UNDERGRADUATE DEGREE / DIPLOMA / CERTIFICATE

SYLLABUS

OF

I SEMESTER

AS PER THE

ICAR - SIXTH DEANS' COMMITTEE REPORT

FOR

MAHARASHTRA STATE AGRICULTURAL UNIVERSITIES

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

Finalized & Approved by the

DIRECTORS OF INSTRUCTION COORDINATION COMMITTEE (DICC)

(vide DICC-Circular No. MAUEB/DICC-Circular/New UG Syllabi/420/24; Dtd. 29.11.2024)

w.e.f. A.Y., 2024-25

CONTENT

w.e.f. A.Y., 2024-25

ANNEXURE-I

(~ of DICC-Circular No. MAUEB/DICC-Circular/New UG Syllabi/420/24; Dtd. 29.11.2024)

New Undergraduate Degree Syllabus of I-Semester of

B.Sc. (Hons.) Agriculture

Finalized & Approved by the DICC as per the

ICAR - SIXTH DEANS' COMMITTEE REPORT

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

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Compiled & Submitted by

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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 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.

ANNEXURE-II

(~ of DICC-Circular No. MAUEB/DICC-Circular/New UG Syllabi/420/24; Dtd. 29.11.2024)

New Undergraduate Degree Syllabus of I-Semester of

B.Sc. (Hons.) Horticulture

Finalized & Approved by the DICC as per the

ICAR - SIXTH DEANS' COMMITTEE REPORT

Course Curriculum of First Semester

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

HORTICULTURE

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

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. P.C. Mali
Associate Dean, College of Horticulture, Mulde (Dr.BSKKV)
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 First Semester as per the
ICAR-Sixth Deans' Committee Report for Academic Programmes in
HORTICULTURE

Course Layout

B.Sc. (Hons.) Horticulture

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.	**HORT-111**	Fundamentals of Horticulture	3(2+1)	
7.	**FS-111**	Plant Propagation and Nursery Management of Fruit and Plantation Crops	3(1+2)	
8.	**FLA-111**	Commercial Production of Flower Crops	3(1+2)	
9.	**IDE-111**	Sprinkler and Micro Irrigation Systems	2(1+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(8+13) 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.

B.Sc. (Hons.) Horticulture : First Semester

Course-wise Syllabus with Teaching Schedules

Semester	**:**	**I**	
Course No.	**:**	**CAC-111**	**Credit Hrs. : 2 (0+2) NG / 2 Weeks**
Course Title	**:**	***Deeksharambh* (Induction-cum-Foundation Course)**	
Non-Gradial Common Academic Course for the respective UG degree with the activities to be conducted during initial two weeks.			

Objectives:

(i) To create a platform for students to help for cultural Integration of students from different backgrounds,

(ii) To know about the operational framework of academic process in university, instilling life and social skills,

(iii) To create Social awareness, Ethics and Values, Team work, Leadership, Creativity,

(iv) To identify the traditional values and indigenous cultures along with diverse potentialities both in indigenous and developed scenario.

ACTIVITIES

- Introduction/Orientation and Discussions on operational framework of academic process in University/ College, as well as interactions with Academic and Research Managers of the University.
- Interaction with Alumni, Business Leaders, Perspective Employers, Outstanding Achievers in related fields and people with inspiring life experiences.
- Group activities to identify the strength and weakness of students and to learn from each others' life experiences.
- Activities to enhance Cultural Integration of students from different backgrounds.
- Field visits to the relevant fields/ establishments.
- Sessions on Personally Development (Instilling Life and Social skills, Social awareness, Ethics and Values, Team work, Leadership etc.) and imbibing the Communication skills.

Note: *The details of the relevant activities will be decided by the parent University in line with the above-mentioned broad activities.*

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 [NSS-I]

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, Fire fighting, 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 [NCC-I]

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; Precís 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, Visualize 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		Precís 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 [AEC-112]

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	Organization of events

Suggested Readings [AEC-112]:

1. **Allport, G.W. 1937.** Personality: A Psychological Interpretation, Holt, New York.
2. **Brown, M. and Brandreth G. 1994**. How to Interview and be Interviewed. Sheldon Press, London.
3. **Dale, C. 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, L. 2011.** Communication Skills, Oxford University Press.
6. **Neuliep James, W. 2003.** Intercultural Communication-A Contextual Approach, Houghton Mifflin Co Boston.
7. **Pease, A. 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.L. and Mondal S. 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/ Title
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. and 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. and 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. and 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 *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 *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., and 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.	**:**	**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	Definitions 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.

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

SYLLABUS

Objectives:

(i) To provide basic knowledge of Horticulture in a brief and prescribed manner,

(ii) To familiarize students with principles and practices of management for Horticultural crops.

THEORY

Scope and Importance, Classification of horticultural crops and nutritive value, Area and Production, Exports and imports, Fruit and vegetable zones of India and of different states, Nursery techniques and their management, Soil and climate, Vegetable gardens, Nutrition and kitchen garden and other types of gardens-principles, planning and layout, management of orchards, planting systems and planting densities. Principles, objectives, types and methods of pruning and training of fruit crops. Types and use of growth regulators in Horticulture, Water management: irrigation methods, merits and demerits. Weed management. Fertility management in horticultural crops, manures and fertilizers, different methods of application, Cropping systems, intercropping, multi-tier cropping, mulching – objectives, types, merits and demerits. Classification of bearing habits of fruit trees, Factors influencing the fruitfulness and unfruitfulness. Rejuvenation of old orchards, top working, frame working. Principles of Organic and Natural farming, Market chain management.

PRACTICAL

Features of orchard, Planning and layout of orchard, tools and implements, Identification of various horticultural crops, Layout of nutrition garden, Preparation of nursery beds for sowing of vegetable/ flower seeds, digging of pits for fruit plants, planting systems, training and pruning of orchard trees, Calculation of fertilizer doses, Preparation of fertilizer mixtures and field application, Preparation and application of growth regulators, Layout of different irrigation systems, Identification and management of nutritional disorder in fruits and vegetable crops, Assessment of bearing habits, maturity standards, harvesting, grading, packaging and storage.

TEACHING SCHEDULE

THEORY [HORT-111]

Lecture No.	Topic	Sub-topics/ Key Points	Weightage (%)
1	Scope and Importance of Horticulture	Definition, Income/Employment generation, Industrial/religious value, Export value, Nutritional value, Aesthetic value etc.	10
2-3	Classification of Horticultural crops	Classification based on life cycle, Nature of stem, Season, Ripening behaviour, Light requirement, Fruit type, Edible portion, Botanical, Growth habit, etc. with examples of fruit, vegetable, flower, spice and plantation crops	
4	Nutritive value of Horticultural crops	Role and Deficiency of vitamins and minerals, and their sources.	05
5	Area and Production, Exports and Imports of fruit and vegetable	Global, Indian and State Scenario in major fruit and vegetable crops	05
6	Fruit and Vegetable zones of India and of different states	Fruit and Vegetable zones of India and Maharashtra	05
7	Nursery techniques and their management	Definition, Component, Bed preparation, Growing media, Method of propagation Sexual, Asexual	10
8	Soil and Climate requirement of Horticultural crops	Optimum condition, Effect of various parameters	
9-10	Vegetable gardens, Nutrition and Kitchen garden and other types of gardens	Kitchen garden, Market garden, Truck garden, Vegetable garden for processing, Vegetable garden for seed production, Vegetable forcing and Floating vegetable garden	05
11-12	Principles, Planning, Layout and Management of Orchards	Points to be considered, Features of orchard	10
13	Planting systems and Planting densities	Square, Rectangle, Diagonal, Hexagonal, Contour etc.	

Continued….

14-15	Pruning and Training of fruit crops	Principles, Objectives, Types and Methods	05
16-17	Types and use of growth regulators in Horticulture	Auxins, Gibberellins, Cytokinins, Ethylene, Growth Retardants/ Inhibitors.	05
18	Water management in Horticultural crops	Role of water, Methods of irrigation, Merits and Demerits.	03
19-20	Weed management in Horticultural crops	Definition, Methods of weed control in Horticultural crops.	03
21-22	Fertility management in Horticultural crops	Soil management practices, Sources of nutrient, Manures and Fertilizers, Methods of application of fertilizers	05
23	Cropping systems in Horticultural crops	Types, Advantages, Cropping systems, Intercropping, Multi-tier cropping	05
24	Mulching	Objectives, Types, Merits and Demerits	03
25	Classification of bearing habits of fruit trees	Shoot bearing: Terminal, Lateral/Axillary bearing, SPUR bearing and Stem /Branch bearing with examples.	05
26-27	Fruitfulness and Unfruitfulness	Influencing factors: External and Internal.	05
28	Rejuvenation of old orchards	Top working and Frame working.	04
29-30	Principles of Organic and Natural farming	Concepts, Advantages.	05
31-32	Market chain management	Meaning, Components and Importance of market chain management in Horticulture	02
		Total=	**100**

TEACHING SCHEDULE

PRACTICAL [HORT-111]

Exercise No.	Exercise Title
1	Identification of various Horticultural crops
2	Tools and implements
3	Features of orchard; Planning and layout of orchard
4	Layout of nutrition garden
5	Preparation of nursery beds for sowing of vegetable/ flower seeds
6	Digging of pits for fruit plants
7	Planting systems for orchard trees
8	Training and pruning of orchard trees
9	Calculation of fertilizer doses, preparation of fertilizer mixtures and field application
10	Preparation and application of growth regulators in horticultural crops
11	Layout of different irrigation systems in horticultural crops
12	Identification and management of nutritional disorder in fruits and vegetable crops
13	Assessment of bearing habits of horticultural crops
14	Maturity standards & harvesting of horticultural crops
15	Grading, packaging and storage of horticultural crops

Suggested Readings [HORT-111]:

1. **Singh, J. 2011.** Basic Horticulture, Kalyani Publications, New Delhi.
2. **Salunkhe, D. K. and Kadam, S. S. 2013.** A Handbook of Fruit Science and Technology, CRC Press.
3. **Chattopadhyay, T. K. 2013.** A Textbook on Pomology Vol. I-IV. Kalyani Publications, New Delhi.
4. **Peter, K.V. 2009.** Basics Horticulture, New India Publishing Agency.
5. **Misra, K.K. and Kumar, R. 2014.** Fundamentals of Horticulture, Biotech Books.
6. **Singh, N.P. 2005.** Basic Concepts of Fruit Science, 1st Edn. IBDC Publishers.
7. **Kumar, P. 2014.** Principles of Horticulture, 2nd Edn. Agrobios India.
8. **Kunte, Y.N., Kavthalkar, M.P. and Yawalkar, K.S. 2013.** Principles of Horticulture and Fruit Growing, 11th Edn. Agri-Hort Publishers.

Semester	**:**	**I**		
Course No.	**:**	**FS-111**	**Credit Hrs.** **:**	**3(1+2)**
Course Title	**:**	**Plant Propagation and Nursery Management of Fruit and Plantation Crops**		

SYLLABUS

Objectives: (i) To know different methods of propagation techniques,

(ii) To learn the horticultural significance of specialized vegetative structures,

(iii) To study the different types of plant propagation methods and structures.

THEORY

Status and Importance of plant propagation and nursery production in fruits and plantation crops. Sexual and Asexual methods of propagation, their advantages and disadvantages. Apomixis, Seed dormancy, Types of dormancy and Methods to overcome seed dormancy. Use of vegetative propagation methods viz., division, cutting, layering, budding and grafting. Propagation structures in nursery production: Mist chamber, Humidifiers, Greenhouses, Glasshouses, Cold frames, Hot beds and Polyhouses. Use of growth regulators in nursery production. Components of a Nursery, maintenance of mother trees and seed gardens, collection of scion-wood and bud wood certification. Growing medium and containers used for nursery production. Role of tissue culture techniques viz., Micropropagation, Micrografting and Meristem culture. Nursery Registration Act. Management of insect-pests and diseases in nursery. Cost of establishment of a modern nursery.

PRACTICAL

Selection of site, soil sterilization and preparation of beds for nursery raising. Preparation of growing media and use of different nursery containers for containerized nursery production in fruits and plantation crops. Seed treatments for breaking dormancy and prevention of nursery diseases. Sowing of seed, raising and maintenance of rootstock/seedlings. Practicing different vegetative propagation methods viz., cutting, layering, grafting and budding. Preparation of plant growth regulators for seed germination and vegetative propagation. Digging, labelling and packing of field grown nursery plants. Familiarisation with propagation structures mist chamber, greenhouse, glasshouse, polyhouse and net house, and their maintenance. Micropropagation and hardening of plants. Tissue culture media preparation, explant preparation, *in vitro* culturing and shoot tip culture, primary and secondary hardening of tissue culture plants. Maintenance of nursery records. Identification and management of insect-pests and diseases in nursery. Project formulation for small and high-tech nurseries. Nursery accreditation.

TEACHING SCHEDULE

THEORY [FS-111]

Lecture No.	Topic	Sub-topics/ Key points	Weightage (%)
1	Status and Importance of Plant propagation and Nursery production in Fruits and Plantation crops	Scope and Importance of plant propagation and Nursery production of fruit and plantation crops: Creating diversity, Production of genetically pure nurseries stock, Export of nursery stock, Employment generation, Create the new cultivar, Cloning desirable specimens, Development of disease and pest resistant	10
2	Sexual and Asexual methods of plant propagation and their advantages and disadvantages	Definition of propagation, Objectives of propagation, Methods of propagation-Sexual and Asexual, Advantages and Disadvantage of Sexual and Asexual propagation.	10
3	Seed dormancy, Types of dormancy, Internal and External factors affecting seed dormancy and Seed treatment	Definition of Seed dormancy, Types of Seed dormancy: Exogenous- Physical (Seed coat dormancy), Mechanical, Chemical and Endogenous- Morphological, Physiological (Non deep, Photo, Thermo), Double dormancy, Secondary dormancy. Factors affecting seed dormancy; Different Seed treatments (in brief).	10
4	Methods to overcome Seed dormancy	Methods of breaking seed dormancy: Definition of Scarification and Stratification, Scarification methods: Mechanical, Acid scarification, Hot water scarification and Warm moist scarification, Stratification methods- Outdoor stratification.	
5	Apomixis	Definition of Apomixis, Types of Apomixis, Definitions, Monoembrony, Polyembrony, Chimera etc.	4

Continued…

6	Use of vegetative propagation methods viz., division, cutting, layering,	Definition of Cutting, Types of cutting: Stem cuttings (Herbaceous, Softwood, Semi-hard wood, Hardwood), Root cutting, Leaf cutting, Leaf bud cutting. Definition of Layering, Types of Layering: Simple or Tongue layering, Serpentine or Compound layering, Trench or Continuous layering, Mount or Stool layering, Air or Gootee or Marcottage, Definition of Division, Types of specialized plant organs: Bulbs, Corns, Tuber, Runner, Suckers, Offset, Rhizomes etc.	15
7	Budding and Grafting	Methods of budding: T-budding (Shield budding), Patch budding, Chip budding, Flute budding, I-budding, Forkert budding. Definition of Grafting, Types of grafting: Splice or Whip grafting, Whip and Tongue grafting, Cleft or Wedge grafting, Side grafting, Veneer grafting, Approach grafting, Root grafting, *In-situ* grafting, Double grafting, Top working, Stone grafting. Scion-stock relationship (compatibility, closeness of fit, cambial contact etc.)	
8	Propagation structures in nursery production:	Detail information of propagation structures in nursery production: Mist chamber, Humidifiers, Greenhouses, Glasshouses, Cold frames, Hot bed sand Polyhouses.	8
9	Use of Plant Growth Regulators in Nursery propagation	Definition of Plant growth regulators, Use of plant growth regulators: Plant propagation- Seed germination, Rooting of cuttings, Rootings of layers, Hastening the growth of rootstocks in nursery, Other roles; Methods of application: Application of powder mixture, Lanolin paste methods, Soaking method, Quick deep methods, Aerosol method, Vapour method.	8

