life extension.
32. Visit to commercial pack house.
33. Visit to fruits and vegetable market.

34. Final Practical Examination

Suggested Readings:

1. Battacharjee, S. K. and De, L. C. 2005. Post Harvest Technology of Flowers and Ornamentals Plants. Ponteer Publisher, Jaipur, India.
2. Saraswathy, S. et. al. 2008. Post harvest Management of Horticultural Crops. Agribios (India).
3. Mitra, S. K. 1997. Post Harvest Physiology and Storage of Tropical and Sub-tropical Fruits. CAB International.
4. Verma, L. R. and Joshi, V. K. 2000. Post Harvest Technology of Fruits and Vegetables. Vol. I & II. Indus Publishing Co., New Delhi.
5. Postharvest Management and Value Addition of Fruits and Vegetables by Kureel M.K. Biotech, 181p.

Course No.	:	SEC 110
Course Title	:	Post-Harvest Management of Produce
Credit Hours	:	0+2
Course Category	:	Skill Enhancement Course

Course Learning Rationale / Course Objective (CLR):

The purposed of learning this course is to:

1. Understand basic knowledge of different pre-harvest and post-harvest factors, maturity and harvesting techniques of fruits and vegetables.
2. Basic knowledge on layout of postharvest experiments and packhouse and different packaging of horticultural crops.
3. Know the importance about cold chain management in produces.
4. Gain knowledge on commercial techniques for processing of fruits and vegetables.

Course Learning Outcomes (CLO):

1. Provide practical knowledge on various methods for determining maturity of fruits and vegetables.
2. Describe about postharvest treatments for shelflife extension of horticultural produce.
3. Hands on experience on various packaging technology of fruits and vegetables.
4. Provide skill on postharvest loss reduction through processing of fruits and vegetables.

Practical

Layout and planning of postharvest experiments, Maturity and harvesting of produce. Judging maturity by different methods. Harvesting tools. Objective measurement of colour, texture and dry matter. Components and equipment used in Postharvest laboratory, Different types of cleaning agents and washing methods for horticultural produce. Layout of packhouse and General Packhouse operation. Sorting, surface sanitizing and drying of fruit. Postharvest treatments for shelflife extension of fruits and vegetables. Packing of fruits in different packaging materials, preparation of different coating materials and their method of applications. Pre-cooling of horticultural produce. Ripening technology for horticultural crops. Significance of sorting and grading in produce: Types of grading system and standards. Cold-chain management. Storage requirements. Commercial technologies for processing of horticultural produce.

Practical Schedule

1. Determining maturity stages of commercially important fruits.
2. Determining maturity stages of commercially important vegetables.
3. Studies on harvesting techniques in horticultural crops.
4. Determining quality (colour, texture and dry matter) of fruits and vegetables by objective methods.

5. Studies on important equipments used in post-harvest technology laboratory.
6. Studies on different types of cleaning agents and washing methods for horticultural produce.
7. Layout of packhouse and general packhouse operation.
8. Studies on importance of sorting, grading, washing, surface sanitizing and drying of fruits and vegetables.
9. Studies on different postharvest treatments for shelf life extension of fruits and vegetables.
10. Studies on different packaging materials and methods for horticultural crops.
11. Edible waxing of fruits and vegetables.
12. Studies on different pre-cooling methods of horticultural produces.
13. Ripening management in fruits.
14. Studies of different grading system and standards for fruits and vegetables.
15. Cold chain management of horticultural crops.
16. Studies on storability of fruits and vegetables

17. Mid Semester Examination

18. Studies on storability of tuber and bulb crops.
19. Studies on packaging and storage of flowers.
20. Studies on vase life extension of cut flowers.
21. Studies on 'on-farm' storage structures for fruits and vegetables.
22. Estimation of PLW during storage of fruits and vegetables
23. Studies on biochemical changes during storage of fruits and vegetables.
24. Preparation and quality evaluation of RTS.
25. Preparation and quality evaluation of squash.
26. Preparation and quality evaluation of jam and jelly.
27. Preparation and quality evaluation of candy and preserve.
28. Preparation and quality evaluation of sauce/ Ketchup and chutney.
29. Dehydration of fruits - Sapota, Mango, Banana, Papaya and Grapes.
30. Dehydration of vegetables - Brinjal, Tomato, Cluster bean, Bitter gourd and Bhendi.
31. Minimal processing of fruits and vegetables.
32. Visit to cold storage / grading and packing unit
33. Visit to fruits and vegetables processing industry.

