Course Curriculum of First Semester
as per the ICAR-Sixth Deans' Committee Report for
the Academic Programmes in
AGRICULTURE

- UG-Certificate in Agriculture
- UG-Diploma in Agriculture
- UG-Degree: B.Sc. (Hons.) Agriculture

Mahatma Phule Krishi Vidyapeeth, Rahuri

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with

UG Degree Syllabus Discipline Coordinators &

DICC - UG Degree Syllabus Core Committee

Submitted to the

Directors of Instruction and Deans (F/A) Coordination Committee

~ w.e.f. AY, 2024-25 ~

Course Layout

B.Sc. (Hons.) Agriculture

Semester: I (New) ***w.e.f.*** **Academic Year: 2024-25**

Sr. No.	Course No.	Course Title	Credit Hrs.	Remark
1.	**CAC-111**	*Deeksharambh* (Induction-cum-Foundation Course)	2(0+2)	NG (2 Weeks)
2.	**AEC-111**	National Service Scheme (NSS-I) / National Cadet Corps (NCC-I)	1(0+1)	
3.	**AEC-112**	Communication Skills	2(1+1)	
4.	**MDC-111**	Farming-based Livelihood Systems	3(2+1)	
5.	**MATH-111*/ BIO-111****	Introductory Mathematics*/ Basic Biology**	1(1+0)	NG & Need-based
6.	**EXTN-111**	Rural Sociology and Educational Psychology	2(2+0)	
7.	**AGRO-111**	Fundamentals of Agronomy	3(2+1)	
8.	**SOIL-111**	Fundamentals of Soil Science	3(2+1)	
9.	**HORT-111**	Fundamentals of Horticulture	3(2+1)	
10.	**SEC-111**	Skill Enhancement Course-I *(#To be offered from the bouquet of SEC Courses)*	2(0+2)	
11.	**SEC-112**	Skill Enhancement Course-II *(#To be offered from the bouquet of SEC Courses)*	2(0+2)	
		Total Credits Hrs.	**21(11+10) G 3(1+2) NG**	

CAC: Common Academic Course, **AEC**: Ability Enhancement Course,
MDC: Multidisciplinary Course, **SEC**: Skill Enhancement Course,
G: Gradial, **NG**: Non-Gradial

Note: *MATH-111 for **PCB** student/ **BIO-111 for **PCM** student/ **PCMB** student is NOT required to take any of these Need-based/Deficiency Courses.

[#] **List/ Bouquet of Skill Enhancement Courses (SECs)**:

Sr. No.	Course No.	Course Title	Credit Hrs.
1.	SEC-xxx	Biofertilizer and Biopesticide Production	2(0+2)
2.	SEC-xxx	Mushroom Production Technology	2(0+2)
3.	SEC-xxx	Seed Production Technology	2(0+2)
4.	SEC-xxx	Post-harvest Processing Technology	2(0+2)
5.	SEC-xxx	Beneficial Insect Farming	2(0+2)
6.	SEC-xxx	Horticulture Nursery Management	2(0+2)
7.	SEC-xxx	Plantation Crops Production and Management	2(0+2)

Note: Skill Enhancement Courses can be added/offered as per the facilities and resources available at the respective universities/colleges based on the relevance to the region and the UG degree subject.

The detailed course-wise syllabus of above SEC courses can be primarily developed and followed at College/ University level in the academic year, 2024-25; However, the same will be obtained from the respective UG Degree Coordinator/ Discipline Coordinators and can be followed w.e.f. AY, 2025-26.

[Above list is an indicative list/bouquet of SEC courses and subject to modification as applicable therein]

Course-wise Syllabus with Teaching Schedules

Semester	**:**	**I**	
Course No.	**:**	**AEC-111**	**Credit Hrs. : 1 (0+1)**
Course Title	**:**	**National Service Scheme (NSS-I) / National Cadet Corps (NCC-I)**	
Gradial Common Course across all UG Degrees			

Course No.: AEC-111	**Course Title: National Service Scheme-I (NSS-I)**	**Credit Hrs: 1(0+1)**

SYLLABUS

PRACTICAL

Introduction and Basic Components of NSS

- Orientation: History, Objectives, Principles, Symbol, Badge; Regular Programs under NSS.
- Organizational structure of NSS, Code of conduct for NSS volunteers, Points to be considered by NSS Volunteers' awareness about Health.
- 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.
- 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.
- 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.
- 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.

TEACHING SCHEDULE

PRACTICAL

Exercise No.	Exercise Topic	Weightage (%)
1	Orientation, History, Objectives, Principles, Symbols, Badge	10
2	Regular Programmes under NSS	10
3	Organisational Structure of NSS	10
4	Code of Conduct of NSS Volunteer	10
5	Points to be considered about NSS Volunteers awareness about Health	5
6	NSS Programme Activities- Concept of Regular activities	5
7	NSS Programme Activities- Special Campaign	5
8	NSS Programme Activities- Day Camps	5
9	NSS Programme Activities- Adoption of village, Conducting survey, Analysing Guiding financial patterns of scheme	5
10	NSS Programme Activities- Youth programs/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
11	Community Mobilization- Mapping of community stakeholders, Designing the message as per problems and their culture; Identifying methods of mobilization involving youth-adult partnership.	5
12	Community Mobilization- Culture, Social harmony and National integration.	5
13	Indian History and Culture- Role of youth in Nation Building	5
14	Volunteerism and Shramdaan: Indian tradition of volunteerism, its need, importance, motivation and constraints; Shaman as part of volunteerism.	5
15	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.	5
16	Family and Society: Concept of family, Community (PRIs and other community-based organizations) and Society.	5
	Total =	**100**

Course No.: AEC-111	Course Title: National Cadet Corps-I (NCC-I)	Credit Hrs.: 1(0+1)

SYLLABUS

Objective: To integrate and develop qualities of leadership, discipline, character and patriotism and foster the NCC Motto: **"Unity and Discipline"** among the youth.

PRACTICAL

- 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, Honours 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 defence 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.

TEACHING SCHEDULE

PRACTICAL [AEC-111]

Exercise No.	Exercise Topic	Exercise Sub-topics	Weightage (%)
1-2	Introduction to NCC	Aims, Objectives, NCC Organizational structure, NCC Song, DG's Cardinals of Discipline.	4
3-5	Drill Basics	Aim of drill, General words of command, Positions of attention, Stand-at-ease and Stand-easy, Turning.	8
6-8	Formation Drills	Sizing, Numbering, Forming in three ranks, Open and Close order march and Dressing.	8
9-11	Saluting Drills and Parade Movements	Saluting at halt, Getting on parade, Dismissing and Falling-out.	8
12-14	Marching Techniques	Length of pace and time of marching in Quick/slow march, Side pace, Forward/rear pace, Turning on the march, Wheeling and Saluting on the march	10
15-17	Squad Formation and Control	Marking time, Forward march, Halt, Changing step, Formation of squad and Squad drill.	10
18-19	Command and Control in NCC	Organization, Badges of rank, Honours and Awards.	4
20-22	Nation Building and Citizenship; Leadership	Cultural heritage, Religions, Traditions, Customs of India, National integration, Values and Ethics, Communication, Leadership traits, Discipline and Motivation, Character/ Personality Development.	12
23-24	Civil Defence and Emergency Management	Types of emergencies, Fire fighting techniques, Maintenance of essential services, Disaster management and Aid during development projects, Civil Defence Organizations.	10
25-26	Social Service and Youth Welfare	Weaker sections of society, Role of NGOs, Youth participation in Social welfare and Family planning	8
27-29	Health, Hygiene and First Aid	Human body structure, Diet, Hygiene, Preventable diseases (including AIDS), Safe blood donation, First aid practices, Mental and Physical health.	10
30-32	Environment and Ecology	Basic Principles of Ecology, Environmental conservation, Pollution and its control, Adventure activities.	8
		Total =	**100**

Semester	**:**	**I**			
Course No.	**:**	**AEC-112**	**Credit Hrs.**	**:**	**2(1+1)**
Course Title	**:**	**Communication Skills**			
Gradial Common Course across all UG Degrees					

SYLLABUS

Objectives: (i) To acquire competence in oral, written and non-verbal communication,

(ii) To develop strong personal and professional communication and

(iii) To demonstrate positive group communication.

THEORY

Communication Process: The magic of effective communication; Building self-esteem and overcoming fears; Concept, nature and significance of communication process; Meaning, types and models of communication; Verbal and Non-verbal communication; Linguistic and non-linguistic barriers to communication and reasons behind communication gap/ miscommunication. 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; 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.

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.

TEACHING SCHEDULE

THEORY [AEC-112]

Lecture No.	Topic	Sub-topics/ Key Points	Weightage (%)
1	Communication Process: The Magic of Effective Communication	Elements of Communication process such as Communicator, Message, Channel treatment of message, Audience and Audience response.	5
2	Building Self-esteem and Overcoming Fears	Points to build Self-esteem, Build social connections, Encourage yourself, Focus on solutions and Set realistic goals, Strategies to overcome fears, Practice, Visualise Success, Preparation, Know your audience, Seek feedback and Active listening.	5
3	Communication	Concept, Nature and Significance of Communication process	10
4		Meaning, Types and Models of communication	10
5		Verbal and Non-verbal communication, Linguistic and Non-linguistic communication	10
6		Barriers to communication and Reasons behind communication gap/ miscommunication	5
7	Basic Communication Skills	Listening, Speaking, Reading, Writing skills	5
8		Precis writing/ Abstracting/ summarizing- Styles of technical communication, Curriculum Vitae/resume writing	10
9		Innovative methods to enhance vocabulary, analogy questions	5
10	Structural and Functional Grammar	Sentence structure, modifiers, connecting words and verbal; Phrases and Clauses	5
11		Case: Subjective case, Possessive case, Objective case	5
12		Correct usage of nouns, Pronouns and Antecedents	5
13		Adjectives, Adverbs and Articles	5
14		Agreement of verbs with the subject: Tense, Mood, Voice	5
15		Writing effective sentences	5
16		Basic sentence faults	5
		Total =	**100**

TEACHING SCHEDULE

PRACTICAL

Exercise No.	Exercise Topic
1	Listening and Note taking
2	Writing skills- Precís writing
3	Writing skills- Abstracting
4	Writing skills- Summarizing
5	Reading and Comprehension (written and oral) of general and technical articles
6	Micro-presentations
7	Impromptu presentations
8	Feedback on presentations
9	Stage manners- Grooming
10	Stage manners- Body language
11	Stage manners- Voice modulations, speed
12	Group discussions
13	Public speaking exercise
14	Vocabulary building exercises
15	Interview techniques
16	Organisation of events

Suggested Readings:

1. Allport, G W, 1937. Personality: A Psychological Interpretation. Holt, New York.
2. Brown Michele & Gyles Brandreth, 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 Pushpa Lata, 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. Ray G L, 2008. Extension, Communication and Management. Kalyani Publishers, Ludhiana
10. Ray G. Land Mondal Sagar 2012. Textbook on Rural Development Entrepreneurship and Communication Skills. Kalyani Publishers, Ludhiana.
11. Seely J, 2013, Oxford Guide to Effective Writing and Speaking. Oxford University Press.
12. Thomson A J and Martinet A V, 1977, A Practical English Grammar. Oxford University.

Semester	**:**	**I**		
Course No.	**:**	**MDC-111**	**Credit Hrs.**	**: 3(2+1)**
Course Title	**:**	**Farming-based Livelihood Systems**		
Gradial Common Course across all UG Degrees				

SYLLABUS

Objectives: (i) To make the students aware about farming-based livelihood systems in Agriculture,

(ii) To disseminate the knowledge and skills that how farming-based systems can be a source of livelihood.

THEORY

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, approach, approaches and framework, 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: Crops and cropping systems, Livestock, (Dairy, Piggery, Goatry, Poultry, Duckry etc.), Horticultural crops, Agroforestry systems, Aquaculture, 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, 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, Schemes and programs by Central and State Governments; 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.

PRACTICAL

Survey of farming systems and agriculture-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.

TEACHING SCHEDULE

THEORY [MDC-111]

Lecture No.	Topic	Sub-topics/ Key Points	Weightage (%)
1	Status of Agriculture in India	Historical background, Current status, Role of Agriculture in Indian Economy	4
2	Status of Agriculture in Different States	State-wise scenario, Major crops, Regional diversity	4
3	Income of Farmers and Rural People in India	Factors affecting income, Rural-urban income gap, Government initiatives	4
4	Livelihood: Definition, Concept, and livelihood Patterns in urban and rural areas	Livelihood- Definition and its Concept, Urban vs Rural livelihood patterns, Sources of income	4
5	Different Indicators to Study Livelihood Systems	Economic, Social and Environmental indicators, Measuring livelihood resilience	4
6	Agricultural Livelihood Systems (ALS): Meaning and Approaches	Definition, Significance of ALS, Integrated farming systems, Approaches	4
7	ALS Framework and Case studies	Framework for ALS, Case studies in India	4
8	Definition of Farming Systems and farming based Livelihood Systems	Definition and Role of farming systems in rural livelihoods, Examples of systems	4
9	Prevalent Farming Systems in India contributing to livelihood	Traditional vs. Modern farming systems, Regional differences	4
10	Types of Traditional and Modern Farming Systems	Types; Differences; Strengths, Limitations, Case studies	4
11	Components of farming system/farming-based livelihood systems - Crops and Cropping Systems	Components, Crop diversification, Cropping pattern, Mixed cropping, Importance for rural livelihoods	4
12	Livestock-based Farming Systems	Importance and Management of dairy, piggery, poultry, goatry, duckry, etc.	4
13	Horticultural Crops and Livelihoods	Role of fruits, vegetables and spices in rural income generation	4
14	Agroforestry Systems	Agroforestry- Definition, Combining trees and crops, Agroforestry models in India	2
15	Aquaculture as a Livelihood System	Importance of Aquaculture, Integrated systems (e.g. Duck/Poultry-cum-Fish, Dairy-cum-Fish, Piggery-cum-Fish etc.)	4
16	Challenges in Aquaculture-based Systems	Feasibility, Government support and Market access	2

Continued….

17	Small Enterprises in Farming	Role of small enterprises, Value addition, Local processing	2
18	Medium and Large Enterprises in Farming	Value chains, Secondary enterprises as livelihood components for farmers, Agri-processing.	2
19	Factors affecting Integration of various enterprises of farming for livelihood	Technology, Market access, Credit and infrastructure challenges etc.	4
20	Strategies for Enterprise Integration	Successful integration, Government policies, Examples.	2
21	Overview of Agro-Climatic Zones in India	Characteristics of different zones and their agricultural potential.	2
22	Feasibility of different Farming Systems for different Agro-Climatic Zones	Suitable farming systems for different zones, Climate adaptation.	2
23	Commercial Farming Based Livelihood Models by NABARD, ICAR and other organizations across the country	Role of NABARD, ICAR and other Organizations in promoting commercial models, Successful cases.	4
24	Case studies on different Livelihood Enterprises associated with farming	Analysis of successful enterprises, Dairy Cooperatives etc.	4
25	Risk Factors in Farming-based Livelihood Systems	Climate, Market fluctuations, Input costs; Mitigation strategies etc.	4
26	Success Factors in Farming-based Livelihood Systems	Innovation, Market access, Government support, Social capital etc.	2
27	Schemes and Programmes by the Central Government	Overview of schemes like, PM-KISAN, National Rural Livelihood Mission.	2
28	Schemes and programmes by State Governments	State-specific programs promoting rural livelihoods, Case examples.	2
29	Role of Private Sector in Livelihood Promotion	Public-Private Partnerships, Role of private agribusiness.	2
30	Public-Private Partnerships in Agriculture	Successful collaborations in rural development and farming systems	2
31	Farming-based Livelihoods in the 21st Century	Circular economy, Green economy, Climate change, Sustainability.	2
32	Impact of Digitalization and Changing Lifestyles	Technology in Agriculture, Future prospects for rural livelihoods.	2
		Total =	**100**

TEACHING SCHEDULE

PRACTICAL [MDC-111]

Exercise No.	Exercise Topic	Exercise Sub-topics
1	Survey of Farming Systems and Agriculture-based Livelihood Enterprises	Methods of data collection; Field survey techniques; Preparing reports on surveyed farms.
2	Study of Components of Farming-based Livelihood Models in Different Agro-Climatic Zones	Components: Crop, livestock, fishery, agroforestry; Identifying models suited to specific zones.
3	Study of Production and Profitability of Crop-based Models	Analysis of input-output relations; Identifying profitable crops
4	Study of Livestock-based Models	Livestock systems: Dairy, poultry, goat farming; Profitability and market access
5	Study of Processing-based Models	Value addition in agriculture; Studying small-scale food processing units
6	Study of Integrated Farming-based Models	Study of crop-livestock-aquaculture integration; Synergies and challenges
7	Field Visit to Innovative Farming System Models	Visit to farms using modern technologies; Documenting practices
8	Visit to Agri-based Enterprises	Enterprises involved in input supply or value addition
9	Study of Functional Aspects: Integration of Production, Processing and Distribution	Backward and forward linkages; Assessing supply chain models
10	Agri-Enterprises in Industry and Service Sectors (Value Chain Models)	Studying value chain enterprises; Evaluating sustainability models
11	Concept of Project Formulation on Farming-based Livelihood Systems	Identifying project objectives; Structuring budgets and timelines
12	Cost and Profit Analysis of Farming-based Livelihood Projects	Developing Cost-Benefit analysis; Identifying Break-Even points
13	Case Study of Start-ups in Agri-sectors	Analysing real-world Start-ups; Identifying success factors
14	Group Project: Develop a Farming-based Livelihood Model	Formulating a working model; Feasibility and sustainability analysis
15	Preparation of Report on Farming Systems Survey and Livelihood Models	Compiling field data; Preparing reports with recommendations
16	Presentation and Evaluation of Practical Project Reports	Group presentations; Internal assessment of reports and participation

Suggested Readings (MDC-111):

1. **Ashley, C., & Carney, D. (1999)**. *Sustainable Livelihoods: Lessons from Early Experience.* Department for International Development, London, UK.
    - **Relevance**: This book explores sustainable livelihood frameworks, which are key to understanding livelihood patterns and rural income systems.
2. **Agarwal, A., & Narain, S. (1989)**. *Towards Green Villages: A Strategy for Environmentally Sound and Participatory Rural Development.* Centre for Science and Environment, New Delhi, India.
    - **Relevance**: Provides strategies for participatory rural development, focusing on environmental sustainability—a core concept in farming systems.
3. **Carloni, A. (2001)**. *Global Farming Systems Study: Challenges and Priorities to 2030 – Regional Analysis: Sub-Saharan Africa.* FAO, Rome, Italy.
    - **Relevance**: Offers insights into global farming system challenges, with lessons that can be adapted for Indian contexts in agricultural development.
4. **Dixon, J., Gulliver, A., & Gibbon, D. (2001)**. *Farming Systems and Poverty: Improving Farmers' Livelihoods in a Changing World.* FAO & World Bank, Rome & Washington, DC.
    - **Relevance**: Focuses on farming systems' role in poverty alleviation and rural livelihood improvement.
5. **Evenson, R.E. (2000)**. *Agricultural Productivity and Production in Developing Countries.* In *FAO, The State of Food and Agriculture.* FAO, Rome, Italy.
    - **Relevance**: Discusses agricultural productivity, a critical factor in sustainable farming and improved livelihoods.
6. **Bhatt, B.P., *et al.* (ICAR Research Complex for Eastern Region)**. *Livelihood Improvement of Underprivileged Farming Community: Experiences from Bihar.* Patna, Bihar.
    - **Relevance**: Case studies on improving livelihoods in rural India, relevant to learning about region-specific agricultural interventions.
7. **Panwar *et al.* (2020)**. *Integrated Farming System Models for Agricultural Diversification, Enhanced Income, and Employment.* Indian Council of Agricultural Research, New Delhi.
    - **Relevance**: Provides models for agricultural diversification and income enhancement, which align with farming system topics.
8. **Reddy, S.R. (2016)**. *Farming System and Sustainable Agriculture.* Kalyani Publishers, New Delhi.
    - **Relevance**: Covers sustainable agriculture principles and farming system models, essential for sustainable livelihood systems.
9. **Singh, J.P. *et al.* (2015)**. *Region Specific Integrated Farming System Models.* ICAR-Indian Institute of Farming Systems Research, Modipuram.
    - **Relevance**: Discusses integrated farming models tailored to different agro-climatic regions of India, essential for practical learning.
10. **Walia, S.S., & Walia, U.S. (2020)**. *Farming System and Sustainable Agriculture.* Scientific Publishers, Jodhpur, Rajasthan.
    - **Relevance:** Provides insights into sustainable agricultural practices and integrated farming systems with regional focus.

Semester	**:**	**I**	
Course No.	**:**	**EXTN-111**	**Credit Hrs : 2(2+0)**
Course Title	**:**	**Rural Sociology and Educational Psychology**	

SYLLABUS

Objective: To provide knowledge on concept and importance of Sociology and Rural Sociology as well as the relationship with Extension Education.

THEORY

Extension Education and Agricultural Extension: Meaning, Definition, Scope and Importance. 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. 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. 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. 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. Leadership: Meaning, Definition, Classification, Roles of leader, Different methods of selection of Professional and Lay leaders. Training of Leaders: Meaning, Definition, Methods of training, Advantages and limitations in use of Local leaders in Agricultural Extension, Psychology and Educational Psychology: Meaning, Definition, Scope and Importance of Educational Psychology in Agricultural Extension. 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. Teaching - Learning Process: Meaning and Definition of Teaching, Learning, learning experience and Learning situation, Elements of learning situation and its characteristics. Principles of learning and their implication of teaching.

TEACHING SCHEDULE

THEORY [EXTN-111]

Lecture No.	Topic	Sub-topics/ Key Points	Weightage (%)
1-2	Extension Education and Agricultural Extension	Meaning, Definition, Scope and Importance	5
3-4	Sociology and Rural Sociology	Meaning, Definition, Scope, Importance of Rural Sociology in Agricultural Extension and Interrelationship between Rural Sociology and Agricultural Extension.	10
5-6	Indian Rural Society	Important characteristics, Differences and relationship between Rural and Urban societies.	5
7-8	Social Groups	Meaning, Definition, Classification, Factors considered in formation and organization of groups and Role of social groups in Agricultural Extension.	10
9-10	Social Stratification	Meaning, Definition, Functions, Basis for stratification, forms of social stratification, characteristics and differences between Class and Caste system	5
11-12	Cultural Concepts	Culture, Customs, Folkways, Mores, Taboos, Rituals. Traditions - Meaning, Definition and their role in Agricultural Extension.	5
13	Social Values and Attitudes	Meaning, Definition, Types and Role of social values and attitudes in Agricultural Extension.	5
14-15	Social Institutions	Meaning, Definition, Major institutions in rural society: Marriage, family and religion, functions and their role in Agricultural Extension.	5
16-17	Social Organization	Meaning, Definition and Types of organization, Role of social organization in Agricultural Extension	5
18	Social Control	Meaning, Definition, Need of social control and Means of social control.	5
19-20	Social Change	Meaning, Definition, Nature of social change, Dimensions of social change and Factors of social change.	5
21-22	Leadership	Meaning, Definition, Classification, Roles of leaders, Different methods of selection of Professional and Lay leader types and their role in Agricultural Extension	5
23-24	Training of Leaders	Meaning, Definition, Methods of training, Advantages and Limitations in use of Local Leaders of Agricultural Extension.	5

Continued…

25-26	Psychology and Educational Psychology	Meaning, Definition, Scope and Importance of Educational Psychology in Agricultural Extension.	5
27-28	Intelligence	Meaning, Definition, Types, Factors affecting intelligence and Importance of intelligence in Agricultural Extension	5
29-30	Personality	Meaning, Definition, Types, Factors influencing personality and Role of personality in Agricultural Extension.	5
31-32	Teaching-Learning Process	Meaning and Definition of teaching, Learning, Learning experience and Learning situation, Elements of learning situation and its characteristics, Principles of learning and their implication for teaching.	10
		Total=	**100**

Suggested Readings [EXTN-111]:

1. Ray, G.L. (2003). Extension Communication and Management. Kalyani Publishers. Fifth Revised and Enlarged Edition.
2. Dahama, O.P. and Bhatnagar, O.P. (2003). Education and Communication for Development. Oxford and IBH Publishing Co. Pvt. Ltd.
3. Sandhu, A.S. (1993). Textbook on Agricultural Communication: Process and Methods. Oxford and IBH Publishing Co. Pvt. Ltd.
4. Chitambar, J.B. (2008). Introductory Rural Sociology. New Age International (P) Limited.
5. Sachdeva, D.R. and Bhushan, V. (2007). An Introduction to Sociology. Kitab Mahal Agency.
6. Chitambar, J.B. (1973). Introductory Rural Sociology. New York, John Wilex and Sons.
7. Desai, A.R. (1978). Rural Sociology in India. Bombay, Popular Prakashan, 5th Rev. Edn.
8. Doshi, S.L. (2007). Rural Sociology. Delhi Rawat Publishers.
9. Jayapalan, N. (2002). Rural Sociology. New Delhi, Altanic Publishers.
10. Sharma, K.L. (1997). Rural Society in India. Delhi, Rawat Publishers.
11. Velusamy R. Textbook on Rural Sociology and Educational Psychology.
12. Ghorpade M.B. - Essential of Psychology.

Semester	**:**	**I**		
Course No.	**:**	**AGRO-111**	**Credit Hrs.**	**: 3(2+1)**
Course Title	**:**	**Fundamentals of Agronomy**		

SYLLABUS

Objective: To impart the basic and fundamental knowledge of Agronomy.

THEORY

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: Classification, Importance, Ecology and ecosystem. Seeds and sowing: Definitions of Crop, 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, sowing behind country plough and transplanting etc.). Tillage and tilth: Definition, Objectives, types, advantages and disadvantages of tillage including Conservation tillage, Modern Concept of Tillage. Crop density and Geometry: Plant geometry and Planting geometry, its effect on growth and yield. Crop nutrition: Definition of essential nutrients, Criteria of essentiality, Functional elements, Classification of essential nutrients, Role of macro and micro nutrients. Nutrient absorption, Active and Passive absorption of nutrients, forms of plant nutrients absorbed by plants, Combined/ Un-combined forms. Manures and fertilizers, Nutrient use efficiency: Sources of nutrients: Inorganic (fertilizers), organic (manures) and biofertilizers; their classification and characteristics, method of preparation and role of organic manures in crop production. Integrated Nutrient Management (INM): Meaning, different approaches and advantages of INM. Green manures- role in crop production: Definition, objectives, types of green manuring, desirable characteristics, advantages and limitations of green manuring. Water management: Water resources of the World, India and the State; Soil Moisture Constants: gravitational water, capillary water, hygroscopic water. Weeds: Definition, importance and basis of classification of weeds and their control. Agro-climatic 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. Growth and development of crops: Definition, meaning and factors affecting growth and development.

PRACTICAL

A visit to Instructional Crop Farm and study of field crops, 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.

TEACHING SCHEDULE

THEORY [AGRO-111]

Lecture No.	Topic	Sub-topics/ Key Points	Weightage (%)
1-2	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. Role of Agronomist.	6
3	Field crops	Classification and importance of field crops, Ecology and ecosystem.	6
4	Growth and Development of crops	Definition, Meaning, Factors affecting growth and development, Growth curve.	4
5-7	Seeds and Sowing:	Definitions- Crops, Variety and Seed. Factors affecting crop stand and its establishment; good quality seed, proper tillage, sowing time, seed rate, sowing depth, seed treatment; Methods of sowing/planting: (broadcasting, drilling, dibbling and transplanting, sowing behind plough etc.), Advantages, Disadvantages, Crops to be sown.	10
8	Tillage and Tilth	Definition, Objectives, Types, Advantages and Disadvantages of tillage, including Conservation tillage.	4
9-10	Modern Concept of Tillage	Modern Concept of Tillage: Types, Definition, Concept, Advantages and Disadvantages.	8
11	Crop Density and Geometry	Definitions- Crop density, Crop geometry and Plant geometry. Effects of planting geometry on growth and yield.	5
12-13	Crop Nutrition	Definition of Essential nutrients; Criteria of essentiality, Functional elements, Classification of essential nutrients; Role of macro- and micro- nutrients in plant growth and development.	8
14	Nutrient Absorption	Active and Passive absorption of nutrients, Forms of major plant nutrients (NPK) absorbed by plants; Combined/ Un-combined forms.	

Continued….