Continued…

10	Component of nursery, Maintenance of mother trees and Seed garden and Budwood certification	Components of Nursery: (Nursey bed, production areas, nursery stock, nutrient, water tank or well/pond, potting shed, seed and fertilizer store room, propagation structure, office room, etc.) Selection of mother trees, Maintenance of mother trees and Budwood certification.	10
11	Selection/collection of scion-wood, and Bud wood Certification	Selection/Collection of scion-wood and Budwood Certification, Importance of scion mother tress.	
12	Growing medium and Containers used for nursery production	Ideal quality/Characteristics of growing media, Different media: Soil, sand, peat, sphagnum moss, vermiculite, perlite, pumice, leaf mold, cocopeat, sawdust and wood shavings etc. Features of ideal containers, Types of plant containers: Clay pots, wooden boxes, hanging baskets, plant tubes and urns, polythene bags etc.	8
13	Role of tissue culture techniques:	Role of tissue culture techniques viz., Micropropagation, Micrografting and Meristem culture.	4
14	Management of Insect-Pest and Diseases in Nursery	Important pest and diseases in nursery and their control measures.	4
15	Nursery Registration Act	Nursery Registration Act: Rules and regulations and Features of Nursery Act.	5
16	Cost of establishment of a modern nursery.	Cost of establishment of Greenhouse/ Glasshouses, Plastic houses, Shadenet houses, Lathhouse.	4
		Total=	**100**

TEACHING SCHEDULE

PRACTICAL [FS-111]

Exercise No.	Exercise Title
1	Selection of site for plant propagation and nursery management of fruits and Plantation crops.
2-3	Preparation of Nursery beds and sowing of seeds
4-5	Study of different media for plant propagation
6	Study of different containers for containerized nursery production
7-8	Seed treatment for breaking seed dormancy including germination and growth of seedlings
9	Sowing of seeds, raising and maintenance of rootstock/seedlings
10-11	Potting, repotting, and preparation of plant material for potting
12	Practicing different types of cutting
13-14	Practicing different types of layering
15-16	Practicing different types of runners, offsets and other specialized plant parts for propagation
17-18	Practicing different methods of budding
19-20	Practicing different grafting methods
21-22	Preparation of growth regulators for seed germination and vegetative propagation
23	Digging/uprooting, labelling and packaging of field grown nursery plants
24	Use of mist chambers in plant propagation and hardening of plants
25	Study of propagation structures, greenhouse, polyhouse and net house and their maintenance.
26-27	Tissue culture media preparation, *Ex-plant* preparation, *in vitro* culturing and shoot tip culture
28	Primary and Secondary hardening of Tissue culture plants
29	Maintenance of nursery records
30	Identification and management of insect-pests and diseases in nursery
31	Project formulation for small and High-tech nurseries
32	Nursery accreditation

Suggested Readings [FS-111]:

1. **Davies, F.T., Geneve, R.L. and Wilson, S.B. 2018.** *Hartmann and Kester's Plant Propagation: Principles and Practices* (9th ed.), Pearson, USA.
    - **Relevance**: Covers principles and techniques of plant propagation, an essential topic for nursery management and crop establishment.
2. **ICAR. 2019**. *Handbook of Horticulture* (2nd ed., Vol 1 & 2), ICAR, New Delhi.
    - **Relevance**: A comprehensive reference on horticultural crops, including information on production, management practices, and horticultural zones of India.
3. **Peter, K.V. 2002.** *Plantation Crops.* National Book Trust, New Delhi.
    - **Relevance**: Focuses on key plantation crops in India, with insights into production, management, and marketing, aligning with market chain management concepts.
4. **Sharma, R.R. and Krishna, H. 2017.** *Textbook of Plant Propagation and Nursery Management.* CBS Publishers, New Delhi.
    - **Relevance**: Provides detailed guidance on nursery management and propagation techniques, complementing topics on nursery techniques and management.
5. **Sharma, R.R. and Srivastava, M. 2004.** *Plant Propagation and Nursery Management.* IBDC Publishers, New Delhi.
    - **Relevance**: This book further elaborates on propagation methods and nursery management, useful for developing practical skills in orchard establishment.

Semester	**:**	**I**		
Course No.	**:**	**FLA-111**	**Credit Hrs.**	**: 3(1+2)**
Course Title	**:**	**Commercial Production of Flower Crops**		

SYLLABUS

Objectives: To impart knowledge about climatic and soil requirements, commercial varieties/hybrids, sowing/planting times and methods, nutritional and irrigation requirements, intercultural operations, weed management, physiological disorders, postharvest management, plant protection measures of major flower crops.

THEORY

Scope and Importance of commercial floriculture, Soil climate, varieties, propagation, special intercultural operations, fertilizers requirement, irrigation, use of growth regulators, weed management, plant protection measures, harvesting, grading, packaging and storage of flowering flower crops for following flower crops: Rose, Jasmine, Carnation, Chrysanthemum, Gladiolus, Tuberose, Marigold, Cut foliage under open/ partial shade, Seed production of flowering annuals.

PRACTICAL

Identification of commercially important floricultural crops, Propagation technique in Rose, Jasmine, Carnation, Chrysanthemum, Gladiolus, Tuberose, Marigold, Sowing of seeds and Raising of seedlings of annuals, Propagation of ornamental plants with particular reference to cutting, layering, grafting and budding, bed preparation, soil decontamination. Planting and layout. Staking, Training and Pruning of roses. Growing media and containers for growing flower for exhibition, potting, depoting and repotting. Fertilizer application, Growth regulator measures. Special horticulture practices in cut flower and cut foliage crops. Weed management and plant protection measures, Determination of harvesting indices. Harvesting methods and post-harvest handling. Commercial standards and packaging methods, Project preparation, Visit to commercial flower market and progressive growers having high tech-farms.

TEACHING SCHEDULE

THEORY [FLA-111]

Lecture No.	Topic	Sub-topics/ Key Points	Weightage (%)
1-2	Scope and Importance of Commercial Floriculture	Scope- Domestic, Export, Urban Horticulture, Industrial, Entrepreneurship, etc. Importance- Economic, Social and Cultural, Aesthetic and Environmental, Health and Therapeutic etc.	10
3-4	Rose	Soil, Climate, Varieties, Propagation, Special intercultural operations, Training and pruning, Fertilizers requirement, Irrigation, Use of growth regulators, Weed management, Plant protection measures, Harvesting, Grading, Packaging and Storage of respective flower crops.	10
5	Jasmine		10
6	Carnation		10
7-8	Chrysanthemum		10
9-10	Gladiolus		10
11-12	Tuberose		10
13-14	Marigold		10
15	Cut foliage under Open/ Partial shade	Definition, Plant names, Factors, Use, Media, Maintenance (water, fertilizers, plant protection) Harvesting, Storage.	10
16	Seed Production of Flowering Annuals	Soil, Climate, Planting, Irrigation, Pest management, Harvesting, Seed storage.	10
		Total =	**100**

TEACHING SCHEDULE

PRACTICAL [FLA-111]

Exercise No.	Exercise Title
1	Introduction of flower crops; their Identification, B.N., Family Origin.
2	Identification of commercial flower crop varieties
3	Study of Propagation techniques: Sexual and Asexual
4	Bed preparation: Ridges and furrows, flat bad, raised bed, broad ridge.
5	Soil Decontamination: Chemical use like, formalin etc.
6	Planting and layout: Seed sowing, Transplanting, Dibbling
7	Training and pruning, staking: Rose, Jasmine, Carnation, Tuberose, Gladiolus.
8	Preparation of growing media and containers for growing flower for exhibition: Identification Characteristics, Advantages and Disadvantages.
9	Experiment of Potting, depotting and repotting.
10	Study of Fertilizer application: Direct application; Fertigation.
11	Study of Growth Regulators Measures, their Use and Application.
12	Special horticultural practices in cut flower and cut foliage crops: Rose, Chrysanthemum, Carnation.
13	Weed management and plant protection measures (*All six crops major pest and diseases control*)
14	Determination for harvesting indices, harvesting methods and post-harvest handling (Harvesting sign, Time Post harvest handling)
15	Commercial standards and packaging methods; Packaging materials
16	Project preparation and Visit to commercial flower market and progressive growers having high-tech farms

Suggested Readings [FLA-111]:

1. **Singh, A.K. 2006.** *Flower Crops, Cultivation and Management*. New India Publishing Agency, Pitampura, New Delhi.
2. **Arora, J.S. 2006.** *Introductory Ornamental Horticulture*. Kalyani Publishers, Ludhiana-141 008.
3. **Bhattacharjee, S.K.** *Advanced Commercial Floriculture*. Aavishkar Publishers Distributors, Jaipur - 320 003.
4. **Choudhary D. and Mehta, A. 2010**. *Flower Crops Cultivation and Management*. Oxford Book Company Jaipur, India.
5. **Randhawa, G.S. and Mukhopadhyay A. 2004.** *Floriculture in India*. Allied Publishers Pvt. Ltd.
6. **Bhattacharjee, S.K. and De, L.C. 2003.** *Advanced Commercial Floriculture*. Aavishkar Publishers, Distributors, Jaipur (Rajasthan) India.
7. **Bose,T.K., Yadav, L.P., Patil, P., Das P. and Partha Sarthy V.A. 2003.** *Commercial Flowers.* Partha Sankar Basu, Nayaudyog,206, Bidhan Sarani, Kolkata-700006.
8. **Sheela, V.L. 2008.** *Flower for Trad*e. New India Publishing Agency, Pitampura, New Delhi.
9. *Relevant e-Readings:* **http://ecourses.iasri.res.in/**

Semester	**:**	**I**			
Course No.	**:**	**IDE-111**	**Credit Hrs.**	**:**	**2(1+1)**
Course Title	**:**	**Sprinkler and Micro Irrigation System**			

SYLLABUS

Objectives: To acquaint the students with the basic knowledge of modern irrigation systems.

THEORY

Sprinkler irrigation: Adaptability, types, problems and prospects. Sprinkler/Micro sprinkler irrigation system design: steps, layout, selection, design of lateral, sub-main and main pipeline, selection of pump and power unit. Performance evaluation of sprinkler irrigation system: Uniformity coefficient and pattern efficiency. Microirrigation system: types, merits and demerits, components. Design of drip irrigation system: general considerations, wetting patterns, irrigation requirement, emitter selection, hydraulics and design steps. Steps for proper operation of a drip irrigation system. Maintenance of microirrigation system: clogging, filter cleaning, flushing and chemical treatment. Fertigation: advantages, limitations, methods, fertilizers solubility and their compatibility, precautions, frequency, duration and injection rate. Economics: Cost estimation of sprinkler and micro irrigation systems.

PRACTICAL

Study of different components, design and installation of sprinkler irrigation system. Determination of precipitation pattern, discharge and uniformity coefficient. Study of different components, design and installation of drip irrigation system. Determination of pressure discharge relationship and emission uniformity for emitter. Study of different types of filters and determination of filtration efficiency. Determination of rate of injection and calibration for chemigation/ fertigation. Design of irrigation and fertigation schedule for crops. Field visit to microirrigation system and evaluation of drip system. Cost economics of sprinkler and drip irrigation systems.

TEACHING SCHEDULE

THEORY [IDE-111]

Lecture No.	Topic	Sub-topics/ Key points	Weightage (%)
1	Sprinkler irrigation: Adaptability, Types, Problems and Prospects.	Introduction, Advantages, Limitations, Basic concepts	10
2- 4	Sprinkler/Micro sprinkler irrigation system design: Steps, layout, selection, design of lateral, sub-main and main pipeline, selection of pump and power unit.	Hydraulic design of Sprinkler system, Sprinkler selection, Spacing, Design of main line, Sub main line and Sprinkler laterals	15
5-6	Performance evaluation of sprinkler irrigation system: Uniformity coefficient and Pattern efficiency.	Moisture distribution pattern, Testing of uniformity, Distribution uniformity, Uniformity coefficient (Uc), Determination of Uc	05
7	Microirrigation system: Types, Merits and demerits, Components.	Types, Merits and Demerits, Components	10
8-10	Design of drip irrigation system: General considerations, Wetting patterns, Irrigation requirement, Emitter selection, Hydraulics and Design steps.	Basic hydraulics of drip lines, Steps in design of drip system, Selection of drippers, Selection and design of laterals, sub main, mainline, Selection of pump, Calculation of irrigation time	20
11	Steps for proper operation of a drip irrigation system:	Steps for proper operation of a drip irrigation system in detail.	10
12	Maintenance of microirrigation system:	General maintenance, Clogging, Filter cleaning, Sub main and lateral flushing, Chemical treatment in detail	10
13-14	Fertigation:	Advantages, Limitations, Methods of fertilizer injection, Fertilizer solubility and their compatibility, Precautions; Frequency, Duration and Injection rate.	10
15-16	Economics of sprinkler and drip irrigation system:	Calculation of quantities of material required and Cost estimation of sprinkler and drip irrigation system	10
		Total=	**100**

TEACHING SCHEDULE

PRACTICAL [IDE-111]

Exercise No.	Exercise Title
1-2	Study of different components, design and installation of sprinkler irrigation system.
3-4	Determination of precipitation pattern, discharge and uniformity coefficient.
5-6	Study of different components, design and installation of drip irrigation system.
6-7	Determination of pressure discharge relationship and emission uniformity for emitter.
8	Study of different types of filters and determination of filtration efficiency.
9-10	Determination of rate of injection and Calibration for chemigation / fertigation.
11-12	Design of irrigation and fertigation schedule for crops.
13-14	Field Visit(s) to micro irrigation system and evaluation of drip system.
15-16	Study of Cost Economics of sprinkler and drip irrigation systems.

Suggested Readings [IDE-111]:

1. **Mane, M.S. and Ayare, B.L. 2019.** Principles of Sprinkler Irrigation. Publ.-Jain Brothers, New Delhi, 4th Edn.

2. **Mane, M.S. and Ayare, B.L. 2019**. Principles of Drip Irrigation. Publ.- Jain Brothers, New Delhi, 4th Edn.

List/ Bouquet of Skill Enhancement Courses (SECs)

Sr. No.	Course No.	Course Title	Credit Hrs.
1.	**SEC-xxx**	Mushroom Cultivation	2(0+2)
2.	**SEC-xxx**	Orchard Floor Management	2(0+2)
3.	**SEC-xxx**	Apiculture	2(0+2)
4.	**SEC-xxx**	Landscape Gardening	2(0+2)
5.	**SEC-xxx**	Packing and Packaging of Horticultural Crops	2(0+2)
6.	**SEC-xxx**	Farm Machinery	2(0+2)
7.	**SEC-xxx**	Introduction to Forestry	2(0+2)
8.	**SEC-xxx**	Installation, Operation and Maintenance of Microirrigation System	2(0+2)
9.	**SEC-xxx**	Computer Programming and Data Structures	2(0+2)
10.	**SEC-xxx**	Turf and Turf Management	2(0+2)
11.	**SEC-xxx**	Post-harvest Management of Horticulture Crops	2(0+2)
12.	**SEC-xxx**	Nursery Production in Horticulture Crops	2(0+2)
13.	**SEC-xxx**	Seed production Techniques in Vegetables Crops	2(0+2)
14.	**SEC-xxx**	Sericulture	2(0+2)
15.	**SEC-xxx**	Dairy Management	2(0+2)
16.	**SEC-xxx**	Ornamental Fishery	2(0+2)
17.	**SEC-xxx**	Poultry Management	2(0+2)
18.	**SEC-xxx**	Biofertilizers and Biopesticides	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.