34. Final Practical Examinations

Suggested Readings:

1. Post-harvest technology of horticultural crops by S.K. Sharma and M.C Nautiyal.
2. Postharvest Management and Value Addition by Aswini Kumar Goel, Rajender Kumar and Satwinder S. Mann. Daya Publishing House.
3. Postharvest Management and Value Addition of Fruits and Vegetables by Kureel M.K. Biotech,181p.
4. Verma, L. R. and Joshi, V. K. 2000. Post Harvest Technology of Fruits and Vegetables. Vol. I & II. Indus Publishing Co., New Delhi.

5. Chadha, K. L. and Kalloo, G.1993. Advances in . Vol. 4 to 10. MPH, New Delhi.y Hulme, A.C. 1970. Food Science & Technology - A Series of Monograph. The Biochemistry of Fruits and their Products. Vol.-1. Academic Press London & New York.
6. Saraswathy, S. et. al. 2008. Post harvest Management of Horticultural Crops. Agribios (India).

Course No.	:	SEC 111
Course Title	:	Seed Production Techniques in Vegetable Crops
Credit Hours	:	0+2
Course Category	:	Skill Enhancement Course

Practical

Vegetable seed industry in India, Floral biology, pollination and breeding behaviour of important vegetable crops, Categories of seeds and their maintenance, Characteristics of quality seed, Agronomical principles and methods of seed production in important vegetable crops, Use of growth regulators and chemicals in vegetable seed production, Methods of hybrid seed production, Seed harvesting, extraction, curing, drying, grading, packaging and storage, Seed sampling and seed testing (genetic purity, seed viability, seedling vigour, germination, physical purity), Visit to seed processing units, seed testing laboratory and seed production farms.

Practical Schedule

1. Scope and importance of Vegetable of seed industry in India.
2. Studying floral biology, pollination and breeding behaviour of solanaceous and malvaceous vegetable crops.
3. Studying floral biology, pollination and breeding behaviour of cucurbitaceous and leguminous vegetable crops.
4. Categories of seeds and their maintenance - Characteristics of quality seed.
5. Agronomic principles of seed production in vegetable crops.
6. Tools employed in hybrid seed production in vegetable crops.
7. Designing of planting ratio and border rows - Physical and genetic contaminants - Isolation distance.
8. Planning of seed production - season and land selection - assessment of seed source and seed selection.
9. Pre-sowing seed invigouration treatments - Dormancy breaking treatments
10. Seed quality enhancement techniques - priming - pelleting - polymer coating.
11. Practicing nursery preparation - Practicing sowing of seeds in the nursery - protray nursery.
12. Main field preparation - layout - formation of beds – transplanting.
13. Use of growth regulators and chemicals in vegetable seed production.

14. Fertilizer and nutrient management.
15. Weed management and Irrigation management.
16. Special cultural practices and practicing hybridization techniques (Emasculation and pollination).