15-17	Manures and Fertilizers	Classification of manures and fertilizers including biofertilizers with examples; Methods of preparation (FYM and Compost) and Role of organic manures in crop production.	8
18	INM and NUE	Definition, Meaning, Different approaches and Advantages of Integrated Nutrient Management (INM); Concept of Nutrient Use Efficiency (NUE)	6
19	Role of Green Manures in Crop Production	Definition, Objectives and Types of Green manuring; Desirable characteristics, Advantages and Limitations of Green manuring.	6
20	Water Management	Water resources of the World, India and State (Maharashtra)	10
21-24	Soil Moisture Constants and Methods of Irrigation	Soil Moisture Constants- Field capacity, Saturation point and PWP; Soil water: Gravitational water, Capillary water, Hygroscopic water; Methods of irrigation, Scheduling of irrigation, Different approaches of scheduling irrigation	
25-26	Weed Management	Definition, Importance and classification of weeds on season and life cycle basis; Weed control methods- preventive, curative (cultural, physical, mechanical, biological and chemical)	8
27	Allelopathy	Meaning, its effect on crops and weed; Importance in crop production	
28-29	Major Cropping Patterns and Systems in India.	Cropping system: Definition, Classification with examples. Factors affecting cropping systems, Major cropping patterns and Systems in the country.	5
30-32	Sustainable Crop Production	Definition, Components, Importance and Limitations; Practices, Natural resources and Conservation, Pollution and pollutants.	6
		Total =	**100**

TEACHING SCHEDULE

PRACTICAL [AGRO-111]

Exercise No.	Exercise	Practical Sub-topics/ Titles
1	Instructional Crop Farm Visit	Visit to Instructional Crop Farm and Study on field crops.
2	Identification of crops, seeds, fertilizers and pesticides	Identification of crops, seeds, fertilizers and pesticides; Preparation of Seed Album.
3	Crops and cropping systems in different Agro-climatic state zones	Study of crops and cropping systems in Agro-climatic zones of Maharashtra.
4	Study of some preparatory tillage implements	Study of implements required for primary tillage and secondary tillage operations.
5	Study of inter-tillage implements	Study of implements required for inter tillage or after cultivation operations.
6	Practice of ploughing/ puddling	Study of ploughing/ puddling in rice.
7-8	Study and practice of inter-cultivation in field crops	Study and Practices of inter-cultivation in field crops with tools and implements.
9-10	Numerical exercises on calculation of seed, plant population and fertilizer requirement	Numerical problems on seed rate and plant population. Calculation of fertilizer doses.
11	Study of yield contributing characters and yield estimation of crops	Study of yield contributing characters and yield estimation of major crops of region.
12	Identification of weeds in different crops	Identification and preparation of Weed Herbarium of 20 major weeds in different crops [*Parthenium, Lavala, Hariayali, Ekdandi, Kena, Math, Dudhani* (small, medium and large), *Ghaneri, Kunjru, Reshimkata* etc.].
13	Seed germination and viability test of seed	Study of seed germination test of major crops; Methods of viability test of seed of major crops.
14	Practice on time and method of application of manures and fertilizers.	Organic Manure application; Basal application, top dressing and foliar application of fertilizers.
15	Determination of soil moisture	Determination of soil moisture using gravimetric method
16	Determination of field capacity	Determination of field capacity by field method

Suggested readings:

1. William L Donn. 1965. Meteorology. McGraw-Hill Book Co. New York.
2. Yawalkar K S and Agarwal J P. 1977. Manures and Fertilizers. Agricultural Horticultural Publishing House, Nagpur.
3. Rao V S. 1992. Principles of Weed Science. Oxford and IBH Publishing Co. Ltd., New Delhi.
4. Reddy Yellamanda T and Shankar Reddy G H. 1995. Principles of Agronomy. Kalyani Publishers, Ludhiana.
5. Reddy S R. 2008. Principles of Crop Production, Kalyani Publisher, Ludhiana.

Semester	**:**	**I**	
Course No.	**:**	**SOIL-111**	**Credits : 3(2+1)**
Course Title	**:**	**Fundamentals of Soil Science**	

SYLLABUS

Objective: To impart knowledge on soil genesis, basic soil properties with respect to plant growth.

THEORY

Soil: Pedological and Edaphological Concepts; Rocks and minerals, Weathering; Silicate clays: constitution and properties; Sources of charge, ion exchange, cation and anion exchange capacity and base saturation (after buffering capacity); Soil formation, Soil organic matter, Pedogenic processes; Soil colloids: inorganic and organic, Properties of soil colloids and Ion exchange in soils; Soil profile, Soil texture, Soil structure; Bulk density and Particle density; Soil consistency; Soil temperature, Soil air, Soil water; Soil reaction and Buffering capacity; Soil taxonomy; Keys to soil orders; Soils of India.

PRACTICAL

Study of general properties of minerals; Study of minerals-silicate and non-silicate minerals; Study of rocks-igneous, sedimentary and metamorphic rocks; Study of a soil profile, Collection and processing of soil for analysis; Study of soil texture-feel method, mechanical analysis, determination particle density and soil porosity, Determination of soil colour; Study of soil structure and aggregate analysis; Determination of soil moisture; Determination of soil moisture constants field capacity; water holding capacity; Study of infiltration rate of soil; Determination of pH and Electrical conductivity of soil.

TEACHING SCHEDULE

THEORY [SOIL-111]

Lecture No.	Topic	Sub-topics/ Key points	Weightage (%)
1 & 2	History and development of Soil Science, its scope and importance. Soil as natural body, Pedological and edapholgical concept of soil.	History, Scope and importance of Soil Science, Approaches of Soil Study, Pedological concepts, Edapholgical concept of soil.	6
3 & 4	Soil genesis, soil forming rocks and minerals	Definitions, Formation of rocks, Classification of rocks, Classification of minerals, Properties of minerals, Soil forming minerals.	4
5 & 6	Weathering of rocks and minerals	Definitions, Types of weathering, Subtypes of weathering, Examples.	6
7 & 8	Processes and factors of soil formation	Definitions, Types of soil forming processes, Soil forming factors, Equation, Types of soil forming factors.	6
9	Soil profile, Soil horizons and Soil components	Definitions, Development of Soil Profile, Components of soils, Volume composition of mineral soil, Soil horizons.	4
10 & 11	Soil physical properties: Soil texture, Soil structure	Definitions, Types of soil physical properties, Importance of soil texture, Soil textural classes, Soil structure, Formation of soil structure, Types and Classes of structure, Factors affecting soil structure, Importance of structure	4
12	Soil bulk density and Particle density	Definitions, Importance of soil density, Porosity of soil, Factors affecting soil density.	4

Continued….

13 & 14	Soil consistency, Plasticity and Soil colour	Definitions, Soil consistency, Soil stickiness and plasticity.	4
15	Soil Temperature: Source, effect on plant growth and nutrient availability	Definition, Importance of soil temperature, Source of soil temperature, Factors affecting absorption of heat, Factors affecting soil temperature, Role of soil temperature in nutrient availability	4
16	Soil Air- Composition of gases, exchange in soil, its impact on plant growth	Definition, Soil air and its composition of gases, Gases exchange in soil, Impact on plant growth, Effect on plant growth,	4
17 &18	Soil Water: Soil water classification, Soil water retention, Soil water potential, Soil moisture constants, Hydraulic conductivity, Permeability, Percolation, Movement and availability in soil.	Importance of Soil Water, Classification of Soil water, Factors affecting soil water, Soil water potential, Measuring soil moisture, Soil Moisture Constants, Soil water movement, Hydraulic conductivity, Water permeability, Percolation, Water movement and availability in soil.	6
19 & 20	Soil Organic Matter: Sources, composition, Properties, Factors affecting SOM, its importance and influence on soil properties	Definitions, Sources of soil organic matter, Decomposition of soil organic matter, Role of Organic matter, Properties of soil organic matter, Factors affecting Soil organic matter, Influence on Soil properties.	6
21 & 22	Silicate Clays: Constitution and Properties	Definition, Layer silicate clays, Types of silicate clay minerals; Properties of silicate minerals	6
23 & 24	Sources of charge, ion exchange, cation and anion exchange capacity and base saturation (after buffering capacity)	Definitions, Sources of charge, Ion exchange, Cation and anion adsorption, Mechanism of Cation Exchange, Cation Exchange Capacity, Importance of Cation Exchange, Source of positive charge, Importance of anion exchange	6

Continued….

25 & 26	Humic substances: Nature and Properties	Definition, Importance of humic substances, Nature and properties of humic substances	6
27	Soil Colloids: Inorganic and Organic, Properties of Soil colloids and Ion exchange in soils	Definitions, General Properties of Soil colloids, Types of Soil colloids, Ion exchange in soil.	5
28	Soil reaction and Buffering capacity: Soil pH, Buffering capacity, Effect of soil pH on nutrient availability.	Definition of pH, Buffering capacity, Buffer action, Importance of buffering, Significance of soil reaction in plant nutrition.	4
29 & 30	Soil Taxonomy: Soil Survey, Soil Taxonomy, Classification, Land Capability Classification, Land Irrigability Classification.	Definition, Salient features of Soil Taxonomy, Importance of Soil survey, Types of Soils survey, Diagnostic Horizons of Mineral Soils, Land Capability Classification, Land Irrigability Classification.	5
31	Keys to Soil Orders	Definition, Importance of soil orders, Classification of soil orders, Characteristics of soil orders.	6
32	Soils of India and Maharashtra	Soils of India, Classification of soils of India, Soils of Maharashtra, Distribution and classification of soils of Maharashtra.	4
		Total=	**100**

Suggested Readings (Theory- SOIL-111):

1. ISSS. 2009. Fundamentals of Soil Science. 2nd Edn. Indian Society of Soil Science, New Delhi- 110 012. pp. 728.
2. Das D.K. 2011. Introductory Soil Science, 3rd revised and Enlarged Edn, Kalyani Publisher, Ludhiana. pp. 645.
3. Patil, V.D. and Mali C.V. 2007. Fundamentals of Soil Science, Aman Publication, Meerut.
4. Brady, N.C. 2016. The Nature and Properties of Soils. 15th Edn. Publisher: Pearson Education.
5. Biswas, T.D. and Mukherjee, S.K. 1995. Text Book of Soil Science 2nd Edn. Tata McGraw Hill Publisher, Delhi. pp. 433.
6. Daji J.A., Kadam J.R. and Patil N.D. 1996. Textbook of Soil Science, Bombay Media Promoters and Publishers Pvt. Ltd.

PRACTICAL [SOIL-111]

Exp. No.	Title of Experiment
1	Study of general properties of minerals.
2	Study of silicate and non-silicate minerals.
3	Study of rocks- Igneous, sedimentary and metamorphic.
4	Study of soil profile.
5	Study of soil sampling tools, collection and processing of soil for analysis.
6	Determination of soil texture by feel method.
7	Determination of soil texture by mechanical analysis.
8	Determination of bulk density by clod coating method.
9	Determination of particle density by pycnometer method and porosity of soil.
10	Determination of soil colour by Munsell soil colour chart.
11	Study of soil structure and aggregate analysis.
12	Determination of moisture content in soil by gravimetric method.
13	Determination of soil moisture constants- Field capacity.
14	Determination of water holding capacity.
15	Study of infiltration rate of soil.
16	Determination of pH and electrical conductivity of soil.
17	Determination of hydraulic conductivity of soil by constant head method.
18	Estimation of organic carbon and organic matter content in soil by Walkely and Black method.

Suggested Readings (Practical- SOIL-111):

1. Somawanshi, *et al*. 2012. Laboratory Methods for Analysis of Soil, Irrigation Water and Plants, Department of Soil Science and Agricultural Chemistry, MPKV, Rahuri. Revised Ed. pp. 307.
2. Jakson, M.L. 1973. Soil Chemical Analysis. Printice Hall, India, Pvt. Ltd. New Delhi. pp 498.
3. Page, *et. al*. 1982. Methods of Soil Analysis, Part 1 and 2. Chemical and Microbiological Properties. 2nd Ed. Soil Science Soc. of America Am. Soc. Agron., Madison, Wisconsin, USA.
4. Klute, A. 1986. Methods of Chemical Analysis, 2nd Ed. American Soc. Agron. Inc. and Soil Science Society of America. Madison, Wisconsin, USA.
5. Piper, C.S. 1966. Soil and Plant Analysis. Inters Science. Hans Publisher, Mumbai.
6. Black, C.A. 1965. Soil Chemical Analysis, Part I and Part II. American Soc. Agron, Inc. and Soil Science Society of America. Madison, Wisconsin, USA.
7. Hesse, P.R. 1971. A Text Book of Soil Chemical Analysis. John Murray, London.
8. Richards, L.A. 1968. Diagnosis and Improvement of Saline Alkali Soils. Oxford and IBH Publication Co. Calcutta.
9. Chopra, S.L. and Kanwar, J.S. 1991. Analytical Agricultural Chemistry, Kalyani Publisher New Delhi.
10. Chapman, H.D., and P.F. Pratt. 1961. Methods of Analysis for Soils, Plants and Waters. Division of Agricultural Sciences, University of California.

Semester	**:**	**I**		
Course No.	**:**	**HORT-111**	**Credit Hrs.**	**: 3(2+1)**
Course Title	**:**	**Fundamentals of Horticulture**		

SYLLABUS

Objectives:

(i) To provide knowledge on different branches of Horticulture *viz.*, Pomology, Olericulture, Floriculture and Landscaping, Spices and Medicinal plants,

(ii) To provide knowledge on orchard management, propagation methods, cultural operations and nutrient management of horticultural crops,

(iii) To provide knowledge on different physiological aspects of horticultural crops.

THEORY

Horticulture: Its different branches, importance and scope; Horticultural and Botanical classification; Soil and Climate for horticultural crops; Plant propagation: Methods and propagating structures; Seed dormancy and seed germination; Merits and demerits of sexual and asexual propagation; Stock-Scion relationship. 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; Medicinal and aromatic plants; Spices and condiments; Importance of plant bio-regulators in horticultural crops; Irrigation and its methods; Fertilizers application in horticultural crops; Principles, features and styles and types of garden; Types of vegetable gardening; Kitchen gardening.

PRACTICAL

Identification of garden tools; Identification and nomenclature of fruits; 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 and harvesting; Grading, packaging and storage.

TEACHING SCHEDULE

THEORY [HORT-111]

Lecture No.	Topic	Subtopics/ Key Points	Weightage (%)
1-2	Scope and Importance of Horticulture	Definitions and Branches of Horticulture, Meaning; Role, Scope, Importance, - Areas with examples.	10
3-4	Classification of Horticultural crops	Basis of Classification, Horticultural and Botanical Classification, Types with suitable examples.	10
5-6	Soil and Climate for Horticultural crops	Meaning, Soil and Climatic requirement for Horticultural crops, Suitable examples.	
7-11	Plant Propagation - Methods and Propagating Structures	Sexual and Asexual methods of Propagation, Its merits and demerits; Propagation by propagules, Propagating structures, Stock-Scion relationship.	15
12-13	Seed Dormancy and Seed Germination	Definitions, Types of Seed dormancy, Causes of seed dormancy and methods to break seed dormancy; Seed germination and changes in seed during germination.	10
14-15	Principles of Orchard Establishment	Site selection criteria, Principles, Preparation of land and layout, Planting systems.	
16-17	Training and Pruning of Fruit crops	Principles and methods of training and pruning of fruit crops and Canopy management.	10
18-19	Juvenility and Flower Bud Differentiation	Definitions, Maturation phase, Techniques to reduce juvenile phase, Ways for rejuvenation or reversion to juvenile stage.	10
20	Unfruitfulness in Horticultural crops	Definitions, Fruitfulness, Fruit setting, Unfruitfulness and factors responsible for it, Steps to overcome it, Suitable examples.	
21-22	Pollination, Pollinizers and Pollinators	Definitions, Types of pollinations, Mechanisms to promote self and cross-pollination, Advantages and disadvantages, Important pollinators and pollinizers with examples.	05
23	Fertilization and Parthenocarpy	Definitions, Types of Parthenocarpy with examples.	

Continued…

24	Medicinal and Aromatic Plants	Scope, Importance and its Classification	05
25	Spices and Condiments	Scope, Importance and its Classification	
26	Importance of Plant Bio-regulators in Horticultural crops	Definition, Role of Bio-regulators and its uses in Horticulture with examples	05
27	Irrigation Methods in Horticultural crops	Irrigation methods and its advantages and disadvantages.	10
28	Fertilizers Application in Horticultural crops	Types of fertilizers; Methods of fertilizers application, their advantages and disadvantages	
29-30	Principles, Features and Styles and Types of Garden	Principles, Features and Styles and Types of Garden.	05
31	Types of Vegetable Gardening	Different types of Vegetable gardening	05
32	Kitchen Gardening	Explanation and Components of Kitchen gardening.	
		Total =	**100**

TEACHING SCHEDULE

PRACTICAL [HORT-111]

Exercise No.	Title
1	Identification of garden tools
2-3	Identification and Nomenclature of fruits
4	Layout of an orchard
5	Pit making and system of planting
6	Nursery raising techniques of fruit crops
7	Understanding of plant propagation structures
8	Propagation through seeds and plant parts
9	Propagation techniques for horticultural crops
10	Container, potting mixture, potting and repotting
11	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
16	Grading, packaging and storage

Suggested Readings:

1. Basics of Horticulture by Jitendra Singh
2. Introduction to Horticulture by N. Kumar
3. Handbook of Horticulture by K.L. Chadda
4. Jain, S.K. 1968. Medicinal Plants. National Book Trust New Delhi. Oxford & IBH, New Delhi.
5. Atal, E.K. and Kapur, B. 1982. Cultivation and Utilization of Medicinal and Aromatic Plants. CSIR, New Delhi.

Semester	**:**	**I**	
Course No.	**:**	**MATH-111***	**Credit Hrs. : 1(1+0) NG; Need-based**
Course Title	**:**	**Introductory Mathematics**	
*Need-based, Non-Gradial Common Course across 5 UG Degrees: **B.Sc. (Hons.) Agri. / B.Sc. (Hons.) Horti. / B.Sc. (Hons.) Forestry / B.F.Sc. (Hons.) / B.Sc. (Hons.) C.S.**			

SYLLABUS

Objective: To impart knowledge on Introductory Mathematics as a need-based/ deficiency course.

THEORY

Algebra: Progressions: Arithmetic Progression: Definition, Sum of n terms, Examples. Geometric Progression: Definition, Sum of n terms, Examples. Harmonic Progression: Definitions, Examples.

Determinants: Definition of Determinant, Expansion of determinant up to 3rd order, Examples Properties of determinants up to 3rd order (without proof).

Matrices: Definition of Matrices, Order of Matrix, Types of Matrices, Algebra of Matrices: Addition, Subtraction, Multiplication, Examples, Transpose of Matrix and it's properties (without proof).

Differential Calculus: Definition, Differentiation of function using first principle, Examples. Rules of Differentiation: Derivatives of sum, Difference, Product and quotient of two functions (Formulae only) and Derivative of Standard functions: Algebraic Function, Trigonometric, Logarithmic and exponential functions (Formulae only), Examples. Increasing and Decreasing Functions, Growth rate, Average Cost and Marginal cost, Marginal Revenue. Examples.

Partial Differentiation: Definition, Homogeneous function, Euler's Theorem, Examples.

Maxima and Minima of the functions of the form y = f (x) Examples.

Integral Calculus: Definition of Indefinite and Definite Integrals, Integrals of elementary functions (Formulae only), Theorems of integration (without proof), Integration by substitution, Examples.

Integration by parts, Examples, Application of Integration: to find Area under simple well-known curves (Simple problems based on it).

Mensuration: Statement of Simpson's 1/3rd Rule (Without Proof). Examples on Simpson's Rule.

Suggested Readings:

1. NCERT, 2012, Mathematics of Class XII, NCERT, India.
2. A Textbook of Mathematics XI and XII (Part I and II), Maharashtra State Board of Secondary and Higher Secondary Education, Pune.
3. Sharma RD, 2014, Mathematics of Class XII, Dhanpat Rai Publisher.
4. Mensuration-I by Pierpoint.

TEACHING SCHEDULE

THEORY

Lecture No.	Topic	Subtopics/ Key Points	Weightage (%)
1-2	Algebra: Progressions	Arithmetic Progression: Definition, Sum of n terms, Examples.	10
		Geometric Progression: Definition, Sum of n terms, Examples. Harmonic Progression: Definitions, Examples.	
3-4	Determinants	Definition of Determinant, Expansion of determinant up to 3rd order, Examples	10
		Properties of determinants up to 3rd order (without proof)	
5-7	Matrices	Definition of Matrices, Order of Matrix, Types of Matrices	20
		Algebra of Matrices: Addition, Subtraction, Multiplication, Examples	
		Transpose of Matrix and it's Properties (without proof)	
8-10	Differential Calculus	Definition, Differentiation of function using First principle, Examples.	20
		Rules of Differentiation: Derivatives of sum, Difference, Product and quotient of two functions (Formulae only) and Derivative of Standard functions: Algebraic Function, Trigonometric, Logarithmic and Exponential functions (Formulae only), Examples.	
		Increasing and Decreasing Functions,	
		Growth rate, Average Cost and Marginal cost, Marginal Revenue. Examples.	
11-12	Partial differentiation	Definition, Homogeneous function, Euler's theorem, Examples.	10
		Maxima and Minima of the functions of the form y = f (x) Examples.	
13-15	Integral Calculus	Definition of Indefinite and Definite Integrals	20
		Integrals of elementary functions (Formulae only)	
		Theorems of integration (without proof)	
		Integration by substitution, Examples	
		Integration by parts, Examples	
		Application of Integration: to find Area under simple well-known curves, (Simple problems based on it).	
16	Mensuration	Statement of Simpson's 1/3rd Rule (without Proof). Examples on Simpson's Rule.	10
		Total =	**100**

Semester	**:**	**I**				
Course No.	**:**	**BIO-111****	**Credit Hrs.**	**:**	**1(1+0)**	**Need-based; NG**
Course Title	**:**	**Basic Biology**				
Need-based, Non-Gradial Common Course across 5 UG Degrees: **B.Sc. (Hons.) Agri. / B.Sc. (Hons.) Horti. / B.Sc. (Hons.) Forestry / B.F.Sc. (Hons.) / B.Sc. (Hons.) C.S.						

SYLLABUS

Objectives:

(i) To impart foundational knowledge of biological principles including diversity, genetics, evolution of living organisms,

(ii) To impart basic knowledge about flowering plants and animals with a focus on their application in Agriculture.

THEORY

Introduction to the living world, Diversity and characteristics of life. Origin of life, Evolution and Eugenics. Genetics and Basics concepts. Binomial nomenclature and Classification. Cell and cell division. Morphology of flowing plants. Seed and Seed germination. Plant systematics- *viz*., Brassicaceae, Fabaceae and Poaceae. Role of animals in agriculture.

TEACHING SCHEDULE

THEORY

Lecture No.	Topic	Sub-topics/ Key Points	Weightage (%)
1	Introduction to Living World	Definition of Biology; Composition and Biological Classification of living world.	5
2	Diversity and Characteristics of Life	Definitions: Diversity, Biodiversity; Characteristics of life; Building blocks of life and relationship between different organisms.	5
3	Origin of Life	Theories of Origin of Life; Oparin - Haldane Theory of Chemical origin.	5
4	Evolution and Eugenics	Evidences of Organic Evolution, Theories of Evolution; Eugenics: Definition.	5

Continued…

5	Genetics and Basics Concepts	Genetics and Mendel's Experiments (Basic Concepts)	5
6	Binomial Nomenclature	Binomial nomenclature and classification; Overview of taxonomic hierarchy/ ranks.	10
7	Cell: Structure and Function	Cell structure, Composition and Cell organelles and their functions.	5
8-9	Cell Division	Definition, Types: Mitosis and Meiosis, their Significance, Stages.	10
10-12	Morphology of Flowering plants	Morphology, Structure and Functions: Roots, Stems, Leaves, Flowers and Fruits.	25
13	Seed and Seed Germination	Definitions, Types of seed (Monocot and Dicot seed), Types of seed germination and factors affecting it.	5
14-15	Plant Systematics – Study of Families	Key features, Economic importance and Examples of - A) Brassicaceae B) Fabaceae C) Poaceae	15
16	Role of Animals in Agriculture	Livestock in farming systems: Nutritional and economic contributions; Role of pollinators in crop production; Biological pest control (Predatory use); Sustainable integration of animals in agroecosystems.	5
		Total =	**100**

Suggested Readings [BIO-111]:

1. Cell Biology, Genetics, Molecular Biology and Evolution by P.S. Verma, V.K. Agrwal. Publisher- S. Chand and Company Ltd., Ram Nagar, New Delhi. India.
2. Evolution of Vertebrates by Edwin H. Colbert, Publisher- A Wiley, Inter Science Publication, John Wiley and Sons, New York. US.
3. A Class-book of Botany by A.C. Dutta, Publisher- Oxford University Press, YMCA Library Building. Jai Singh Road, New Delhi - 110001, India.
4. Fundamentals of Genetics by B.D. Singh, Publisher- Kalyani Publ. B-I/1292, Rajinder Nagar, Ludhiana.
5. A Textbook of Practical Botany-2 by Ashok M. Bendre, Ashok Kumar, Publisher- Rastogi Publications, Shivaji Road, Meerut, India.
6. Botany-An Introduction to Plant Biology by Jamesh D. Mauseth, Publisher- Continental Prakashan, 1962, Pune.
7. Anatomy of Seed Plants by A.C. Datta, Sigh V., Pande P.G., Publisher- Sai Print Opack, New Delhi, Rastogi Publication, Meerut, India.
8. Handbook of Animal Husbandry by ICAR, New Delhi Publication, Publisher- Directorate of Knowledge Management in Agriculture, Krishi Anusandhan Bhavan, Pusa, New Delhi - 110012, India.

Letterhead of the College Associate Dean / Principal

To,

The Dean (F/A) & Director of Instruction,

(*University Name*)

Subject: Declaration/Compliance with DICC Circular No. MAUEB/DICC-Circular/New UG Syllabi/420/24; Dated. 29.11.2024; *Reg*.- Implementation of New UG Degree Syllabus as per Sixth DCR…

Declaration/ Compliance Report

This is to confirm and declare hereby that in response to the above-referred DICC-Circular, the undersigned has ensured the initiation and implementation of the New Undergraduate Syllabus for the **UG Degree:** _____ at **(College Name & Address)** and the implementation is effective from the Academic Year, 2024-25 and strictly adheres to the finalized course layouts and syllabi as detailed in **Annexure - _____** appended to the said Circular.

It is further certified that this implementation aligns with the **ICAR - Sixth Deans' Committee Report** and is in full compliance with the guidelines stipulated under the regime of **the DICC Core Committee**. No deviations have been made in the course allotments, credit hours, or any other aspects of the prescribed syllabus/ curriculum.

Hence, Certified and Submitted.

Signature and Seal:

Name of AD/ Principal: _____

Designation: _____

College Name: _____

Official Stamp/Seal: _____

Date: _____

Course Curriculum of Second Semester

as per the ICAR-Sixth Deans' Committee Report for the Academic Programme in

AGRICULTURE

- **UG-Certificate in Agriculture**
- **UG-Diploma in Agriculture**
- **UG-Degree: B.Sc. (Hons.) Agriculture**

Mahatma Phule Krishi Vidyapeeth, Rahuri

Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola

Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani

Dr. Balasaheb Sawant Konkan Krishi Vidyapeeth, Dapoli

Maharashtra Agricultural Universities Examination Board, Pune

Compiled & Submitted by

Dr. S.B. Kharbade
Dean (F/A) & DI and Associate Dean, PGI, MPKV, Rahuri.
UG Degree Syllabus State Coordinator

with

UG Degree Syllabus Discipline Coordinators & DICC - UG Degree Syllabus Core Committee

Submitted to the

Directors of Instruction and Deans (F/A) Coordination Committee

~ w.e.f. AY, 2024-25 ~

Course Curriculum of Second Semester as per the ICAR-Sixth Deans' Committee Report for Academic Programme in AGRICULTURE

Course Layout

B.Sc. (Hons.) Agriculture

Semester: II (New) ***w.e.f.*** **Academic Year: 2024-25**

Sr. No.	Course No.	Course Title	Credit Hrs.	Remark (if any)
1.	**AEC-123**	National Service Scheme (NSS-II)/ National Cadet Corps (NCC-II)	1(0+1)	--
2.	**AEC-124**	Personality Development	2(1+1)	--
3.	**VAC-121**	Environmental Studies and Disaster Management	3(2+1)	--
4.	**SOIL-122**	Soil Fertility Management	3(2+1)	--
5.	**ENTO-121**	Fundamentals of Entomology	3(2+1)	--
6.	**PATH-121**	Fundamentals of Plant Pathology	3(2+1)	--
7.	**AHDS-121**	Livestock Production and Management	2(1+1)	--
8.	**SEC-123**	Skill Enhancement Course-III# (*To be offered from the list of SEC Courses*)	2(0+2)	--
9.	**SEC-124**	Skill Enhancement Course-IV# (*To be offered from the list of SEC Courses*)	2(0+2)	--
		Total Credits Hrs.	**21(10+11)**	**G**
AEC: Ability Enhancement Course, **MDC**: Multidisciplinary Course, **SEC**: Skill Enhancement Course, **VAC**: Value Added Course, **G**: Gradial				
Post-II Semester (Only for Exit option for award of UG-Certificate)				
10.	**INT-121**	Internship (10 Weeks)	10(0+10)	--

Semester	**:**	**II**	
Course No.	**:**	**AEC-123**	**Credit Hrs. : 1 (0+1)**
Course Title	**:**	**National Service Scheme-II (NSS-II)/ National Cadet Corps-II (NCC-II)**	
Gradial Common Course across all UG Degrees			

Course No.: AEC-123	**Course Title: National Service Scheme-II (NSS-II)**	**Credit Hrs.: 1(0+1)**

SYLLABUS

Objectives :

(i) To evoke social consciousness among students through various activities viz., working together, constructive and creative social work,

(ii) To be skillful in executing democratic leadership, developing skill in program,

(iii) To be able to seek self-employment, reducing gap between educated and uneducated, increasing awareness and desire to help sections of society.

PRACTICAL

Importance and role of youth leadership. Meaning, types and traits of leadership, qualities of good leaders; Importance and roles of youth leadership, Life competencies. Definition and importance of life competencies, Problem-solving and Decision-making, Interpersonal communication. Youth development programs Development of youth programs and policy at the national level, state level and voluntary sector; Youth-focused and youth-led organizations Health, hygiene and sanitation. Definition Needs and Scope of health education; Role of food, nutrition, safe drinking water, water borne diseases and sanitation (Swachh Bharat Abhiyan) for health; National health programs and reproductive health. Youth health, lifestyle, HIV-AIDS and first aid. Healthy lifestyles, HIV-AIDS, drugs and substance abuse, home nursing and first aid. Youth and yoga. History, philosophy, concept, myths and misconceptions about yoga; Yoga traditions and its impacts, Yoga as a tool for healthy lifestyle, preventive and curative method.