In case of unavailability of said detailed course-wise syllabus 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 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]

Skill Enhancement Courses (SECs): Detailed Syllabi

Course No. : SEC-xxx	**Credit Hrs. : 2(0+2)**
Course Title : Mushroom Cultivation	

TEACHING SCHEDULE

PRACTICAL

Exercise No.	Exercise Title (with Sub-topics)
1	Study of Current status and Scope in India and Maharashtra, Potential for entrepreneurship.
2	Study of Important features of edible fungi: Nutritional composition, Medicinal benefits, Therapeutic applications.
3	Study of Nutritional and Medicinal value of mushrooms: Types of media, Sterilization techniques, Preparation for tissue culture.
4-5	Preparation of media: Types of media, Sterilization techniques, Preparation for tissue culture
6-7	Tissue Culture Preparation, Sub-culturing, Culture maintenance and Preservation
8	Sub-culturing for culture maintenance and its preservation
9-10	Spawn preparation techniques: Types of spawn (grain, sawdust, liquid), Methods of spawn preparation, Quality control
11-12	Collection of wild mushroom flora: Identification of wild mushrooms, Ecological significance and Safety measures
13	Raw material formulations for *Agaricus bisporus* (Button mushroom): Sourcing and Preparation.
14-15	Composting: Long and Short methods - Long method vs. Short method of composting, Environmental factors and Common challenges.
16	Casing preparation: Importance of casing, Types of casing materials, Methods and Maintenance.
17	Study of Crop Management Practices: Environmental controls, Watering, Ventilation and Humidity management.
18-19	Mushroom farm design and Infrastructure required for commercial unit: (Farm layout, Design requirements, Essential infrastructure for commercial units)

Continued…

20	Cultivation techniques of *Pleurotus florida* (Dhingri) mushroom
21	Cultivation techniques of *Volvoriella volvacea* (Paddy straw) mushroom
22	Cultivation techniques of *Calocybe indica* (Milky) mushroom
23	Cultivation techniques of *Lentunus edodes* (Shiitake) mushroom
24	Study of Marketing of mushrooms: Market analysis, Distribution channels, Pricing strategies and Customer engagement
25-26	Mushroom diseases and their control: Common diseases, Symptoms, Prevention and Control measures
27-28	Preparation of value-added products from mushrooms: (Types of value-added products, Processing techniques, Product development ideas)
29	Working-out the Economics of Mushroom Production: Input requirement and its cost for mushroom production.
30-32	Exposure visit(s) to Commercial Unit(s): Practical learning through visits to established commercial mushroom farms

Suggested Readings:

1. **Mishra, S.R. 2014.** Techniques of Mushroom Cultivation, Discovery Publishing House.
2. **Kumaresan, V. 2023.** Fundamentals of Mushroom Cultivation, Saras Publication.
3. **Suman, B.C. and Sharma, V.P. 2007.** Mushroom Cultivation in India, Daya Publishing House.
4. **Gupta R. and Singh, A. 2023.** Textbook of Mushroom Cultivation, Daya Publishing House.
5. **Tripathi, D.P. 2014.** Mushroom Cultivation, Oxford and IBH.
6. **Cotter, T. 2014.** Organic Mushroom Farming and Mycoremediation: Simple to Advanced and Experimental Techniques for Indoor and Outdoor Cultivation. White River Junction.
7. **Oss, O.T. 1991.** Psilocybin: Magic Mushroom Grower's Guide: A Handbook for *Psilocybin enthusiasts*. San Francisco, Calif: Quick American Pub.
8. **Stamets, P. 2000.** Growing Gourmet and Medicinal Mushrooms: Shokuyō Oyobi Yakuyō Kinoko No Saibai.
9. **Money, N.P. 2004.** Mr. Bloomfield's Orchard: The Mysterious World of Mushrooms, Molds, and Mycologists. Oxford: Oxford University Press**.**

Course No. : SEC-xxx	Credit Hrs. : 2(0+2)
Course Title : Orchard Floor Management	

TEACHING SCHEDULE

PRACTICAL

Exercise No.	Exercise Title (with Sub-topics)	*Skills to be developed*
1	Introduction to Orchard floor Management: Overview, Objectives, and Significance of floor management	Conceptual understanding of orchard management
2-3	Study of Fruit Crop Nutrition Garden: Importance and Scope, Layout and Layout management practices for availability of fruits	Skill for planning and layout management
4-5	Planning and Design of Orchard layouts, Floor designs and Calculation of plant population.	Skills in planning Orchard floor systems
6-9	Soil Management Practices- Clean Cultivation, Sod Culture, Sod Mulch: Demonstration of clean cultivation techniques, Practical exposure to sod-based orchard management.	Techniques of: Weed-free cultivation, Identifying benefits of Sod culture & mulch
10-11	Practical exposure to intercropping systems, cover crop selection and Maintenance, Mixed crop selection.	Practical skill of selection & maintenance
12	Mulching with Organic materials using Straw, Leaves & Compost	Hands-on mulching skills; Application and Evaluation of mulch
13	Mulching with Inorganic materials using Plastic, Gravel and Fabric	
14	Soil sampling Techniques: Collection and preparation of soil samples for testing	Precision in soil sampling
15	Demonstration of moisture conservation techniques	Skills in irrigation and mulching
16	Weed identification and classification of common orchard weeds	Weed recognition and classification
17	Mechanical Weed Control: Use of manual and mechanical tools for weeding	Use of mechanical weeding tools
18	Chemical weed control: Herbicide application techniques	Safe handling of chemicals
19-20	Irrigation techniques: Use of drip and sprinkler irrigation systems	Skills in water management
21-22	Organic fertilizers application of organic manures and biofertilizers	Practical organic fertilizer application
23-24	Inorganic fertilizers application of chemical and liquid fertilizers	Precision in inorganic fertilizer use
25	Study of Biofertilizers: Types of biofertilizers, Advantages and Application of beneficial microbes	Application, Techniques and Procedure for preparation of different biofertilizers

26	Study of Green Manuring and Bioagents: Advantages of green manuring; Green manuring crops; Different sources of bioagents and their role.	Identification of green manuring crops and bio-agents; Practice of incorporation of green manuring
27-30	Visit to Orchards of Progressive Fruit Growers: Observing orchard floor management practices in a commercial setting.	Observation & Exposure to real-world practices

Suggested Readings:

1. **Hartmann, H.T., Kester, D.E., Davies, F.T. and Geneve, R.L. 2018.** *Plant Propagation : Principles and Practices (9th ed.).* Pearson, USA.
    - **Relevance**: Covers essential principles of plant propagation and orchard management techniques, including floor preparation.
2. **Sharma, R.R. and Pal, R. K. 2016.** *Horticulture for Sustainable Development.* New India Publishing Agency, New Delhi.
    - **Relevance**: Focuses on sustainable horticultural practices, including organic orchard management and mulching.
3. **Fageria, N. K., Baligar, V. C. and Jones, C. A. 2011.** *Growth and Mineral Nutrition of Field Crops.* CRC Press.
    - **Relevance**: Provides detailed insights on soil fertility management, nutrient cycling and integrated nutrient management practices.
4. **Atkinson, D. 2018.** *The Biology of Horticultural Crops.* Elsevier Science.
    - **Relevance**: Explores soil management, root systems and orchard floor practices in the context of horticultural crop production.
5. **Bhattacharyya, P. and Chakraborty, G. 2017.** *Handbook of Organic Farming and Bio-fertilizers.* Astral International, New Delhi.
    - **Relevance**: Offers in-depth knowledge of organic practices for floor management, such as composting, cover cropping and mulching.
6. **Singh *et al*. 2015.** *Region-Specific Integrated Farming System Models.* ICAR-IIFSR, Modipuram.
    - **Relevance**: Provides practical models for integrating orchard systems with other components like livestock and cover crops.
7. **Weinbaum, S.A., Johnson, R.S. and DeJong, T.M. 2019.** *Orchard Systems Management: Ecology and Agronomy.* CABI Publishing.
    - **Relevance**: Covers orchard design, weed management, inter cropping and ecological aspects of orchard systems.
8. **Panwar *et al.* 2020.** *Integrated Farming Systems for Agricultural Diversification.* ICAR, New Delhi.
    - **Relevance**: Discusses orchard integration with other farming components and sustainable floor management strategies.
9. **Yadav, A. K. and Chauhan, S. 2016.** *Orchard and Plantation Management Practices.* Scientific Publishers, Jodhpur.
    - **Relevance**: Offers insights on orchard layout, weed management, water conservation and post-harvest management.
10. **Brady, N.C. and Weil, R.R. 2017.** *The Nature and Properties of Soils (15th ed.).* Pearson.
    - **Relevance:** Essential reference for soil health management and the impact of orchard floor practices on soil properties.

ANNEXURE-III

(~ of DICC-Circular No. MAUEB/DICC-Circular/New UG Syllabi/420/24; Dtd. 29.11.2024)

New Undergraduate Degree Syllabus of I-Semester of

B.TECH. (AGRIL. ENGINEERING)

Finalized & Approved by the DICC as per the

ICAR - SIXTH DEANS' COMMITTEE REPORT

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

- UG-Certificate in Agricultural Engineering
- UG-Diploma in Agricultural Engineering
- UG-Degree: B.Tech. (Agricultural Engineering)

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. P.U. Shahare

Associate Dean, College of Agril. Engineering & Technology, Dr.BSKKV, Dapoli.

UG Degree Syllabus State Coordinator

with

UG Degree Syllabus Discipline Coordinators &

DICC - UG Degree Syllabus Core Committee

Submitted to the

Directors of Instruction Coordination Committee

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

Course Layout

B.Tech. (Agricultural Engineering)

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.	**MATH-111***	Basic Mathematics*	2(2+0)	NG & Need-based
4.	**AGEN-111**	Crop Production and Protection Technology	4(3+1)	(MDC)
5.	**GAE-111**	Introduction to Agricultural Engineering	4(3+1)	
6.	**SWCE-111**	Surveying and Levelling	3(1+2)	
7.	**FMPE-111**	Workshop Technology and Practice	2(0+2)	
8.	**REE-111**	Basic Electrical Gadgets and Instruments	3(2+1)	
9.	**COMP-111**	Agricultural Informatics and Artificial Intelligence	3(2+1)	
		Total Credits Hrs.	**20(11+9) G 4(2+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 and for **PCM** or **PCMB** student, there is no need to offer any Need-based course.

Currently, during AY 2024-25, **AEC-112** & **MDC-111** are being offered in II-semester as **AEC-122** & **MDC-121**, respectively. However, this layout is subject to change and will be regularized **w.e.f. AY 2025-26**, wherein said courses will be offered in I-semester by shifting any 2 above listed courses to II-semester.

Semester	**:**	**I**	
Course No.	**:**	**CAC-111**	**Credit Hrs. : 2 (0+2) NG/ 2 Weeks**
Course Title	**:**	***Deeksharambh* (Induction-cum-Foundation Course)**	
Non-Gradial Common Academic Course for the said UG degree with the activities to be conducted during initial two weeks.			

Objectives:

(i) To create a platform for students to help for Cultural Integration of students from different backgrounds,

(ii) To know about the operational framework of academic process in the University, instilling life and social skills,

(iii) To create Social awareness, Ethics and Values, Team work, Leadership, Creativity,

(iv) To identify the traditional values and indigenous cultures along with diverse potentialities both in indigenous and developed scenario.

ACTIVITIES

- Introduction/Orientation and Discussions on operational framework of academic process in University/ College, as well as interactions with Academic and Research Managers of the University.
- Interaction with Alumni, Business Leaders, Perspective Employers, Outstanding Achievers in related fields and people with inspiring life experiences.
- Students shall be made aware about the field of food processing, the industry, production, systems, importance of nutrition, packaging, quality issues involved, shelf life and the legal standards available using simple day-to-day example.
- Students shall be exposed to the job opportunities at various levels like production, product development, entrepreneurship opportunities and research opportunities that exist in this area of food processing technology.
- Group activities to identify the strength and weakness of students and to learn from each other's life experiences.
- Activities to enhance Cultural Integration of students from different backgrounds.
- Field visits to the relevant fields/ establishments.
- Sessions on Personality Development (Instilling Life and Social skills, Social awareness, Ethics and Values, Team work, Leadership etc.) and imbibing the Communication skills.

Note: *The details of the relevant activities will be decided by the parent University in line with the above-mentioned broad activities.*

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 [AEC-111]

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, Fire fighting, 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/ Titles	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.	**:**	**MATH-111***	**Credit Hrs. : 2(2+0) Need-based; G/NG**
Course Title	**:**	**Basic Mathematics**	
***Gradial** Need-based Common Course for **B.Tech. (Biotechnology)**; ***Non-Gradial** Need-based Common Course for **B.Tech. (Agril. Engg.)** & **B.Tech. (Food Technology)**			

SYLLABUS

Objectives:

(i) To study the basic principles and functions in mathematics like limits and continuity,

(ii) To study differentiation and integration,

(iii) To study matrices and determinants.

THEORY

Functions:

Function and types of functions, Limit: Introduction, left-handed and right-handed limits, Algebra of limits, Standard limits. Continuity: Definition of continuity, continuity of algebraic functions. Continuity of trigonometric and exponential functions.

Differentiation:

Differentiation by the first principle, Rules of Differentiation: sum, difference, product and quotient formulae, differentiation using the chain rule, differentiation of functions in parametric and implicit form, logarithmic differentiation, geometrical interpretation of derivative. Successive differentiation, maxima and minima.

Integration:

Definition of indefinite integrals, Integrals of elementary functions (Formulae only), Theorems of integration (without proof), Integration by substitution, integration by partial fractions, integration by parts, Definition of definite Integral with examples, properties of definite integral (without proof).

Matrices and Determinants:

Definition of determinants, example up to Third order determinant, properties of determinant (statements only), Definition of matrix, types of matrices, Algebra of Matrix (addition, subtraction and multiplication), inverse of matrix, Solution of linear equations by Crammer's rule.

TEACHING SCHEDULE

THEORY [MATH-111]

Lecture No.	Topic	Subtopics/ Key Points	Weightage (%)
1-5	**Functions:**	Definition of Function, Types of functions	15
		Some Basic Functions: Definition and Properties of: Constant Function, Identity Function, Power Function. Polynomial Function, Linear, quadratic and cubic function, Radical Function, Rational Function. Exponential, Logarithmic and Trigonometric Function	
	Limit:	Introduction, Definition of Limit, left-handed and right-handed limits, Algebra of limits	
		Standard limits: Method of Factorization, Rationalization, Limit of Trigonometric, Exponential Logarithmic and Functions. Limit of Infinity	
	Continuity:	Definition of continuity, Continuity of algebraic functions, Continuity of trigonometric and exponential functions.	
6 -15	**Differentiation:**	Definition, Differentiation by the first principle, Derivative of Some standard functions (Formulae only), Rules of Differentiation (Sum, Difference, Product and quotient without proof), Differentiation using the chain rule, Differentiation of functions in parametric and implicit form, Logarithmic Differentiation, Successive differentiation, Maxima and minima	30
16 -25	**Indefinite and Definite Integration**:	Definition of indefinite Integral, Integrals elementary functions (Formulae only) Theorems of integration (without proof) Methods of Integration: Integration by Substitution, Integration by parts, Integration by partial fractions Some special integrals formulae only. Definition of definite Integral with examples Properties of definite integral (Without proof)	30
26 -32	**Determinants and Matrices:**	Definition of determinants, Expansion up to third order determinant, Properties of determinant (statements only) Definition of matrix, Order of Matrix, Types of matrices, Algebra of Matrices, Inverse of matrix by elementary transformations, Solution of linear equations by Crammer's rule	25
		Total=	**100**

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.