17. Mid Semester Examination

18. Identification and removal of off-types and volunteer plants.
19. Pest and disease management.
20. Identification of physiological disorders and management.
21. Identification of physiological and harvestable maturity indices - harvesting methods.
22. Post-harvest verification.
23. Threshing / extraction of seeds - Practicing wet and dry seed extraction methods - curing.
24. Seed Drying – principles, moisture equilibrium – Types of drying- Seed driers- types.
25. Seed processing - principle - importance - seed cleaning, grading and upgrading – equipments.
26. Seed sampling procedure and submission of samples.
27. Seed testing procedure (genetic and physical purity).
28. Seed testing procedure (seed viability, seedling vigour and germination).
29. Seed treatment and packaging materials - measures for pest and disease control during storage and godown sanitation.
30. Seed storage - principles - factors affecting seed longevity during storage.
31. Visit to seed production farms.
32. Visit to seed processing plant.
33. Visit to seed testing laboratory.

34. Final Practical Examination

Suggested Readings:

1. George, R.A.T.1985. Vegetable Seed Production. Lohman Inc., New York.
2. Hazra P and Som M G. 2009. Vegetable seed production and Hybrid Technology. Kalyani Publishers, Ludhiana.
3. Kulkarni, G. N. 2011. Principles of Seed Technology. Kalyani Publishers, New Delhi.
4. Ram HH, Upadhyay R, Dubey R K and Mandal B C. 2017. Vegetable seed production, Principles and practices. Kalyani Publishers, Ludhiana.
5. Singh, S P. 2001. Seed production of commercial vegetables. Agrotech Publishing, Udaipur.
6. Vanangamudi, K., Natarajan, N., Srimathi, P., Natarajan, K., Saravanan, T., Bhaskaran, M., Bharathi, A., Natesan, P. and Malarkodi, K. 2006. Advances in Seed Science and 1330 Technology. Vol. 2. Quality Seed Production in Vegetables. Agro bios, Jodhpur.

Course No.	:	SEC 112
Course Title	:	Sericulture
Credit Hours	:	0+2
Course Category	:	Skill Enhancement Course

Practical

Morphology and botanical aspects of mulberry plant - mulberry varieties - Mulberry nursery and their management - Main field preparation - Identification of weeds in mulberry and their management - Nutritional deficiency in mulberry - Pruning, harvesting and preservation of mulberry leaves - Pests and diseases of mulberry and their management - Morphology and biology of mulberry silkworm - Voltinism and silkworm breeds - Rearing house and their appliances - Disinfectant - Grainage technology - Methods of Rearing - chawki silkworm and late age silkworm - Pests and diseases of mulberry silkworm and their management - Mounting, harvesting and marketing of cocoon - Post-cocoon technology - Mechanization in sericulture – Morphology, biology and rearing techniques of eri silkworm - tasar silkworm - muga silkworm - Mulberry byproducts, Silkworm byproducts and practicing cocoon craft - Visit to mulberry nursery and main field - Chawki and late age silkworm rearing unit - Grainage centre - Cocoon market and reeling/weaving unit - Quality control and silk mark organisation.

Practical Schedule

1. Morphology and botanical aspects of mulberry plant
2. Special features of mulberry varieties
3. Practicing the propagation of mulberry plants
4. Mulberry nursery and their management
5. Main field preparation for establishment of mulberry garden
6. Identification of weeds in mulberry and their management
7. Identification of Nutritional deficiency in mulberry and their management
8. Pruning, harvesting and preservation of mulberry leaves
9. Pests of mulberry and their management
10. Diseases of mulberry and their management
11. Morphology and biology of mulberry silkworm
12. Voltinism and silkworm breeds
13. Rearing house and their appliances
14. Disinfectant and practicing the disinfection methods in rearing house, larval rearing and grainage
15. Grainage technology
16. Methods of rearing – chawki silkworm
17. Mid Semester Examination
18. Methods of rearing – late age silkworm
19. Pests of mulberry silkworm and their management
20. Diseases of mulberry silkworm and their management

21. Mounting, harvesting and marketing of cocoon
22. Post-cocoon technology
23. Mechanization in sericulture
24. Morphology and biology of eri silkworm
25. Rearing techniques of eri silkworm
26. Morphology, biology and rearing techniques of tasar silkworm
27. Morphology, biology and rearing techniques of muga silkworm
28. Mulberry byproducts, silkworm byproducts and practicing cocoon craft
29. Visit to mulberry nursery and main field
30. Visit to chawki and late age silkworm rearing unit
31. Visit to grainage centre
32. Visit to cocoon market and reeling/weaving unit
33. Visit to quality control and silk mark organisation
34. Final Practical Examination