TEACHING SCHEDULE

PRACTICAL [AEC-123/ NSS-II]

Exercise No.	Title	Sub-topics
1	**Orientation on NSS**	Introduction to NSS, its Objectives, History and Role in community service.
2	**Youth Leadership**	Discuss the importance and role of youth leadership, types and traits of leadership and qualities of good leaders.
3	**Life Competencies**	Understanding life competencies, their importance and Practical exercises in problem-solving and decision-making.
4	**Interpersonal Communication**	Practice exercises to improve interpersonal communication skills, Focusing on active listening and effective communication.
5	**Youth Development Programs**	Overview of youth development programs, Policies at national and state levels and Understanding youth-led organizations.
6	**Health, Hygiene, and Sanitation**	Practical activities on the importance of hygiene and sanitation, including Swachh Bharat Abhiyan tasks.
7	**Nutrition and Health Education**	Discuss the role of food, nutrition, and safe drinking water in health; Explore the impact of waterborne diseases.
8	**National Health Programs**	Introduction to key national health programs and their roles in promoting public health and awareness on reproductive health.
9	**Youth Health and Lifestyle**	Sessions on healthy lifestyle choices including exercise, balanced diet and stress management.
10	**HIV/AIDS Awareness**	Educational activities on HIV/AIDS, its prevention, and reducing stigma; Awareness on reproductive health.
11	**Substance Abuse Awareness**	Discussing the dangers of drug and substance abuse, its impact on health and practical ways to prevent addiction.
12	**First Aid and Home Nursing**	Hands-on training in first aid techniques including handling injuries, CPR basics and home nursing care.
13	**Introduction to Yoga**	Introduction to the History, Philosophy and various Traditions of Yoga as a Holistic health practice.
14	**Yoga Practice**	Practical Yoga Sessions focusing on Asanas, Pranayama and Meditation for a healthy lifestyle.
15	**Yoga as Preventive and Curative Tool**	Understanding and Practicing Yoga as a preventive and curative approach for physical and mental health.
16	**Reflection on NSS and Youth Development**	Group Discussion and Reflection on the role of NSS in community building and personal growth, Focusing on youth leadership.

Course No.: AEC-123	Course Title: National Cadet Corps-II (NCC-II)	Credit Hrs.: 1(0+1)

SYLLABUS

Objectives :

i. 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,

ii. 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.

PRACTICAL

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.

TEACHING SCHEDULE

PRACTICAL (AEC-123/ NCC-II)

Exercise No.	Title	Sub-topics
1	**Basic Arms Drill**	Attention, stand at ease, stand easy, getting on parade, dismissing and falling out.
2	**Advanced Arms Drill**	Ground/take up arms, examine arms, shoulder from the order and vice versa.
3	**Saluting with Arms**	Saluting at the shoulder both at a halt and while on the march.
4	**Rifle Handling Techniques**	Short/long trail from the order and vice versa, guard mounting and guard of honor procedures.
5	**Platoon and Company Drill**	Practice and demonstration of platoon and company drill formations.
6	**Rifle Characteristics and Handling**	Characteristics of rifles (.22/.303/SLR), ammunition, firepower, and basic care, cleaning, and sight setting.
7	**Rifle Operations and Safety**	Loading, cocking, unloading, safety procedures; lying position, trigger control, and firing a shot.
8	**Range Procedures and Target Practice**	Range procedures, aiming, sight alteration, theory of groups, snap shooting, and firing at moving targets.
9	**Map Reading Basics**	Introduction to maps, scales, conventional signs, topographical forms, and the grid system.
10	**Advanced Map Skills**	Relief, contours, gradients, cardinal points, bearings, and use of the service protractor.
11	**Field Navigation with Compass**	Use of prismatic compass, setting a map, finding north, positioning, map-to-ground, and ground-to-map.
12	**Field Engineering Skills**	Knots and lashings, camouflage, handling explosives, IEDs, field defenses, obstacles, and mines.
13	**Watermanship and Field Water Supplies**	Bridging techniques, field water supplies, track construction, and distance judgment.
14	**Target Recognition and Indication**	Identifying and describing targets, observing, concealment, field signals, and indication of landmarks.
15	**Section Battle Drills and Movement**	Section formations, fire control orders, fire and movement, movement with/without arms, section battle drill.
16	**Communication Skills and Modern Trends**	Types of communication, media and latest trends in NCC communication.

Semester	**:**	**II**			
Course No.	**:**	**AEC-124**	**Credit Hrs.**	**:**	**2(1+1)**
Course Title	**:**	**Personality Development**			
Gradial Common Course across all UG Degrees					

SYLLABUS

Objectives: To make students realize their potential strengths and cultivate their inter-personal skills and improve employability.

THEORY

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. Foundations of individual behavior and Factors influencing individual behavior, Models of individual behavior, Perception and Attributes; Factors affecting perception, Attribution theory and Case studies on Perception and Attribution. Learning: Meaning and Definition, Theories and Principles of Learning, Learning and Organizational behavior, Learning and Training, Learning feedback. Attitude and Values, Intelligence- Types of Intelligence, Theories of intelligence, Measurements of intelligence, Factors influencing intelligence, Intelligence and Organizational behavior, Emotional intelligence. Motivation- Theories and Principles, Teamwork and Group dynamics.

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.

TEACHING SCHEDULE

THEORY [AEC-124]

Lecture No.	Topic	Sub-topics/ Key Points	Weightage (%)
1	**Personality**	Definition, Nature of Personality	5
2	**Theories of Personality and its Types**	The Humanistic Approach- Maslow's self-actualization theory; Types- Extroversion, Introversion, Conscientiousness, Agreeableness	10
3		Shaping of Personality - improving communication skills, stepping out of comfort zone, learning to say no, tapping into creativity, getting curious, giving yourself a daily affirmation, practicing self-care. Determinants of Personality- Physical, Intellectual, Social and Psychological	10
4		Myers- Briggs Typology indicator Four Indicators- Introvert/ Extrovert, Thinking/ Feeling, Sensing/ Intuiting, Judging/ Perception, Locus of Control and Performance	10
5		Type A and Type B Behaviours Theory	5
6	**Personality and Organizational Behaviours**	Difference between Personality and Organizational behaviours	5
7		Foundations of individual behaviours, Factors influencing individual behaviour- personality, values, motivation, perspectives and social impacts	5
8		Models of Individual behaviour- Rational Economic man, Social man, The Self actuating man, Complex man	5
9	**Perception**	Attributes and Factors affecting perception; Attribution theory and Case studies on Perception and Attribution	10
10	**Learning**	Meaning, Definition; Theories and Principles of Learning	10
11		Difference between Learning and Organizational behavior; Difference between Learning and Training; Feedback of Learning	5
12	**Attitude and Values**	Meaning, Definitions, Concept	5
13	**Intelligence**	Types of Intelligence, Theories of intelligence	
14		Measurement of intelligence Factors affecting intelligence Difference between intelligence and organizational behaviour, Emotional intelligence	5
15	**Motivation**	Meaning, Theories and Principles	5
16	**Team and Group Dynamics**	Meaning, Definitions, Concept	5
		Total=	**100**

TEACHING SCHEDULE

PRACTICAL [AEC-124]

Exercise No.	Exercise Topic
1	Myers- Briggs Type Indicator (MBTI) analysis- Extroversion/ Introversion
2	Myers- Briggs Type Indicator (MBTI) analysis- Sensing/ Intuition
3	Myers- Briggs Type Indicator (MBTI) analysis- Thinking/ Feeling
4	Myers- Briggs Type Indicator (MBTI) analysis- Judging/ Perception
5	Learning Styles and Strategies
6	Motivational Needs
7	Fundamental Interpersonal Relations Orientation Behaviour (FIRO-B)
8	Interpersonal Communication
9	Team Work
10	Team Building
11	Group Dynamics
12	Win-Win Game
13	Conflict Management
14	Leadership Styles
15	Case studies on Personality
16	Case studies on Organizational Behaviour

Suggested Readings [AEC-124]:

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.
5. Lucas, Stephen, 2001, Art of Public Speaking. New Delhi. Tata - McGraw Hill.
6. Mile, D.J., 2004, Power of Positive Thinking. Delhi. Rohan Book Company.
7. Smith, B., 2004, Body Language. Delhi: Rohan Book Company.
8. Shaffer, D. R., 2009, Social and Personality Development (6th Edn). Belmont, CA: Wadswo.

Semester	**:**	**II**	
Course No.	**:**	**VAC-121**	**Credit Hrs. : 3(2+1)**
Course Title	**:**	**Environmental Studies and Disaster Management**	
Gradial Common Course across all UG Degrees			

SYLLABUS

Objectives : 1. To expose and acquire the knowledge on the environment,

2. To gain the state-of-the-art skill and expertise on management of disasters.

THEORY

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. 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 flow in the ecosystem. Types of Ecosystems. Biodiversity and its conservation: Introduction, Definition, Types. Biogeographical Classification of India. Importance and Value of Biodiversity. Biodiversity Hotspots. Threats and Conservation of Biodiversity. 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. (g) 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. 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. 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, coal fire, 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.

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 un polluted 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 ecosystems – Visit to pond/river/hills. Visit to areas affected by natural disaster.

TEACHING SCHEDULE

THEORY [VAC-121]

Lecture No.	Topic	Sub-topics/ Key Points	Weightage (%)
1	Introduction to Environmental Studies	Definition, Scope and Importance; Multidisciplinary nature	4
2	Segments of Environment	Spheres of Earth – Lithosphere, Hydrosphere, Atmosphere and Different Layers of Atmosphere.	4
3 - 5	Natural Resources	Classification of resources; Forest, water, mineral, food, energy, land, and soil resources	10
6 - 7	Concept of an Ecosystem	Concept, Structure, Function and Energy flow in ecosystems	5
8 - 9	Types of Ecosystems	Terrestrial, Aquatic, Agroecosystems, Forest ecosystems and Human-modified ecosystems	5
10 - 12	Biodiversity and its Conservation	Importance, Value, Types, Biogeographical classification, Hotspots, Threats, Conservation strategies	8
13 - 16	Environmental Pollution	Definition, Causes, Effects, Control measures: Air, Water, Soil, Marine, Noise, Thermal and Light pollution	12
17 - 18	Solid Waste Management	Classification of solid wastes; Management methods like, Composting, Incineration, Pyrolysis, Biogas production	6
19	Urban and Industrial waste	Causes, Effects and Control measures of Urban and Industrial waste	4
20	Social Issues Related to the Environment	Urban energy problems, Water conservation, Rainwater harvesting, Watershed management	4
21 - 22	Environmental Ethics	Issues, Possible solutions, Climate change, Global warming, Acid rain, Ozone layer depletion, Nuclear accidents and Holocaust.	6

Continued…

23	Environment Protection Laws	Environment Protection Act, Air and Water (Pollution) Acts, Wildlife Protection Act, Forest Conservation Act	4
24 - 25	Human Population and Environment	Environment and human health, Human rights, Value education, Women and child welfare, Role of IT in environment and health	5
26 - 28	Introduction to Disaster Management	Definition, Types of natural and man-made disasters; Floods, Droughts, Cyclones, Earthquakes, Landslides, Fires	10
29 - 30	Disaster Management Framework	National and International strategies, disaster response framework, Financial arrangements, Role of NGOs and media	5
31	Central and Local Administration in Disasters	Role of Central, State, District and Local Administrations; Coordination in disaster response	4
32	Disaster Response Organizations	Central, State, District and Local Administrations in Disaster Control; Role of Armed Forces, Police and Other organizations in disaster response & control	4
		Total =	**100**

TEACHING SCHEDULE

PRACTICAL [VAC-121]

Exercise No.	Exercise Title
1	Visit to a local area to document environmental assets: River/ Forest/ Grassland/ Hill/ Mountain.
2	Visit to Biogas production, Windmill, Hydro/Solar power generation units
3	To assess floral and faunal diversity in farming systems.
4	Assessment of biodiversity 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 the common plants, insects and birds. Environmental sampling and preservation.
7	Water quality analysis: pH and electrical conductivity (EC) in water samples.
8	Estimation of total dissolved solids (TDS) in water samples
9	Estimation of acidity and alkalinity in water samples.
10	Estimation of water hardness in water samples.
11	Determination of dissolved oxygen (DO) and biological oxygen demand (BOD) in water samples.
12	Performing COD estimation on water samples.
13	Enumeration of *E. coli* in water samples to check for contamination.
14	Assessment of Suspended Particulate Matter (SPM) in an environmental sample.
15	Study of simple ecosystem – Visit to Pond/ River/ Hills.
16	Visit to areas affected by natural disaster.

Suggested Readings (VAC-121):

1. De, A.K. 2010. Environmental Chemistry. Published by New Age International Publishers, New Delhi. ISBN:139788122426175. 384 pp.
2. Dhar Chakrabarti, P.G. 2011. Disaster Management - India's Risk Management Policy Frameworks and Key Challenges. Published by Centre for Social Markets (India), Bangaluru. 36 pp.
3. Erach Bharucha, Text Book for Environmental Studies. University Grants Commission, New Delhi.
4. Parthiban, K.T., Vennila, S., Prasanthrajan, M. and Umesh Kanna, S. 2023 Forest, Environment, Biodiversity and Sustainable development. Narendra Publishing House, New Delhi, India.
5. Prasanthrajan, M. and Mahendran, P.P. 2008. A Text Book on Ecology and Environmental Science.1st Edn. ISBN 8183211046. Agrotech Publishing Academy, Udaipur - 313 002.
6. Prasanthrajan, M. 2018. Objective Environmental Studies and Disaster Management, ISBN 9789387893825. Scientific Publishers, Jodhpur, India. 146 pp.
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.

Semester	**:**	**II**	
Course No.	**:**	**SOIL-122**	**Credit Hrs. : 3(2+1)**
Course Title	**:**	**Soil Fertility Management**	

SYLLABUS

Objective: To provide a comprehensive knowledge and its application in respect of Soil Fertility, Plant Nutrition, Fertilizers and Nutrient Management.

THEORY

History of Soil Fertility and Plant Nutrition. Criteria of essentiality. Role, Deficiency and Toxicity symptoms of essential plant nutrients, Mechanisms of nutrient transport to plants, Factors affecting nutrient availability to plants. Chemistry of macro- and micro-nutrients. Soil fertility evaluation, Soil testing. Critical levels of different nutrients in soil. Forms of nutrients in soil, plant analysis, rapid plant tissue tests. Indicator plants. Introduction and importance of manures and fertilizers. Fertilizer recommendation approaches. Integrated Nutrient Management. Chemical fertilizers: Classification, Composition and Properties of Major fertilizers, Secondary and Micronutrient fertilizers, Complex fertilizers, Customized fertilisers. Water soluble fertilizers, Nanofertilizers, Soil amendments, Fertilizer Storage, Fertilizer Control Order. Methods of fertilizer recommendations to crops. Factors influencing nutrient use efficiency (NUE), Methods of application under rainfed and irrigated conditions. STCR/ RTNM/ IPNS, Carbon sequestration and Carbon Trading, Preparation and properties of major manures (FYM, Compost, Vermicompost, Green manuring, Oilcakes).

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.

TEACHING SCHEDULE

THEORY [SOIL-122]

Lecture No.	Topic	Subtopics/ Key Points	Weightage (%)
1 - 2	History of Soil Fertility and Plant Nutrition	Definitions of Soil Fertility; History of Soil Fertility and Plant Nutritions; Role of Soil Fertility in Sustainable Agriculture	4
3 - 5	Essential Plant Nutrients	Criteria of Essentiality of Nutrients; Essential and Beneficial Nutrients and their Role; Forms of nutrients in soil and critical levels of different nutrients in soil; Deficiency and Toxicity symptoms of essential plant nutrients.	8
6 - 7	Manures and Fertilizers	Introduction and Importance of Manures and Fertilizers; Preparation and Properties of Major Manures: FYM, Compost, Vermicompost, Green Manuring, Oilcakes.	8
8	Carbon Sequestration and Carbon Trading	Definitions, Carbon cycle, Concept, Carbon sink, Types of Carbon sequestration and Carbon trading	6
9 - 11	Chemical Fertilizers; Nitrogenous fertilizers	Definition and their Classification Nitrogenous fertilizers: Classification, Composition, Properties and their Reaction in soils.	6
12 - 13	Phosphatic Fertilizers	Classification, Composition, Properties and their Reaction in soils.	6
14 - 15	Potassic Fertilizers	Classification, Composition, Properties and their reaction in soils.	6
16 - 17	Secondary and Micronutrient Fertilizers	Definitions, Types, Composition, Reaction in soil and Effect on crop growth; Soil amendments.	6
18 - 19	Complex Fertilizers	Complex fertilizers: Definition, their fate and reaction in the soil; Liquid fertilizers and Nanofertilizers	4
20	Handling and Storage of Fertilizers	Handling and Storage of Fertilizers (in detail); Fertilizer Control Order Inorganic, Organic, Inorganic or Mixed: Purpose & Key Provisions of FCO, Regulatory Bodies.	4
21 - 22	Methods of Fertilizer Recommendations in Crops	STCR, RTNM, IPNS and INM Concepts	6
23 - 24	Soil Fertility Evaluation	Soil Fertility Evaluation and Different Approaches (in detail)	6
25 - 26	Mechanism of Nutrient Uptake and Transport to Plants	Mechanism of nutrient uptake and transport to plants: Factors affecting nutrient availability to plants.	6

Continued…

27 - 28	Chemistry of Soil Nutrients	Chemistry of Soil N, P, K, Calcium, Magnesium, Sulphur and Micronutrients.	6
29	Plant Analysis and Critical Levels	Plant Analysis and Critical Levels of different Nutrients in Plant, Rapid plant tissue test and Indicator plants.	6
30	Nutrient Use Efficiency (NUE).	Definition & Factors influencing Nutrient Use Efficiency (NUE).	6
31 - 32	Methods of Nutrient Applications	Methods of Nutrient Applications for different Soils and Crops grown under Rainfed and Irrigated conditions.	6
		Total	**100**

TEACHING SCHEDULE

PRACTICAL (SOIL-122)

Exercise No.	Exercise Title
1	Introduction of analytical instruments and their principles.
2	Calibration and applications of colorimetry and flame photometry.
3	Determination of organic carbon content from soil by wet oxidation method.
4	Determination of calcium carbonate content from soil by rapid titration method.
5	Estimation of available nitrogen in soil by alkaline permanganate method.
6	Estimation of available phosphorous content in soil.
7	Estimation of available potassium in soil by flame photometric method.
8	Estimation of exchangeable calcium and magnesium in soil by Versenate titration method.
9	Estimation of available sulphur in soil by turbidimetric method.
10	Estimation of DTPA extractable micronutrients (Fe, Mn, Zn and Cu) from soil.
11	Estimation of total nitrogen in plant by micro-Kjeldhal method.
12	Estimation of total phosphorus in plant sample by Vanado molybdate method.
13	Estimation of total potassium from plant sample by flame photometric method.
14	Estimation of sulphur concentration in plant sample.
15	Estimation of total micronutrients (Fe, Mn, Cu & Zn) from plant sample.
16	Determination of organic matter from compost / FYM / oilcake by Ignition method.

Suggested Readings [SOIL-122]:

1. Dilip Kumar Das, Introductory Soil Science, Kalyani Publishers.
2. Singh, S.S. Soil Fertility and Nutrient Management, Kalyani Publishers.
3. Samual L. Tisdale, Werner L. Nelson and James D. Beaton, Soil Fertility and Fertilizers by Macmillan Publishing Company, New York.
4. Brady, N.C. 2016. The Nature and Properties of Soils. 15th edition Publisher, Pearson Education.
5. Jakson, M.L. 1973. Soil Chemical Analysis. Printice Hall, India, Pvt. Ltd. New Delhi. pp 498.
6. Piper, C.S. 1966. Soil and Plant Analysis. Inters Science. Hans Publisher, Mumbai.
7. Chopra, S.L. and Kanwar, J.S. 1991. Analytical Agricultural Chemistry, Kalyani Publisher New Delhi.

Semester	**: II**		
Course No.	**: ENTO-121**	**Credit Hrs.**	**: 3(2+1)**
Course Title	**: Fundamentals of Entomology**		

SYLLABUS

Objectives:

1. To understand the basic knowledge of Entomology and insect classification, morphology along with their relationship with other arthropods,
2. To explore insect physiology, growth, development and communication,
3. To identify major insect orders and economically important families.

THEORY

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 Insecta with other Classes of Arthropoda. Morphology: Structure and functions of insect cuticle and moulting. Body segmentation. Structure of head, thorax and abdomen. Structure and modifications of insect antennae, Mouth parts, Legs, Wing venation, Modifications and wing coupling apparatus. Metamorphosis and diapause in insects. Types of larvae and pupae. Structure and functions of digestive, circulatory, excretory, respiratory, nervous, secretary (Endocrine) and reproductive systems in insects. Types of reproduction in insects. Major sensory organs. Insect Ecology: Introduction, Environment and its components. Effect of abiotic factors and biotic factors. Categories of pests. 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, Papiloinidae, Noctuidae, Sphingidae, Pyralidae, Gelechiidae, Arctiidae, Saturnidae, Bombycidae; Coleoptera: Coccinellidae, Chrysomelidae, Cerambycidae, Curculionidae, Bruchidae, Scarabaeidae; Hymenoptera: Tenthridinidae, Apidae, Trichogrammatidae, Lchneumonidae, Braconidae, Chalcididae; 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. Types of insect larvae and pupae; Dissection of digestive system in insects (Grasshopper); Study of characters of Orders: Orthoptera, Dictyoptera, Odonata, 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.

TEACHING SCHEDULE

THEORY [ENTO-121]

Lecture No.	Topic	Sub-topics/ Key points	Weightage (%)
1	Introduction and History of Entomology in India	Introduction; Definitions: Insect, Entomology and Agril. Entomology. History of Entomology in India including contributions of Scientists	10
	Premier Institutes concerned with Entomology	IARI, CAB, IOBC, IIIP, NBAIR, NIPHM, IISA, CIB & RC, CSB, NRIIPM, IGSMRI (Long form, Location and Role)	
2	Insect Dominance	Measures of dominance and Reasons of dominance (*in brief*)	
3	Classification of Phylum Arthropoda up to Classes	Onychophora, Crustacea, Arachnida, Chilopoda, Diplopoda, Trilobita and Hexapoda; Relationship of Class Insecta with other Classes of Arthropoda.	
4	Insect Cuticle	Structure and Functions of Cuticle, Cuticular appendages and processes; Moulting- Definition and Steps in moulting (*in brief*).	10
5	Body Segmentation	Structure of head, thorax and abdomen	
6	Insect Head	Insect Head Capsule: Important sclerites and sutures, Positions of head; Structure and modifications of insect antennae (with examples).	
7-8	Insect Mouthparts	Mouthparts and its modifications with feeding mechanisms. (Cockroach, Red cotton bug, House fly, Honeybee, Thrips and Butterfly)	
9	Insect Leg	Structure of Typical insect leg and its Modifications.	10
10	Insect Wing	Structure of wing, Modifications, Venation and Wing coupling apparatus with Examples.	
11-12	Metamorphosis	Metamorphosis: Definition, Types with examples; Significance of Insect Diapause: Definition and examples; Seasonal adaptations in insect: Aestivation Hibernation and Quiescence, Definitions, Types of larvae and pupae.	

Continued…..

13	Digestive system	Structure and Functions of digestive system in insects	10
14	Circulatory, Excretory and Respiratory systems	Structure and functions of circulatory, excretory and respiratory system in insects (*in brief*)	
15	Nervous System	Structure and Functions of Nervous System	
16	Secretary (Endocrine) System	Structure and Functions of Secretary (Endocrine) System in Insects	10
17-18	Reproductive System in Insects	Structure and functions of male and female reproductive systems; Types of reproduction in insects	
19	Major Sensory Organs	Mechanoreceptors, Chemoreceptors, Audioreceptors: Johnston's organ and Tympanum, Photoreceptors: Compound and Simple eyes, Thermo/Hygro-receptors; Sound producing organs in insects (*Only brief comments*)	
20	Insect Ecology	Introduction, Definition, Scope, Environment and its components.	10
21	Effect of Abiotic and Biotic Factors	(*Brief expln's of each factor*)- Abiotic factors: Temperature, moisture, humidity, rainfall, light, atmospheric pressure and air currents. Biotic factors: Food competition, Natural and Environmental resistance. Categories of Pests.	
22	Integrated Pest Management (IPM)	Concept, History, Scope, Limitations and Components of IPM	
23-24	Classification of Insecticides	Classification of insecticides- (Mode of entry, Mode of action, Chemical composition and Toxicity)	10
25	Toxicity and Formulations of Insecticides	Definitions (Toxicity, LD50, LC50, KD50, LT50, EC50, MRL, Waiting Period, Residue); Definition and types of formulations with examples (*in brief*).	
26	Systematics	Definition of Systematics, Classification, Taxonomy, Binomial nomenclature, Biotype, Sub-species, Species, Genus, Family and Order. Classification of Class Insecta upto Orders with examples.	10

Continued…..

ENTO-121…

Basic groups of present-day insects with special emphasis to following Orders and Families of Agricultural importance (with Key features in brief and examples of each) ~		
27 - 29	Orthoptera: Acrididae, Tettigoniidae, Gryllidae, Gryllotalpidae, Odonata; Dictyoptera: Mantidae, Blattidae; Odonata; Isoptera: Termitidae; Thysanoptera: Thripidae; Hemiptera: Pentatomidae, Coreidae, Cimicidae, Pyrrhocoridae, Lygaeidae, Cicadellidae, Delphacidae, Aphididae, Coccidae, Lophophidae, Aleurodidae, Pseudococcidae.	10
30 - 32	Neuroptera: Chrysopidae; Lepidoptera: Pieridae, Papiloinidae, Noctuidae, Sphingidae, Pyralidae, Gelechiidae, Arctiidae, Saturnidae, Bombycidae; Coleoptera: Coccinellidae, Chrysomelidae, Cerambycidae, Curculionidae, Bruchidae, Scarabaeidae; Hymenoptera: Tenthridinidae, Apidae, Trichogrammatidae, Ichneumonidae, Braconidae, Chalcididae; Diptera: Cecidomyiidae, Tachinidae, Agromyziidae, Culicidae, Muscidae, Tephritidae.	10
	Total=	**100**

TEACHING SCHEDULE

PRACTICAL (ENTO-121)

Exercise No.	Exercise Title
1	Methods of collection and preservation of insects including immature stages.
2	External features of Grasshopper/Cockroach.
3	Study of different types of insect antennae.
4 - 5	Study of mouth parts and its modifications (Cockroach and Red cotton bug)
6	Study of typical insect leg and its modifications.
7	Study of wing venation, types of wings and wing coupling apparatus.
8	Study of types of insect larvae and pupae.
9	Dissection of digestive, female reproductive and nervous system in insect: Cockroach.
10	Study of characters of Orders: Orthoptera, Dictyoptera, Odonata and their Families of agricultural importance.
11	Study of characters of Orders: Isoptera, Thysanoptera, Hemiptera and their Families of agricultural importance.
12	Study of characters of Orders: Lepidoptera, Neuroptera, and their Families of agricultural importance.
13	Study of characters of Orders: Coleoptera, Hymenoptera, Diptera and their Families of agricultural importance.
14	Insecticides and their formulations and Calculation of doses/concentrations of insecticides.
15	Study and Hands-on session on pesticide appliances and their maintenance.
16	Sampling techniques for estimation of insect population and damage.

Suggested Readings [ENTO-121]:

1. Imms' General Textbook of Entomology - O.W. Richards and R.G. Davies.
2. Introduction to the Study of Insects - D.J. Borror and DeLong's.
3. Fundamentals of Ecology - Eugene. P. Odum & Gray W. Barrett.
4. Integrated Pest Management Concept and Approaches- G.S. Dhaliwal and Ramesh Arora.
5. Insect Physiology and Anatomy - N.C. Pant and Swaraj Ghai.

Semester : II		
Course No. : PATH-121	**Credit Hrs. : 3 (2+1)**	
Course Title : Fundamentals of Plant Pathology		

SYLLABUS

Objectives:

1. To study the importance of plant disease epidemics and its economic impact on crops.
2. To study biotic (living), mesobiotic (viruses/viroids) and abiotic (non-living and environmental) causes of disease/ disorders.
3. To study the different types of symptoms, cause and pathogens characteristics and its reproduction.
4. To study the epidemiology of diseases.
5. To study and apply methods of management of plant diseases.

THEORY

Introduction, Scope and Objectives of Plant Pathology: Definition, Derivation and different disciplines of Plant Pathology; General Terms (glossary) commonly used in Plant Pathology; Scope and Objectives; Importance of Plant Pathology in Agriculture.

Importance of Plant Diseases: Plant disease epidemics that cause economic imbalance over the years; Historical and Present examples of losses caused by plant diseases viz. Irish famine, Bengal famine, Coffee rust, Discovery of Bordeaux mixture, Wheat rust etc.

History and Development of Plant Pathology: Important Milestones, Famous discoveries/ inventions and Contributions of National and International Phytopathologists; Development of Plant Pathology in India.

Definition and Concept of Plant Disease: Plant Disease; Conditions necessary for disease development; Disease triangle, disease tetrahedron/ pyramid concepts; Classification of diseases based on causal organism/ agent, symptoms, plant organs they affect and type of host plant affected and mode of spread & severity.

Causes of Plant Diseases and Symptoms: Plant diseases caused by abiotic and biotic agents; Diseases caused by Fungi, Bacteria, Viruses, Phytoplasmas and Phanerogamic parasites.

Diseases due to Biotic Agents: Symptoms and Signs; Hypoplasia, Hyperplasia, Hypertrophy and Necrotic symptoms caused by Fungi, Bacteria, Viruses, Phytoplasmas etc.

General Characteristics of Plant pathogens: Classification of Prokaryotes according to Bergey's Manual of Systemic Bacteriology, Classification of Fungi, Viruses and Mollicutes (Outlines).

Growth and Reproduction of plant pathogens and Replication of plant viruses: Types of growth, methods of measurement and kinetics of growth observed in pathogens; Reproduction types and reproductive structures in plant pathogens; Multiplication of plant viruses and phytoplasmas. Reproduction in bacteria.

Liberation/ Dispersal of Plant pathogens and Survival of Plant pathogens: Active and passive discharge of spores/ inoculum; mechanism of liberation; Distribution-dissemination, and direct and indirect methods of transmission; Introduction of plant diseases into India and in other countries; Survival of plant pathogens.