Semester	**:**	**I**			
Course No.	**:**	**AGEN-111**	**Credit Hrs.**	**:**	**4(3+1)**
Course Title	**:**	**Crop Production and Protection Technologies**			

SYLLABUS

Objectives:

(i) To enable the students to have basic idea on crop production and protection practices to understand the domain of agricultural sciences,

(ii) To impart the basic knowledge of the different types of machineries/equipments that can be adopted for the said operations.

THEORY

AGRONOMY:

Introduction and scope of Agronomy; Classification of crops; Effect of different weather parameters on crop growth and development; Principles of tillage, tilth and its characteristics; Crop seasons; Time and method of sowing of major field crops, seed rate for important crops; Methods and time of application of manures and fertilizers, fertigation; Basic principles of natural farming, organic farming and sustainable agriculture; Soil-water-plant relationship, crop coefficients, water requirement of crops and critical stages for irrigation; Weeds and their management in crops; Crop rotation, cropping systems, cropping scheme, relay cropping, mixed cropping and intercropping.

SOIL SCIENCE:

Soil forming processes; Classification and composition of soil, Soil taxonomy orders; Important soil physical properties and their importance; Soil particle distribution; Soil inorganic colloids – their composition, properties and origin of charge; Ion exchange in soil and nutrient availability; Soil organic matter– its composition and decomposition, effect on soil fertility; Soil reaction – acidic, saline and sodic soils; Quality of irrigation water; Essential plants nutrients- their functions and deficiency symptoms in plants; Important inorganic fertilizers and their reactions in soils; Gypsum requirement for reclamation of sodic soils and neutralizing RSC; Liquid fertilizers and their solubility and compatibility.

HORTICULTURE:

Types of Horticultural crops; Sowing and planting times and methods; Seed rate and seed treatment for vegetable crops; Macro- and micro- propagation methods; Types of plant growing structures; Pruning and training; Water requirements and critical stages; Management of orchard; Major pests and diseases of horticultural crops and their management.

PRACTICAL

AGRONOMY: Identification of crops and their varieties, seeds and weeds; Study of different fertilizer application methods and weed control methods; Judging the maturity time for harvesting of crop; Study of seed viability and germination test.

SOIL SCIENCE: Identification of rocks and minerals; Examination of soil profile in the field; Determination of bulk density, particle density and porosity of soil; Determination of organic carbon of soil; Identification of nutrient deficiency symptoms of crops in the field; Determination of gypsum requirement of sodic soils.

HORTICULTURE: Identification and description of important fruits, flowers and vegetables crops; Study of different garden tools; Preparation of nursery bed; Practices of pruning and training in some important fruit crops; Study of cultural operations for vegetable crops (sowing, fertilizer application, mulching, irrigation and weed control); Seed extraction techniques; Visit to commercial greenhouse/ polyhouse.

Suggested Readings [AGEN-111]:

1. Ahamad S, Anwar Ali and Sharma P K (Eds.). 2018. Plant Disease Management in Horticultural Crops. Daya Publishing House, Delhi.
2. Biswas T D and Mukharjee S K. 1987. A Textbook of Soil Science. Tata McGraw-Hill publishing Co. Ltd.
3. Brady N C and Ray R Weill. 2002. The Nature and Properties of Soil. Pearson Education Inc. New Delhi.
4. Chadha K L. 2003. Handbook of Horticulture. ICAR Publication, New Delhi.
5. Das D K. 2020. Introductory to Soil Science. Kalyani publication, Ludhiana.
6. Dey G C. 2013. Fundamentals of Agronomy. Jain Book Depot.
7. Ghildyal B P and Tripathy R P. 1987. Soil Physics. Wiley Eastern Ltd., New Delhi.
8. Hillel D. 1982. Introduction to Soil Physics. Academic Press, New York.
9. Indian Society of Soil Science. 2002. Fundamentals of Soil Science. ISSC, IARI, New Delhi.
10. Janick J. 1979. Horticultural Science. Surjeet Publications, Delhi.
11. Kumar N. 2017. Introduction to Horticulture. Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi.
12. Muthukrishnan N, Ganapathy N, Nalini R and Rajendran R. 2005. Pest Management in Horticultural Crops. New Madura Publishers, Madurai, Tamil Nadu.
13. Reddy S R. 2020. Principles of Agronomy. Kalyani Publisher.
14. Reddy Yellamanda T and Reddy Shankar G H. 1995. Principles of Agronomy. Kalyani Publishers, Ludhiana.
15. Sehgal J L. 1996. Soil Pedology. Kalyani Publication, Ludhiana.
16. Singh Jitendra. 2018. Fundamentals of Horticulture. Kalyani Publishers, Ludhiana.
17. Singh S S and Singh R. 2013. Principles and Practices of Agronomy. Kalyani Publisher.
18. Sudheer K P and Indira V. 2016. Post-harvest Technology of Horticultural Crops. New India Publishing Agency, New Delhi.

TEACHING SCHEDULE

THEORY [AGEN-111]

Lecture No.	Topic with Sub-topics	Weightage (%)
AGRONOMY		
1	Introduction and scope of Agronomy	2
2	Classification of crops (with e.g.)	2
3	Effect of different weather parameters on crop growth and development	2
4	Principles of tillage, tilth and its characteristics	2
5	Crop seasons	2
6	Time and methods of sowing of major field crops, Seed rate for important crops	2
7-8	Methods and time of application of manures and fertilizers, Fertigation	3
9-10	Basic principles of Natural farming, Organic farming and Sustainable Agriculture	4
11-12	Soil-Water-Plant relationship, Crop coefficients, Water requirement of crops and Critical stages for irrigation	4
13-14	Weeds and their management in crops	4
15-16	Crop rotation, Cropping systems, Cropping schemes, Relay cropping, Mixed cropping and Intercropping	4
	Sub-Total =	**33**
SOIL SCIENCE		
17	Soil forming processes	2
18	Classification and composition of soil, Soil taxonomy orders	2
19-20	Important soil physical properties and their importance; Soil particle distribution	4
21	Soil inorganic colloids– their composition, properties and origin of charge	2
22	Ion exchange in soil and nutrient availability	2
23-24	Soil organic matter– its composition and decomposition, effect on soil fertility	4
25-26	Soil reaction – acidic, saline and sodic soils	4
27	Quality of irrigation water	2
28	Essential plants nutrients- their functions and deficiency symptoms in plants	4
29-30	Important inorganic fertilizers and their reactions in soils	4
31	Gypsum requirement for reclamation of sodic soils and neutralizing RSC	2
32	Liquid fertilizers and their solubility and compatibility	2
	Sub-Total =	**34**

Continued…

HORTICULTURE		
33-34	Types of horticultural crops (with e.g.)	4
35	Sowing and planting time and methods	4
36	Seed rate and seed treatment for major/ important vegetable crops	3
37-38	Macro- and micro-propagation methods	5
39-40	Types of plant growing structures	4
41-42	Pruning and training	4
43	Water requirements and critical stages	2
44-45	Management of orchard	3
46-48	Major pests and diseases of horticultural crops and their management	4
	Sub-Total =	**33**
	Total =	**100**

PRACTICAL [AGEN-111]

Exercise No.	Exercise Title
AGRONOMY	
1-2	Identification of crops and their varieties, seeds and weeds
3	Study of different fertilizer application methods and weed control methods
4	Judging the maturity time for harvesting of crop
5	Study of seed viability and germination test
SOIL SCIENCE	
6	Identification of rocks and minerals; Examination of soil profile in the field
7	Determination of bulk density, particle density and porosity of soil
8	Determination of organic carbon of soil
9	Identification of nutrient deficiency symptoms of crops in the field
10	Determination of gypsum requirement of sodic soils
HORTICULTURE	
11	Identification and description of important fruits, flowers and vegetables crops
12	Study of different garden tools
13	Preparation of nursery bed; Study of cultural operations for vegetable crops (sowing, fertilizer application, mulching, irrigation and weed control)
14	Practices of pruning and training in some important fruit crops
15	Seed extraction techniques
16	Visit to commercial greenhouse/ polyhouse

Semester	**:**	**I**		
Course No.	**:**	**GAE-111**	**Credit Hrs.**	**: 4 (3+1)**
Course Title	**:**	**Introduction to Agricultural Engineering**		

SYLLABUS

Objectives: To enable the students to have basic idea on different agricultural engineering applications of machinery for different farm operations, post-harvest, technologies on renewable energy, soil and water conservation, irrigation and farm structure and allied areas.

THEORY

FARM MACHINERY AND POWER ENGINEERING:

Importance of Agricultural Mechanization for today's Agriculture; Different sectors of Farm Machinery for employment for Agricultural Engineers; Scope of research and higher studies in Farm Machinery and Power in India and abroad; Farm mechanization needs and strategy, Classification of farm machinery on the basis of unit operations; Principles of selection of machinery for different sizes of land and matching power sources; Different types of equipment for tillage, sowing, planting and transplanting, fertilizer application, weed control, plant protection; Harvesting and threshing equipment for rice, wheat, maize, cotton, sugarcane, fruits, tuber crops and other locally important crops; Functions and capabilities of tractor and power tillers; Introduction to the IC engine systems, fuel and air supply systems, cooling and lubricating systems, and electrical systems in a tractor; Basic parts of a power tiller; Hitching system.

RENEWABLE ENERGY ENGINEERING:

Introduction to Renewable Energy Engineering for today's Agriculture; Different sectors of employment in Renewable Energy Engineering; Scope of research and higher studies in renewable energy Engineering in India and abroad. Types of Solar energy collectors; Application of Solar energy: Solar water heating system and Solar dryer; Solar photovoltaic system: components and applications; Wind energy: Working principle of WECS, Types and components of WECS; Biogas production and types of biogas plants.

SOIL AND WATER CONSERVATION ENGINEERING:

Importance of Soil and Water Conservation Engineering for today's Agriculture; Different sectors of employment in Soil and Water Conservation Engineering; Scope of research and higher studies in Soil and Water Conservation Engineering in India and abroad. Different agronomical measures for control of water erosion, mixed cropping, crop rotation, tillage practices, mulching; Different engineering measures, gully control measures; Use of topographical survey and contour maps; Different types of water harvesting structures.

IRRIGATION AND DRAINAGE ENGINEERING:

Importance of Irrigation and Drainage Engineering for today's Agriculture; Different sectors of employment in Irrigation and Drainage Engineering; Scope of research and higher studies in Irrigation and Drainage Engineering in India and abroad. Introduction to soil-plant-water relationship; Equipment for measurement of irrigation water viz., weirs, notches, orifices and mouth pieces; Introduction to different surface irrigation methods as border, furrow and check basin, sprinkler, drip irrigation and their different components; Underground water conveyance methods in pipes; Introduction to planning of drainage systems; Introduction to centrifugal pumps and different components.

FARM STRUCTURE ENGINEERING:

Importance of Farm Structural Engineering for today's Agriculture, Scope of research and higher studies in Farm Structural Engineering and Environment management in India and abroad. Different types of Agriculture structures, Introduction to planning layout of farmsteads, animal houses, poultry houses; Different types of grain storage structures; Greenhouse and its different parts, Low cost protected structures.

PROCESS AND FOOD ENGINEERING:

Importance of Process and Food Engineering for today's Agriculture; Different sectors of employment in Process and Food Engineering; Scope of research and higher studies Process and Food Engineering in India and abroad. Classification of different types of agricultural commodities as durables, perishables etc.; Moisture content and its importance in grain storage: common reasons of food spoilage, food preservation methods; Different primary operations and their necessity; Methods and equipments used for cleaning, washing, sorting, grading, peeling, size reduction; Different types of traditional and modern storage structures, Storage of perishables commodities; Different types of packaging materials and their suitability for various food products; Basic principles of value addition of food as drying and dehydration, evaporation, thermal processing, refrigerated and frozen storage, Chemical preservation and other novel methods.

PRACTICAL

Study of various implements (tillage, sowing, planting, weeding, fertilizer application); Study of farm implements (pesticide application, harvesting and threshing); Study of various components of tractor and matching implements; Study of various components of power tiller and matching implements. Study of biogas plants and operational parameters, Study of solar energy application systems. Visit to a watershed, Study on various components of sprinkler and drip irrigation. Study on various components centrifugal pump. Visit to a greenhouse with modern irrigation system. Study of various post-harvest operations, study of different food processing equipments, value addition of common crops. Visit to implement manufacturing unit, Visit to mechanized farm, Visit to food processing industry.

TEACHING SCHEDULE

THEORY [GAE-111]

Lecture No.	Topic	Sub-topics/ Key Points	Weightage (%)
FARM MACHINERY AND POWER ENGINEERING			
1	Importance of Agricultural Mechanization	Importance of Agricultural Machinery for today's Agriculture; Different sectors of Farm Machinery for employment for Agricultural Engineers; Scope of research and higher studies in Farm Machinery and Power in India and abroad	5
2	Farm Mechanization	Farm mechanization advantages, strategy, Classification of farm machinery on the basis of unit operations; Selection of machinery for different sizes of land and matching power sources	
3	Tillage	Tillage: Types, Tillage machinery, Introduction to M.B. plough, disc plough, subsoiler, harrows, cultivators	5
4	Planting	Seed drill, planters, zero till drill, calibration, rice and vegetable transplanter	
5	Intercultural Equipments	Fertilizer applicators, types of weeders, uses, intercultural equipments	
6	Spraying Equipments	Sprayers: Manual and battery-operated knapsack sprayer, mist blowers, boom sprayer	5
7	Harvesting Equipments	Introduction to harvesting machines for rice, wheat, maize, cotton, sugarcane, fruit crop, tuber crop, sugarcane	
8	Threshing Equipments	Introduction to thresher for rice, wheat, maize; Combine harvester	
9	Engine	Introduction to the IC engine: C.I. and S.I. engines, their working principles, engine components their functions, valve operating mechanism, firing order in multi cylinder engine and trouble shooting	5
10	Engine System	Intake, exhaust system: types of air cleaner, their working, exhaust system Fuel supply system: in tractor, components their functions, carburetor, components, working principle, trouble shooting	

Continued…

11	Tractor systems	Cooling system: types, components and functions. Lubrication system: types, combination of splash and pressure system, components and function trouble shooting. Electrical system of tractor: Battery, electrolyte, charging, discharging system: components and functions	5
12	Tractor and Power tiller	Functions and capabilities of tractor and power tiller, Basic parts of a power tiller; Tractor hitching system	
		Sub-Total =	**25**
RENEWABLE ENERGY ENGINEERING			
13	Introduction to Renewable Energy Sources	Importance of renewable energy for today's agriculture; Different sectors of renewable energy for employment for Agricultural Engineers; Scope of research and higher studies in renewable energy in India and abroad. Definition, Classification, Types, Advantages/limitations and prospectus of renewable energy sources. Comparison between Conventional (Commercial) and Non-conventional energy (Renewable energy) sources.	5
14	Solar Energy Collector	Working principal and function of solar collector. Types and Application of solar collectors; Advantages and disadvantages of different solar collectors over each other.	
15	Application of Solar energy	Generalized classifications of solar energy applications; Solar Water Heating System: Working Principle, types, advantages and uses. Solar Drying System: Working principle, Types, advantages and uses.	
16	Solar Photovoltaics Systems	Definition and Principles of photovoltaic effect, Solar cell and semiconductor junction, Basic photovoltaics system for power generation; Applications, advantages and disadvantages of solar photovoltaic system	3
17	Wind Energy Systems	Basic components of wind energy conversion system, Types of wind energy machines; Applications, advantages and disadvantages of wind energy system	