Suggested Readings:

1. Dandin, S. B., J. Jayaswal and K. Giridhar. 2003. Hand book of Sericulture Technologies. Central Silk Board, Bangalore.
2. FAO. 1987. Manual on Sericulture, FAO Agricultural Services Bulletin, Rome.
3. Ganga, G. and J. Sulochana Chetty. 2022. An Introduction to Sericulture. Oxford and IBH publication, New Delhi.
4. Narasimhanna, M. N. 1988. Manual on Silkworm Egg Production. Central Silk Board, Bangalore.
5. Singh, T. and B. Saratchandra. 2004. Principles and techniques of silkworm seed production. Discovery publishing house, New Delhi.

Course No	:	SEC 113
Course Title	:	Turf and Turf Management
Credit Hours	:	0+2
Course Category	:	Skill Enhancement Course

Course Learning Rationale / Course Objective (CLR):

The purpose of learning this course is to:

1. To impart hands on training on practical aspects of turf management practices.
2. To impart entrepreneurial skills in turf establishment.
3. To provide knowledge on the classification, characteristics and ecological requirements of major turf grass species used in different climatic regions.

4. To acquaint with the principles and practices of turf grass establishment, including site preparation, seeding, sodding and sprigging techniques.

Course Learning Outcomes (CLO):

The students will be able to

1. Prepare a turf establishment project and to execute the same.
2. Manage turf in commercial units.
3. Understand the taxonomy, growth habits, and ecological requirements of various turf grass species suited to different landscapes and climates.
4. Demonstrate the ability to plan and implement turf grass establishment methods including site preparation, selection of species, and planting techniques.
5. Apply scientific principles and techniques for turf maintenance such as mowing, irrigation scheduling, fertilization, aeration, and pest management.

Practical

Site analysis for turf establishment. Field preparation and layout for turf making. Identification and classification of turf grasses. Turf establishment methods. Sod production. Turf irrigation management. Nutrient management in turf grasses. Special practices in turf management. Rejuvenation of old and withered turf. Equipment for turf management. Selection and maintenance of grasses for Golf course and Cricket ground. Turfing for roof top gardens. Applications and use of Turf growth regulators (TGRs). Identification of seasonal turf grass weeds. Integrated approaches for turf weed management. Identification and management of Turf grass diseases, insect-pests, abiotic stress disorders and nutrient deficiencies.

Practical Schedule

1. Site selection for turf establishment
2. Site analysis for turf establishment
3. Field preparation
4. Lay out for turf making
5. Classification of turf grass
6. Identification of turf grass
7. Turf establishment methods – I
8. Turf establishment methods – I
9. Sod production
10. Equipment for turfing and Propagation of turf grasses.
11. Irrigation methods
12. Irrigation management
13. Layout of drainage systems.
14. Nutrient management in turf grasses
15. Special practices in turf management – I
16. Special practices in turf management – II

17. Mid Semester Examination

18. Rejuvenation of old and withered turf
19. Equipment for turf management
20. Selection and maintenance of grasses for Golf course
21. Selection and maintenance of grasses for cricket ground
22. Turfing for roof top gardens
23. Applications and use of Turf growth regulators (TGRs)
24. Identification of seasonal turf grass weeds
25. Renovation of lawns
26. Integrated approaches for turf weed management – I
27. Integrated approaches for turf weed management – II
28. Identification and management of Turf grass diseases
29. Identification and management of insect-pests
30. Abiotic stress disorders
31. Nutrient deficiencies and remedial measures
32. Astrourfing practices
33. Visit to Botanical Garden, model cricket ground, Govt. organizations
34. Final Practical Examination