Types of Parasitism and Variability in Plant pathogens: Biotrophs, necrotrophs, pathotrophs, facultative saprophytes; Variability in microorganisms and its necessity for survival; Mechanisms of variability in fungi: bacteria and viruses. Mechanisms: Mutation, Recombination, Heterokaryosis, Heteroploidy, Parasexualism; Transmission, Transformation, Transduction and Conjugation.

Pathogenesis: Definition; Phenomenon of host infection/ Mechanism of infection by various plant pathogens; Avenues of penetration and defence mechanism associated with host.

Introduction to Principles of Plant Disease and Management: Principles; Integrated Disease Management (IDM); Methods of management. Introduction to Plant Disease Epidemiology, Factors governing epidemics. Classification of fungicides and antibiotics on the basis of chemical nature and mode of action.

PRACTICAL

Study of Laboratory Equipments and Microscopes, Study of symptoms and diagnosis of plant diseases; Study of disease symptoms caused by Virus, Viroids and Mollicutes; Morphological characters of Fungi, Bacteria, Virus, Viroids, and Mollicutes; Microscopic examination of plant pathogenic Fungi; Preparation of culture media and sterilization; Isolation and Purification techniques for Fungi and Bacteria; Methods of inoculation and Proving Koch's Postulates; Field/ Museum Visit to get acquainted with various plant disease symptoms. Detection of seed borne plant pathogens. Methods of seed treatment. Preparation of Bordeaux Mixture and Paste. Fungicide formulations. Plant disease assessment (Phytopathometry). Methods of application of fungicides. Use of biocontrol agents in plant disease management.

TEACHING SCHEDULE

THEORY [PATH-121]

Lecture No.	Topic	Sub-topics/ Key Points	Weightage (%)
1 - 2	**Introduction, Scope and Objectives of Plant Pathology**	Definition, Objectives of Plant Pathology; Derivation and different Disciplines of Plant Pathology; General Terms (Glossary) commonly used in Plant Pathology; Scope and Objectives.	10
3 - 4	**Importance of Plant Diseases**	Importance of Plant Pathology in Agriculture: Importance of Plant Diseases- (Crop losses, food security, environmental impact, health hazards, environmental sustainability). Plant disease epidemics that cause economic imbalance over the years; Historical and Present examples of losses caused by plant diseases viz., Irish famine, Bengal famine, Coffee rust, Discovery of Bordeaux mixture, Wheat rust etc. (*in brief*)	10
5 - 6	**History and Development of Plant Pathology**	Important Milestones, Famous Discoveries/ inventions and Contributions of National and International Phytopathologists; Development of Plant Pathology in India- (Contribution of Indian Scientists in brief)	
7 - 8	**Definition and Concept of Plant Disease**	Definition: Plant Disease; Conditions necessary for disease development: Disease triangle, Disease tetrahedron/ pyramid concepts; Classification of Plant diseases based on: Causal organism/ agent, Symptoms, Plant organs they affect and Type of host plant affected and Mode of spread & severity, etc.	10
9 - 10	**Causes of Plant Diseases and Symptoms**	Causes of Plant Disease with examples: i) Biotic causes: Eukaryotic- (Fungi, Protozoa, Algae, Nematode and Flowering parasites); Prokaryotic- (Bacteria, Fastidious vesicular bacteria, Phytoplasmas, Spiroplasmas, Actinomycetes). ii) Mesobiotic causes: iii) Abiotic causes:	5
11 - 12	**Diseases due to Biotic Agents**	Symptoms and Signs; Hypoplasia, Hyperplasia, Hypertrophy and Necrotic symptoms caused by Fungi, Bacteria, Viruses, Phytoplasmas.	5

Continued….

13 - 15	**General Characteristics of Plant Pathogens**	Outline of Classification of Plant Pathogens: Prokaryotes according to Bergey's Manual of Systemic Bacteriology, Classification of Fungi (according to Krik *et al*., 2008), Viruses and Mollicutes.	10
16 - 19	**Growth and Reproduction of Plant Pathogens and Replication of Plant Viruses**	Types of growth, Methods of measurement and Kinetics of growth observed in pathogens; Reproduction types and reproductive structures in plant pathogens; Multiplication of plant viruses and phytoplasmas; Reproduction in bacteria.	10
20 - 22	**Liberation/ Dispersal of Plant pathogens and Survival of Plant pathogens**	Active and passive discharge of spores/ inoculum; Mechanism of liberation; Distribution-dissemination (direct & indirect), Direct and indirect methods of transmission; Introduction of plant diseases into India and in other countries; Survival and perpetuation of plant pathogens.	10
23 - 25	**Types of Parasitism and Variability in Plant Pathogens**	Definitions; Biotrophs, Necrotrophs, Pathotrophs, Facultative saprophytes; Variability in microorganisms and its necessity for survival; Mechanisms of variability in fungi, bacteria, and viruses; Mechanisms: Mutation, Recombination, Heterokaryosis, Heteroploidy, Parasexualism, Transmission, Transformation, Transduction and Conjugation.	5
26 - 28	**Pathogenesis**	Pathogenesis: Definition; Phenomenon of host infection/ Mechanism of infection by various plant pathogens; Avenues of penetration and defence mechanism associated with host.	10
29 - 31	**Introduction to Principles of Plant Disease and Management**	Principles and Methods of plant disease management: Avoidance, Exclusion, Eradication, Protection (Chemical and Biological), Host resistance; Concept of Integrated Disease Management (IDM); Classification of fungicides and antibiotics on the basis of chemical nature and mode of action.	10
32	**Introduction to Plant Disease Epidemiology**	Definitions, Introduction to Plant Disease Epidemiology, Factors governing epidemics.	5
		Total=	**100**

TEACHING SCHEDULE

PRACTICAL (PATH-121)

Exercise No.	Exercise Title
1	Study of microscope and Acquaintance with various laboratory equipments.
2	Study of different plant disease symptoms.
3	Field/ Museum visit to observe various disease symptoms.
4	Microscopic examination of diseased specimens.
5 - 6	Study of important fungal plant pathogens (*Alternaria, Botrytis, Colletotrichum, Cercospora, Curvularia, Dreschela, Fusarium, Pythium, Phytophthora,* Downy mildew and Powdery mildew genera, Smut and rust genera)
7	Preparation of culture media (PDA, NA, Oat meal Agar< Richard's medium)
8	Isolation and purification of plant pathogens.
9	Study of Koch's Postulates (Foliar and soil borne plant pathogens).
10	Detection of seed borne plant pathogens.
11	Methods of seed treatment.
12	Preparation of Bordeaux Mixture and Paste.
13	Fungicide formulations.
14	Plant disease assessment (Phytopathometry).
15	Methods of application of fungicides.
16	Use of biocontrol agents in plant disease management.

Suggested Readings [PATH-121]:

1. Pathak VN. Essentials of Plant Pathology. Prakash Publ., Jaipur.
2. Agrios GN. 2010. Plant Pathology. Acad. Press.
3. Kamat MN. Introductory Plant Pathology. Prakash Pub, Jaipur.
4. Singh RS. 2008. Plant Diseases. 8th Ed. Oxford & IBH Publ. Co.
5. Singh RS. 2013. Introduction to Principles of Plant Pathology. Oxford and IBH Publ. Co.
6. Alexopoulos, Mims and Blackwel. Introductory Mycology.
7. Mehrotra RS & Aggarwal A. 2007. Plant Pathology.7th Ed. Tata-McGraw Hill Publ. Co. Ltd.
8. Gibbs A & Harrison B. 1976. Plant Virology - The Principles. Edward Arnold, London.
9. Hull R. 2002. Mathews Plant Virology. 4th Ed. Academic Press, New York.
10. Verma JP. 1998. The Bacteria. Malhotra Publ. House, New Delhi.
11. Goto M. 1990. Fundamentals of Plant Bacteriology. Academic Press, New York.
12. Dhingra OD & Sinclair JB. 1986. Basic Plant Pathology Methods. CRC Press, London, Tokyo.
13. Nene YL & Thapliyal PN.1993. Fungicides in Plant Disease Control. 3rd Ed. Oxford & IBH, N. Delhi.
14. Vyas SC. 1993. Handbook of Systemic Fungicides. Vols. I-III. Tata McGraw Hill, New Delhi.
15. Rajeev K & Mukherjee RC. 1996. Role of Plant Quarantine in IPM. Aditya Books.
16. Rhower GG. 1991. Regulatory Plant Pest Management. In: Handbook of Pest Management in Agriculture. 2nd Ed. Vol. II. (Ed. David Pimental). CRC Press.
17. Kajal Kumar Biswas, Parimal Sinha, Pranab Dutta, Prashant P. Jambhulkar, Bishnu Maya Bashyal, Srujani Behera, Manjunath Hubballi, R. Viswanathan (2024) Concepts of Plant Pathology and Disease Management, Indian Phytopathological Society Publ., New Delhi.

Semester	**:**	**II**		
Course No.	**:**	**AHDS-121**	**Credit Hrs.**	**: 2(1+1)**
Course Title	**:**	**Livestock Production and Management**		

SYLLABUS

Objectives:

1. Provide basic knowledge to the students about scientific livestock practices
2. Entrepreneurship development through Livestock production

THEORY

Importance of livestock in the national economy and different development programmes of Govt. of India. Livestock Census and trends of livestock production. Terminology used in livestock management. Concepts of Precision livestock farming: Scope and limitations. Important Indian and exotic breeds of cattle and buffalo. Principles of maximization of livestock production. Feeding and management of calf, heifer and milking animal. Feeding and management of dry, pregnant, draft animals and breeding bull. Common diseases and its preventive, curative measures in cattle and buffalo. Bovine male and female reproductive system, fertility, sterility and reproductive behavior viz., estrus and parturition. Mammary gland and milk secretion. Organic livestock production- definition, importance, principles, standards, certifications, SWOT analysis. Effect of climate change on livestock production. Farm hygiene and their economic disposal of farm wastes. Cost of milk production, economical unit of cattle and buffalo.

PRACTICAL

External body parts of cattle and buffalo. Routine management practices followed on livestock farm. Methods of handling and restraining of animals. Methods of identification Marks and dehorning of animals. Estimation of age and body weight of animal. Recording the pulse rate, respiration rate and body temperature of animal. Preparation of feeding schedule and feeding different categories of cattle and buffalo. Clean and hygienic milk production and milking methods. Judging of animals for dairy and draft purpose. Study of computerized database on dairy farm. Vaccination and control of ecto and endo parasites in cattle and buffalo. Study of various dairy structures. Collection of semen, artificial insemination and pregnancy diagnosis in farm animal. Utilization of dairy farm wastes. Preparation of viable bank proposals for cattle and buffalo. Visit to dairy farms.

TEACHING SCHEDULE

THEORY [AHDS-121]

Lecture No.	Topic	Subtopics/ Key Points	Weightage (%)
1	Scope and Importance	Importance of Livestock in the National Economy and Different Development Programmes of Govt. of India.	8
2	Livestock Census and Trends	Livestock census and Trends of Livestock Production	4
3	Terminology in Livestock	Terminology used in Livestock Management	6
4	Precision Livestock Farming	Concepts of Precision Livestock Farming: Scope and Limitations	6
5	Cattle and Buffalo Breeds	Important Indian and Exotic Breeds of Cattle and Buffalo	10
6	Principles of Livestock Production	Principles of Maximization of Livestock Production	4
7	Feeding and Management	Feeding and Management of calf, heifer and milking animal	8
8	Feeding and Management	Feeding and Management of dry, pregnant, draft animals and breeding bull	6
9	Common Diseases	Common diseases and its Preventive and Curative measures in cattle and buffalo	7
10	Bovine Reproductive System	Bovine Male and Female Reproductive Systems	6
11	Reproductive Behavior of Animals	Fertility, Sterility and Reproductive behavior viz., Oestrus and Parturition.	7
12	Mammary Gland and Milk Secretion	Mammary gland and Milk secretion.	6
13	Organic Livestock Production	Organic Livestock Production- Definition, Importance, Principles, Standards, Certifications, SWOT Analysis	6
14	Climate Change	Effect of climate change on livestock production	6
15	Farm Hygiene	Farm hygiene and their economic disposal of farm wastes	6
16	Economics	Cost of milk production, Economical unit of cattle and buffalo	4
		Total=	**100**

TEACHING SCHEDULE

PRACTICAL (AHDS-121)

Exercise No.	Exercise Title
1	Study of external body parts of cattle and buffalo
2	Routine management practices followed on livestock farm
3	Methods of handling and restraining of animals
4	Methods of identification Marks and dehorning of animals
5	Estimation of age and body weight of animal
6	Recording the pulse rate, respiration rate and body temperature of animal
7	Preparation of feeding schedule and feeding different categories of cattle and buffalo
8	Clean and hygienic milk production and milking methods
9	Judging of animals for dairy and draft purpose
10	Study of computerized database on dairy farm
11	Vaccination and control of ecto and endo parasites in cattle and buffalo
12	Study of various dairy structures
13	Collection of semen, artificial insemination and pregnancy diagnosis in farm animal
14	Utilization of dairy farm wastes
15	Preparation of viable bank proposals for cattle and buffalo
16	Visit to Dairy Farms

Suggested Readings: (AHDS-121)

1. G.C. Banerjee, A Text Book of Animal Husbandry.
2. Thomas C.K. and Sastry, N.S.R., Livestock Production and Management
3. Jagdish Prasad, Principles and Practices of Dairy Farm Management.
4. Thomas C.K. and Sastry N.S.R., Dairy Bovine Production.

B.Sc. (Hons.) Agriculture

[#] List/ Bouquet of Skill Enhancement Courses (SECs): Detailed Syllabi

Sr. No.	Course No.	Course Title with Title Code	Credit Hrs.
1.	**SEC-xxx**	001-Biofertilizer and Biopesticide Production	2(0+2)
2.	**SEC-xxx**	002-Mushroom Production Technology	2(0+2)
3.	**SEC-xxx**	003-Seed Production Technology	2(0+2)
4.	**SEC-xxx**	004-Post-harvest Processing Technology	2(0+2)
5.	**SEC-xxx**	Beneficial Insect Farming	2(0+2)
6.	**SEC-xxx**	Horticulture Nursery Management	2(0+2)
7.	**SEC-xxx**	Plantation Crops Production and Management	2(0+2)
8.	**SEC-xxx**	Poultry Production and Management Technology	2(0+2)
9.	**SEC-xxx**	Processing of Milk and Milk Products	2(0+2)
10.		*(To be added)*	
11.		*(To be added)*	

Note: (i) Skill Enhancement Courses can be added/offered as per the facilities and resources available at the respective universities/colleges based on the relevance to the region and the UG degree subject.

(ii) The host University/ College may also choose suitable SEC courses from those listed under other UG degree programs.

(iii) Above list/ bouquet of SEC courses is an indicative list and subject to modification as applicable therein.

(iv) In case of unavailability of the detailed course-wise syllabus/ teaching schedules of any of above SEC courses, the same can be primarily developed and followed at College/ University level in the academic year, 2024-25. However, the same can be obtained from the respective UG Degree Coordinator/ Discipline Coordinators and can be followed w.e.f. AY, 2025-26.

Course Curriculum of Third Semester

as per the ICAR-Sixth Deans' Committee Report for the Academic Programmes in

AGRICULTURE

- UG-Certificate in Agriculture
- UG-Diploma in Agriculture
- UG-Degree: B.Sc. (Hons.) Agriculture

Mahatma Phule Krishi Vidyapeeth, Rahuri	Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola	Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani	Dr. Balasaheb Sawant Konkan Krishi Vidyapeeth, Dapoli	Maharashtra Agricultural Universities Examination Board, Pune

Compiled & submitted by

Dr. S.B. Kharbade
Dean (F/A) & DI and Associate Dean, PGI, MPKV, Rahuri.
UG Degree Syllabus State Coordinator

with

UG Degree Syllabus Discipline Coordinators & DICC -

UG Degree Syllabus Core Committee

Submitted to the

Directors of Instruction and Deans (F/A) Coordination Committee

~ w.e.f. AY, 2025-26 ~

Course Curriculum of Third Semester as per the ICAR-Sixth Deans' Committee Report for Academic Programme in AGRICULTURE

Course Layout

B.Sc. (Hons.) Agriculture

Semester: III (New) ***w.e.f.*** **Academic Year: 2025-26**

Sr. No.	Course No.	Course Title	Credit Hrs.	Remark
1.	**AEC-235**	Physical Education, First Aid, Yoga Practices and Meditation	2(0+2)	--
2.	**GPB-231**	Principles of Genetics	3(2+1)	--
3.	**AGRO-232**	Crop Production Technology-I (*Kharif* Crops)	3(1+2)	--
4.	**AGRO-233**	Principles and Practices of Natural Farming	2(1+1)	--
5.	**HORT-232**	Production Technology of Fruit and Plantation Crops	2(1+1)	--
6.	**AE-231**	Farm Machinery and Power	2(1+1)	--
7.	**NEMA-231**	Fundamentals of Nematology	2(1+1)	--
8.	**ECON-231**	Principles of Agricultural Economics and Farm Management	2(2+0)	--
9.	**AHDS-232**	Technology of Milk and Milk Products	2(1+1)	--
10.	**SEC-235**	Skill Enhancement Course-V[#] (*To be offered from the list of SEC Courses*)	2(0+2)	--
11.	**OC-1/ OC-2/…**	Online Course(s)/ MOOCs[†]	As opted by student	**NG**
		Total Credits Hrs.=	**22(10+12)**	**G**

AEC: Ability Enhancement Course, **SEC**: Skill Enhancement Course, **OC**: Online Course, **G**: Gradial, **NG**: Non-gradial

[†] **Note:** It is mandatory for each Student to complete **total 10 credits** (Non-gradial) of **Online Courses** from available resources across III to VIII semesters under the guidance of assigned Faculty/Advisor.

Semester	**: III**		
Course No.	**: AEC-235**	**Credit Hrs.**	**: 2(0+2)**
Course Title	**: Physical Education, First Aid, Yoga Practices and Meditation**		
Gradial Common Course across all UG Degrees			

SYLLABUS

Objectives : (i) To make the students aware about Physical Education, First Aid and Yoga Practices,

(ii) To disseminate the knowledge and skill how to perform physical training, perform first aid and increase stamina and general wellbeing through Yoga.

PRACTICAL

Physical Education; Training and Coaching- Meaning and concept; Aerobic and Aerobic exercises; Calisthenics, Weight Training, Circuit Training, Interval Training, Fartlek Training; Effect of Exercise on Muscular, Respiratory, Circulatory and Digestive systems; Balanced Diet and Nutrition- Effect of Diet on Performance; Physiological Changes due to ageing and Role of exercise on ageing process; Personality, its dimensions and types, Role of Sports in Personality Development; Motivation and Achievements in Sports; Learning and Theories of Learning; Adolescent Problems and its Management; Posture; Postural Deformities, Exercises for Good Posture.

Yoga: History of Yoga, Types of Yoga, Introduction to Yoga.

- Asanas (Definitions and Importance)- - Padmasan, Gaumukhasan, Bhadrasan, Vajrasan Shashakasan, Pashchimothasan, Ushtrasan, Tadasan, Padhastasan, Ardhchandrasan, Bhujangasan, Utanpadasan, Sarvangasan, Parvatasan, Patangasan, Shishupalanasan- left & right leg, Pavanmuktasan, Halasan, Sarpasan, Ardhdhanurasan, Shawasan.
- Suryanamaskar, Pranayama (Definitions and Importance)- Omkar, Suryabhedan, Chandrabhedan, Anulom, Vilom, Shitali, Shitkari, Bhastrika, Bhramari.
- Meditation (Definitions and Importance)- Yogic Kriyas (Kapalbhati), Tratak, Jalneti and Tribandh
- Mudras (Definitions and Importance)- Gyanmudra, Dhyanmudra, Vayumudra, Akashmudra, Prutvimudra, Shunyamudra, Suryamudra, Varunmudra, Pranmudra, Apanmudra, Vyanmudra, Uddanmudra.
- Role of Yoga in Sports.
- Teaching of Asanas- Demonstration, Practice, Correction and Practice.

History of Sports and Ancient games, Governance of Sports in India; Important Sporting events-Awards in sports, History, Latest rules, Measurement of playfield, Specifications of equipment, Skill, Technique, Style and Coaching of major games (Cricket, Football, Table tennis, Badminton, Volleyball, Basketball, Kabaddi and Kho-Kho) and Athletics.

Need and Requirement of First Aid: First Aid techniques, Equipment and Upkeep First Aid techniques; First aid-related with respiratory system; First aid-related with Heart, Blood and Circulation; First Aid-related with wounds and injuries; First Aid-related with Bones, Joints muscles related injuries; First Aid-related with Nervous system and Unconsciousness; First Aid-related with Gastrointestinal Tract, Skin Burns; First Aid-related with Bites and stings, poisoning; First Aid-related with Sense organs; Handling and transport of injured traumatized persons- Sports injuries and their Treatments.

TEACHING SCHEDULE

PRACTICAL [AEC-235]

Exercise No.	Topic	Exercise Title / Sub-topics
1	**Physical Education**	To study the training and coaching- Meaning and concept of Physical Education.
2 - 7	**Methods of Training**	To study the method of training - Aerobic and Aerobic Exercises.
		To study the method of training - Calisthenics
		To study the method of training - Weight Training
		To study the method of training - Circuit Training
		To study the method of training - Interval Training
		To study the method of training - Fartlek Training
8	**Effect of Exercise**	To study the effect of exercise on Muscular, Respiratory, Circulatory and Digestive systems.
9	**Balanced Diet and Nutrition**	To study the Balanced Diet and Nutrition- Effect of diet on performance.
10	**Physiological Changes**	To study the physiological changes due to ageing and role of exercise on ageing process.
11	**Personality Development**	To study the dimensions and types - Role of sports in personality development.

Continued…

12	**Motivation and Achievements in Sports**	To study the Motivation and Achievements in Sports
13	**Learning and Theories of Learning**	To study the Learning and Theories of Learning
14	**Adolescent Problems and its Management**	To study the Adolescent Problems and its Management
15	**Posture**	To study the Postural Deformities, Exercises for Good Posture
16 - 22	**Yoga**	To study the Introduction, History and Types of Yoga
		To study the Asanas: Padmasan, Gaumukhasan, Bhadrasan, Vajrasan Shashakasan, Pashchimotasan, Ushtrasan, Tadasan, Padhastasan, Ardhchandrasan, Bhujangasan, Utanpadasan, Sarvangasan, Parvatasan, Patangasan, Shishupalanasan- left leg- right leg, Pavanmuktasan, Halasan, Sarpasan, Ardhdhanurasan, Shawasan.
		To study the Suryanamaskar, Pranayama, Omkar, Suryabhedan, Chandrabhedan, Anulom, Vilom, Shitali, Shitkari, Bhastrika, Bhramari.
		To study the Meditation, Yogic Kriyas (Kapalbhati), Tratak, Jalneti and Tribandh
		To study the Mudras: Gyanmudra, Dhyanmudra, Vayumudra, Akashmudra, Prutvimudra, Shunyamudra, Suryamudra, Varunmudra, Pranmudra, Apanmudra, Vyanmudra, Uddanmudra.
		To study the Role of Yoga in Sports
		To study the Demonstration, Practice, Correction and Practice of Asanas.
23 - 26	**Sports**	To study the History of Sports and Ancient games
		To study the Governance of Sports in India
		To study the Awards in Sports, History, Latest rules, Measurement of playfield, Specifications of equipment in important sporting events.
		To study the Skill, Technique, Style and Coaching of major games (Cricket, Football, Table Tennis, Badminton, Volleyball, Basketball, Kabaddi and Kho-Kho and Athletics).

Continued...

27 - 32	**First Aid**	To study the Need and Requirement of First Aid-First Aid techniques, Equipment and Upkeep.
		To study the First aid related with Respiratory system, Heart, Blood and Circulation.
		To study the First aid related with Wounds and Injuries, Bones, Joints muscles related injuries.
		To study the First aid related with Nervous system Unconsciousness, Sense organs.
		To study the First aid related with Gastrointestinal Tract, Skin Burns, Bites and Stings, Poisoning.
		To study the Handling and Transport of Injured Traumatized Persons- Sports Injuries and their Treatments.

Semester	**:**	**III**		
Course No.	**:**	**GPB-231**	**Credit Hrs.**	**: 3(2+1)**
Course Title	**:**	**Principles of Genetics**		

SYLLABUS

Objectives : To acquaint the students with both principles and practices in the areas of Classical Genetics, Modern Genetics, Quantitative Genetics and Cytogenetics.

THEORY

Pre- and post-Mendelian concepts of heredity, Mendelian principles of heredity; Study of model organisms (Drosophila, Arabidopsis, Garden pea, *E. coli* and Mice), Architecture of chromosomes, chromonemata, chromosome matrix, chromomeres, centromere, secondary constriction and telomere, Special types of chromosomes, Chromosomal theory of inheritance-Cell cycle and Cell division- mitosis and meiosis. Probability and Chi-square. Types of DNA and RNA, Dominance relationships, Epistatic interactions with examples, Introduction and Definitions of Cytology, Genetics and Cytogenetics and their interrelation. Multiple alleles, Pleiotropism and Pseudoalleles, Sex determination and sex linkage, Sex-limited and sex-influenced traits, Blood group genetics, Linkage and its estimation, Crossing over mechanism, Chromosome mapping, Structural and numerical variations in chromosomes and their implications, Use of haploids, dihaploids and double haploids in Genetics, Mutation, Classification, Methods of inducing mutations, Mutagenic agents and induction of mutation. Qualitative and quantitative traits, Polygenes and continuous variations, Multiple factor hypothesis; Cytoplasmic inheritance; Nature, structure and replication of genetic material, Protein synthesis, Transcription and translational mechanism of genetic material, Gene concept: Gene structure, function and regulation.

PRACTICAL

Study of microscope, Study of cell structure, Mitosis and Meiosis cell divisions, Experiments on monohybrid, dihybrid, test cross and back cross, Experiments on epistatic interactions including test cross and back cross, Practice on mitotic and meiotic cell division, Experiments on probability and Chi-square test, Determination of linkage and cross-over analysis (through two-point test cross data), Study on sex-linked inheritance in Drosophila. Study of models on DNA and RNA structures.

TEACHING SCHEDULE

THEORY [GPB-231]

Lecture No.	Topic	Sub-topics/ Key Points	Weightage (%)
1	Genetics	History of Genetics, Relation of Genetics with other fields of science, Introduction and Definitions of Cytology, Genetics, Cytogenetics and their interrelation.	4
2	Pre- and Post-Mendelian Concepts of Heredity: Pre-Mendelian Era-(500 BC-1850 AD); Mendelian Era-(1850-1900); Post-Mendelian Era-(1900>)	*Brief Statement/ Concept and Proposers of ~* 1. Pre-formation Theory 2. Theory of Epigenesis 3. Theory of Acquired Characters 4. Theory of Pangenes 5. Germplasm Theory Other significant contributions during pre-Mendelian, Mendelian and post-Mendelian era and advances after 1900; Impact of Genetics and its Application in Agriculture	
3	Mendelian Principles of Heredity	Mendel's Laws of Heredity, Reasons of Mendel's success and deviations or exceptions or anomalies to Mendelism.	4
4	Study of Model Organisms	Drosophila, Arabidopsis, Garden pea, *E. coli* and Mice (in brief)	2
5	Chromosomes Structure, Morphology, Number, Types and Function	Types and Functions of chromosomes; Architecture of chromosomes, chromonemata, chromosome matrix, chromomeres, centromere, secondary constriction, telomere and Special types of chromosomes	4
6	Chromosomal Theory of Inheritance	Chromosomal theory of inheritance (in short)	
7-8	Cell Division: Mitosis and Meiosis	Ultra structure of Cell, Cell organelles & their functions; Types of Cells; Differences between Animal cell and Plant cell. Stages of Mitosis and Meiosis. Significance of Mitosis and Meiosis, Differences between Mitosis and Meiosis.	4
9	Probability and Chi-square Test	Definitions of Probability and Chi-square test; Application and requirement of Chi-square test.	2
10	DNA and RNA	Structure, Functions and Types of DNA and RNA	6
11-12	Nature and Replication of Genetic Material	Introduction; DNA as a genetic material, Replication of DNA- Dispersive, Conservative, Semi-conservative. Differences between DNA and RNA	

Continued…

13	Dominance Relationships	Different patterns of Dominance relationship like, Complete dominance, Incomplete dominance, Co-dominance, Overdominance and Lethal gene action.	2
14-16	Gene Interaction, Epistatic interactions with Examples and Ratios	Differences and Similarities between Epistasis and Dominance. 1. Recessive epistasis (Supplementary gene action) 2. Dominant epistasis (Simple epistasis) 3. Dominant Inhibitory epistasis (Inhibitory g. a.) 4. Duplicate recessive epistasis (Complementary g. a.) 5. Duplicate dominant epistasis (Duplicate g. a.) 6. Polymeric gene action 7. Typical dihybrid ratio	8
17	Multiple Alleles Pleiotropism, Pseudo-alleles, Blood Group Genetics	Important features of multiple alleles Examples of multiple alleles 1. Fur colour in a rabbit, 2. ABO blood groups in man. Pleiotropism, pseudo-alleles, penetrance and expressivity	4
18	Sex Determination and Sex Linkage, Sex-limited and Sex-influenced traits	Introduction, Importance of Sex determination, Differences between Autosomes and Allosomes. Allosomal sex determination: 1. XX-XY System 2. XX-XO System 3. XO-XX System 4. ZW-ZZ (XY-XX) System Sex-linked characters: (Colour blindness in human being); Differences between Sex-limited and Sex-influenced traits	6
19	Linkage and its Estimation	Introduction, Features of Linkage, Phases of Linkage, Types of Linkage, Linkage and Pleiotropy, Significance of Linkage	4
20	Crossing over Mechanisms	Introduction, Main features of crossing over, Types of crossing over; Molecular mechanism of Crossing over, Factors affecting crossing over, Significance of Crossing over. Interference and Coincidence (Definitions), Differences between Crossing over and Linkage.	4
21	Chromosome Mapping	Definition and Concept of Chromosome Mapping (in brief)	2

Continued…

22	Structural Variation in Chromosome	Introduction, Types of Structural chromosome changes, Genetic effects and Significance	4
23	Numerical Variation in Chromosome	Introduction, Types of numerical chromosome variation; Genetic effects and Significance. Use of haploids, dihaploids and double haploids in Genetics.	4
24-25	Mutation and Mutagens	Introduction, Characteristics of Mutation, Classification of mutation, Kinds of mutation, Methods of inducing mutations; Mutagenic agents with examples; Application in crop improvement.	8
26	Qualitative and Quantitative Traits, Polygenes and Continuous Variation	Introduction, Characteristics of Qualitative and Quantitative traits, Differences between them, Examples of Qualitative and Quantitative traits.	4
27	Multiple Factor Hypothesis	Introduction; Concept of Multiple factor hypothesis by Nilsson-Ehle in Wheat.	4
28	Cytoplasmic Inheritance	Introduction, Characteristics of Cytoplasmic inheritance, Differences between Mendelian inheritance and Cytoplasmic inheritance; Classes of cytoplasmic inheritance, Plastid and mitochondrial inheritance, Significance of Cytoplasmic inheritance in crop improvement.	4
29-30	Protein Synthesis; Transcriptional and Translational Mechanisms of Genetic Material	Introduction, Overview of Protein Synthesis; • Transcription: Definition, Role of RNA polymerase, Stages/ Steps of transcription/ Regulatory mechanism; Types of RNA, Post-transcriptional modifications; • Translation: Definition, Role of Ribosome & transfer tRNA. Stages/ Steps of transcription/ Regulatory mechanism- Process of peptide bond formation; • Genetic code and its properties.	8
31	Gene Concept: Gene Structure, Function and Regulation	Gene structure, Fine structure of gene, Classical and Modern concept of gene, Benzer's concept of Fine structure of gene; Cistron, Recon and Muton	4
32		Introduction, Mechanism of gene regulation- 1. Negative regulation, 2. Positive regulation Emphasis on the Lac Operon Model	4
		Total=	**100**

TEACHING SCHEDULE

PRACTICAL [GPB-231]

Exercise No.	Exercise Title
1	Study of microscope
2	Study of cell structure
3	Preparation of microscopic slides of mitosis - Onion root tips
4	Preparation of microscopic slides of meiosis - Tradescantia/ Onion/ Wheat inflorescence
5	Methods of finding-out the gametes and gametic recombinations
6	Problems on monohybrid ratio and its modifications
7	Problems on dihybrid ratio and its modifications
8	Experiments on test cross and back cross
9	Gene Interaction-I: Gene interaction without modification of F_2 ratio (comb-shape) and Complementary gene interaction.
10	Gene Interaction-II: Gene interaction with modification of F_2 ratio: Supplementary factor, Epistasis factor, Inhibitory factor
11	Gene Interaction-III: Gene interaction with modification of F_2 ratio: Additive factor, Duplicate factor and Lethal factor
12	Problems on Probability
13	Problems on Chi-square test
14	Determination of linkage and cross over analysis (through two-point test cross and three-point test cross data)
15	Study on sex-linked inheritance in Drosophila
16	Study of models on DNA and RNA structures.