Continued…

18	Biogas Production and Types	Working, Components, Classification and Types of Biogas plants Comparison of floating gas and fixed dome, Applications of biogas system, Factors affecting biogas generation	2
		Sub-Total =	**10**
SOIL AND WATER CONSERVATION ENGINEERING			
19	Importance of Soil and Water Conservation for today's Agriculture	Principles, Benefits, Problems by erosion, causes of erosion, Different sectors of employment in SWCE, Scope of research and higher studies in SWCE in India and Abroad	4
20	Agronomical Measures for Control of Water Erosion	Mixed cropping, crop rotation, tillage practices, mulching	
21	Different Engineering Measures; Temporary Gully Control Measures	Single row brusho wood dam, Double row brusho wood dam, Loose rock fill dam, log check dam, netting dam	3
22	Permanent Gully Control Structures	Drop inlet spillway, chute spillway and straight drop spillway (functional uses, adaptability, advantages, limitations of all)	3
23	Survey and Maps	Contour lines, Characteristics of contour lines, use of contour maps and topographical maps	2
24	Different Types of Water Harvesting Structures	Roof harvesting, Runoff harvesting (short term and long-term storage), flood water harvesting.	3
		Total =	**15**
IRRIGATION AND DRAINAGE ENGINEERING			
25	Importance and Scope	Importance of Irrigation and Drainage Engineering for today's Agriculture; Different sectors of employment in Irrigation and Drainage Engineering; Scope of research and higher studies in Irrigation and Drainage Engineering in India and abroad.	5
	Introduction to Soil-Plant-Water Relationship	Soil-Plant-Water Relationship: Relevant Terms/Definitions	
	Water Relations of Soil	Kinds of soil water, Movement of water into soils, Infiltration, Evaporation and Transpiration (Definitions only)	
26	Measurement of Irrigation Water	Units of measurement of water, Methods of water measurement, Weir and notches (Rectangular, Cipoletti weir, V-notch weir, Orifices, Parshall flume) Mouthpieces	

Continued…

27	Surface Irrigation Methods	Methods of irrigation- Border irrigation: Basic details only Check basin irrigation: Basic details only Furrow irrigation: Basic details only	5
28	Sprinkler, Drip irrigation and their Different Components	Sprinkler irrigation system: Basics, adaptability, limitations, Types of sprinkler systems: Components of sprinkler system (*List of components and their functions only*) Drip irrigation system: Basics, Advantages of drip system; Components of drip systems (*List of components and their functions only*)	
29	Underground Water Conveyance Methods in Pipes	Basics, Pipes for underground water distribution systems, Discharge capacity of pipelines	5
30	Introduction to Planning of Drainage Systems	Basics of Drainage- Definitions, Water logging- Definition, Causes of water logging, Benefits of Drainage, Drainage coefficient and Subsurface drainage.	
31	Introduction to Centrifugal Pumps and Different Components	Basics, Principle of operation of Centrifugal pumps, Centrifugal pump classification, components of centrifugal pump	
		Total =	**15**
FARM STRUCTURE ENGINEERING			
32	Importance	Importance of Farm Structural Engineering for today's Agriculture, Scope of research and higher studies in Farm Structural Engineering and Environment management in India and abroad	3
	Farmstead Planning	Introduction, location, size and arrangement, Defects in traditional houses, Rooms of improved farm house.	
33	Dairy barn and Poultry housing	Types of Dairy barns, Types of poultry houses with drawings	2.5
34	Grain Storage Structures	Grain storage methods, requirements of good storage structures, indigenous storage structures- Bukhari, Morai and Kothar structure, Grain bins- cylindrical, Rectangular and Pusa bin.	2
35	Protected Structures	Factors affecting plant growth, Greenhouse effect, Orientation of Greenhouse, Classification of Greenhouse based on shape. Greenhouse, Shade-net house and Low cost protected structures with drawings.	2.5
		Total =	**10**

Continued…

AGRICULTURAL PROCESS ENGINEERING			
36	Importance	Importance of Agricultural Processing, Different employment sectors for processing and Food Engineers, Scope of research and higher studies in processing and Food Engineering in India and abroad.	5
37	Agricultural Commodities	Its classification as durables, perishables, etc. Common reasons of spoilage and different preservation methods	
38	Unit Operations	Cleaning, sorting, grading	
39	Grain Processing Equipments	Air screen cleaner, Specific gravity separator, Indented cylinder and Disk separator, Spiral separator	5
40	Unit Operation of Fruit and Vegetable Processing	Methods of sorting, grading, washing, peeling of fruits and vegetables	
41	Size Reduction	Method and Equipment	5
42	Moisture content and its Representation	Wet and dry basis moisture content; Numerical only on conversion of wet and dry basis	
43-44	Drying and Dehydration	Principles of drying, importance and advantages of drying, different methods of drying	5
45	Thermal Processing	Sterilization, pasteurization, blanching and evaporation	5
46	Storage	Storage of perishables, air tight storage	
47	Packaging	Different types of packaging materials	
48	Novel Processing	Different novel processing techniques (in brief)	
		Sub-Total =	**25**
		Total =	**100**

TEACHING SCHEDULE

PRACTICAL [GAE 111]

Exercise No.	Exercise Title
FARM MACHINERY AND POWER ENGINEERING	
1	Study of tillage, sowing and planting equipments
2	Study of weeding, fertilizer application, pesticide application equipments
3	Study of harvesting and threshing equipments
4	Study of matching implements of tractor and power tiller
5	Study of various components of tractor and power tiller
6	Study of intake exhaust, lubrication and cooling systems
7	Study of fuel, ignition system and electrical system of tractor
RENEWABLE ENERGY ENGINEERING	
8	Study of various types of biogas plants and operating parameters.
9	Study of various applications of solar energy systems.
SOIL AND WATER CONSERVATION ENGINEERING	
10	Study of various Soil and Water Conservation measures
IRRIGATION AND DRAINAGE ENGINEERING	
11	Study on various components of sprinkler and drip irrigation
12	Study on various components centrifugal pump
PROCESSING AND FOOD ENGINEERING	
13	Determination of moisture content of agricultural produce
14	Value addition of horticultural crops
15	Value addition of food grains
Common for all above Departments*	
16	Visit to implement manufacturing unit, mechanised farm, Visit to watershed, Visit to a greenhouse with modern irrigation system, Visit to a food processing industry.

Suggested Readings [GAE 111]:

FARM MACHINERY AND POWER ENGINEERING

1. Jain S C and Philip G 2009. Farm Machinery: An Approach. Second Ed. Standard Publisher and distributor, New Delhi
2. Michel A.M. and Ojha T.P. 2003. Principles of Agricultural Engineering-I, Jain Brothers, New Delhi
3. Nakra C.P 1980. 1980. Farm Machines and Equipments, Dhanpat Rai Publishing Company Pvt Ltd. New Delhi.

RENEWABLE ENERGY ENGINEERING

1. Rai G.D.2017. Non-Conventional Energy Sources, Khanna Publishers, New Delhi.
2. Rai G.D.2014. Solar Energy Utilization, Khanna Publishers, New Delhi.
3. Rathore N. S., Panwar N.L. & Kurchaniya A. K. 2008. Renewable Energy-Theory and Practices, Himanshu Publications, Udaipur.
4. Kalbande S. R., Bhale V. M. & Sedani S.R. 2022. Renewable Energy Technologies, Narendra Publications, New Delhi.

SOIL AND WATER CONSERVATION ENGINEERING

1. Michael, A.M. and T.P. Ojha 2020. Principles of Agricultural Engineering. Volume II. 5th Edition, Jain Brothers, New Delhi.
2. Suresh, R. 2020. Soil and Water Conservation Engineering. Standard Publ. Distributors, New Delhi.
3. Suresh, R. 2009. Soil and Water Conservation Engineering. Standard Publ. Distributors, New Delhi.

IRRIGATION AND DRAINAGE ENGINEERING

1. Irrigation: Theory and Practice (2nd Edition) by A.M. Michael,Vikas Publishing House, New Delhi.
2. Principles of Agricultural Engineering- Vol.-II (3rd Edition), A.M. Michael and T.P. Ojha published by Jain Brothers, New Delhi.
3. Fluid Mechanics and Hydraulic Machines by R.K. Bansal, Laxmi Publication New Delhi.

FARM STRUCTURE ENGINEERING

1. Principles of Agricultural Engineering, Volume-I by T.P. Ojha and A.M. Michael, Jain Brothers, New Delhi -110 005 (Fourth Edition, 2003).
2. Greenhouse Technology and Applications by Vilas M. Salokhe and Ajay K. Sharma. Agrotech Publishing Academy, Udaipur (Raj.), First Edition (2006).

PROCESS AND FOOD ENGINEERING

1. Chakraverty, A. Post Harvest Technology of Cereals, Pulses and Oilseeds Oxford & IBH Publishing Pvt Ltd 66, Janpath, New Delhi 110001.
2. Sahay K.M .and K.K. Singh, Unit operations of Agricultural Processing-2022 Vikas Publishing house, Pvt. Ltd.576, Masjid Road, Jangpura, New Delhi 110014.
3. Girdharilal, G.S. Siddappa and G.L. Tandon, Preservation of Fruits and Vegetables Indian Council of Agricultural Research, New Delhi.
4. Akash Pare and B L. Mandhyan, Food Process Engineering and Technology Nipa GenX Electronic Resources and Solutions Pvt Ltd, Pritam Pura New Delhi.
5. I.S. Singh, Post-Harvest Handling and Processing of Fruits and Vegetables, Westville Publishing houses, New Delhi.

Semester	**:**	**I**		
Course No.	**:**	**SWCE-111**	**Credit Hrs.**	**: 3(1+2)**
Course Title	**:**	**Surveying and Levelling**		

SYLLABUS

Objectives: To enable the students to conduct the survey work for any area and also to prepare layout of engineering structures.

THEORY

Surveying: Introduction, classification and basic principles; Linear measurements, chain surveying, cross staff survey, compass survey, planimeter; Errors in measurements, their elimination and correction; Plane table surveying, methods, advantages and disadvantages. Levelling, levelling difficulties and error in levelling, contouring, computation of area and volume; Theodolite traversing, introduction to setting of curves; Total station; Introduction to GPS survey, Remote Sensing and GIS use in survey.

PRACTICAL

Linear measurements using different instruments; Reconnaissance survey in the field; Use of field book; Study on various types of chain used in chain survey and its components; Study of errors in chain surveying; Use of ranging rods and ranging in the field; Obstacles during chaining; Offsets in chain survey; Cross Staff; Survey of an area; Preparation of map; Study on various types of compass; Compass survey of an area; Plotting of compass survey; Plane table surveying and different methods; Study on various types of levels and its components; Setting up of dumpy level in the field; Computation of various methods for RL; Study on Levelling, L section and X sections and its plotting; Measurement of slope in the field; Study on contour and its characteristics; Contour survey of an area and preparation of contour map; Introduction of software in drawing contour; Theodolite surveying; Ranging by Theodolite; Height of object by using Theodolite; Setting out curves by Theodolite; Use of minor instruments; Use of total station, Use of modern computers for surveying.

Suggested Readings [SWCE-111]:

1. Kanetkar T.P. and S.V. Kulkarni, Surveying and Levelling, Part 1, 24th edition, reprint, 2017.
2. Remote Sensing and GIS by M. Anji Reddy.
3. Kanetkar T.P. and S.V. Kulkarni Surveying and Levelling, Part 2, 21st edition, reprint 1983.
4. Agor R.A Textbook of Surveying & Levelling. Khanna Publishers, New Delhi.
5. Arora K R. 1990. Surveying (Vol.I), Standard Book House, Delhi.
6. Kanetkar T P. 1993. Surveying and Levelling. Pune Vidyarthi Griha, Prakashan, Pune.
7. Punmia B C. 1987. Surveying (Vol.I). Laxmi Publications, New Delhi.

TEACHING SCHEDULE

THEORY [SWCE-111]

Lecture No.	Topic	Sub-topics/ Key Points	Weightage (%)
1-4	Surveying	Definitions, Object of Survey, Primary Divisions of Survey, Classification and use of survey	30
		Principle of surveying, Measurement, Units of measurements, Methods of locating points, Precision in surveying, Works of the surveyor.	
		Reconnaissance survey in the field; Principles of Chain Surveying, Triangulation survey, offsets in chain survey, ranging and types of ranging	
		Chaining, Type of chains used in chain survey and its components, Errors in lengths due to incorrect chain, Numerical on chain and tape corrections	
5	Computation of area and volume	Computation of areas, Computation of earth work volume, Prizmoidal formula and Numerical, Planimeter	
6	Instruments for setting right angles	Instruments for setting right angles, Cross staff, Prism square and optical square, Obstacles during chaining, Numerical	
7-8	Compass survey	Types and Methods of Traverse survey, Prismatic Compass, Surveyor Compass, Bearing of line, and computation of angles.	25
		Local attraction and numerical, Magnetic declinations, Dip of needles, Plotting of traverse survey, Errors and limitation of compass survey.	
9-10	Plane Table Surveying	Plane Tabling, Instruments and Accessories. Advantages and Disadvantages, setting and orienting tables,	
		Methods of Plane tabling, Radiation, Intersection, Traversing and Resection, Errors in Plane Tabling	
11-13	Levelling	Terms used in Levelling, Types of levels, Levelling staffs, Focusing, Bench Marks, Adjustment of Level.	25
		Principles of levelling, Reduction of levels, Booking of staff reading, Numerical.	
		Classification of levelling, Differential, Profile, Cross sectioning, effect of curvature and refraction, check levelling, Reciprocal and precise levelling.	
14	Contouring	Contouring, Characteristics of contours Use of contours, Locating the contours, Interpolation of contours.	20
15	Theodolite Traversing	Theodolites, Traversing, Measurement of horizontal and vertical angle, Introduction to setting of curves, Total Survey Stations	
16	GPS, RS & GIS use in survey	Introduction to GPS, Remote Sensing and GIS use in survey	
		Total=	**100**

TEACHING SCHEDULE

PRACTICAL [SWCE-111]

Exercise No.	Exercise Title
1	Reconnaissance survey in the field, introduction to different linear measuring instruments and Use of Field Book
2	Study on various types of chain used in chain survey and its components
3	Study of errors in chain survey
4	Study of direct ranging of survey line and Offsets in chain survey
5	Study of indirect ranging of survey line
6	Study on various obstacles or obstructions in Chaining
7	Chain survey of an area by Triangulation using cross staff
8	Plotting of chain survey and computation of area
9	Study of Prismatic Compass and surveyor compass,
10	Open traverses survey of Road or Stream and Plotting
11	Closed Traverse survey of field / building and Plotting
12	Plane Table survey by Radiation Methods
13	Plane Table survey by Intersection Methods
14	Plane Table survey by Traversing Methods
15	Study of different levels, levelling staff and their adjustment
16	To study booking of staff reading to determine the reduced level
17	To study the simple and differential levelling to determine reduced levels
18	To study the profile levelling and determine reduced levelling
19	To study the plotting of profile levelling and compute cutting and filling
20	To study the contour survey of field
21	Plotting of contours, interpolation of contours and determine the slope of field
22	Study the software for drawing of contours
23	Cross sectioning of gully or nala and plotting
24	L-section of a gully or nala and plotting
25	To study the Theodolite, Measurement of vertical and horizontal angle by Theodolite
26	Determine the height of object with Theodolite
27	Setting of curves with Theodolite
28	Study of Total Survey Station and height of object with Total Survey Station
29	Study of Minor Instruments (Abney level, hand level, Box sextant and Clinometers)
30	Study of Planimeter and measurement of area from map
31	Study of GPS and Measuring area with GPS
32	Study of DEM and preparation of contour map in GIS

Semester	**:**	**I**			
Course No.	**:**	**FMPE-111**	**Credit Hrs.**	**:**	**2(0+2)**
Course Title	**:**	**Workshop Technology and Practice**			

SYLLABUS

Objectives: To expose the students to the basic manufacturing processes involved for production of different machine elements and to facilitate hands-on experience of using these machines.

PRACTICAL

Introduction about different shops in the workshop; Safety and precautions to be taken in the workshop; Study of different tools used for fitting and different fitting operations; Study of various measuring instruments used for fitting; Exercise in fitting: sawing, filing and right angle fitting of MS flat; Working with complex fitting jobs: operations of drilling, reaming, and threading and with tap dies; Preparation of a paper weight; Study of various carpentry tools, types of wood and their characteristics and working with carpentry tools; Preparation of simple joints in carpentry: cross half lap joint or T-half joint, Mortise and Tenon joint in carpentry; Preparation of dovetail joint in carpentry; Study of welding, types of welding, oxyacetylene gas welding, types of flames, welding techniques and equipment used for gas welding, working with welding equipment; Working with electric arc welding; Equipment and tools, safety and precautions taken in arc welding; Preparation of Butt joint and lap joint with ARC welding; Preparation of Lap and Butt joints using gas welding; Working on a lathe machine and study of different tools used in lathe machine; Exercise on simple turning, step turning in lathe machine; Preparation of job on taper turning, drilling, knurling and threading in lathe machine; Working with different machines in machine shop such as shaper ,milling machine, etc. and with different tools used in machine shop; Exercise on bending, shaping etc.; Exercise on Drawing, Punching, Riveting; Making different types of sheet metal joints using G.I. sheets; Practice job on shaper; Changing a round MS rod into square section with a shaper; Exercise on a milling machine such as making a slot, gear tooth forming and indexing.

Suggested Readings [FMPE-111]:

1. Chapman W.A.J. 2018. Workshop Technology (Vol. I and II), Arnold Publishers (India) Pvt Ltd. New Delhi.
2. Hajra Choudhari, S. K. Roy N, Hajra Choudhary A.K. 2017. Elements of Workshop Technology (Vol. I and II), Media Promoters and Publishers Pvt Ltd, Mumbai
3. Khurmi R.S and Gupta J.K. 2018 A Textbook of Workshop Technology. S. Chand and Company Ltd., New Delhi.
4. Raghuwanshi B.S. 2016. A Course on Workshop Technology (Vol. I and II), Dhanpat Rai and Sons, New Delhi.

TEACHING SCHEDULE

PRACTICAL [FMPE-111]

Exercise No.	Exercise Title
1	Introduction about different shops in the manufacturing workshop, study of safety tools and safety precautions/measures
2	Exercise in fitting shop: sawing, filing
3	Exercise in fitting shop: right-angle fitting of MS flat
4	Exercise on operations of drilling, reaming
5	Exercise on operations of threading and with tap dies
6	Preparation of a paper weight
7	Preparation of cross half lap joint or T-half joint in carpentry
8	Preparation of Mortise and Tenon joint in carpentry
9	Preparation of dovetail joint in carpentry
10	Preparation of Butt joint with ARC welding
11	Preparation of Lap joint with ARC welding
12	Preparation of Butt joint using gas welding
13	Preparation of Lap joint using gas welding
14	Introduction and demonstration on a lathe machine
15	Exercise on simple turning in lathe machine
16	Exercise on step turning in lathe machine
17	Preparation of job on taper turning in lathe machine
18	Preparation of job on drilling in lathe machine
19	Preparation of job on knurling in lathe machine
20	Preparation of job on threading in lathe machine
21	Introduction and demonstration on shaper machine
22	Introduction and demonstration on milling machine
23	Exercise on Bending
24	Exercise on Shaping
25	Exercise on Drawing
26	Exercise on Punching
27	Exercise on Riveting
28	Making different types of sheet metal joints using G.I. sheets
29	Exercise on changing a round MS rod into square section with a shaper
30	Introduction and demonstration of a slot making with milling machine
31	Introduction and demonstration of a gear tooth forming
32	Introduction and demonstration of indexing mechanisms.

Semester	**:**	**I**			
Course No.	**:**	**REE-111**	**Credit Hrs.**	**:**	**3(2+1)**
Course Title	**:**	**Basic Electrical Gadgets and Instruments**			

SYLLABUS

Objectives:

(i) To enable the students to take up repair and maintenance of different common electrical gadgets.

(ii) To acquire the basic knowledge of instruments used for scientific measurements.

THEORY

Introduction to different electrical appliances used in agricultural buildings, structures and farm operations; Difference between AC and DC supply system; Introduction to AC fundamentals; AC through series RL, RC, and RLC circuits, parallel AC circuit, series and parallel resonance; Q-factor and bandwidth. Three-phase AC circuit: Concept of balanced three-phase AC circuits, line and phase quantity in star and delta network, power in three-phase circuit, various methods of three phase power measurement like (one wattmeter and two-wattmeter method). Diode and its applications: Rectifier, Clipper, Clamper, voltage multiplier and capacitive filter zener diode as voltage regulator. Transistor and its applications: Bipolar junction transistor, operating point. Various biasing methods, fixed, self-biasing and potential divider biasing method; OP-AMP, Ideal OP-AMP characteristics, Linear and non-linear applications of OP-AMP (adder, subtractor, integrator, active rectifier, comparator). Introduction to digital electronics and logic gates: Basic theorem of Boolean algebra, Combinational logic circuits (basic gates, SOP rule and K-map), binary adder. Principles of general instruments, measurement of displacement, temperature, velocity, force and pressure using different instruments like, strain gauges, load cell, thermistors, thermocouples, pyrometer, linear variable differential transformer (LVDT), capacitive transducers, RTD, instruments for measurement of speed, wind velocity, solar radiation, anemometer, multimeter etc.

PRACTICAL

BASIC ELECTRICAL AND ELECTRONICS GADGETS

To prepare an electrical switch board to control two light points, one plug point, one fan point and fuse (House wiring); To prepare an electrical switch board to control two light points using two two-way switch (staircase wiring); To connect and test a fluorescent lamp; To find faults and repair home appliances such as heater, electric iron, fans and mixer-grinder, etc.; To find faults and repair UPS; To measure the power requirement and power factor in a AC single phase series RLC circuit; To measure energy of a single phase AC circuit with the help of ammeter, voltmeter and power factor meter and energy meter; To measure the power consumption in a three-phase circuit using two-wattmeter method.

INSTRUMENTATION

To prepare a DC power supply unit using diode and filter circuit; To study the Zener diode as voltage regulator circuit; To study transistor characteristics in CE configurations; To verify different logic gates; To measure unknown resistance using Wheatstone bridge; To measure the displacement and to determine the characteristics of LVDT; To measure the displacement using LVDT and potentiometer; To measure the pressure using strain gauge and Bourden tube; To measure the temperature using RTD, thermistors and thermocouple and study their characteristics; To measure the speed, wind velocity, solar radiation etc., using different measuring tools like tachometer, anemometer, pyranometer, multimeter, etc.; To acquaint with different other types of instruments used in agriculture and food processing application

TEACHING SCHEDULE

THEORY [REE-111]

Lecture No.	Topic	Sub-topics/Key Points	Weightage (%)
1	Introduction to different Electrical Appliances used in Agricultural Buildings Structures and Farm Operations. Difference between AC and DC Supply systems.	Brief Introduction of electrical appliances used in: Electrified Dairy Farm, Electrified Fruit and Vegetable Farm, Electrified Livestock Farm, Electrified Poultry Farm, Electrified General Farm, Electrified Farm Shop, Definitions and Concepts of Time period, Frequency, Magnitude, Waveform to differentiate A.C. and D.C.	5
2-4	Introduction to AC Fundamentals	Generation of Alternating Voltages and Current Equation of Alternating Voltages and Current Cycle, Time Period, Frequency, Amplitude Different Forms of E.M.F equation Phase and Phase Difference, Root Mean-Square (R.M.S) Value and its Analytical Derivation Average Value and its Analytical Derivation Form, Crest or Peak or Amplitude Factor A.C Through Pure Ohmic Resistance, Pure Inductance and Pure Capacitance Alone.	10
5-6	AC through series RL, RC and RLC Circuits	A.C. Through Resistance and Inductance. Definition and Concept of Power Factor, Active Power, Reactive Power and Apparent Power. A.C. through Resistance and Capacitance A.C. through Resistance Inductance and Capacitance. Examples on A.C. through Resistance and Inductance.	
7	Parallel AC Circuit	Solving Parallel Circuit by Vector or Phasor Method	5
	Series and Parallel Resonance	Resonance in R-L-C series Circuit and in Parallel Circuit.	
	Q-factor and Bandwidth	Brief concept Q factor and Bandwidth	

Continued…

8-10	Three-phase AC Circuit	Concept of balanced three-phase AC circuits Generation of Poly phase Voltage. Phase sequence. Interconnection of Three Phases,	10
	Line and Phase Quantity in Star and Delta Network	Star or Wye Connection, Voltages and Currents in Star or Wye Connection, Delta or Mesh Connections; Voltages and Currents in delta or Mesh Connection	
11	Power in Three-phase Circuit	Power Measurement in 3-Phase Circuits, Three wattmeter Method, Two wattmeter Method (Balanced or Unbalanced Load), One Wattmeter Method.	5
12-16	Diode and its Applications	Principal, Types and Uses of Rectifier and Capacitive filter. Principal, Types and Uses of Clipper, Clamper, Voltage multiplier and Zener diode as Voltage regulator	5 5
17-19	Transistor and its Applications	Working principle of : Bi-polar junction Transistor with CE, CB, CC Operating point; Various biasing methods (viz., fixed, self and potential divider biasing methods).	10
20-22	Operational Amplifier (OP-AMP) and its Application	Basic concept of OP-AMP and its Ideal Characteristics; Linear and Non-linear applications of OP-AMP (adder, subtractor, integrator, active rectifier, comparator)	10
23-25	Introduction to Digital Electronics	Concept and Working of Logic gates. Basic theorem of Boolean Algebra. Combinational Logic circuits (Basic gates, Introduction to K-Map binary adder and SOP rule)	10
26-32	Measuring Instrumentation (Transducer and Sensors)	Principles of General instrumentation system with Block diagram; Electrical measurement of: Displacement [like, Linear variable differential transformer (LVDT), Capacitive transducers, Strain gauge]	10
		Temperature (Thermistors, Thermocouples, RTD, Pyrometer); Force (Strain gauge, Pressuductor load cell)	5
		Pressure (Strain gauges, Load cell, Capacitive, Potentiometric); Speed (Resonance tachometer, Eddy current Tachometer)	5
		Wind velocity (Anemometer); Solar radiation (Pyranometer).	5
		Total	**100**

TEACHING SCHEDULE

PRACTICAL [REE-111]

Exercise No.	Exercise Title
1	To prepare an electrical switch board to control two light points, one plug point, one fan point and fuse (House wiring).
2	To prepare an electrical switch board to control two light points using two two-way switch (Staircase wiring).
3	To connect and test a fluorescent lamp.
4	To find faults and repair home appliances such as heater, electric iron, fans and mixer-grinder and UPS etc.
5	To measure the power requirement and power factor in an AC single phase series RLC circuit.
6	To measure energy of a single-phase AC circuit with the help of ammeter, voltmeter and power factor meter and energy meter.
7	To measure the power consumption in a three-phase circuit using two-wattmeter method.
8	To prepare a DC power supply unit using diode and filter circuit.
9	To study the Zener diode as voltage regulator.
10	To study transistor characteristics in CE configurations.
11	To verify different logic gates.
12	To measure unknown resistance using Wheatstone bridge.
13	To measure the displacement and to determine the characteristics of LVDT and Potentiometer.
14	To measure the pressure using strain gauge and Bourden tube.
15	To measure the temperature using RTD, thermistors and thermocouple and study their characteristics.
16	To measure the speed, wind velocity, solar radiation etc., using different measuring tools like tachometer, anemometer, pyranometer, multimeter etc.

Suggested Readings [REE-111]:

1. Boylestad R L and Nashelsky L N. 2011. Electronic Device and Circuit Theory. Pearson.
2. Ghosh S. 2007. Fundamentals of Electrical & Electronics Engineering, 2nd Ed PHI Learning, New Delhi.
3. Metha V K and Metha R. 2012. Basic Electrical Engineering, Fifth edition. S Chand & Co., New Delhi.
4. Metha V K and Metha R. 2012. Principle of Electronics, Fifth edition. S Chand & Co., New Delhi.
5. Rajput R K. 2007. Basic Electrical and Electronics Engineering. Laxmi Publications, New Delhi.
6. Theraja B L and Theraja A K. 2005. A Text Book of Electrical Technology Vol. I. and II, S Chand & Co., New Delhi.
7. Robert H. Brown, Farm Electrification. Allied Pacific Private Limited Bombay, Indian Edition.
8. Singh S K, Industrial Instrumentation and control, third edition, published by Tata McGraw-Hill Companies.

Semester	**:**	**I**		
Course No.	**:**	**COMP-111**	**Credit Hrs.**	**: 3(2+1)**
Course Title	**:**	**Agricultural Informatics and Artificial Intelligence**		

SYLLABUS

Objectives:

(i) To acquaint students with the basics of computer applications in Agriculture, multimedia, database management, application of mobile apps 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 Visual Basic, Java, Fortran, C/C++, etc. 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, structure, 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, postharvest management etc. Geospatial technology: Concepts, 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, Handling macros. 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, Hands on practice on preparation of Decision Support System, Preparation of contingent crop planning, India Digital Ecosystem of Agriculture (IDEA).

TEACHING SCHEDULE

THEORY [COMP-111]

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, Multiuser 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 work sheet and graph, Functions for Data Analysis: AVERAGE, COUNT, SUM, MIN, MAX, MEDIAN, MODE, STDEV, STDEVP, VAR, VARP, CORREL, PERCENTILE Mathematical functions in excel: SUM, AVERAGE, AVERAGEIF, COUNT, COUNTIF, MOD, ROUND	7
7-9	**Database and DBMS**	Database, concepts and types, creating database, Uses of DBMS in Agriculture. Database concepts Database- Definition: 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…

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	**Computer Programming**	General concepts, Introduction to Visual basic, java, FORTRAN, C, C++ etc.: concepts and standard input/output operations. C 'language - character set, data type, concepts and standard input/output – scanf( ), printf( ) operations Assignment - any five C simple language program	7
13-14	**e-Agriculture**	Concepts, Importance of IT in e-Agril., AGRINET: Introduction, Objectives. Advantages and Challenges in Agriculture.	7
15-16	**Crop Simulation Models**	Crop Simulation Models Definition, Concept: Requirement of Good Modeling. Input-output files, limitation, advantages Types: Statistical Models, weather analysis Dynamic Models, Mechanistic Models, Functional Models and Crop Modeling. Classifications of Models based on their Applications: Primary Model, Comprehensive Model, Summary of Model, Characteristics of Models, Uses of Models	7
17-19	**IOT and IT Applications in Agriculture**	IoT Definition, Challenges and Benefits of IOT in Agriculture Use of IoT Applications in Agriculture: Precision Farming, Agricultural Drones, Smart Greenhouses. IT Applications in Agriculture for Computation of Water and Nutrient Requirement of Crop. Role of IT Application in water and nutrient requirement. Brief introduction of: Computation of water and nutrient requirement using weather parameters. Advantages	7

Continued…

COMP-111…

20-21	**Computer-controlled Devices (Automated systems), Smartphone Apps and GPS**	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 and Insurance Services; Introduction and Uses to Geospatial Technology.	7
22-23	**Decision Support System (DSS)**	Decision support systems (DSS) Introduction, Concepts, Components, Types and Applications in Agriculture.	7
24-25	**Agriculture Expert System (AES)**	Introduction, Concepts, Components and Applications in Agriculture.	7
26-27	**Contingent / Crop Planning Calendars using IT Tools**	Introduction, Definition, Benefits, Steps to Prepare Contingent Crop Planning using IT Tools.	7
28-30	**Introduction and Uses to Artificial Intelligence and Overview**	Introduction and its uses to Artificial Intelligence and Overview and Examples of AI in Agriculture - Turing test. Control strategies, Breadth-first search, Depth-first search, Heuristics search techniques: Best-first search, A* algorithm, IoT and Big Data; (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).	8
31-32	**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
		Total	**100**

TEACHING SCHEDULE

PRACTICAL [COMP-111]

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 Handling Macros, MS-EXCEL chart-Line, XY, Bar and Pie
5-6	MS-ACCESS- Creating Database, Preparing queries and reports.
7-8	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).
10-11	Hands-on Practice on Crop Simulation Model (CSM)(:- CROPWAT 8.0.
12-13	Use of Smartphone Apps (Developed by SAU).
14-15	Hands-on Practice on Decision Support System (DSS).
16	Introduction to India Digital Ecosystem of Agriculture (IDEA).