Suggested Readings [GBP-231]:

1. Principle of Genetics. E.J. Gardner, M.J. Simmons, D.P. Snustad. Wiley India (P) Ltd.
2. Genetics. P.K. Gupta, Rastogi Publication, Meerut (UP).
3. Fundamentals of Genetics. B.D. Singh, Kalyani Publication, New Delhi.
4. Genetics. M.W. Strickberger, Pearson Education, Inc.
5. Elements of Genetics. Phundan Singh, Kalyani Publication, New Delhi.
6. Genetics. Sushant Elrod and William Stansfield, McGraw Hill Publishing Co. Ltd., New Delhi.
7. Principles of Genetics. Edmund W. Sinnott, L.C. Dunn, Th. Dobzhansky. New York; London: McGraw-Hill, 1950.

Semester	**:**	**III**	
Course No.	**:**	**AGRO-232**	**Credit Hrs. : 3(1+2)**
Course Title	**:**	**Crop Production Technology-I (*Kharif* crops)**	

SYLLABUS

Objectives : (i) To impart basic and fundamental knowledge on principles and practices of *kharif* crop production,

(ii) To impart knowledge and skill on scientific crop production and management.

THEORY

Origin, Geographical distribution, Economic importance, Soil and climatic requirements, Varieties, Cultural practices and Yield of *Kharif* crops. Cereals- Rice, Maize, Sorghum, Pearl millet, Finger millet and Other Minor millets (Foxtail millet, Proso millet, Barnyard millet); Pulses- Pigeon pea, Mungbean, Urdbean and Horse gram; Oilseeds-Groundnut, Soybean, Sesame, Niger and Castor; Fibre crops- Cotton and Jute; Forage crops- Sorghum, Cowpea, Cluster bean, Maize, Guinea and Napier.

PRACTICAL

Rice- Nursery preparation and transplanting; Sowing of Soybean, Pigeon pea and Mungbean, Maize, Groundnut and Cotton; Effect of seed size on germination and seedling vigour of *Kharif* crops; Effect of sowing depth on germination of *Kharif* crops; Identification of weeds in *Kharif* crops; Top dressing and foliar feeding of nutrients; Study of yield contributing characters and yield calculation of *Kharif* crops; Study of crop varieties and important agronomic experiments at experiential farm; Recording biometric observations; Study of forage experiments; Morphological description of *Kharif* crops; Visit to research centres of related crops.

Allotment of 2 R area to each student for undertaking various cultural operations as part of *Practical Work Experience*, specifically for raising *Kharif* crop(s) on the allotted plot, to be carried-out concurrently with the above-mentioned practical sessions.

TEACHING SCHEDULE

THEORY [AGRO-232]

Lecture No.	Topic	Subtopics/ Key Points	Weightage (%)
1 - 5	Cereals and Millets – Rice, Maize, Sorghum, Pearl millet Finger millet and other Minor millets, (Foxtail millet, Proso millet and Barnyard millet)	Origin, Geographical distribution, Economic importance, Soil and climatic requirements, Varieties/ Hybrids, Cultural practices: Land preparation, Seeds and Sowing, Irrigation and Nutrient Management Intercultural operations including weed management, Plant Protection (Major pests and diseases and their management), Harvesting, Yield and Crop specific post-harvest processing	30
6 - 8	Pulses – Pigeon pea, Mungbean, Urdbean and Horse gram		20
9 - 11	Oilseeds – Groundnut, Soybean, Sesame, Niger and Castor		20
12 - 14	Fiber crops – Cotton and Jute		15
15 - 16	Forage crops: Cereal forages: Maize, Sorghum, Leguminous forages: Cowpea, Cluster bean, Grasses: Napier and Guinea		15
		Total =	**100**

PRACTICAL [AGRO-232]

Part-I (Practical/ Demonstration Sessions)	
Exercise No.	**Exercise Title**
1 - 3	To study the tillage, sowing and transplanting operations in major *Kharif* crops, like: Rice (Nursery preparation and transplanting) **or / &** Soybean, Pigeonpea, Mungbean, Maize, Groundnut, Cotton (Sowing) and Forage crops
4 - 5	To study the effect of seed size on germination of *Kharif* crops
	To study effect of sowing depth on germination of *Kharif* crops
6	Calculations of plant population, seed rate and fertilizers doses.
7	Identification of weeds in *Kharif* crops.
8 - 9	Top dressing and foliar feeding of nutrients.
10 - 11	Study of yield contributing characters and yield calculation of *Kharif* crops.
12	Study of *Kharif* crop varieties.
13	Study of agro-morphological description of *Kharif* season crops.
14	Harvesting and threshing of cereals, pulses, oilseeds and cash *Kharif crops*.
15	Mechanization in *Kharif* crop cultivation.
16	Visit to Research Centers of related crop(s) and Study of important Agronomic Experiments at Agronomy Instructional Farm.

Continued…

Part-II (Work Experience)	
Exercise No.	**Exercise Title**
Allotment of 2 R area to each student towards carrying-out various following agronomic operations for raising *kharif* crop(s) in the allotted plot in parallel mode with Part-I:	
1	Study of package of practices of given *kharif* crop(s)
2	Preparation of calendar of operations for the allotted crop(s)
3 - 4	Study of preparatory, secondary tillage and seed bed preparation
5	Seed treatment and sowing
6	Study of integrated nutrient management (INM)
7	Study of water management
8	Assessment of agro-morphological traits, yield and its contributing characters
9 - 10	Interculturing and weed management in allotted *kharif* crop(s)
11	Study of integrated insect pest and disease management
12	Study of crop maturity signs and harvesting
13 - 14	Threshing, drying, winnowing, storage, preparation of produce for marketing
15	Study of cost of cultivation and working out net returns per student
16	Preparation of 'Summary Report on Crop Production Technology' applied in given crop.

Suggested Readings [AGRO-232]:

1. B. Gurarajan, R. Balasubramanian and V. Swaminathan. Recent Strategies on Crop Production. Kalyani Publishers, New Delhi.
2. Chidda Singh.1997. Modern Techniques of Raising Field Crops. Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi.
3. Rajendra Prasad. Textbook of Field Crops Production - Commercial Crops. Volume-II, ICAR Publication.
4. S.R. Reddy. 2009. Agronomy of Field Crops. Kalyani Publishers, New Delhi.
5. S.S. Singh. 2005. Crop Management. Kalyani Publishers, New Delhi.
6. UAS, Bangalore. 2011. Package of Practice. UAS, Bangalore.
7. Subhash Chandra Bose, M. and Balakrishnan, V. 2001. Forage Production South Asian Publishers, New Delhi.

Semester : III		
Course No. : AGRO-233	**Credit Hrs. : 2(1+1)**	
Course Title : Principles and Practices of Natural Farming		

SYLLABUS

Objectives : (i) To provide comprehensive understanding and knowledge to students about natural farming.
(ii) To teach students the concept, need and principles of native ecology-based production under natural farming.
(iii) To impart practical knowledge of natural farming and related agricultural practices in Indian and global environmental and economic perspectives.

THEORY

Indian Heritage of Ancient Agriculture, History of Natural Farming, Importance of natural farming in view of climate change, soil health, water use carbon sequestration, biodiversity conservation, food security and nutritional security, and sustainable development goals (SDGs), Concept of natural farming; Definition of natural farming; Objective of natural farming, Essential characteristics and Principles of natural farming; Scope and importance of natural farming. Main Pillars of natural farming; Methods/ types/schools of natural farming. Characteristics and design of a natural farm, Concept of ecological balance, ecological engineering and community responsibility in natural versus other farming systems, Introduction to concept of ecological, water, carbon and nitrogen foot prints, Concept and evaluation of ecosystem services, integration of crops, trees and animals, cropping system approaches, Biodiversity, indigenous seed production, farm waste recycling, water conservation and renewable energy use approaches on a natural farm, Rearing practices for animals under natural farming, Nutrient management in natural farming and their sources, Insect, pest, disease and weed management under natural farming; Mechanization in natural farming, Certification and standards in natural farming, marketing and export potential of natural farming produce and products. Initiatives taken by Government (central/state), NGOs and other organizations for promotion of natural farming and chemical free agriculture, Entrepreneurship opportunities in natural farming.

PRACTICAL

Visit of Natural farm and Chemical-free Traditional Farms to study the various components and operations of Natural Farming principles at the farm; Indigenous Technical Knowledge (ITKs) for seed, tillage, water, nutrient, insect-pest, disease and weed management; On-farm inputs preparation methods and protocols, Studies in green manuring in-situ and green leaf manuring, Studies on different types of botanicals and animal urine and dung based non-aerated and aerated inputs for plant growth, nutrient, insect and pest and disease management; Weed management practices in natural farming; Techniques of Indigenous seed production- storage and marketing, Partial and complete nutrient and financial budgeting in natural farming; farming; Evaluation of ecosystem services in natural farming (Crop, Field and System). Case studies and Success stories in natural farming and chemical-free traditional farming,

TEACHING SCHEDULE

THEORY [AGRO-233]

Lecture No.	Topic	Subtopics/ Key Points	Weightage (%)
1	Natural Farming	Indian Heritage of Ancient Agriculture; History of Natural Farming	6
2-3	Importance of Natural Farming	Importance of natural farming in view of- i. Climate change ii. Soil health iii. Water use iv. Carbon sequestration v. biodiversity conservation vi. Food security vii. Nutritional security and viii. Sustainable development goals (SDGs)	8
4	Concept of Natural Farming	Definition, Objectives, Essential characteristics and Principles of Natural Farming	8
5	Scope, Importance and Pillars of NF	Scope and importance of Natural Farming, Main Pillars of Natural Farming (*Jivamrit, Beejamrit,* Mulching *Whapasa*)	8
6	Natural farming and farm	Methods/Types/Schools of Natural Farming, Characteristics and Design of a Natural farm	8
7	Ecological Balance in Natural Farming *vs* Other Farming	Concept of Ecological Balance, Ecological Engineering and Community Responsibility in Natural versus Other farming systems	8
8	Foot print	Introduction to Concept of Ecological, Water, Carbon and Nitrogen footprints	8
9-10	Integration Approaches on Natural Farm	Integration of crops, trees and animals, Cropping system approaches, Biodiversity, Indigenous seed production, Farm waste recycling, Water conservation and Renewable energy use approaches on a Natural farm	12
11-13	Animal rearing and nutrient, insect, pest, disease and Weed management	Rearing practices for animals under Natural Farming**;** Nutrient management in Natural Farming and their sources; Insect, pest, disease and weed management under Natural Farming	16
14	Mechanization	Mechanization in Natural Farming	7
15	Promotion of Natural Farming	Initiatives taken by Government (Central/State), NGOs and other organizations for promotion of Natural farming and Chemical-free agriculture	6
16	Entrepreneurship in Natural Farming	Entrepreneurship opportunities in Natural Farming; Marketing and Export potential of Natural Farming produce and products.	5
		Total=	**100**

TEACHING SCHEDULE

PRACTICAL [AGRO-233]

Exercise No.	Exercise Title
1	Visit of natural farm and chemical-free traditional farms to study the various components and operations of Natural farming principles at the farm
2 - 3	Indigenous technical knowledge (ITK) for seed, tillage, water, nutrient, insect-pest, disease and weed management
4	On-farm inputs preparation methods and protocols
5	Studies in green manuring in-situ and green leaf manuring
6 - 7	Studies on different types of botanicals and animal urine and dung based non-aerated and aerated inputs for plant growth,
8	Nutrient management in Natural Farming
9 - 10	Insect and pest and disease management in Natural Farming
11	Weed management practices in Natural Farming
12	Techniques of Indigenous Seed Production- Storage and marketing,
13	Partial and complete nutrient and financial budgeting in Natural Farming.
14	Evaluation of ecosystem services in Natural Farming (Crop, Field and System)
15 - 16	Case studies and Success stories in Natural Farming and Chemical-free Traditional Farming.

Suggested Readings [AGRO-233]:

1. Ayachit, S.M. 2002. *Kashyapi Krishi Sukti* (A Treatise on Agriculture by Kashyapa). Brig Sayeed Road, Secunderabad, Telangana: Asian Agri-History Foundation 4: 205.
2. Boeringa, R. (Eed.). 1980. Alternative Methods of Agriculture. Elsevier, Amsterdam, 199 pp.
3. Das, P., Das, S.K., Arya, H.P.S., Reddy, G. Subba, Mishra, A. and others: Inventory of Indigenous Technical Knowledge in Agriculture: Mission mode Project on Collection, Documentation and Validation of Indigenous Technical Knowledge, Document 1 To 7, Indian Council of Agricultural Research, New Delhi.
4. Ecological Farming -The Seven Principles of a Food System That Has People at its Heart. May 2015, Greenpeace.
5. FAO. 2018. The 10 Elements of Agro-ecology: Guiding the Transition to Sustainable Food and Agricultural system. https://www.fao.org/3/i9037en/i9037en.pdf Agro-ecosystem Analysis for Research and Development Gordon R. Conway.1985.
6. Fukuoka, M. 1978. The One-Straw Revolution: An Introduction to Natural Farming. Rodale Press, Emmaus, PA. 181 pp.

7. Fukuoka, M. 1985. The Natural Way of Farming: The Theory and Practice of Green Philosophy. Japan Publications, Tokyo, 280 pp.
8. Hill S.B and Ott. P. (Eeds.). 1982. Basic Techniques in Ecological Farming Berkhauser Verlag, Basel, Germany, 366 pp.
9. HLPE. 2019. Agroecological and other innovative approaches for sustainable agriculture and food systems that enhance food security and nutrition. A Report by the High-Level Panel of Experts on Food Security and nutrition of the Committee on World Food Security, Rome. https://fao.org/3/ea5602en/ea5602en.pdf.
10. INFRC. 1988. Guidelines for Nature Farming Techniques. Atami, Japan. 38 pp.
11. Khurana, A. and Kumar, V. 2020. State of Organic and Natural Farming: Challenges and Possibilities, Centre for Science and Environment, New Delhi.
12. Malhotra R. and S.D. Babaji. 2020. Sanskrit Non-Translatable- The Importance of Sanskritizing English. Amaryllis, New Delhi, India.
13. Nalini, S. 1996. *Vrikshayurveda* (The Science of Plant Life) by Surapala. AAHF Classic Bulletin 1. Asian Agri-History Foundation, Brig Sayeed Road, Secunderabad, AP (now Telengana), India. 94 pp.
14. Nalini, S. 1999. *Krishi-Parashara* (Agriculture by Parashara) by Parashara. Brig Sayeed Road, Secunderabad, Telangana: AAHF Classic Bulletin, Asian Agri-History Foundation. 104pp.
15. Nalini, S. 2011. *Upavana Vinoda* (Woodland Garden for Enjoyment) by Sarangdhara (13th century CE): AAHF Classic Bulletin 8. Asian Agri-History Foundation, Brig Sayeed Road, Secunderabad, AP (now Telangana), India. 64p REPORT OF THE ICAR-SIXTH DEANS' COMMITTEE -78.
16. Natural Asset Farming: Creating Productive and Biodiverse Farms by David B. Lindenmayer, Suzannah M. Macbeth, *et al*. (2022)
17. Natural Farming Techniques: Farming without Tilling by Prathapan Paramu (2021). Plenty for All: Natural Farming A to Z; Prayog Pariwar Methodology by Prof. Shripad A. Dabholkar and Prayog Pariwar Prayog Pariwar (2021)
18. Reyes Tirado. 2015. Ecological Farming- The Seven Principles of a Food system that has People at its Heart. Greenpeace Research laboratories. University of Exeter, Ottho Heldringstraat.
19. Shamasastry, R. 1915. Kautilya's Arthashastra.
20. The Ultimate Guide to Natural Farming and Sustainable Living: Permaculture for Beginners (Ultimate Guides) by Nicole Faires (2016).
21. U.K. Behera. 2013. A text Book of Farming System. Agrotech Publishing House, Udaipur.

Semester : III		
Course No. : HORT-232	**Credit Hrs. : 2(1+1)**	
Course Title : Production Technology of Fruit and Plantation Crops		

SYLLABUS

Objectives : (i) To educate about the different forms of classification of fruit crops.
(ii) To educate about the origin, area, climate, soil, improved varieties and cultivation practices.
(iii) To educate about the physiological disorders of fruit crops, palms and plantation crops.

THEORY

Production status of fruit and plantation crops: Importance and scope of fruit and plantation crop industry in India; Nutritional value of fruit crops; Classification of fruit crops, Area, Production, Productivity and Export potential of fruit and plantation crops. Crop production techniques in Tropical, Sub-tropical and Temperate fruit crops: Climate and soil requirements, Varieties, Propagation and Use of rootstocks, Planting density and systems of planting: High density and Ultra-high-density planting, Cropping systems, After care -Training and Pruning; Water, Nutrient and Weed management, Fertigation, Special horticultural techniques, Plant growth regulation. Important disorders, Maturity indices and harvest, Value addition.

Fruit crops: Mango, Banana, Papaya, Guava, Sapota, Citrus, Grape, Litchi, Pineapple, Pomegranate, Apple, Pear, Peach, Strawberry, Nut crops, Jackfruit and Minor fruits-date, Ber, Apple; Plantation crops-coconut, Arecanut, Cashew, Tea, Coffee and Rubber.

Crop production techniques in Palms and Plantation crops: Climate and soil requirements, Varieties, Propagation, Nursery management, Planting and planting systems, Cropping systems, After care, Training and pruning for plantation crops, Water, Nutrient and Weed management, Intercropping, Multi-tier cropping system, Mulching, Special horticultural practices, Maturity indices, Harvest and yield, Pests and diseases, Processing- Value addition.

Palms: Coconut, Arecanut, Oil palm and Palmyrah.

Plantation crops: Tea, Coffee, Cocoa, Cashewnut, Rubber.

PRACTICAL

Propagation techniques, Selection of Planting material, Varieties, Important cultural practices for Mango, Banana, Papaya, Guava, Sapota, Grapes. Citrus (mandarin and acid lime), Pomegranate, Jackfruit, Preparation and application of PGR's for propagation, Micropropagation, Protocol for mass multiplication and Hardening of fruit crops, Identification and description of varieties, Mother palm and Seed nut selection, Nursery practices, Seedling selection, Fertilizers application, Nutritional disorders, Pests and diseases of Coconut, Arecanut and Cocoa, Tea and Coffee, Rubber and Cashew; Visit to Commercial Orchard and Plantation Industries.

TEACHING SCHEDULE

THEORY [HORT-232]

Lecture No.	Topic	Sub-topics/ Key Points	Weightage (%)
1	Present status and Importance of Fruit and Plantation crops	Status, Importance and Scope; Area and Production; Productivity, Export and Nutritional Value of Fruits and Plantation crops' Industry in India.	5
2	Classification	Classification of fruit crops (Different forms with Examples).	5
3	Mango	Climate and Soil requirements, Varieties, Propagation and use of rootstocks; Planting density and Systems of planting: High density and Ultra-high-density planting, Cropping systems; After care - Training and pruning; Water, Nutrient and Weed Management, Fertigation; Special horticultural techniques, Plant growth regulation; Important disorders; Maturity indices and Harvest, Value addition.	10
4	Banana		10
5	Citrus		25
6	Grape		
7	Guava		
8	Papaya, Sapota		
9	Jackfruit Litchi		5
10	Apple, Pear, Peach		5
11	Pineapple, Pomegranate, Strawberry		5
12	Date and Ber		5
13	Palms: Coconut, Arecanut, Oil palm & Palmyrah	Climate and soil requirements; Varieties, Propagation, Nursery management, Planting density and planting systems; Cropping systems; After care, Training and Pruning for plantation crops, Water, Nutrient and Weed management, Intercropping, Multi-tier cropping system, Mulching, Special horticultural practices, Maturity indices, harvest and yield, Pests and diseases, Processing- Value addition.	10
14 - 15	Plantation Crops: Tea, Coffee, Rubber, Cocoa,		10
16	Cashew		5
		Total =	**100**

TEACHING SCHEDULE

PRACTICAL [HORT-232]

Exercise No.	Exercise Title
1	Identification and brief description of propagation techniques in fruit crops.
2	Selection of planting material in fruit crops.
3	Identification and description of fruit crop varieties.
4 - 5	Important cultural practices for Mango, Banana, Papaya, Sapota, Guava, Grapes, Citrus (Mandarin and Acid lime), Pomegranate, Jackfruit.
6	Preparation and application of PGRs for propagation.
7	Fertilizer applications in fruit crops and plantation crops.
8	Nutritional disorders in fruit crops.
9	Micropropagation protocol for mass multiplication and hardening of fruit crops.
10	Identification and description of plantation crop varieties.
11	Mother palm and seed nut selection in palms.
12	Nursery practices in plantation crops.
13	Seedling selection in Palms.
14	Study of maturity indices of different fruit and plantation crops.
15	Pests and diseases of - Coconut, Arecanut, Cocoa, Tea, Coffee, Rubber and Cashew.
16	Visit to Commercial Orchard and Plantation Industries.

Suggested Readings [HORT-232]:

1. Banday, F.A. and Sharma, M.K. 2010. Advances in Temperate Fruit Production. Kalyani Publishers, Ludhiana.
2. Bose, T.K., S.K. Mitra and D. Sanyal. 2001. Fruits: Tropical and Subtropical (2 Volumes) Naya Udyog, Calcutta.
3. Bose, T.K., S.K. Mitra, A.A. Farooqi and M.K. Sadhu (Eds). 1999. Tropical Horticulture, Vol.1. Naya Prokash, Calcutta.
4. Chadha, K.L. 2001. Handbook of Horticulture. ICAR, Delhi.
5. Chadha, T.R. 2001. Textbook of Temperate Fruits. ICAR, New Delhi.
6. Chattopadhyay, T.K. 2001. A Text Book on Pomology (4 Volumes). Kalyani Publishers, Ludhiana.
7. Chattopadhyay 1998. A Textbook on Pomology (su,-tropical fruits) Vol. III. Published by Kalyani Publishers, Ludhiana, New Delhi, Noida UP.
8. Chudawat, B.S.1990. Arid Fruit Culture, Oxford & IBH, New Delhi.
9. Das, B.C. and Das S.N. Cultivation of Minor Fruits. Kalyani Publishers, Ludhiana.
10. David Jackson and N.E. Laone, 1999. Subtropical and Temperate Fruit Production. CABI Publications.
11. H.P. Singh and M.M. Mustafa, 2009. Banana- New Innovations Westville Publishing House, New Delhi
12. Kumar, N. 1997. Introduction to Horticulture. Rajalakshmi Publications, Nagercoil, Tamil Nadu.

Semester	**:**	**III**		
Course No.	**:**	**AE- 231**	**Credit Hrs.**	**: 2 (1+1)**
Course Title	**:**	**Farm Machinery and Power**		

SYLLABUS

Objectives : To enable the students to understand the need of farm power, basic principles and parts of IC engine, different tillage, sowing, intercultural, plant protection equipment, working principles of threshers, harvesting of field and horticultural crops.

THEORY

Status of Farm Power in India; Sources of Farm Power, I.C. engines, working principles of I.C. engines; comparison of two stroke and four stroke cycle engines, Study of different components of I.C. engine, I.C. engine terminology and solved problems; Familiarization with different systems of I.C. engines: Air cleaning, cooling, lubrication, fuel supply and hydraulic control system of a tractor; Familiarization with Power transmission system : clutch; gear box, differential and final drive of a tractor; Tractor types; Cost analysis of tractor power and attached implement; Criteria for selection of tractor and machine implements. Familiarization with Primary and Secondary Tillage implement; Implement for hill agriculture; implement for intercultural operations; Familiarization with sowing and planting equipment; calibration of a seed drill and solved examples; Familiarization with Plant Protection equipment; Familiarization with harvesting and threshing equipment.

PRACTICAL

Study of different components of I.C. engine. Study of air cleaning and cooling system of engine; Familiarization with clutch, transmission, differential and final drive of a tractor; Familiarization with lubrication and fuel supply system of engine; Familiarization with brake, steering, hydraulic control system of engine; Learning of tractor driving; Familiarization with operation of power tiller; Implements for hill agriculture; Familiarization with different types of primary and secondary tillage implements: mould plough, disc plough and disc harrow; Familiarization with seed-cum-fertilizer drills their seed metering mechanism and calibration, Planters and transplanters; Familiarization with different types of sprayers and dusters; Familiarization with different inter-cultivation equipment; Familiarization with harvesting and threshing machinery; Calculation of power requirement for different implements.

TEACHING SCHEDULE

THEORY [AE-231]

Lecture No.	Topic	Sub-topics/ Key Points	Weightage %
1	Farm Power	Status of Farm Power in India; Sources of Farm Power.	8
2 - 3	I.C. Engines	I.C. engines, Working principles of I.C. engines; Comparison of two-stroke and four-stroke cycle engines, Study of different components of I.C. engine, I.C. engine Terminology and Solved problems.	12
4 - 6	Systems of I.C. Engines	Familiarization with different systems of I.C. engines: Air cleaning, Cooling, Lubrication, Fuel supply and Hydraulic control system of a tractor.	10
		Familiarization with Power transmission system: Clutch; Gear box, Differential and Final drive of a tractor.	10
7 - 8	Tractor	Tractor types; Cost analysis of tractor power and attached implement; Criteria for selection of tractor and Machine implements.	10
9 - 10	Tillage	Familiarization with Primary and Secondary Tillage implement.	12
11 - 12	Implements	Implement for hill agriculture; implement for intercultural operations.	10
13 - 14	Sowing Equipment	Familiarization with sowing and planting equipment; Calibration of a Seed drill and Solved examples.	10
15	Plant Protection Equipment	Familiarization with Plant Protection equipment.	8
16	Harvesting and Threshing Equipment	Familiarization with harvesting and threshing equipment.	10
		Total =	**100**

TEACHING SCHEDULE

PRACTICAL [AE-231]

Exercise No.	Exercise Title
1	Study of different components of I.C. engine.
2	To study air cleaning and cooling system of engine.
3	Familiarization with clutch, transmission, differential and final drive of a tractor.
4 - 5	Familiarization with lubrication and fuel supply system of engine.
6	Familiarization with brake, steering, hydraulic control system of engine.
7	Implements for hill agriculture.
8 - 9	Familiarization with different types of primary and secondary tillage implements: mould plough, disc plough and disc harrow.
10	Familiarization with seed-cum-fertilizer drills their seed metering mechanism and calibration, planters and trans planter.
11	Familiarization with different types of sprayers and dusters.
12	Familiarization with different inter-cultivation equipment.
13	Familiarization with harvesting and threshing machinery.
14	Calculation of power requirement for different implements.
15	Familiarization with operation of power tiller.
16	Learning of tractor driving.