Suggested Readings [COMP-111]:

1. Fundamentals of Computer by V. Rajaraman.
2. Introduction to Information Technology by Pearson.
3. Introduction to Database Management System by C. J. Date.
4. Concepts and Techniques of Programming in C by Dhabal Prasad Sethi and Manoranjan, Wiley India.
5. Introductory A g r i 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.
8. Agricultural Informatics and Artificial Intelligence for B Tech (Agricultural Technology) by Prashant Publication.

Online resources: ***(COMP-111)***

- 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: (COMP-111)

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

ANNEXURE-IV

(~ of DICC-Circular No. MAUEB/DICC-Circular/New UG Syllabi/420/24; Dtd. 29.11.2024)

New Undergraduate Degree Syllabus of I-Semester of

B.TECH. (BIOTECHNOLOGY)

Finalized & Approved by the DICC as per the

ICAR - SIXTH DEANS' COMMITTEE REPORT

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

- UG-Certificate in Biotechnology
- UG-Diploma in Biotechnology
- UG-Degree: B.Tech. (Biotechnology)

Mahatma Phule Krishi Vidyapeeth, Rahuri

Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola

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UG Degree Syllabus State Coordinator

with

UG Degree Syllabus Discipline Coordinators &

DICC - UG Degree Syllabus Core Committee

Submitted to the

Directors of Instruction Coordination Committee

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

Course Layout

B.Tech. (Biotechnology)

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*/ BOT-111****	Basic Mathematics*/ Basic Botany**	2(2+0)	Need-based
6.	**BT-111**	Molecular Biology	3(3+0)	
7.	**BT-112**	Introductory Cell Biology	3(3+0)	
8.	**BT-113**	Fundamentals of Genetics	3(3+0)	
9.	**SEC-111**	Skill Enhancement Course-I *(To be offered from the bouquet of SEC Courses)*	2(0+2)	
10.	**SEC-112**	Skill Enhancement Course-II *(To be offered from the bouquet of SEC Courses)*	2(0+2)	
		Total Credits Hrs.	**21(14+7) G 2(0+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/ **BOT-111 for PCM student / **PCMB** students may opt any 1 choice-based course viz., MATH-111 or BOT-111 for completion of the mandatory gradial credits.

Course-wise Syllabus with Teaching Schedules

Semester	**:**	**I**	
Course No.	**:**	**CAC-111**	**Credit Hrs. : 2 (0+2) NG/ 2 Weeks**
Course Title	**:**	***Deeksharambh* (Induction-cum-Foundation Course)**	
Non-Gradial Common Academic Course for the said UG degree with the activities to be conducted during initial two weeks.			

Objectives:

(i) To create a platform for students to help for cultural Integration of students from different backgrounds,

(ii) To know about the operational framework of academic process in university, instilling life and social skills,

(iii) To create Social awareness, Ethics and Values, Team work, Leadership, Creativity,

(iv) To identify the traditional values and indigenous cultures along with diverse potentialities both in indigenous and developed scenario.

ACTIVITIES

- Introduction/Orientation and Discussions on operational framework of academic process in University/ College, as well as interactions with Academic and Research Managers of the University.
- Interaction with Alumni, Business Leaders, Perspective Employers, Outstanding Achievers in related fields and people with inspiring life experiences.
- Group activities to identify the strength and weakness of students and to learn from each other's life experiences.
- Activities to enhance Cultural Integration of students from different backgrounds.
- Field visits to the relevant fields/ establishments.
- Sessions on Personality Development (Instilling Life and Social skills, Social awareness, Ethics and Values, Team work, Leadership etc.) and imbibing the Communication skills.

Note: *The details of the relevant activities will be decided by the parent University in line with the above-mentioned broad activities.*

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/ Title	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, Fire-fighting, 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: précis 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		Précis 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 [AEC-112]

Exercise No.	Exercise Topic/ Title
1	Listening and Note taking
2	Writing skills- Précis 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 patterns 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 lifestyle.

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/ Titles
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.* (2016)**. *Region Specific Synthesized Integrated Farming System Models for Improved Production, Profitability and Nutrition (Series-1).* Bulletin, ICAR-Indian Institute of Farming Systems Research, Modipuram, Meerut (U.P.).
    - **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.	**:**	**MATH-111***	**Credit Hrs. : 2(2+0) Need-based; G/NG**
Course Title	**:**	**Basic Mathematics**	
***Gradial** Need-based Common Course for **B.Tech. (Biotechnology)**; ***Non-Gradial** Need-based Common Course for **B.Tech. (Agril. Engg.)** & **B.Tech. (Food Technology)**			

SYLLABUS

Objectives:

(i) To study the basic principles and functions in mathematics like limits and continuity,

(ii) To study differentiation and integration,

(iii) To study matrices and determinants.

THEORY

Functions:

Function and types of functions, Limit: Introduction, left-handed and right-handed limits, Algebra of limits, Standard limits. Continuity: Definition of continuity, continuity of algebraic functions. Continuity of trigonometric and exponential functions.

Differentiation:

Differentiation by the first principle, Rules of Differentiation: sum, difference, product and quotient formulae, differentiation using the chain rule, differentiation of functions in parametric and implicit form, logarithmic differentiation, geometrical interpretation of derivative. Successive differentiation, maxima and minima.

Integration:

Definition of indefinite integrals, Integrals of elementary functions (Formulae only), Theorems of integration (without proof), Integration by substitution, integration by partial fractions, integration by parts, Definition of definite Integral with examples, properties of definite integral (without proof).

Matrices and Determinants:

Definition of determinants, example up to Third order determinant, properties of determinant (statements only), Definition of matrix, types of matrices, Algebra of Matrix (addition, subtraction and multiplication), inverse of matrix, Solution of linear equations by Crammer's rule.

TEACHING SCHEDULE

THEORY [MATH-111]

Lecture No.	Topic	Subtopics/ Key Points	Weightage (%)
1-5	**Functions:**	Definition of Function, Types of functions	15
		Some Basic Functions: Definition and Properties of: Constant Function, Identity Function, Power Function. Polynomial Function, Linear, quadratic and cubic function, Radical Function, Rational Function. Exponential, Logarithmic and Trigonometric Function	
	Limit:	Introduction, Definition of Limit, Left-handed and Right-handed limits, Algebra of limits	
		Standard limits: Method of Factorization, Rationalization, Limit of Trigonometric, Exponential Logarithmic and Functions. Limit of Infinity	
	Continuity:	Definition of continuity, Continuity of algebraic functions, Continuity of trigonometric and exponential functions.	
6 -15	**Differentiation:**	Definition, Differentiation by the first principle, Derivative of some standard functions (Formulae only), Rules of Differentiation (Sum, Difference, Product and quotient without proof), Differentiation using the chain rule, Differentiation of functions in parametric and implicit form, Logarithmic Differentiation, Successive differentiation, Maxima and minima	30
16 -25	**Indefinite and Definite Integration**:	Definition of indefinite Integral, Integrals elementary functions (Formulae only) Theorems of integration (without proof) Methods of Integration: Integration by Substitution, Integration by parts, Integration by partial fractions Some special integrals formulae only. Definition of definite Integral with examples Properties of definite integral (without proof)	30
26 -32	**Determinants and Matrices:**	Definition of determinants, Expansion up to third order determinant, Properties of determinant (Statements only) Definition of matrix, Order of Matrix, Types of matrices, Algebra of Matrices, Inverse of matrix by elementary transformations, Solution of linear equations by Crammer's rule	25
		Total=	**100**

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.

Semester	**:**	**I**		
Course No.	**:**	**BOT-111****	**Credit Hrs. : 2(2+0)**	**Need-based; G/NG**
Course Title	**:**	**Basic Botany**		

**Need-based Common Course among 3 UG Degrees:

B.Tech. (Biotech.) - Gradial / B.Sc. (Hons.) A.B.M. - Gradial / B.Tech. (Food Tech.) - Non-Gradial

SYLLABUS

Objectives:
i. To study the basic taxonomy and classification of plants,
ii. To study the features of plant kingdom and morphology,
iii. To study the internal structures of plants.

THEORY

Plant Kingdom and Features of each group. Plant taxonomy, Systems of classification. Morphology, Modifications and Functions of Root, Stem, Leaf, Flower and Inflorescence. Pollination and Fertilization. Fruit types. Structure of dicot and monocot seed, and seed germination. Cell structure. Chromosome, DNA and Genes. Cell and tissue types. Internal structure of root, stem and leaf. Characteristics and economic importance of Poaceae, Brassicaceae, Fabaceae, Malvaceae, Rutaceae, Rosaceae, Asteraceae and Solanaceae families.

TEACHING SCHEDULE

THEORY [BOT-111]

Lecture No.	Topics	Sub-topics/ Key Points	Weightage (%)
1-3	**Plant Kingdom and Features:**	Classification of Plant Kingdom (Major plant groups: Bryophytes, Pteridophytes, Gymnosperms, and Angiosperms.) Key distinguishing features/ characteristics of each group with examples. Plantae Kingdom.	8
4-5	**Plant Taxonomy and Systems of Classification:**	Binomial nomenclature and other systems of classification (in brief)	5
6-7	**Plant Cell and Tissue Types:**	Basic Structure of a Plant Cell and Tissue, Types of Plant Cells and Tissues; Plant Cell Functions.	8
8-9	**Chromosome:**	Definition and Overview, Chemical Composition; Chromosome Morphology, Types of Chromosomes**.**	8

Continued…

10-11	**DNA:**	Brief historical overview of DNA discovery, Watson-Crick model of DNA, Chemical composition, Components of a nucleotide, Structures of Purines and Pyrimidines.	8
12	**Genes:**	Definitions (Gene, Allele, Genotype, Phenotype, Exon, Intron, Codon) and Historical Overview; Structure: Basic layout of a gene- (Exon, Intron, etc.); Types of genes, Codons (Start/ Stop).	8
13-14	**Pollination and Fertilization:**	Definitions/Terminology, Types, Agents of pollination, Processes/Events, Significances, Barriers to Fertilization, Differences between their types.	10
15-16	**Root and Stem:**	Morphology, Modifications with examples and Functions	8
17-19	**Leaf, Flower and Inflorescence:**	Morphology, Modifications with examples and Functions	8
20	**Fruits:**	Types of fruits with examples	3
21-22	**Structures of Monocot and Dicot Seeds:**	Structure, Diagrams, Differences	5
23-24	**Seed Germination:**	Definitions, Types, Differences and Stages of seed germination	5
Plant taxonomy-Classification; Characteristics and Economic Importance; Members/ Examples of following Families viz.,			
25-26	Poaceae and Brassicaceae		4
27-28	Fabaceae and Malvaceae		4
29-30	Rutaceae and Rosaceae		4
31-32	Asteraceae and Solanaceae		4
		Total=	**100**

Suggested Readings [BOT-111]:

1. Bendre AM and Kumar A, 1999, Textbook of Practical Botany. Vol. 2, 7th Edn, Rastogi Publications.
2. Bendre AM and Pande PC, 2009, Introduction to Botany, Rastogi Publications.
3. Bhatia KN and Tyagi MP, 2020, Elementary Biology. A Truemen Publication.
4. David M Hillis, H Craig Heller, Sally D Hacker, David W Hall, David E Sadava, 2020. (eBook) Life: The Science of Biology, 12th Edn, Sunderland Publication.
5. Dutta AC, 1995, A Class-Book of Botany, 16th Edn, Oxford University Press.
6. NCERT, 2021. Biology of Class XI. NCERT, India.
7. Pande PC and Jain DK, 2022, A Textbook of Botany Angiosperm. S. Chand Publications.

Semester	**:**	**I**	
Course No.	**:**	**BT-111**	**Credit Hrs : 3(3+0)**
Course Title	**:**	**Molecular Biology**	

SYLLABUS

Objectives:

(i) To study the principles and techniques of Molecular Biology.

(ii) To study the Central dogma of life.

(iii) To study the tools in Molecular Biology.

THEORY

History of Molecular Biology. Central Dogma of Life. Structures of DNA and RNA. Gene structure and function. DNA replication and transcription. Genetic code and translation. Structure of prokaryotic and eukaryotic nuclear, and organelle genomes. Gene regulation in prokaryotes. *Lac* Operon concept and *Tryp* Operon concept. Introduction to Microbial Genetics; Conjugation, transformation and transduction. Tools in Molecular Biology. Role of enzymes in Molecular Biology. Principles of Polymerase Chain Reaction and Electrophoresis.

TEACHING SCHEDULE

THEORY [BT-111]

Lecture No.	Topic	Sub-topics/ Key Points	Weightage (%)
Unit-I			
1	**History of Molecular Biology**	Concept, Historical evidences and prospects	2
2-3	**Central Dogma of Life**	Concept Evidences for DNA as the genetic material- the transformation experiments.	6
4-7	**Structures of DNA and RNA**	History, Watson and Crick model of DNA, Structure of DNA and RNA; its types and function of nucleic acids (DNA and RNA).	6
8-9	**Gene Structure and Function**	Gene: Gene concept, Unit of function, One gene - one enzyme hypothesis	3
10-14	**DNA Replication**	Outline of DNA replication, Meselson and Stahl experiment, Mechanism of DNA replication in prokaryotes and eukaryotes.	8
15-17	**Transcription**	Prokaryotic and Eukaryotic transcription.	6
18-19		Post-transcriptional modifications mechanism.	3

Continued…

20-21	**Genetic Code**	Amino acids involved in Protein synthesis, Characteristics of Genetic code *viz*; Triplet code, Non-overlapping, Comma less, Polarity, Codons and anticodons, Initiation codons, Termination codons, Degenerate and universal, Wobble hypothesis.	4
22-24	**Translation**	Prokaryotic and Eukaryotic translation	6
25-26		Post-translational modification mechanism	2
Unit-II			
27-29	**Prokaryotes and Eukaryotes Nuclear and Organelle Genomes**	Genome organization in Prokaryotes and Eukaryotes, Special features of eukaryotic gene structure and organization, Genome organization of mitochondria and chloroplast.	6
30-31	**Gene Regulation in Prokaryotes**	Concept of Operon, *Lac* Operon and *Tryptophan* Operon.	6
32-34	**Introduction to Microbial Genetics**	Scope and development, Recombination in bacteria and viruses, Conjugation, Transformation, Transduction- generalized and specialized.	8
Unit-III			
35-36	**Tools in Molecular Biology**	Types, nomenclature, characteristics and uses of restriction endonucleases	6
37-38	**Role of enzymes/ DNA Modifying Enzymes in Molecular Biology**	Nuclease, Ligases, Polymerase, Topoisomerase, Alkaline phosphatase etc.	4
39-41	**Vectors**	Concept, Properties and Vectors i.e. Plasmid (pBR 322, pUC 18/19, Bacteriophage and Cosmid.	8
42-43		Construction of Genomic and c-DNA Libraries.	4
44-46	**Principles of Polymerase Chain Reaction**	Concept, Components, Procedure and Applications of PCR.	7
47-48	**Principles of Electrophoresis**	Principles and its Types *viz*; SDS-PAGE, Agarose gel and 2D Electrophoresis.	5
		Total=	**100**

Suggested Readings [BT-111]:

1. Lewin B, 2017, Gene XII, Oxford University Press.
2. Cooper GM and Hausman RE, 2018, The Cell: A Molecular Approach. Sinauer Associates Inc, 8th Edn.
3. Nelson DL and Cox MM, 2017, Lehninger Principles of Biochemistry, 7th Edn, W. H. Freeman.
4. Satyanarayana U and Chakrapani U, 2021, Essentials of Biochemistry, Elsevier.