Suggested Readings [AE-231]:

1. Jagdiswar Sahay – Elements of Agricultural Engineering.
2. Jain, S.C. and C.R. Rai- Farm Tractor and Maintenance and Repair. Standard Publishers, 1705-B, Naisarak. Delhi - 110 006.
3. Ojha, T.P. and Michael, A.M. Principles of Agricultural Engineering. Vol. I. Jain Brothers, 16/893, East Park Road, Karol Bagh, New Delhi -110005
4. Surendra Singh- Farm machinery –Principles and Applications, ICAR, New Delhi
5. Deogirikar Amit Ashokrao, Kishor Ganpat Dhande, Atul Ganesh Mohod (2018): A Text Book on Farm Machinery and Power. Publ. Shri Rajlaxmi Prakash.

Semester	**:**	**III**			
Course No.	**:**	**NEMA-231**	**Credit Hrs.**	**:**	**2 (1+1)**
Course Title	**:**	**Fundamentals of Nematology**			

SYLLABUS

Objectives : (i) To impart knowledge on history, economic importance of plant parasitic nematodes, morphology, biology, host parasitic relationship of nematodes.

(ii) To impart knowledge on nematode pests of different crops of national and local importance and their management.

THEORY

Introduction: History of Phyto-nematology, habitats and diversity, Economic importance of nematodes. General characteristics of plant parasitic nematodes. Nematode: definition, general morphology and biology. Classification of nematodes up to family level with emphasis on groups containing economically important genera. Classification of nematodes on the basis of feeding/ parasitic habit. Symptomatology, Role of nematodes in disease development, Importance of entomopathogenic nematodes. Interaction between plant parasitic nematodes and disease-causing fungi, bacteria and viruses. Nematode pests of crops: Rice, wheat, vegetables, pulses, oilseeds and fiber crops, citrus and banana, tea, coffee, coconut, guava, pomegranate and spices. Different methods of nematode management: Cultural methods, Physical methods, Biological methods, Chemical methods, Plant Quarantine, Plant resistance and Integrated Nematode Management.

PRACTICAL

Sampling methods, collection of soil and plant samples; Extraction of nematodes from soil and plant tissues following Cobb's sieving and decanting technique, Baermann funnel technique, Picking and counting of plant parasitic nematode. Identification of economically important plant nematodes up to generic level with the help of keys and description: *Meloidogyne, Pratylenchus; Heterodera, Tylenchulus, Xiphinema, Radopholus* and *Helicotylenchus*, etc. Study of symptoms caused by important nematode pests of cereals, vegetables, pulses, plantation crops, etc. Methods of application of nematicides and organic amendments. Mass production of entomopathogenic nematodes.

TEACHING SCHEDULE

THEORY [NEMA-231]

Lecture No.	Topic	Sub-topics/ Key points	Weightage (%)
1	Introduction	Definitions of ~ Nematology, Plant Nematology, Agricultural Nematology, Phytonematology, Helminthology	15
	History of Phytonematology	Important Milestones in Development of Nematology in World and India	
2	Habitats and Diversity	Key types of habitats and Diversity of nematodes	
	Economic Importance of Nematodes	Economic importance of nematodes to Agriculture with suitable examples	
3	General Characteristics of Plant Parasitic Nematodes	General Characteristics of Phytonematodes	10
4	Nematode: Definition, General Morphology and Biology	Definition of Nematode; General morphology: Body shape, size, posture, segmentation, coloration, symmetry, organization, regions; outer body tube, inner body tube (alimentary canal)	10
5		Reproductive, nervous, excretory, respiratory and circulatory systems; Life cycle of nematode	
6	Classification of Nematodes up to Family level	With emphasis on groups containing economically important genera (examples)	5
7	Classification of Nematodes on the basis of Feeding/ Parasitic habit.	Ectoparasites, Semi-endoparasites and Endoparasites	10
8	Symptomatology; Role of Nematodes in Disease Development	Above and below ground symptoms; Understanding the role of nematodes in disease development;	10

Continued…

9	Interaction between Plant Parasitic Nematodes and Disease-causing Fungi, Bacteria and Viruses; Importance of EPN	Pathogenic interaction of Phytonematodes with disease-causing fungi, bacteria and virus; Various entomopathogenic nematodes and their role in insect pests management	10
10	Nematode Pests of Crops: Rice, Wheat, Vegetables, Pulses, Oilseed and Fiber crops	Feeding habit, Symptoms, Impact and Management of nematode pests of Rice, Wheat and Vegetables	10
11		Feeding habit, Symptoms, Impact and Management of Nematode pests of Pulses, Oilseeds and Fiber crops	
12	Nematode Pests of Crops: Citrus, Banana, Tea, Coffee, Coconut, Guava, Pomegranate and Spices.	Feeding habit, Symptoms, Impact and Management of nematode pests of Citrus, Banana, Tea, Coffee	10
13		Feeding habit, Symptoms, Impact and Management of nematode pests of Coconut, Guava, Pomegranate and Spices	
14	Different Methods of Nematode Management	Cultural methods, Physical methods and Biological methods	10
15		Chemical methods, Plant quarantine and Plant resistance	
16		Integrated Nematode Management	
		Total =	**100**

TEACHING SCHEDULE

PRACTICAL [NEMA-231]

Exercise No.	Exercise Title
1	Sampling methods, collection of soil and plant samples.
2	Extraction of nematodes from soil and plant tissues following Cobb's sieving and decanting technique, Baermann funnel technique.
3	Picking and counting of plant parasitic nematode
4	Identification of economically important plant nematodes up to generic level with the help of keys and description.
5	Study of *Meloidogyne*
6	Study of *Pratylenchus*
7	Study of *Heterodera*
8	Study of *Tylenchulus*
9	Study of *Xiphinema*
10	Study of *Radopholus* and *Helicotylenchus*
11 - 13	Study of symptoms caused by important nematode pests of cereals, vegetables, pulses, plantation crops etc.
14 - 15	Methods of application of nematicides and organic amendments.
16	Mass production of entomopathogenic nematodes.

Suggested Readings [NEMA-232]:

1. Text Book on Introductory Plant Nematology – by R.K. Walia and H.K. Bajaj.
2. A Text Book of Plant Nematology – by K.D. Upadhyay & Kusum Dwivedi, Aman Publishing House.
3. Economic Nematology- Edited by J.M. Webster.
4. Plant Parasitic Nematodes (Vol-1) - by Zukerman, Mai, Rohde.
5. Plant Parasitic Nematodes of India: Problems and Progress - by Gopal Swarup, D.R. Dasgupta, P.K. Koshy.

Semester	**:**	**III**	
Course No.	**:**	**ECON-231**	**Credit Hrs.: 2(2+0)**
Course Title	**:**	**Principles of Agricultural Economics and Farm Management**	

SYLLABUS

Objectives : (i) To aware the students about broad areas covered under agricultural Economics and farm management,

(ii) To impart knowledge on judicious use of resources for optimum production.

THEORY

Economics: Meaning, Scope and Subject matter, Definitions, Activities, Approaches to economic analysis; Micro- and macro-economics, Positive and normative analysis. Nature of economic theory; Rationality assumption, Concept of equilibrium, Economic laws as generalization of human behavior. Basic concepts: Goods and services, desire, want, demand, utility, cost and price, wealth, capital, income and welfare. Agricultural Economics: Meaning, Definition, Characteristics of agriculture, Importance and its role in economic development. Agricultural planning and development in the country. Demand: Meaning, Law of demand, Demand schedule and Demand curve, Determinants, Utility theory; Law of diminishing marginal utility, Equi-marginal utility principle. Consumer's equilibrium and derivation of demand curve, Concept of consumer surplus. Elasticity of demand: Concept and measurement of price elasticity, Income elasticity and cross elasticity. Production: process, creation of utility, factors of production, input output relationship. Laws of returns: Law of variable proportions and law of returns to scale. Cost: Cost concepts, Short run and long run cost curves. Supply: Stock v/s Supply, Law of supply, Supply schedule, Supply curve, Determinants of supply, elasticity of supply. Distribution theory: meaning, factor market and pricing of factors of production. Concepts of rent, wage, interest and profit. National income: Meaning and importance, Circular flow, Concepts of national income accounting and approaches to measurement, Difficulties in measurement. Population: Importance, Malthusian and Optimum population theories, Natural and socio-economic determinants, Current policies and Programmes on population control. Money: Barter system of exchange and its problems, Evolution, Meaning and Functions of money, Classification of money, money supply, General price index, Inflation and deflation. Economic systems: Concepts of economy and its functions, Important features of capitalistic, socialistic and mixed economies, Elements of economic planning. Forms of business organizations, international trade and balance of payments. GST and its implication on Indian economy.

TEACHING SCHEDULE

THEORY [ECON-231]

Lecture No.	Topic	Sub-topics/ Key Points	Weightage (%)
1	Economics	Meaning, Scope and Subject matter, Definitions of Economics, Divisions of Economics - Traditional and Modern approach	3
2	Approaches to Economic Analysis	Micro- and Macro-economics, Positive and Normative analysis	3
3	Nature of Economic Theory	Rationality assumption, Concept of equilibrium, Economic Laws as generalization of human behavior.	3
4	Basic Concepts	Goods and Services, Classification of goods, Characteristics of goods and services, Desire, Want, Demand, Utility, Cardinal and Ordinal approaches, Characteristics of utility - Forms of utility. Cost and price, wealth, capital, income and welfare	5
5	Agricultural Economics	meaning, definition, characteristics of agriculture, importance and its role in economic development.	4
6	Demand	Meaning, Definition, Types of demand - Income demand, Price demand, Cross demand. Demand schedule, Demand curve, Law of demand - contraction and extension, increase and decrease in demand, Determinants of demand	4
7	Law of Diminishing Marginal Utility	Utility theory, Statement, Assumptions of Law, Explanation, Limitations and importance of it.	4
8	Law of Equi-marginal Utility	Meaning, Assumptions, Explanation of the Law, Practical importance and Limitations of it.	4
9	Consumer's Equilibrium and Derivation of Demand Curve, Consumer's Surplus	Meaning, Assumptions, Explanation, Difficulties in measuring Consumer's Surplus, Importance.	3
10 - 11	Elasticity of Demand	Definition, Elastic and Inelastic demand, Kinds of elasticity of demand, Concept and measurement of price elasticity, Income elasticity and Cross elasticity of demand, Factors affecting demand, Practical importance of elasticity of demand	4
12	Production	Concept and Meaning, Process, Creation of utility, Factors of production, Input-output relationship.	3
13	Laws of Returns	Meaning, Concept of Law of variable proportions and Law of returns to scale	4
14	Cost Concepts	Short run and Long run cost curves.	3
15 - 16	Supply	Meaning, Definition, Concept of Stock v/s Supply, Law of supply, Supply schedule, Supply curve, Increase and decrease in supply, Contraction and extension in supply, Factors affecting supply.	3

Continued…

17 - 18	Elasticity of Supply	Meaning and Kinds of Elasticity of Supply - Perfectly elastic, Perfectly inelastic, Relatively elastic, Relatively inelastic and Unitary elastic – Factors affecting elasticity of supply.	5
19 - 20	Distribution Theory	Meaning, Factor market and Pricing of factors of production. Concepts of rent, wage, interest and profit.	8
21 - 22	National Income	Meaning and Importance, Circular flow, Concepts of National Income Accounting- Gross domestic product, Gross national product, Net national product, Net domestic product- National income at factor cost, Personal income, Disposable income.	4
23	Approaches of Measurement of National Income	Methods/Approaches of measurement of National income- Product method, Income method and expenditure method, Difficulties in measurement.	3
24	Population	Importance, Malthusian and Optimum Population Theories	3
25	Natural and Socio-economic Determinants and Policies	Natural and Socio-economic determinants, Current policies and programmes on Population Control	4
26 - 27	Money	Barter system of Exchange and its problems, Evolution, Meaning and functions of money, Classification of money and Money supply	6
28	Inflation	General price index, Concept and Recent trend of inflation and deflation.	3
29	Economic Systems	Concepts of Economy and its Functions	4
30	Important Economic Systems	Important features of Capitalistic, Socialistic and Mixed Economies, Elements of Economic Planning.	4
31	International Economics	Forms of Business Organization, International trade and Balance of payment	3
32	Goods and Service Tax (GST)	Goods and Service Tax (GST), Meaning and its Implications on Indian Economy.	3
		Total=	**100**

Suggested Readings: [ECON-231]

1. S. Subha Reddy, P. Raghu Ram, T.V. Neelakanta and I. Bhvani Devi. 2004. Agricultural Economics. Oxford & IBH publishing Co. Pvt. Ltd., New Delhi.
2. Johl,S. And T.R Kapur. 2009. Fundamentals of Farm Business Management. Kalyani Publishers Dewett, K.K. and Chand, A. 2009 Modern Economic Theory S.Chand and Co., New Delhi.
3. Dewett, K.K. and Varma, J.D. 1986 Elementary Economics S.Chand and Co., New Delhi.
4. Jhingan, M.L.1990 Advanced Economic Theory Vikas Publishing House, New Delhi.
5. Nagpure S.C., and Patil E.R.2011, 2014, Principles of Agricultural Economics by, Agroment Publishers, 52B, Indraprasta, Opp. Asha Mangal, Dharampeth, Nagpur- 440010 (MS) India.

Semester	**:**	**III**		
Course No.	**:**	**AHDS-232**	**Credit Hrs.**	**: 2(1+1)**
Course Title	**:**	**Technology of Milk and Milk Products**		

SYLLABUS

Objectives : (i) To provide foundational knowledge of milk science and diverse dairy processing technologies for safe and quality product development.
(ii) To develop practical skills in dairy products manufacturing, fostering readiness for industry roles and entrepreneurial ventures.
(iii) To understand the socio-economic significance of the dairy sector for sustainable development and livelihood enhancement

THEORY

Milestone and present status of dairy industry in India. Terminology of milk, its composition, physicochemical properties and nutritional importance of milk and its constituents. The factors affect the yield and composition of milk. Microbiology of milk, microorganisms associated to milk and its desirable and undesirable changes in milk, Microbial standards for different market milk and milk products. Procurement, pricing policy, transportation and reception of milk. Chilling/cooling and storage of milk, its importance and methods of cooling. Term-pasteurization and its methods, Concept of homogenization of milk. Classification of milk products and their standards/ status and composition. Desirable and undesirable characteristics of various traditional dairy products. Introductory approach for western dairy products: Cheese its definition, market prospectus, Different types/classification and preparation of cheddar and mozzarella cheese. Standards related to milk and milk products; BIS, FSSAI, CAC and HACCP. Preservation of milk and milk products and different methods of milk preservation. Utilization of dairy by-products like, whey and high acid milk. Packaging of milk and milk products with modern techniques.

PRACTICAL

Study of platform test and sampling of milk and milk products. Determination of fat by Gerber's method. Determination of Specific gravity, SNF, TS and acidity of milk. Determination of adulteration in milk and milk products. Standardization of milk by Pearson's method and preparation of toned, double toned and standardized milk. Study of cream separator and separation of cream. Preparation of flavoured and chocolate milk. Preparation of Khoa, Peda/ Burfi and Gulab jamun. Preparation of Paneer, Chhana and Rasogolla. Preparation of Dahi, Chakka and Shrikhand. Preparation of Butter and Ghee. Preparation of Ice-cream. Preparation of Basundi, Rabri and Kulfi. Study of cleaning and sanitization of dairy equipments. Layout of milk processing plant. Visit to Milk Processing Plant.

TEACHING SCHEDULE

THEORY [AHDS-232]

Lecture No.	Topic	Sub-topics/ Key points	Weightage (%)
1	Present Status	Milestones and Present Status of Dairy Industry in India	8
2	Milk & its Composition	Milk and its Composition (in detail)	4
3	Properties of Milk	Physico-chemical properties of milk	5
4	Nutritional Importance	Nutritional importance of milk and its constituents	6
5	Factors affecting Milk Production	Factors affecting of yield and Composition of milk	10
6	Microbiology of Milk	Microbiology of milk: Microorganisms associated to milk, Desirable and undesirable changes by microbes in milk, Microbial standards for different market milk and milk products	4
7	Procurement and Transportation	Procurement, Pricing policy, Transportation and Reception of milk	8
8	Importance of Chilling and Storage of Milk	Chilling and Storage of milk; Importance of chilling/ cooling, Methods of cooling	6
9	Pasteurization and Homogenization of Milk	Pasteurization and its Methods, Homogenization of milk	7
10	Classification of Products	Classification of milk products and their standards/ status and composition milk	6
11	Characteristics of Various Traditional Dairy Products	Desirable and undesirable characteristics of various Traditional dairy products- *(Khoa, Peda, Burfi, Gulabjamun, Basundi, Rabri, Kalakand, Paneer, Rasogolla, Dahi, Lassi, Shrikhand, Butter, Ghee, Ice-cream and Kulfi)*	7
12	Western Dairy Products	Introductory approach for Western dairy products: Cheese- (Definition, Market prospectus, Different types/ Classification and Basic protocol for preparation of Cheddar and Mozzarella Cheese)	6
13	Standards to Milk & Milk Products	BIS, FSSAI, CAC and HACCP in relation to milk and milk products	6
14	Preservation of Milk & Milk Products	Preservation of milk and milk products by chemical, biological and herbal preservatives	6

Continued…

15	Dairy By-products	Utilization of Dairy By-products like, Whey and High acid milk	5
16	Packaging of Milk and Milk products	Packaging of Milk and Milk products with Modern Techniques	6
		Total =	**100**

TEACHING SCHEDULE

PRACTICAL [AHDS-232]

Exercise No.	Exercise Title
1	Study of Platform test and Sampling of milk and milk products
2	Determination of fat by Gerber's method
3	Determination of Specific gravity, SNF, TS and Acidity of milk
4	Determination of Adulteration in milk and milk products
5	Standardization of milk by Pearson's method and Preparation of toned, double toned and standardized milk
6	Study of cream separator and separation of cream
7	Preparation of flavoured and chocolate milk
8	Preparation of *Khoa*, *Peda*/*Burfi* and *Gulabjamun*
9	Preparation of *Paneer*, *Chhana* and *Rasogolla*
10	Preparation of *Dahi*, *Chakka* and *Shrikhand*
11	Preparation of *Butter* and *Ghee*
12	Preparation of Ice-cream
13	Preparation of *Basundi*, *Rabri* and *Kulfi*
14	Study of cleaning and sanitization of dairy equipments
15	Layout of Milk Processing Plant
16	Visit to Milk Processing Plant

Suggested Readings [AHDS-232]:

1. Sukumar De, Outlines of Dairy Technology.
2. Sangu K.P.S., Dairy Processing Technology.
3. R.P. Aneja, B.N .Mathur, R.C. Chandan and A.K. Banerjee., Technology of Indian Milk Products.
4. Shivashraya Singh, Dairy Technology Vol. 1 (Milk and Milk Processing).
5. Shivashraya Singh, Dairy Technology Vol. 2 (Dairy Products and Quality Assurance).
6. D.D. Patange, D.K. Kamble and R.C. Ranveer, Text Book on Milk and Milk Products.
7. K.G. Upadhyay, Essentials of Cheese Making.
8. J.S. Yadav, S. Grover and V.K. Batish, A Comprehensive Dairy Microbiology.

B.Sc. (Hons.) Agriculture

List/ Bouquet of Skill Enhancement Courses (SECs)

[in continuation of the SECs' Syllabi prescribed under I and II semesters]

Sr. No.	Course No.	Course Title	Credit Hrs.
1.	**SEC-xxx**	Biofertilizer and Biopesticide Production	2(0+2)
2.	**SEC-xxx**	Mushroom Production Technology	2(0+2)
3.	**SEC-xxx**	Seed Production Technology	2(0+2)
4.	**SEC-xxx**	Post-harvest Processing Technology	2(0+2)
5.	**SEC-xxx**	Beneficial Insect Farming	2(0+2)
6.	**SEC-xxx**	Horticulture Nursery Management	2(0+2)
7.	**SEC-xxx**	Plantation Crops Production and Management	2(0+2)
8.	**SEC-xxx**	Poultry Production and Management Technology	2(0+2)
9.	**SEC-xxx**	Processing of Milk and Milk Products	2(0+2)
10.	**SEC-xxx**	Agrotourism	2(0+2)
11.	**SEC-xxx**	Plantation Crop Production and Processing	2(0+2)
12.	**SEC-xxx**	Agriculture Waste Management	2(0+2)
13.	**SEC-xxx**	Organic Production Technology	2(0+2)
14.	**SEC-xxx**	Fodder Production Technology	2(0+2)
15.	**SEC-xxx**	Marketing and Export of Agricultural Produce	2(0+2)
16.	**SEC-xxx**	Processing of Farm Waste into Organic Inputs	2(0+2)
17.	**SEC-xxx**	Vermicompost Production Technology	2(0+2)
18.	**SEC-xxx**	Apiculture - Commercial Bee Keeping	2(0+2)
19.	**SEC-xxx**	Production Technology of Bioagents	2(0+2)

Note: (i) Skill Enhancement Courses can be added/offered as per the facilities and resources available at the respective universities/colleges based on the relevance to the region and the UG degree subject.

(ii) The host University/ College may also choose suitable SEC courses from those listed under other UG degree programs.

(iii) Above list/ bouquet of SEC courses is an indicative list and subject to modification as applicable therein.

(iv) In case of unavailability of the detailed course-wise syllabus/ teaching schedules of any of above SEC courses, the same can be primarily developed and followed at College/ University level in the current academic year. However, the same can be obtained from the respective UG Degree Coordinator/ Discipline Coordinators and can be followed w.e.f. AY, 2025-26.

Course Curriculum of Fourth Semester

as per the ICAR-Sixth Deans' Committee Report for the Academic Programmes in

AGRICULTURE

- UG-Certificate in Agriculture
- UG-Diploma in Agriculture
- UG-Degree: B.Sc. (Hons.) Agriculture

Mahatma Phule Krishi Vidyapeeth, Rahuri

Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola

Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani

Dr. Balasaheb Sawant Konkan Krishi Vidyapeeth, Dapoli

Maharashtra Agricultural Universities Examination Board, Pune

Compiled & Submitted by

Dr. S.B. Kharbade
Dean (F/A) & DI and Associate Dean, PGI, MPKV, Rahuri.
UG Degree Syllabus State Coordinator

with

UG Degree Syllabus Discipline Coordinators &

DICC - UG Degree Syllabus Core Committee

Submitted to the

Directors of Instruction and Deans (F/A) Coordination Committee

~ w.e.f. AY, 2025-26 ~

Course Curriculum of Fourth Semester as per the ICAR-Sixth Deans' Committee Report for Academic Programme in AGRICULTURE

Course Layout

B.Sc. (Hons.) Agriculture

Semester: IV (New) ***w.e.f.*** **Academic Year: 2025-26**

Sr. No.	Course No.	Course Title	Credit Hrs.	Remark
1.	**MDC-242**	Entrepreneurship Development and Business Management	3(2+1)	--
2.	**VAC-242**	Agricultural Informatics and Artificial Intelligence	3(2+1)	--
3.	**AGRO-244**	Crop Production Technology-II (*Rabi* Crops)	3(1+2)	--
4.	**AGRO-245**	Water Management	2(1+1)	--
5.	**GPB-242**	Basics of Plant Breeding	3(2+1)	--
6.	**HORT-243**	Production Technology of Vegetables and Spices	2(1+1)	--
7.	**SOIL-243**	Problematic Soils and their Management	2(1+1)	--
8.	**EXTN-242**	Fundamentals of Extension Education	2(1+1)	--
9.	**SEC-246**	Skill Enhancement Course -VI[#] *(To be offered from the list of SEC Courses)*	2(0+2)	--
10.	**OC-1/ OC-2/…**	Online Course(s)/ MOOCs[†]	As opted by student	**NG**
		Total Credit Hrs.=	**22(11+11)**	**G**
MDC: Multidisciplinary Course, **VAC**: Value-added Course, **SEC**: Skill Enhancement Course, **OC**: Online Course, **G**: Gradial, **NG**: Non-gradial				
Post-IV Semester (Only for Exit option for award of UG-Diploma)				
11.	**INT-242**	Internship (10-week)	10(0+10)	**NG**

[†] **Note:** It is mandatory for each Student to complete **total 10 credits** (Non-gradial) of **Online Courses** from available resources across III to VIII semesters under the guidance of assigned Faculty/Advisor.

B.Sc. (Hons.) Agriculture: Fourth Semester

Course-wise Syllabus with Teaching Schedules

Semester : IV		
Course No. : MDC-242	**Credit Hrs. : 3(2+1)**	
Course Title : Entrepreneurship Development and Business Management		
Gradial Common Course across B.Sc. (Hons.) Agriculture, B.Tech. (Agricultural Engineering), B.Tech. (Food Technology), B.Sc. (Hons.) Agri. Business Management		

SYLLABUS

Objectives : (i) To provide student an insight into the concept and scope of entrepreneurship,
(ii) To expose the student to various aspects of establishment and management of a small business unit,
(iii) To enable the student to develop financially viable agribusiness proposal.

THEORY

Development of entrepreneurship, motivational factors, social factors, environmental factors, characteristics of entrepreneurs, entrepreneurial attributes/ competencies. Concept, need for and importance of entrepreneurial development. Evolution of entrepreneurship, objectives of entrepreneurial activities, types of entrepreneurs, functions of entrepreneurs, importance of entrepreneurial development and process of entrepreneurship development. Environment scanning and opportunity identification need for scanning– spotting of opportunity- scanning of environment– identification of product/ service – starting a project; factors influencing sensing the opportunities. Infrastructure and support systems- good policies, schemes for entrepreneurship development; role of financial institutions and other agencies in entrepreneurship development. Steps involved in functioning of an enterprise. Selection of the products/ services, selection of form of ownership; registration, selection of site, capital sources, acquisition of manufacturing know how, packaging and distribution. Planning of an enterprise, project identification, selection, and formulation of project; project report preparation, Enterprise Management. Production management– product, levels of products, product mix, quality control, cost of production, production controls, Material management. Production management– raw material costing, inventory control. Personal management– manpower planning, labour turn over, wages/ salaries. Financial management/accounting– funds, fixed capital and working capital, costing and pricing, long-term planning and short-term planning, book keeping, journal, ledger, subsidiary books, annual financial statement, taxation. Marketing management- market, types, marketing assistance, market strategies. Crisis management- raw material, production, leadership, market, finance, natural etc.

PRACTICAL

Visit to small scale industries/agro-industries, Interaction with successful Entrepreneurs/ Agric-entrepreneurs. Visit to financial institutions and support agencies. Preparation of project proposal for funding by different agencies.

TEACHING SCHEDULE

THEORY [MDC-242]

Lecture No.	Topic	Sub-topics/ Key Points	Weightage (%)
1	Introduction to Entrepreneurship	Meaning and Definitions of an Entrepreneur, Entrepreneurship; Concept & Scope of Entrepreneurship	6
2	Importance of Entrepreneurship	Importance of Entrepreneurship in Agribusiness	
3	Entrepreneurship Development	Need for and objectives of Entrepreneurial development	4
4	Motivational Factors	Types of motivational factors, Role of social and environmental factors in entrepreneurship	4
5	Characteristics of Entrepreneurs	Characteristics, Entrepreneurial attributes and Competencies	4
6	Types of Entrepreneurs	Various types and their significance	4
7	Functions of Entrepreneurs	Key roles and Responsibilities	2
8	Evolution of Entrepreneurship	Historical perspective and Growth	3
9	Process of Entrepreneurship Development	Stages and Approaches in developing entrepreneurship	4
10	Environmental Scanning	Need for scanning, Techniques	2
11	Opportunity Identification	Spotting and Analyzing opportunities	2
12	Infrastructure and Support Systems	Policies, Schemes and Role of financial and other agencies in entrepreneurship development	4
13	Enterprise Functioning Steps	Steps to establish an Enterprise	4
14	Selection of Products/Services	Choosing products, Services and Business forms	3
15	Enterprise Location and Capital Sources	Registration, Site selection, Capital sources/ Acquisition	3
16	Manufacturing and Distribution	Acquiring manufacturing know-how, Packaging and Distribution essentials	3
17	Planning of an Enterprise	Short term and Long-term planning of an Enterprise	3
18 - 19	Project Formulation	Project identification, Selection, Steps in project formulation and Report preparation, etc.	8
20	Enterprise Management	Basics and Importance of managing an Enterprise	3

Continued….

21	Production Management	Product types, Levels of products, Product mix, Quality control, Cost of production, Production control	4
22	Material Management	Raw material costing and Inventory control strategies	4
23	Personnel Management/ Human Resource Management	Manpower planning, Labour turnover, Wages/ Salaries	4
24	Financial Management	Funds, Fixed and Working capital, Costing, Pricing, Book-keeping basics	4
25 - 26	Accounting and Taxation	Journals, Ledgers, Subsidiary books, Annual financial statements, Taxation basics	4
27	Marketing Management	Market, Types of markets, Marketing assistance	4
28 - 29	Market Strategies and Pricing	Marketing strategies, Pricing strategies and Market penetration	4
30	Crisis Management	Crisis types, Strategies for managing raw material, etc.	2
31	Leadership in Crisis Situations	Role of leadership in handling crises	2
32	Financial Crises and Solutions	Strategies for financial crisis management	2
		Total =	**100**

TEACHING SCHEDULE

PRACTICAL [MDC-242]

Exercise No.	Exercise Title
1	Visit to Small-Scale Industries/ Agro-Industries. (Objective: To understand setup and operations of small-scale units)
2	Interaction with Successful Entrepreneurs. (Objective: To gain insights from real-life entrepreneurial experiences)
3	Case Study on Agro-Entrepreneurs. (Objective: To analyze successful agribusiness ventures)
4	Visit to Financial Institutions. (Objective: To learn about funding options and financial support)
5	Identification of Agribusiness Ideas. (Objective: To identify viable agribusiness ideas based on demand)
6	Analyzing Project Proposals. (Objective: To study structure and elements of project proposals)

Continued…

7	Preparing a Project Proposal. (Objective: To develop a basic proposal for an agribusiness venture)
8	Project Report Writing Techniques. (Objective: To practice format and structure for project reports)
9	Marketing Strategies Case Study. (Objective: To analyze effective marketing strategies in agribusiness)
10	Production and Cost Control Analysis (Objective: To study basic cost control measures in production)
11	Inventory Control Simulation (Objective: To apply inventory management methods in a hypothetical setup)
12	Basic Bookkeeping (Objective: To practice fundamental bookkeeping for small businesses)
13	Market Research Techniques (Objective: To use surveys and questionnaires for market insights)
14	Project Proposal Presentation (Objective: To present project ideas for feedback)
15	Review of Project Proposal (Objective: To refine project proposals based on feedback)
16	Final Evaluation of Proposals (Objective: To assess and finalize projects)

Suggested Readings [MDC-242]:

1. Charantimath P.M. 2009. Entrepreneurship Development and Small Business Enterprises. Pearson Publications, New Delhi.
2. Desai V. 2015. Entrepreneurship: Development and Management, Himalaya Publishing House.
3. Desai V. 1997. Small Scale Industries and Entrepreneurship. Himalaya Publ. House, Mumbai.
4. Gupta C.B. 2001. Management Theory and Practice. Sultan Chand and Sons, New Delhi.
5. Indu Grover. 2008. Handbook on Empowerment and Entrepreneurship. Agrotech Public Academy, Udaipur.
6. Khanka S.S. 1999. Entrepreneurial Development. S. Chand and Co., New Delhi.
7. Mehra P. 2016. Business Communication for Managers. Pearson India, New Delhi.
8. Pandey M. and Tewari D. 2010. The Agribusiness Book. IBDC Publishers, Lucknow.
9. Singh D. 1995. Effective Managerial Leadership. Deep and Deep Publ., New Delhi.
10. Singhal R.K. 2013. Entrepreneurship Development and Management, Katson Books.
11. Tripathi P.C. and Reddy P.N. 1991. Principles of Management. Tata McGraw Hill, New Delhi.

Semester	**: IV**	
Course No.	**: VAC-242**	**Credit Hrs. : 3(2+1)**
Course Title	**: Agricultural Informatics and Artificial Intelligence**	
Gradial Common Course across B.Sc. (Hons.) Agriculture, B.Sc. (Hons.) Horticulture, B.Tech. (Biotechnology), B.Tech. (Food Technology), B.Sc. (Hons.) Agri. Business Management, B.Sc. (Hons.) Forestry, B.F.Sc. (Hons.), B.Sc. (Hons.) Community Science		

SYLLABUS

Objectives :

(i) To acquaint students with the basics of computer applications in Agriculture, multimedia, database management, application of mobile app and decision-making processes etc.,

(ii) To provide basic knowledge of computer with applications in Agriculture,

(iii) To make the students familiar with Agricultural-Informatics, its components and applications in Agriculture and Artificial Intelligence.

THEORY

Introduction to Computers, Anatomy of Computers, Memory Concepts, Units of Memory, Operating System: Definition and types, Applications of MS-Office® for creating, Editing and Formatting a document, Data presentation, Tabulation and graph creation, Statistical analysis, Mathematical expressions, Database- concepts and types, creating database, Uses of DBMS in Agriculture, Internet and World Wide Web (WWW): Concepts and components. Computer programming: General concepts, Introduction to general programming concepts and standard input/output operations. e-Agriculture, concepts, design and development; Application of innovative ways to use information and communication technologies (IT) in Agriculture, Computer Models in Agriculture: Statistical, weather analysis and crop simulation models, concepts, input-output files, limitation, advantages and application of models for understanding plant processes, sensitivity, verification, calibration and validation, IT applications for computation of water and nutrient requirement of crops, Computer-controlled devices (automated systems) for Agri-input management, Smartphone mobile apps in Agriculture for farm advice: Market price, post-harvest management etc. Geospatial technology: Techniques, components and uses for generating valuable agri-information, Decision support systems: Concepts, components and applications in Agriculture. Agriculture Expert System: Soil Information Systems etc. for supporting farm decisions. Preparation of contingent crop planning and crop calendars using IT tools, Digital India and schemes to promote digitalization of

agriculture in India. Introduction to Artificial Intelligence, background and applications, Turing test. Control strategies, Breadth-first search, Depth-first search, Heuristics search techniques: Best-first search, A*algorithm, IoT and Big Data; Use of AI in Agriculture for autonomous crop management and health, monitoring livestock health, intelligent pesticide application, yield mapping and predictive analysis, automatic weeding and harvesting, sorting of produce and other food processing applications; Concepts of Smart Agriculture, Use of AI in Food and Nutrition Science etc.

PRACTICAL

Study of computer components, accessories, practice of important DoS Commands, Introduction of different operating systems such as Windows, Unix/ Linux, creating files and folders, File Management. Use of MS-WORD and MS-PowerPoint for creating, editing and presenting a scientific document, MS-EXCEL - Creating a spreadsheet, Use of statistical tools, Writing expressions, Creating graphs, Analysis of scientific data. MS-ACCESS: Creating Database, preparing queries and reports, Demonstration of Agri-information system, Introduction to World Wide Web (WWW) and its components, Introduction of programming languages such as-Visual Basic, Java, Fortran, C, C++, Hands-on practice on Crop Simulation Models (CSM), DSSAT/Crop-Info/Crop Syst/Wofost, Preparation of inputs file for CSM and study of model outputs, Computation of water and nutrient requirements of crop using CSM and IT tools, Use of smart phones and other devices in agro-advisory and dissemination of market information, Introduction of Geospatial Technology, AR/VR demonstration, India Digital Ecosystem of Agriculture (IDEA).

TEACHING SCHEDULE

THEORY [VAC-242]

Lecture No.	Topic	Sub-topics/ Key Points	Weightage (%)
1- 3	**Introduction to Computers, Anatomy of Computers** **Memory Concepts:** **Operating System:**	Definitions; Characteristics of Computer; Components of Computer; CPU: CU, ALU, MU; Input Devices; Output Devices; Units of Memory: bit to TB, Types: Primary, Secondary; Definitions and Types: Single user, Multi-user and features. OS Special Types (Brief Overview): Batch, Real-Time, Time Sharing, Distributed, Network OS. Functions of operating system	7
4 - 6	**Applications of MS Office®**	MS Word: Creating a New Document, Formatting option features; Insertion of Table; MS Excel: Creating worksheet and graph, Functions for Data Analysis: AVERAGE, COUNT, SUM, MIN, MAX, MEDIAN, MODE, STDEV, STDEVP, VAR, VARP, CORREL, PERCENTILE; Mathematical functions in MS-Excel: SUM, AVERAGE, AVERAGEIF, COUNT, COUNTIF, MOD, ROUND	7
7 - 9	**Database and DBMS**	Database: Definitions, Concepts and Types; Uses of DBMS in Agriculture; Characteristics of Database; Structure of Database Management System, Tables: Concept of view, Primary key, Foreign key; Creating Database: SQL query: Create, Insert, Select, Delete, Update. Form: Steps for Creating Forms, Entering Data in forms, Report using MS-ACCESS: Steps for Creating Reports, Printing reports.	7

Continued…

VAC-242…

10	**Internet and World Wide Web (www)**	Concepts and components; Internet: Introduction; Definition of LAN, WAN, MAN and Internet Internet Service Provider (ISP); World Wide Web; Hypertext; Web Browser; Web Page and Websites; E-Mail: Creating Email, Email Addresses, Using Email, Sending the message, CC and BCC; Search Engine	7
11 - 12	**Introduction to Computer Programming**	Computer Programming: Introduction, General concepts, Standard input/output operations.	7
13 - 14	**e-Agriculture**	Concepts, Application & Importance of IT in e-Agriculture; AGRINET: Introduction, Objectives; Advantages and Challenges in Agriculture.	7
15 - 16	**Computer Models in Agriculture**	Statistical, Weather Analysis and Crop Simulation Models; Concepts, Input-output files, Limitation, Advantages and Application of models for understanding plant processes, Sensitivity, Verification, Calibration and Validation	7
17 - 19	**IT and IoT Applications in Agriculture**	IT Applications & their role in Agriculture with emphasis on Computation of Water and Nutrient Requirement of Crop; IoT - Definition, Benefits/ Applications/ Uses in Agriculture: Precision Farming, Agricultural Drones, Smart Greenhouses, Drones; Challenges.	7

Continued…

20 - 21	**Computer-controlled Devices; Smartphone Apps and Geospatial Technology**	Computer-controlled Devices (Automated systems) for Agri-input management- Examples of Automation Devices: Robotics Application in Planting, Drones for Irrigation, Harvest Automation Tools, Automated Tractors etc., AWS - Automatic Weather Station, AIS - Automatic Irrigation System. Smartphone Mobile Apps in Agriculture- Introduction- Irrigation Systems, Fertilizer Application, Pest and Disease Management; Seeding and Planting, Harvesting Systems; Weather Forecasting, Soil Testing and Analysis, Crop Management, Market Prices; Farm Management, Financial & Insurance Services. Geospatial Technology (*in brief*) – Introduction, Techniques, Components and Uses for generating valuable agri-information.	7
22 - 23	**Decision Support System (DSS)**	DSS: Introduction, Concepts, Components, Types and Applications in Agriculture.	7
24 - 25	**Agriculture Expert System (AES)**	AES: Introduction, Concepts, Components and Applications in Agriculture- Soil Information Systems for supporting farm decisions.	7
26 - 27	**Contingent Crop Planning using IT Tools**	Preparation of Contingent Crop Planning and Crop Calendars: Introduction, Definition, Benefits, Steps to prepare Contingent Crop Planning & Calendars using IT Tools.	7
28 - 30	**Digital India and Schemes to promote Digitalization of Agriculture in India**	Digital India and Schemes to promote Digitalization of Agriculture in India; Digital Agriculture in India: Status, Challenge, Digital India and Initiatives in Agriculture Sector. Digital Agriculture or NeGP-A 2.0	8
31- 32	**Introduction to and Uses of Artificial Intelligence (Overview)**	Introduction to Artificial Intelligence, Background and Applications, Turing test. Control strategies, Breadth-first search, Depth-first search, Heuristics search techniques: Best-first search, A*algorithm, IoT and Big Data; Use of AI in Agriculture for autonomous crop management and health, monitoring livestock health, intelligent pesticide application, yield mapping and predictive analysis, automatic weeding and harvesting, sorting of produce and other food processing applications; Concepts of Smart Agriculture, Use of AI in Food and Nutrition Science etc.	8
		Total =	**100**

TEACHING SCHEDULE

PRACTICAL [VAC-242]

Exercise No.	Exercise Title
1 - 2	Study of computer components, accessories, practice of important DOS command Introduction to different Operating systems- such as Windows, Unix/ Linux; Creating files and folders, Files Management.
3 - 4	Use of ~ MS-WORD: Creating files and folders; Files management and MS-POWERPOINT: Presentation for creating, editing and presenting scientific documents. MS-EXCEL: Mathematical calculations; Preparation of Spread sheets; Use of statistical tools; Writing expressions; Creating graphs; Analysis of scientific data.
5	MS-ACCESS: Creating Database; Preparing queries and reports.
6	Demonstration of Agri-information system(s)
7 - 8	Introduction of Programming Languages & Program in C-Language: a) Program to enter name and print name b) Program to calculate sum and subtraction of numbers c) Program to calculate Area of Circle d) Program to calculate Area of Triangle e) Program to calculate Area of Rectangle
9	Introduction to Internet, World Wide Web (WWW) and its components.
10 - 11	Hands-on Practice on Crop Simulation Models (CSM): CROPWAT 8.0/ DSSAT/ Crop-Info/ CropSyst/ Wofost/ etc. Computation of water and nutrient requirements of crop using CSM and IT tools.
12	Use of Smartphone Apps (developed by SAUs) and other devices in agro-advisory and dissemination of market information
13	Introduction to Geospatial Technology (Use of Open-source GIS Tools)
14	Study/ Demonstration of general AR/VR tools (as available)
15	Hands-on Practice on Decision Support System (DSS);
16	Introduction to India Digital Ecosystem of Agriculture (IDEA)

Suggested Readings [VAC-242]:

1. Fundamentals of Computer by V. Rajaraman, PHI Learning.
2. Introduction to Information Technology by Pearson.
3. Introduction to Database Management System by C.J. Date, Pearson Education, N. Delhi.
4. Concepts and Techniques of Programming in C by Dhabal Prasad Sethi and Manoranjan, Wiley India.
5. Introductory Agri Informatics by Mahapatra, Subrat K. *et al.*, Jain Brothers Publication.
6. Russell, Stuart, Artificial Intelligence: A Modern Approach, Pearson Edition 2013.
7. Nilson N.J. 2001. Principles of Artificial Intelligence. Narosa Publ.
8. Agricultural Informatics and Artificial Intelligence for B.Tech.(Agril Technology) by Prashant Publ.

- ***Online Resources: (VAC-242)***

  - https://en.wikipedia.org/wiki/Computer
  - https://www.javatpoint.com/computer
  - https://iasri.icar.gov.in/
  - https://www.nrsc.gov.in/EO_Agr_Objective?language_content_entity=en
  - https://www.agrimoon.com
  - https://www.agriinfo.in
  - https://eagri.org
  - https://www.agriglance.com
  - https://agritech.tnau.ac.in
  - https://loksabhadocs.nic.in/Refinput/New_Reference_Notes/English/Agriculture_and_Digital_India.pdf
  - https://www.investindia.gov.in/team-india-blogs/digitalisation-agriculture-india
  - http://courseware.cutm.ac.in/wp-content/uploads/2020/06/Session-11-Preparation-of-Contingent-Crop-Planning-and-Crop-Calendars-Using-IT-Tools.pdf
  - https://optimizeias.com/indias-digital-ecosystem-for-agriculture/
  - https://www.igi-global.com/chapter/introduction-to-agricultural-information-systems/266572#:~:text=Agricultural%20Information%20Systems%3A%20Information%20system,knowledge%20utilization%20by%20agricultural%20producers.
  - https://cropcalendar.apps.fao.org/#/home
  - http://www.irdindia.in/journal_ijrdmr/pdf/vol4_iss1/7.pdf
  - https://learn.microsoft.com/en-us/office365/servicedescriptions/office-applications-service-description/office-applications
  - https://ebooks.inflibnet.ac.in/hsp16/chapter/application-of-software-in-statisticalanalysis-i-microsoft-excel/
  - http://eagri.org/eagri50/STAM102/index.html
  - https://edu.gcfglobal.org/en/internetbasics/using-a-web-browser/1/
  - https://www.javatpoint.com/what-is-world-wide-web
  - https://www.mdpi.com/journal/agriculture/special_issues/Decision_Support_Systems_Application
  - https://apps.gov.in/ministry/ministry-agriculture
  - http://courseware.cutm.ac.in/wp-content/uploads/2020/06/Session-11-Preparation-of-Contingent-Crop-Planning-and-Crop-Calendars-Using-IT-Tools.pdf
  - https://apps.mgov.gov.in/apps_by_category;jsessionid=8206D0DAE69F48FB50962462A8922C23?name=Agriculture

➢ ***Tools available for Student for Academic Purpose only: (VAC-242)***

1. DSSAT (Decision Support System for Agrotechnology Transfer)
- Purpose: A comprehensive crop modeling tool.
- Use: Simulates plant growth, development, and yield for various crops under different management and environmental conditions.
- Download: https://dssat.net/

2. APSIM (Agricultural Production Systems Simulator)
- Purpose: A powerful plant simulation tool.
- Use: Models the effects of environmental variables like soil, climate, and management strategies on plant growth and crop yield.
- Download: https://www.apsim.info/

3. Open Sim Root
- Purpose: A root growth modeling software.
- Use: Helps understand plant root growth processes, interactions with soil, and how they respond to environmental conditions.
- Download: Available as open-source software via research platforms like Git Hub. https://gitlab.com/rootmodels/OpenSimRoot

4. Virtual Plant
- Purpose: A tool for visualizing and modeling plant metabolic and regulatory networks.
- Use: Helps in understanding complex plant processes such as gene regulation, metabolic pathways, and how they respond to environmental conditions.

  Download: https://sourceforge.net/projects/virtualplant/

5. R Studio (with Bioconductor and Plant Modeling Libraries)
- Purpose: A programming environment for statistical computing.
- Use: Using plant modeling libraries like plant and photosynthesis, researchers can model plant growth, carbon assimilation, and nutrient cycling.
- Download: https://posit.co/downloads/

6. WOFOST (World Food Studies)
- Purpose: A plant process and crop growth simulation model developed by the FAO.
- Use: Helps in understanding crop development, photosynthesis, and biomass accumulation under different environmental and management conditions.
- Download: https://www.wur.nl/en/research-results/research-institutes/environmental-research/facilities-tools/software-models-and-databases/wofost/downloads-wofost.htm

7. Green Lab
- Purpose: A plant growth model focused on plant architecture and functional growth processes.
- Use: Simulates plant organ development and growth processes, integrating functional and structural aspects of plant behavior.
- Download: https://greenlab.cirad.fr/GLUVED/html/P3_Tools/Tool_simul_003.html

Semester	**:**	**IV**	
Course No.	**:**	**AGRO-244**	**Credit Hrs : 3 (1+2)**
Course Title	**:**	**Crop Production Technology-II (*Rabi* Crops)**	

SYLLABUS

Objectives : (i) To impart basic and fundamental knowledge on principles and practices of *Rabi* crop production,

(ii) To impart knowledge and skill on scientific crop production and management.

THEORY

Origin, geographical distribution, economic importance, soil and climatic requirements, varieties, cultural practices and yield of *Rabi* crops: **Cereals** – Wheat, Barley and *Rabi* sorghum, **Pulses** - Chickpea, Lentil, Peas and French bean; **Oilseeds** – Rapeseed, Mustard, Sunflower, Safflower and Linseed; **Sugar crops** - Sugarcane and Sugar beet; **Medicinal and Aromatic crops** - Mentha, Lemon grass and Citronella, and **Forage crops** - Berseem, Lucerne and Oat.

PRACTICAL

Identification of major *rabi* crops and their seeds, Study of sowing methods of Wheat and planting method of Sugarcane, Demonstration of mechanization in crop cultivation practices in *rabi* crops, Identification of weeds in *rabi* season crops, study of morphological characteristics of *rabi* crops, Calculations of plant population, seed rate and fertilizers doses, Study of yield contributing characters of *rabi* crops, study of yield and juice quality analysis of sugarcane, Study of important agronomic experiments of *rabi* crops at experimental farms, Study of *rabi* forage experiments, Oil extraction of medicinal crops, Visit to Research Stations of related crops.

Allotment of 2 R area to each student for undertaking various cultural operations as part of Practical Work Experience, specifically for raising *rabi* crop(s) on the allotted plot, to be carried-out concurrently with the above-mentioned practical sessions.

TEACHING SCHEDULE

THEORY [AGRO-244]

Lecture No.	Topic	Sub-topics/ Key Points	Weightage (%)
1 - 3	**Cereals –** Wheat, Barley, *Rabi* Sorghum	Origin, Geographical distribution, Economic importance, Soil and climatic requirements, Varieties/ Hybrids, Cultural practices: Land preparation, Seeds and Sowing, Irrigation and Nutrient Management, Intercultural operations including weed management, Plant Protection (Major pests and diseases and their management), Harvesting, Yield and Crop specific post-harvest processing	25
4 - 6	**Pulses –** Chickpea, Lentil, Pea, French bean		20
7 - 9	**Oilseeds –** Rapeseed, Mustard, Sunflower, Safflower and Linseed		25
10 - 11	**Sugar crops –** Sugarcane and Sugar beet		10
12 - 14	**Medicinal and Aromatic crops –** Mentha, Lemon grass and Citronella		10
15 - 16	**Forage crops –** Berseem, Lucerne and Oat		10
		Total =	**100**

PRACTICAL [AGRO-244]

Part-I (Practical/ Demonstration Sessions)	
Exercise No.	**Exercise Title**
1	Identification of major *rabi* crops and their seeds.
2	Study of sowing methods of Wheat.
3	Study of planting method of Sugarcane.
4	Demonstration of mechanization in crop cultivation practices in *rabi* crops.
5 - 6	Identification of weeds and use of herbicides in *rabi* crops.
7	Study of morphological characteristics of *rabi* crops.
8 - 9	Calculations of plant population, seed rate and fertilizers doses.
10	Study of yield contributing characters of *rabi* crops.
11	Study of maturity signs and juice quality analysis of Sugarcane.
12 - 13	Study of important agronomic experiments of *rabi* crops at experimental farms.
14	Study of *rabi* forage experiments.
15 - 16	Visit to Research Stations of related *rabi* crops.

Continued…

Part-II (Work Experience)	
Exercise No.	**Exercise Title**
Allotment of 2 R area to each student towards carrying-out various following agronomic operations for raising *rabi* crop(s) in the allotted plot in parallel mode with Part-I:	
1 - 2	Study of package of practices of given *rabi* crop(s): (sown/planted as timely, late and rainfed crops).
3 - 4	Preparation of calendar of operations for *rabi* crops.
5	Study of preparatory, secondary tillage and seed bed preparation for *rabi* crops.
6	Seed treatment and sowing of *rabi* crops.
7	Study of integrated nutrient management of *rabi* crops.
8	Study of water management in *rabi* crops.
9 - 10	Measurement of growth and yield contributing characters of *rabi* crops.
11	Study of interculturing and weed management in *rabi* crops.
12	Study of integrated insect pest and diseases management in *rabi* crops.
13	Study of crop maturity signs and harvesting methods of *rabi* crops.
14	Threshing, drying, winnowing, storage and preparation of produce for marketing of *rabi* crops.
15	Economic analysis of allotted *rabi* crop(s) cultivation (Cost of cultivation).
16	Preparation of a *rabi* crop production report/dossier-based on field observations.

Suggested Readings [AGRO-244]:

1. B. Gurarajan, R. Balasubramanian and V. Swaminathan. Recent Strategies on Crop Production. Kalyani Publishers, New Delhi.
2. Chidda Singh.1997. Modern Techniques of Raising Field Crops. Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi.
3. Rajendra Prasad. Textbook of Field Crops Production - Commercial Crops. Volume II, ICAR Publication.
4. Rajendra Prasad. Textbook of Field Crops Production - Foodgrain Crops. Volume I, ICAR Publication.
5. S.R. Reddy. 2009. Agronomy of Field Crops. Kalyani Publishers, New Delhi.
6. S.S. Singh. 2005. Crop Management. Kalyani Publishers, New Delhi.
7. UAS, Bangalore. 2011. Package of Practices. UAS, Bangalore.
8. Rajendra Prasad. 2002. Text Book of Field Crops Production, ICAR, New Delhi.
9. S.R. Reddy. 2004. Agronomy of Field crops, Kalyani Publishers, Ludhiana.
10. Subhash Chandra Bose, M. and Balakrishnan, V. 2001. Forage Production, South Asian Publishers, New Delhi.

Semester	**: IV**		
Course No.	**: AGRO-245**	**Credit Hrs.**	**: 2(1+1)**
Course Title	**: Water Management**		

SYLLABUS

Objectives : (i) To study the important properties of soil affecting water availability to crops and water requirement for optimum growth and development,

(ii) To study different methods of irrigation and water management practices of both field and horticultural crops and drainage,

(iii) To study the soil moisture conservation practices including management of rain water, watershed and command areas.

THEORY

Irrigation: definition and objectives, Importance: function of water for plant growth; Water resources and irrigation development for different crops in India; Soil plant water relationships- Soil-plant-atmosphere continuum (SPAC), Soil moisture – Distribution of soil moisture, Soil moisture constants and Types of soil water; Water budgeting – rooting characteristics – moisture extraction pattern, effect of moisture stress on crop growth; Evaporation, transpiration, evapotranspiration and crop water requirement, Consumptive use of water, Potential evapotranspiration (PET); Effective rainfall; Different approaches of scheduling of irrigation; Methods of irrigation: surface and sub-surface; Pressurized irrigation methods *viz.,* sprinkler and drip irrigation, their suitability, merits and limitations, fertigation, economic use of irrigation water; Irrigation efficiency, water use efficiency and conjunctive use of water and measures to increase water use efficiency; Water management of different crops (rice, wheat, maize, groundnut, sugarcane, mango, banana and tomato); Agricultural drainage, types of drainage, effects of drainage on soil, ill effects of excess of water on soil and Water management in problematic soils; Irrigation automation, Artificial Intelligence and climate-based irrigation practices and its management.

PRACTICAL

Determination of bulk density by field method; Determination of soil moisture content by gravimetric method, tensiometer, electrical resistance block and neutron moisture meter; Determination of field capacity by field method; Determination of permanent wilting point; Measurement of irrigation water by using water measuring devices viz., flumes, weirs, notches, orifices; Calculation of irrigation water requirement (Problems); Determination of infiltration rate; Demonstration of furrow method of irrigation; Demonstration of check basin and basin method of irrigation; Visit to farmers' field and cost estimation of drip irrigation system; Demonstration of filter cleaning, fertigation, injection and flushing of laterals; layout for different methods of irrigation, Erection and operation of sprinkler irrigation system; Measurement of emitter discharge rate, wetted diameter and calculation of emitter discharge variability; Visit to irrigation research centre/station and visit to command area.

TEACHING SCHEDULE

THEORY [AGRO-245]

Lecture No.	Topic	Sub-topics/ Key Points	Weightage (%)
1	Irrigation	Irrigation: Definition and Objectives, Importance Function of water for plant growth	4
2	Water Resources of India	Water resources and irrigation development for different crops in India	6
3 - 4	Soil Plant-Water Relationships	Soil-Plant-Atmosphere Continuum (SPAC), Soil moisture: Distribution of soil moisture, Soil moisture constants and Types of soil water	14
5	Water Budgeting	Water budgeting: Rooting characteristics-Moisture extraction pattern, Effect of moisture stress on crop growth	8
6	Evapotranspiration and CWR	Evaporation, Transpiration, Evapotranspiration and Crop water requirement, Consumptive use of water, Potential evapotranspiration (PET); Effective rainfall	8
7	Scheduling of Irrigation	Different approaches of scheduling of irrigation	6
8	Methods of Irrigation with Layouts	Surface and sub-surface methods with their Layouts	6
9 - 10	Pressurized Irrigation Systems	Sprinkler and drip irrigation, their suitability, Comparison, Merits and limitations, Fertigation, Economic use of irrigation water	10
11	Irrigation Efficiency	Irrigation Efficiency, Water use efficiency and Conjunctive use of water and measures to increase water use efficiency	8
12	Water Quality for Irrigation	Irrigation water quality and its management.	6
13	Water Management of different Crops	Water management of different crops - (Rice, Wheat, Maize, Groundnut, Sugarcane, Mango, Banana and Tomato)	6
14 - 15	Drainage	Agricultural drainage, Types of drainage, Effects of drainage on soil, Ill effects of excess of water on soil and water management in problematic soils	12
16	Irrigation Automation	Irrigation automation, Artificial intelligence and Climate-based irrigation practices and its management.	6
		Total =	**100**

TEACHING SCHEDULE

PRACTICAL [AGRO-245]

Exercise No.	Exercise Title
1	Determination of bulk density by field method
2	Determination of soil moisture content by gravimetric method, tensiometer, electrical resistance block and neutron moisture meter
3	Determination of field capacity by field method
4	Determination of permanent wilting point
5 - 6	Measurement of irrigation water by using water measuring devices *viz.,* flumes, orifices and weirs; Calculation of irrigation water requirement (Problems)
7	Determination of infiltration rate
8	Demonstration of surface irrigation methods
9	Demonstration of drip irrigation system
10	Demonstration of sprinkler irrigation system
11	Demonstration of filter cleaning, fertigation, injection and flushing of laterals
12 - 13	Measurement of emitter discharge rate, wetted diameter and calculation of emitter discharge variability
14	Use of artificial intelligence (AI) in irrigation management
15	Visit to Farmer's field and cost estimation of drip irrigation system
16	Visit to Irrigation Research Centre/ Command Area.

Suggested Readings [AGRO-245]:

1. Rao, Y.P. and Bhaskar, S.R. Irrigation Technology- Theory and Practice. Agrotech Publishing Academy, Udaipur.
2. Dilip Kumar Mujmdar. Irrigation Water Management: Principles and Practices. Prentice Hall of India Pvt. Ltd.
3. Patil, S.V and Rajakumar, G.R., Water Management in Agriculture and Horticultural Crops. Satish Serial Publishing House, Delhi.
4. Carr M.K.V. and Elias Fereres. Advances in Irrigation Agronomy. Cambridge University Press.
5. Michael, A.M. Irrigation Theory and Practice. Vikas Publishing House Pvt. Ltd.

Semester : **IV**		
Course No. : **GPB-242**	**Credits** : **3(2+1)**	
Course Title : **Basics of Plant Breeding**		

SYLLABUS

Objectives : To acquaint with different techniques ranging from simply selecting plants with desirable characteristics for propagation, to more complex molecular techniques for breeding new varieties, which are higher yielding, resistant to biotic and abiotic stresses for ensuring food security.

THEORY

Historical development, concept, nature and role of Plant Breeding, major achievements and future prospects; Genetics in relation to Plant Breeding, Modes of reproduction and apomixes, self-incompatibility and male-sterility genetic consequences; Plant genetic resources, its utilization and conservation. Domestication, Acclimatization and Introduction. Centers of origin/ diversity, Components of Genetic variation. Heritability and genetic advance. Pre-breeding and Universal Plant Breeder's equation. Genetic basis and breeding methods in self-pollinated crops- mass and pure line selection, hybridization techniques and handling of segregating population. Multiline concept, Concepts of Population Genetics and Hardy-Weinberg Law. Genetic basis and methods of breeding cross-pollinated crops- modes of selection. Population movement schemes- Ear-to-Row method, Modified Ear-to-Row, recurrent selection schemes. Heterosis and inbreeding depression, development of inbred lines and hybrids, composite and synthetic varieties. Breeding methods in asexually propagated crops, clonal selection and hybridization. Wide hybridization and Pre-breeding. Polyploidy in relation to Plant Breeding, Mutation breeding- methods and uses. Breeding for important biotic, abiotic stresses and quality. Participatory Plant Breeding. Variety Release and notification. Intellectual Property Rights, Patenting, Plant Breeder's and Farmer's Rights.

PRACTICAL

Plant Breeder's kit. Study of germplasm of various crops. Study of floral structures of self-pollinated and cross-pollinated crops. Emasculation and hybridization techniques in self- and cross-pollinated crops, Consequences of inbreeding on genetic structure of resulting populations, Study of male sterility system, Handling of segregating populations, Methods of calculating mean, range, variance, standard deviation, heritability. Designs used in Plant Breeding experiments, Analysis of Randomized Block Design. To work-out the mode of pollination in a given crop and extent of natural out-crossing. Prediction of performance of double cross hybrids, Maintenance of breeding records and data collection. Screening tests for biotic and abiotic stresses.

TEACHING SCHEDULE

THEORY [GPB-242]

Lecture No.	Topic	Sub-topics/ Key points	Weightage (%)
1	**Plant Breeding: Concept, Historical Development and Role**	Definition, Aims and general objectives of Plant Breeding; History of Plant Breeding, Landmarks of Plant Breeding; Eminent Global and Indian Plant Breeders, Major achievements and Future Prospects; Genetics in relation to Plant Breeding	3
2	**Modes of Reproduction and Apomixis**	Definitions- Sexual, Asexual, Apomixes and their Significance in Plant Breeding; Types of Pollination and Mechanisms promoting self and cross pollination; Differences between self- and cross-pollinated crops with their genetic consequences	4
3	**Self-Incompatibility**	Definitions, Classification/Types- Heteromorphic SI, its features & example, distyly, tristyly; Homomorphic SI, i.e. Gametophytic SI and Sporophytic SI, features and examples, Differences; Utilization of self-incompatibility in Plant Breeding	4
4	**Male Sterility**	Definitions, Types- GMS, CMS, CGMS, Thermosensitive MS, Photosensitive MS, Transgenic MS, Chemical hybridizing agents; Significance of MS in crop improvement	4
5	**Plant Genetic Resources**	Definition of PGR, its utilization and conservation. Gene pool, Kinds of germplasm, Gene pool concept, Genetic erosion, Germplasm collection and conservation, Types and Methods.	3
6	**Centres of Origin/ Diversity,**	Vavilov's Concept, Primary & Secondary Centres, Distribution of species (in brief)	3
7	**Components of Genetic Variation**	Components: Definitions and Features of Additive, dominance and epistatic genetic variance; Phenotypic variance and its components; Environmental variance vs. Genetic variance; Heritability: Definition, Concept and Types- Narrow and Broad sense heritability; Methods of estimating, Factors affecting heritability; Genetic Advance: Definition and its Measurement, GA as % of mean, Application in Plant Breeding (in brief).	4

Continued….

8	**Pre-breeding and Universal Plant Breeder's Equation**	Pre-breeding: Concept/Definition, Importance/ Need, Sources, Steps (in brief); Universal Plant Breeder's Equation: ($R = i \times h^2 \times \sigma_p$) Concept, Components, Significance and Factors influencing Response to selection/ Effect on genetic gain (in brief).	3
9	**Breeding Methods in Self-pollinated Crops: Overview**	List of Breeding Methods in Self-pollinated Crops; Genetic basis; Domestication & Acclimatization: Definitions, Concept, Factors affecting acclimatization; Plant Introduction- Definitions, Purpose, Types i.e. Primary and Secondary; Merits & Limitations.	4
10	**Mass Selection**	Genetic basis; Positive & Negative selection; Procedure/Scheme; Advantages & Limitations; Achievements.	5
11	**Pure Line Selection**	Definition, Concept & importance; Procedure of pure line development; Advantages, disadvantages; Achievements	
12	**Hybridization Techniques**	Definition & Objectives; Types of crosses; Floral biology; Steps in hybridization	5
13	**Handling of Segregating Population (Pedigree, Bulk, SSD)**	Concept, Detailed procedure/scheme, Application, Merits, Demerits, Achievements of ~ Pedigree method-, Bulk method-, Single Seed Descent method (rapid generation advancement)-	
14	**Backcross Method**	Definition of Backcross, its objective, requirements and application; Step-wise Procedures for transfer of dominant & recessive genes; its merits, demerits, achievements.	4
	Multiline Concept	Definition; Development; Advantage, e.g.	
15	**Population Genetics and Hardy-Weinberg Law**	Concept of Population Genetics- Definitions- Random mating population, Gene and Genotypic frequencies; Hardy-Weinberg Law/ Equilibrium: Statement, its validity, Factors affecting gene frequency	4
16	**Breeding Methods in Cross-pollinated Crops: Overview & Selection Concept**	List of Breeding Methods in Cross-pollinated Crops; Genetic basis; Recurrent selection concept (in brief)	2

Continued….

17	**Population Movement Schemes**	Ear-to-Row method, Modified Ear-to-Row, Recurrent selection schemes/methods: its types; Procedure/cycles and applications	4
18	**Heterosis and Inbreeding Depression**	Definitions and Types; Genetic basis/ Theories of heterosis; Estimation of heterosis; Effects of inbreeding	5
19-20	**Development of Inbred lines and Hybrids, Composite and Synthetic Varieties**	Development of Inbred lines: Selfing procedures; Application in F_1 development. Hybrids, Composite and Synthetics: Definitions; Characteristics of Hybrid; Steps for development; Merits, demerits and achievements	4
21-22	**Breeding Methods in Asexually Propagated Crops**	List of breeding methods for asexually propagated crops. Clone; Clonal selection: Definitions, Features of clonal crops; Procedure of clonal selection, its merits and demerits; Steps/procedure of Hybridization in clonal crops	4
23-24	**Wide Hybridization**	Definitions; Types; Main features; Interspecific and Intergeneric crosses/ hybridization, their examples; Incompatibility Pre- & Post-fertilization Barriers Overcoming Techniques; Achievements	4
25-26	**Polyploidy in relation to Plant Breeding**	Polyploidy: Definitions of Haploid, Monoploid, Diploid, Polyploid, Genome, Heteroploidy, Aneuploidy, Euploidy; Types of Aneuploidy & Polyploidy, their applications in crop improvement, Examples; Effects of polyploidy and Limitation	4
27	**Mutation Breeding-Methods and Uses**	Definitions; Need (Conditions in which it is rewarding) & Usefulness; Mutation induction (Physical & Chemical Mutagens); Procedure for seed and vegetatively propagated crops, applications, its merits, demerits and achievements	4

Continued….

28	**Breeding for Important Biotic Stresses**	Breeding for Disease Resistance: Introduction, Mechanisms of disease resistance, Types of genetic resistance; Gene-for-gene hypothesis; Genetics of resistance sources of resistance Breeding methods and Practical achievements. Breeding for Insect Resistance: Introduction, Mechanisms/ Categories of insect resistance, Genetics and resistance sources, Breeding Strategy, Practical achievements.	5
29	**Breeding for Important Abiotic Stresses & Quality**	Breeding for Drought Resistance: Drought: Mechanism, Sources/ Basis, Breeding methods. Breeding for Salinity Resistance: Screening techniques, Breeding for salt tolerance, breeding approaches, Breeding for Quality: Introduction, Quality traits, Nutrition and nutrients, Nutritional quality of cereals and pulses, Breeding methods; Screening techniques, Breeding for low toxic substances; Practical achievements of all above approaches.	5
30	**Participatory Plant Breeding**	Concept and evolution; Objectives; Types of PPB; Applications in Farmer-centric breeding	3
31	**Variety Release and Notification**	Definitions, History, Process of Variety Release and Notification.	3
32	**Intellectual Property Rights; Plant Breeders' and Farmer's Rights**	Definitions, Types and Forms of IPRs, Patenting, Plant Breeders' and Farmer's Rights. (in brief)	3
		Total =	**100**

TEACHING SCHEDULE

PRACTICAL [GPB-242]

Exercise No.	Exercise Title
1	Study and Use of Plant Breeder's Kit.
2	Study of germplasms of various crops.
3	Study of floral structures of self-pollinated and cross-pollinated crops.
4	Emasculation and hybridization techniques in self-pollinated crops: Green gram, Black gram, Rice, Wheat, Groundnut and Soybean.
5	Emasculation and hybridization techniques in self-pollinated crops: Sesame, Chickpea, Okra, Tomato, Brinjal and Chilli.
6	Emasculation and hybridization techniques in cross-pollinated crops: Maize, Bajra, Sunflower, Papaya and Sugarcane.
7	Emasculation and hybridization techniques in often cross-pollinated crops: Cotton, Sorghum, Pigeon pea and Safflower.
8	Handling of segregating populations; Consequences of inbreeding on genetic structure of resulting populations.
9	Study of male sterility systems.
10	Methods of calculating mean, range, variance, standard deviation and heritability.
11	Experimental Designs used in plant breeding experiments and Analysis of Randomized Block Design.
12	To work-out the mode of pollination in a given crop and the extent of natural out-crossing.
13	Prediction of performance of double cross hybrids.
14	Maintenance of breeding records and data collection.
15	Screening tests for biotic stresses.
16	Screening tests for abiotic stresses.

Suggested Readings [GPB-242]:

1. Plant Breeding Principles and Methods, B.D. Singh, Kalyani Publication, New Delhi.
2. Essentials of Plant Breeding. Phundan Singh, Kalyani Publication, New Delhi.
3. Principles and Practices Plant Breeding. J.R. Sharma, McGraw Hill Publishing Company Limited, New Delhi.
4. Plant Breeding Theory and Practices. V.L. Chopra, Oxford and IBH Publishing Company, New Delhi.
5. Introduction to Plant Breeding. R.C. Choudhary, Oxford and IBH Publishing Company, New Delhi.

Semester	**:**	**IV**	
Course No.	**:**	**HORT-243**	**Credit Hrs. : 2(1+1)**
Course Title	**:**	**Production Technology of Vegetables and Spices**	

SYLLABUS

Objectives : (i) To educate about the different forms of classification of vegetables,
(ii) To educate about the origin, area, climate, soil, improved varieties and cultivation practices of vegetables and spices,
(iii) To educate about the physiological disorders of vegetables and spices.

THEORY

Importance of vegetables and spices in human nutrition and national economy, Kitchen gardening, Brief about origin, area, climate, soil, improved varieties and cultivation practices such as time of sowing, transplanting techniques, planting distance, fertilizer requirements, irrigation, weed management, harvesting and yield, physiological disorders of important Vegetables and Spices (tomato, okra, brinjal, chili, capsicum, cucumber, bitter gourd, bottle gourd, sweet potato, cassava and moringa, pumpkin, French bean, peas; Cole crops such as cabbage, cauliflower, knol-khol; Bulb crops such as onion, garlic; Root crops such as carrot, radish, beetroot; Tuber crops such as potato; Leafy vegetables such as amaranth, palak, perennial vegetables, Spice crops like turmeric, ginger, coriander, cumin, black pepper, cardamom, fenugreek, fennel, clove, nutmeg, cinnamon, curry leaf, tamarind and herbal spices).

PRACTICAL

Identification of vegetables and spice crops and their seeds. Description of varieties. Propagation methods- rapid multiplication techniques- seed collection and extraction. Nursery raising. Direct seed sowing and transplanting. Study of morphological characters of different vegetables and spices. Fertilizers applications. Harvesting and post-harvest practices. Economics of vegetables and spices cultivation, Visit to Spices Gardens.

TEACHING SCHEDULE

THEORY [HORT-243]

Lecture No.	Topic with Subtopics	Weightage (%)
1	**Introduction:** Importance of vegetables and spices in human nutrition and national economy; Kitchen gardening	10
Brief about origin, area, climate, soil, improved varieties and cultivation practices such as- time and method of sowing, transplanting techniques, planting distance, fertilizer requirements, irrigation, weed management, harvesting and yield, physiological disorders of the following important crops:		
2 - 3	Solanaceous vegetables: Tomato, Chilli, Brinjal, Capsicum and Potato	10
4	Other vegetables: Okra, French bean and Pea	10
5	Cucurbitaceous vegetables: Cucumber, Bitter gourd, Bottle gourd and Pumpkin	10
6	Cole crops: Cabbage, Cauliflower and Knol-khol	5
7	Bulb and Root crops: Onion and Garlic	5
8	Root and Tuber crops: Radish, Carrot, Beetroot, Cassava	5
9	Leafy vegetables: Amaranthus and Palak	5
10	Perennial vegetables: Moringa and Curry leaf	5
11 - 14	Spices: Black pepper, Nutmeg, Cinnamon, Clove, Cardamom, Turmeric and Ginger	20
15	Seed spices: Coriander, Cumin, Fenugreek and Fennel	10
16	Tamarind and Herbal spices	5
	Total =	**100**

TEACHING SCHEDULE

PRACTICAL [HORT-243]

Exercise No.	Exercise Title
1	Identification of Vegetables crops and their seeds
2	Identification of Spices crops and their seeds
3	Description of varieties of Vegetable crops
4	Description of varieties of Spice crops
5	Propagation methods -Rapid multiplication techniques
6	Nursery raising
7	Direct seed sowing and transplanting
8	Study of morphological characters of different vegetables
9	Study of morphological characters of different spices
10	Fertilizers applications
11	Propagation and raising of nursery of vegetables
12	Propagation and raising of nursery of spices
13	Harvesting and preparation for market of vegetables
14	Harvesting and preparation for market of spices
15	Economics of vegetables cultivation
16	Economics of spices cultivation
17	Visit to Spice Gardens

Suggested Readings [HORT-243]:

SN.	Title of Book	Authors
1.	Vegetables	B. Choudhary
2.	Vegetable Crops	T.K. Bose, M.G. Som and T. Kabir
3.	Vegetable, Tuber and Spices	S. Thamburaj
4.	Production Technology of Vegetable Crops	S.P. Singh
5.	Vegetables – Production Technology Astral International	Haldavnekar, P.C.; Parulekar, Y.R.; Mali, P.C. and Haldankar, P.M.
6.	Major Spices of India	J.S. Pruthi
7.	Minor Spices and Condiments	J.S. Pruthi
8.	Introduction to Spices and Plantation Crops	N. Kumar and others
9.	Spice Crops Vol.I and Vol. II	Parthasarathi and Others

Semester	**:**	**IV**		
Course No.	**:**	**SOIL-243**	**Credit Hrs.**	**: 2(1+1)**
Course Title	**:**	**Problematic Soils and their Management**		

SYLLABUS

Objectives : (i) To acquaint the students about various problem soils like, degraded soils, acid soils, saline soils, alkali soils, eroded soils, sub-merged soils and polluted soils.

(ii) To impart knowledge about remote sensing, GIS, Multipurpose tree and Land capability classification.

(iii) To give hands-on-training about estimation of various soil and water quality parameters associated with problem soils.

THEORY

Soil quality and health, Distribution of Waste land and problem soils in India, Categorization of Problem soils based on properties. Reclamation and management of Acid soils, Saline, Sodic soils, Acid Sulphate soils, Eroded and Compacted soils, polluted soils. Contaminated soils (Pesticide contamination, Heavy metal contamination), Mined soils (Coal mined, Oil mined), Management of Riverine soils, Waterlogged soils; Irrigation water– quality and standards, utilization of saline water in Agriculture. Use of Remote sensing and GIS in diagnosis and management of problem soils. Irrigation and water quality. Multipurpose tree (MPT) species, Bioremediation through MPTs of soils, Land capability and classification, Land suitability classification.

PRACTICAL

Determination of pHs and EC of saturation extract of problematic soil. Determination of redox potential in soil, Estimation of water soluble and exchangeable cations in soil and computation of SAR and ESP and Characterization of problematic soil. Determination of Gypsum requirement of alkali/sodic soil. Determination of lime requirement of acidic soil. Determination of Quality of irrigation water (pH, EC, Ca, Mg, Na, CO_3, HCO_3, Cl, SAR and RSC), Determination of Nitrate (NO_3^-) from irrigation water, Determination of dissolved Oxygen and free Carbon dioxide levels in water samples.

TEACHING SCHEDULE

THEORY [SOIL-243]

Lecture No.	Topic	Subtopics/ Key Points	Weightage (%)
1-2	**Soil Quality and Soil Health**	Importance and Concept, Definitions, Need and Difference between them; Soil Quality Indicators- Physical, Chemical and Biological indicators; Characteristics of healthy soils.	10
3	**Distribution and Categorization of Problematic Soils**	Distribution and extent of problematic soils in World, India and Maharashtra. Categorization of problem soils based on soil chemical and physical properties. Agro-ecological and Management Implications (*in brief*).	6
4-5	**Saline, Saline-sodic and Sodic Soils**	Physical, Chemical and Biological Characteristics of each of these Problem Soils, Reasons for their formation, Effects on plant growth, Reclamation and Management (*in detail*).	10
5	**Calcareous Soils**		10
6-7	**Acid and Acid Sulphate Soils**		10
8-9	**Eroded and Compacted Soils**		10
10-11	**Polluted and Contaminated Soils**	Polluted and Contaminated Soils – (Pesticide contamination, Heavy metal contamination), their Properties, Effect on plant growth, Reclamation and Management.	10
12	**Mined soils**	Mined soils- (Coal and Oil-mined), Riverine soils, Water logged soils- their Features, Effect on plant growth.	8
13	**Quality and Standards of Irrigation Water**	Quality and Standards of Irrigation Water and its suitability for irrigation. Utilization of saline and sewage water in Agriculture.	8
14	**Remote Sensing and GIS**	Remote Sensing and GIS in Diagnosis and Management of problem soils.	6

Continued…

15	**Bioremediation of Problem Soils**	Bioremediation of Problem Soils and their Types, Multipurpose tree species (MPTs): Bioremediation through MPTs.	6
16	**Land Classifications**	Land Capability Classification and Land Suitability Classification: Definitions, Concept and Purpose of LCC; Classes; Subclasses and Units; Factors used in Suitability Evaluation; their Comparison.	6
		Total =	**100**

TEACHING SCHEDULE

PRACTICAL [SOIL-243]

Exercise No.	Exercise Title
1	Visit to salt affected area and collection of salt affected soils
2	Preparation of saturation paste extract of salt affected soils
3	Determination of pHe and ECe of salt affected soils
4-5	Determination of soil exchangeable cations (Ca, Mg, Na and K) and computation of SAR and ESP
6	Determination of gypsum requirement of alkali/sodic soils
7	Determination of calcium carbonate from soil
8	Determination of lime requirement of acidic soil
9	Determination of redox potential in soil
10	Collection of irrigation water samples from bore well, well or canal
11	Determination of pH and EC from irrigation water
12	Determination of cations (Ca, Mg, Na and K) from irrigation water by complexometric method
13	Determination of anions (CO_3, HCO_3, and Cl) from irrigation water and computation of RSC and SAR
14	Determination of nitrate from irrigation water
15	Determination of dissolved oxygen from water sample
16	Determination of free CO_2 levels in water sample by direct titrimetric methods.

Suggested Readings [SOIL-243]:

1. Richards, L.A. (1954). Diagnosis and Improvement of Saline and Alkali soils. United States Department of Agriculture.
2. Agarwal, R.R., Yadav, J.S.P. and Gupta, R.N. (1982). Saline Alkali Soils of India, ICAR, AGROBIOS (India).
3. Indian Society of Soil Science (2002). Fundamentals of Soil Science. IARI, New Delhi.
4. Maliwal, G.L. and Somani, L.L. (2010). Nature Properties and Management of Saline and Alkali Soils. Agrotech Publishing Academy, Udaipur.
5. Abrol, I.P., Yadav, J.S.P. and Masood, F.I. (1988). Salt-Affected Soils and their Management. FAO Soils Bulletin 39. Food and Agriculture Organization of the United Nations, Rome.
6. Tyagi, N.K. and Minhas, P.S. (1998). Agricultural Salinity Management in India. Published by CSRI, Karnal.
7. Twenty-five Years of Research on Management of Salt Affected Soils and Use of Saline Water in Agriculture. 1998. Published by CSRI, Karnal.
8. Cirsan J. Paul, (1985). Principles of Remote Sensing. Longman, New York.
9. Yaduvanshi, N.P.S. (2008). Chemical Changes and Nutrient Transformation in Sodic/Poor Quality Irrigated Soils. Published by CSRI, Karnal.
10. FAO United Nations' Soils Portal: https://www.fao.org/soils-portal/soil-management/management-of-some-problem-soils/

Semester : IV		
Course No. : EXTN-241	**Credit Hrs. : 2(1+1)**	
Course Title : Fundamentals of Extension Education		

SYLLABUS

Objectives :
(i) To state the importance of Extension Education in Agriculture,
(ii) To familiarize with the different types of agriculture and rural development programmes launched by the Govt. of India,
(iii) To classify the types of extension teaching methods,
(iv) To elaborate the importance and different models of communication,
(v) To explain the process and stages of adoption along with adopter's categories.

THEORY

Education: Meaning, Definition and Types; Extension Education- Meaning, Definition, Scope and Process; Objectives and Principles of Extension Education; Extension Programme Planning- Meaning, Process, Principles and Steps in Programme Development. Extension systems in India: Extension efforts in Pre-independence era (Sriniketan, Marthandam, Firka Development Scheme, Gurgaon Experiment, etc.) and Post-independence era (Etawah Pilot Project, Nilokheri Experiment, etc.);

Reorganized Extension System (T&V system)-; various extension/ agriculture development programmes launched by ICAR/ Govt. of India (IADP, IAAP, HYVP, KVK, IVLP, ORP, ND, NATP, NAIP, etc.). Social Justice and Poverty alleviation programmes- ITDA, IRDP/ SGSY/ NRLM.

Women Development Programmes - RMK, MSY etc. New trends in Agriculture Extension: Privatization Extension, Cyber Extension/ e-Extension, Market-led Extension, Farmer-led Extension, Expert systems, etc. Rural Development: Concept, meaning, definition; Various rural development programmes launched by Govt. of India. Community Development - Meaning, definition, concept and principles, Philosophy of C.D. Rural Leadership: Concept and definition, Types of leaders in rural context;

Methods of Identification of Rural Leader. Extension Administration: Meaning and concept, Principles and functions. Monitoring and Evaluation: Concept and definition, Monitoring and evaluation of extension programmes; Transfer of Technology (TOT): Concept and models, Capacity building of Extension Personnel; Extension teaching methods: Meaning, classification, individual, Group and mass contact methods, ICT Applications in TOT (News and Social Media), Media mix strategies; Communication: Meaning and definition; Principles and Functions of Communication, Models and barriers to communication. Agriculture Journalism; Diffusion and Adoption of Innovation: Concept and meaning, Process and stages of adoption, Adopter categories.

PRACTICAL

To get acquainted with University Extension System. Group discussion- Exercise; Identification of rural leaders in village situation; Preparation and use of AV aids, Preparation of extension literature (leaflet, booklet, folder, pamphlet, news stories and success stories); Presentation skills exercise; Micro-teaching exercise; A visit to village to understand the problems being encountered by the villagers/ farmers; To study organization and functioning of DRDA/PRI and other development departments at district level; Visit to NGO/FO/FPO and Learning from their experience in rural development; Understanding PRA techniques and their application in village development planning; Exposure to mass media: Visit to Community Radio and Television studio for understanding the process of programme production; Script writing, Writing for print and electronic media, Developing script for Radio and Television.

TEACHING SCHEDULE

THEORY [EXTN-241]

Lecture No.	Topic	Sub-topics/ Key points	Weightage (%)
1	**Education**	Meaning, Definition, Scope, Importance and Types	5
2	**Extension Education**	Meaning, Definition, Scope and Process, Objectives and Principles of Extension Education	10
3	**Extension Programme Planning**	Meaning, Process, Principles and Steps in Programme Development.	5
4 - 5	**Extension Systems in India**	Extension efforts in Pre-independence Era- (Sriniketan, Marthandam, Firka Development Scheme, Gurgaon Experiment, etc.) and Post-independence Era- (Etawah Pilot Project, Nilokheri Experiment, etc.)	10
6	**Reorganized Extension System**	T & V system, Various Extension/ Agriculture Development Programmes launched by ICAR/ Govt. of India (IADP, IAAP, HYVP, KVK, IVLP, ORP, ND, NATP, NAIP, etc.)	10
7	**Social Justice and Poverty Alleviation Programmes**	ITDA, IRDP/ SGSY/ NRLM. Women Development Programme- RMK, MSY etc.	5

Continued…

8	**New Trends in Agriculture Extension**	Privatization Extension, Cyber Extension/ e-Extension, Market-led Extension, Farmer-led extension, Expert systems, etc.	5
9	**Rural Development**	Concept, Meaning, Definition; Various rural development programmes by the Govt. of India.	5
10	**Community Development**	Meaning, Definition, Concept and Principles, Philosophy of Community Development	5
11	**Rural Leadership**	Concept and Definition, Types of leaders in rural context; Method of identification of Rural Leader.	5
12	**Extension Administration Monitoring and Evaluation**	Meaning and Concept, Principles and Functions. Concept and Definition, Monitoring and Evaluation of Extension Programmes	5
13	**Transfer of Technology**	Concept and Models, Capacity building of Extension Personnel	5
14	**Extension Teaching Methods**	Meaning, classification, individual, group and mass contact methods, ICT Applications in TOT (News and Social Media), Media mix strategies	10
15	**Communication**	Meaning, Definition; Principles and Functions of Communication, Models and Barriers to communication. Agriculture Journalism – (Overview)	10
16	**Diffusion and Adoption of Innovation**	Concept and Meaning, Process and Stages of adoption, Adopter categories.	5
		Total =	**100**

TEACHING SCHEDULE

PRACTICAL [EXTN-241]

Exercise No.	Exercise Title
1	Study of University Extension System
2	Organizing Group Discussion- Exercise
3	Identification of Rural Leaders in village situation
4	Preparation and use of AV aids and Extension Literature (Leaflet, Booklet, Folder, Pamphlet etc.)
5	Presentation Skills exercise and Micro-teaching
6	Writing for Print / Electronic / Social Media
7	Writing of News Story
8	Writing and documentation of Success Story
9	Study of structure and functioning of DRDA/ PRI and other development departments at district level
10	Study of structure and functioning of Department of Agriculture
11	Study of structure and functioning of FPO/ FPC
12	Identification and documentation of ICT tools used for Transfer of Technologies
13	Handling and use of Information Technology tools
14	Visit to NGO/FO/FPO and learning from their experience in rural development
15	Visit to Village: PRA techniques and their application in village development planning
16	Visit to Community Radio/ Television Studio
	Developing Script for Radio/ Television

Suggested Readings [EXTN-241]:

1. Dahama, O.P. and Bhatnagar, O.P. (2003). Education and Communication for Development. Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi.
2. Adivi Reddy, A. (2001) Extension Education, Sree Lakshmi Press, Bapatla.
3. Dahama, O.P. and Bhatnagar, O.P. (1998) Education and Communication for Development, Oxford and IBH publishing Co. Pvt. Ltd., New Delhi.
4. Jalihal, K.A. and Veerabhadraiah, V. (2007) Fundamentals of Extension Education and Management in Extension, Concept Publishing Company, New Delhi.
5. Muthaiah Manoraharan, P. and Arunachalam, R., Agricultural Extension, Himalaya Publishing House, Mumbai.
6. Sagar Mondal and Ray, G.L., Text Book on Rural Development, Entrepreneurship and Communication Skills, Kalyani Publications.
7. Rathore, O.S. *et al.* (2012) Handbook of Extension Education, Agrotech Publishing Academy, Udaipur.
8. Dudhani, C.M.; Hireyenkatgoudar, L.V., Manjunath, L.; Hanchinal, S.N. and Patil, S.L. (2004). Extension Teaching Methods and Communication Technology, UAS, Dharwad.
9. Sandhu, A.S. (1993). Textbook on Agricultural Communication: Process and Methods. Oxford and IBH Publishing Pvt. Ltd., New Delhi.
10. Singh, A.K., Lakhan Singh, R. and Roy Burman (2006). Dimensions of Agricultural Extension. Aman Publishing House, Meerut.

B.Sc. (Hons.) Agriculture

List/ Bouquet of Skill Enhancement Courses (SECs)

[in continuation of the SECs' Syllabi prescribed under I, II and III semesters]

Sr. No.	Course No.	Course Title	Credit Hrs.
1.	**SEC-xxx**	Biofertilizer and Biopesticide Production	2(0+2)
2.	**SEC-xxx**	Mushroom Production Technology	2(0+2)
3.	**SEC-xxx**	Seed Production Technology	2(0+2)
4.	**SEC-xxx**	Post-harvest Processing Technology	2(0+2)
5.	**SEC-xxx**	Beneficial Insect Farming	2(0+2)
6.	**SEC-xxx**	Horticulture Nursery Management	2(0+2)
7.	**SEC-xxx**	Plantation Crops Production and Management	2(0+2)
8.	**SEC-xxx**	Poultry Production and Management Technology	2(0+2)
9.	**SEC-xxx**	Processing of Milk and Milk Products	2(0+2)
10.	**SEC-xxx**	Agrotourism	2(0+2)
11.	**SEC-xxx**	Plantation Crop Production and Processing	2(0+2)
12.	**SEC-xxx**	Agriculture Waste Management	2(0+2)
13.	**SEC-xxx**	Organic Production Technology	2(0+2)
14.	**SEC-xxx**	Fodder Production Technology	2(0+2)
15.	**SEC-xxx**	Marketing and Export of Agricultural Produce	2(0+2)
16.	**SEC-xxx**	Processing of Farm Waste into Organic Inputs	2(0+2)
17.	**SEC-xxx**	Vermicompost Production Technology	2(0+2)
18.	**SEC-xxx**	Apiculture - Commercial Bee Keeping	2(0+2)
19.	**SEC-xxx**	Production Technology of Bioagents	2(0+2)

Note: (i) Skill Enhancement Courses can be added/ offered as per the facilities and resources available at the respective University/ College based on the relevance to the region and the UG degree subject.

(ii) The host University/ College may also choose suitable SEC courses from those listed under other UG degree programs.

(iii) Above list/ bouquet of SEC courses is an indicative list and subject to modification as applicable therein.

(iv) In case of unavailability of the detailed course-wise syllabus/ teaching schedules of any of above SEC courses, the same can be primarily developed and followed at College/ University level in the current academic year. However, the same can be obtained from the respective UG Degree Coordinator/ Discipline Coordinators and can be followed w.e.f. AY, 2025-26.