Semester	**:**	**I**	
Course No.	**:**	**BT-112**	**Credit Hrs. : 3(3+0)**
Course Title	**:**	**Introductory Cell Biology**	

SYLLABUS

Objectives:

(i) To understand the structures and purposes of basic components of prokaryotic and eukaryotic cells, especially macromolecules, membranes and organelles.

(ii) To understand how these cellular components are used to generate and utilize energy in cells.

(iii) To understand the cellular components underlying mitotic cell division.

(iv) To apply the basic knowledge of cell biology to selected examples of changes or losses in cell function that include responses to environmental or physiological changes, or alterations of cell function brought about by mutation.

THEORY

Origin and evolution of cell. Introduction to microscopy. Sub-cellular structure of prokaryotic and eukaryotic cells. Membrane structure and function: Plasma membrane, cell wall and extracellular matrix. Structural organization and function of intracellular organelles and organelle biogenesis. Nucleus, Mitochondria, Endoplasmic reticulum, Golgi apparatus, Lysosomes, Peroxisomes, Plastids and Vacuoles. Structure and function of the cytoskeleton and its role in motility. Cell membrane transport. Introduction to cell signaling. Cell growth, Cell cycle and its control. Cell death and cell renewal.

Suggested Readings [BT-112]:

1. Alberts B, Johnson A, Lewis J, Raff M, Roberts K and Walter P. 2008. Molecular Biology of the Cell. 5th Ed. Garland Science/ Taylor and Francis Group.
2. Lodish H, Berk A, Kaiser CA, Krieger M, Bretscher A, Ploegh H, Amon A & Scott MP. 2012. Molecular Cell Biology. WH Freeman.
3. Sadava DE. 1993. Cell Biology: Organelle Structure and Function. Jones and Bartlett Publishers
4. Verma PS and Agarwal VK, 2016, Cell Biology, Genetics, Molecular Biology, Evolution and Ecology. S Chand and Sons.
5. Cooper GM and Hausman RE, 2018, The Cell: A Molecular Approach. Sinauer Associates Inc.

TEACHING SCHEDULE

THEORY [BT-112]

Lecture No.	Topic	Sub-topics/ Key Points	Weightage (%)
Unit-I			
1-2	**Origin and Evolution of Cell**	a. Evolution of molecules and first cell b. Evolution from Prokaryotes to Eukaryotes c. Evolution of single cells to multicellular organisms d. Cell theory	4
3-4	**Introduction to Microscopy**	Principles and Applications of ~ a. Light microscopy- b. Compound microscopy-	4
5-8		Principles and Applications of ~ c. Phase contrast microscopy d. Dark-field microscopy e. Fluorescence microscopy f. Differential interference microscopy g. Confocal laser scanning microscopy (CLSM) h. Electron microscopy	6
9-11	**Sub-cellular Structure of Prokaryotic and Eukaryotic Cells**	a. Sub-cellular structure of prokaryotic cells b. Sub-cellular structure of eukaryotic cells c. Differences between Prokaryotic and Eukaryotic cells	4
12-14	**Membrane Structure and Function - Plasma membrane**	a. Origin of plasma membrane b. Chemical composition of Plasma membrane (lipids, proteins, carbohydrates) c. Different models of plasma membrane structure d. Functions of plasma membrane	8
15-17	**Cell wall and Extracellular matrix**	a. Cell wall composition and structure: Prokaryotic and Eukaryotic b. Functions of cell wall c. Cell-cell junctions, cell adhesion and extracellular matrix.	4
18-20	**Structural Organization; Functions of Intracellular Organelles and Organelle Biogenesis:**	a. Structural organization and function of intracellular organelles and organelle biogenesis b. Structure and Functions of Nucleus	6
21-22		Structure and Functions of Plastids	8
23-24		Structure and Functions of Mitochondria	
25-26		Structure and Functions of Endoplasmic reticulum	8
		Structure and Functions of Golgi apparatus	
		Structure and Functions of Lysosomes, Peroxisomes, Vacuoles.	2

Continued…

Unit-II			
27-28	**Structure and Functions of Cytoskeleton and its Role in motility**	a. Origin of cytoskeleton b. Cytoskeleton structure- Microtubules, Microfilaments and Intermediate filaments	4
29-30		c. Cilia and centrioles d. Function of cytoskeleton and its role in motility	4
31-34	**Cell Membrane Transport**	a. Principles of membrane transport b. Active transport and its types c. Passive transport and its types d. Transporter, Channels: Types and function	8
35-39	**Introduction to Cell Signaling**	a. General principles of signaling b. Stages of cell signaling c. Types of cell signaling d. Signaling molecules e. Receptor and its types f. Functions of cell surface receptors	10
40-41	**Cell Growth, Cell Cycle and its Control**	a. Overview of Cell cycle	4
42-43		b. Mitosis and Cytokinesis c. Meiosis	4
44-45		d. Components of cell cycle control system e. Regulation of cell cycle	4
46-47	**Cell Death and Cell Renewal**	a. Programmed cell death/ Apoptosis	4
48		b. Cell renewal: stem cells and maintenance of adult tissues	4
		Total =	**100**

Semester	**:**	**I**	
Course No.	**:**	**BT-113**	**Credit Hrs. : 3(3+0)**
Course Title	**:**	**Fundamentals of Genetics**	

SYLLABUS

Objectives:

i. To study the history of Genetics,
ii. To study the principles of inheritance and variation,
iii. To study chromosomes and cell division,
iv. To study the genetic basis of traits.

THEORY

History of Genetics. Mendel's principles and rediscovery. Cell division. Chromosomes structure and function. Chromosomal theory of inheritance. Sex-linked, sex-limited and sex-influenced inheritance. Sex determination and sex differentiation. Multiple allelism. Linkage and crossing-over. Gene-gene interaction. Genetic analysis in prokaryotes and eukaryotes. Extra chromosomal inheritance. Mutations. Hardy-Weinberg law. Quantitative inheritance. Genetic basis of evolution. Introduction to Human Genetics.

Suggested Readings (BT-113):

1. Singh B. D., Fundamentals of Genetics, Kalyani Publication, New Delhi.
2. Phundan Singh, Elements of Genetics, Kalyani Publication, New Delhi.
3. Gardner E. J., Simmons M. J., Snustad D. P., 1991, Principle of Genetics, Wiley India (P) Ltd.
4. Brah G. S., 2014, Animal Genetics: Concepts and Implications, 2nd Edn., Kalyani Publication, New Delhi.

TEACHING SCHEDULE

THEORY [BT-113]

Lecture No.	Topic	Subtopics/ Key Points	Weightage (%)
Unit-I			
1-2	**History of Genetics**	Pre-Mendelian, Mendelian and Post-Mendelian era	4
3-5	**Mendel's Principles and Rediscovery**	Law of dominance, Law of segregation, Law of independent assortment, Reasons of Mendel's success and Mendelian deviations	4
6-9	**Cell Division**	Mitosis definition, Stages of mitosis and Importance of mitosis, Meiosis definition, Stages of meiosis and Significance of meiosis	4
10	**Chromosome Structure and Function**	Morphological structure, Chemical composition and function	4
11-12		**Models of chromosomes structure:** Multi-stranded model, Folded fiber model and Nucleosome solenoid model. **Special chromosomes:** Lampbrush chromosome, Salivary gland chromosome or Giant chromosome.	4
13	**Chromosomal Theory of Inheritance**	Chromosomal theory of inheritance	4
14-16	**Sex-linked, Sex-limited and Sex-influenced inheritance**	Sex-linked, Sex-limited and Sex-influenced inheritance: Definitions, Brief explanations, Examples.	4
17-18	**Sex Determination and Sex Differentiation**	Sex determination and Sex differentiation- Definitions, Brief explanations, Examples.	4
Unit-II			
19	**Multiple Allelism**	**Multiple alleles**: Def'n, Characters of multiple alleles, Examples: Blood groups, Rh factor in humans	4
20-21	**Linkage and Crossing Over**	**Linkage:** Def'n, History, Types of linkage; complete and incomplete linkage **Detection of linkage:** Detection in test cross generation, Detection in F_2 generation	4
22		**Crossing over:** Def'n, Factors affecting recombination frequency, Cytological basis of crossing over	4
23		**Crossing over:** Crossing over in four-strand stage, Relationship between chiasma and crossing over, Molecular mechanisms of c.o., Linkage maps and Linkage groups	4
24-26	**Gene Interaction**	**Gene interaction and its types:** Def'n, Types of gene interactions and allelic gene interactions; Complete dominance, Incomplete dominance, Codominance	6
27-29		**Gene interaction and its types:** Non-allelic, Supplementary, Masking, Complementary gene interactions etc.; Molecular basis of gene interaction	6

Continued…

30-31	**Genetic Analysis in Prokaryotes and Eukaryotes**	Genetic analysis in prokaryotes and eukaryotes (in brief)	4
32	**Extrachromosomal Inheritance**	**Extrachromosomal inheritance:** Definition and Characteristic features of cytoplasmic inheritance with example of *Mirabilis jalapa*, Inheritance of mitochondrial DNA and chloroplast DNA	4
33		**Extra chromosomal inheritance:** Genetic maternal effect with examples of shell coiling in snails, kappa particles in paramecium, inheritance due to parasites, symbionts and viruses	4
34	**Mutation**	**Mutation:** Definition, History, Characters of mutation, Classification of mutation, Spontaneous mutation, Induced mutation,	4
35		**Mutation:** Molecular basis of mutation, Mutator, Antimutator genes and Mutable genes, Suppressor mutation and its Mechanism (Definitions, Brief emphasis)	4
36		**Mutagens and their types with e.g.:** Physical mutagens, Chemical mutagens, Mutation induction and detection, Applications of mutation	4
37	**Hardy-Weinberg Law**	**Hardy-Weinberg Law:** Gene frequency genotype frequency, Gene pool, Random union of gametes, Random mating among genotypes	**2**
38- 39		**Hardy-Weinberg Law:** Hardy-Weinberg equilibrium, Equilibrium for one gene with two alleles, Equilibrium for one gene with multiple alleles, Equilibrium for two genes	4
40-41	**Quantitative Inheritance**	**Quantitative inheritance:** Multiple factor hypothesis, Characters of quantitative traits and their inheritance, Effects of environment on quantitative traits	4
42-45	**Introduction to Human Genetics**	**Introduction to Human Genetics:** Man the organism, Cytogenetics of man: Chromosome banding chromosome aberration. Genetics studies, Genetic diseases, Blood groups, Disputed Parentages	4
46-48	**Genetic Basis of Evolution**	**Genetic basis of evolution and Origin of species:** Theories of evolution: Lamarckism, Darwinism, Mutation theory, Neo-Darwinism.	2
		Total=	**100**

List/ Bouquet of Skill Enhancement Courses (SECs):

Sr. No.	Course No.	Course Title	Credit Hrs.
1.	**SEC-xxx**	Practices in Plant Tissue	2(0+2)
2.	**SEC-xxx**	Laboratory Management and Instrumentation	2(0+2)
3.	**SEC-xxx**	*(To be added)*	2(0+2)
4.	**SEC-xxx**	*(To be added)*	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 or other relevant 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]

Semester	**:**	**I**	
Course No.	**:**	**SEC-xxx**	**Credit Hrs : 2(0+2)**
Course Title	**:**	**Practices in Plant Tissue Culture**	

SYLLABUS

Objectives:

(i) This course aims at imparting hands-on training on the calculation of per cent solutions, molarity, molality, normality; and preparation of buffers.

(ii) To study basic equipments used in Plant Molecular Biology and Cell Culture Laboratories; washing, packing and sterilization of glass and plastic wares for cell culture.

(iii) To study preparation of media and reagents for cell culture, primary culture technique, culturing and sub-culturing of continuous cell lines, viability assay by trypan blue dye exclusion method, micropropagation, haploid production, embryo rescue, cryopreservation of primary cultures and cell lines.

(iv) To prepare the phytohormones and their sterilization.

(v) To study Tissue Culture Laboratory management.

PRACTICAL

Laboratory safety and aseptic techniques, sterilization methods for equipment and media, media preparation, preparation of solid and liquid media, pH adjustment and sterilization of media. Culture initiation and explant selection. Selection of explants; meristem, node, leaf, embryo etc. Surface sterilization of plant material. Techniques for explant preparation and inoculation on to culture media. Callus induction and subculture. Subculture techniques: transfer of cultures to fresh media, monitoring and maintenance of cultures, organogenesis and embryogenesis. Micropropagation. Genetic transformation. Cryopreservation and conservation.

Project Work: Students design and conduct of a small-scale tissue culture project. (Students will choose a plant species, select appropriate explants, culture them *in vitro*, and document the progress and results).

TEACHING SCHEDULE

[Practices in Plant Tissue Culture]

PRACTICAL

Exercise No.	Exercise Title
1-2	Laboratory safety and aseptic techniques
3-5	Preparation of Standard Solution: (Percent solutions, molarity, molality, normality and preparation of buffers)
6-8	Media preparation: Solid and liquid media and pH adjustment
9-10	Sterilization methods for equipments and media
11-12	Culture initiation and explant selection: meristem, node, leaf, embryo etc.
13-14	Surface sterilization of plant material; Techniques for explant preparation and Inoculation on to the culture media.
15-16	Callus induction and subculture to the fresh media
17-18	Micropropagation: a) Organogenesis b) Embryogenesis
19-20	Monitoring and Maintenance of cultures
21-22	Demonstration of genetic transformation techniques
23-24	Demonstration of cryopreservation and conservation techniques
25-30	Project Work – Micropropagation studies: (Ornamental, Horticultural and Medicinal Plants)
31-32	Visit(s) to Commercial Plant Tissue Culture Units

Note: Project work tasks may be conducted from start to end of the semester with group of 10-20 students.

Suggested Readings [SEC-111]:

1. Bhojwani SS and Razdan MK, 1996, Plant Tissue Culture: Theory and Practice, Elsevier.
2. Reinert J and Bajaj YPS (Ed), 1989, Applied and Fundamental Aspects of Plant Cell, Tissue and Organ Culture, Springer-Verlag.

Semester : I		
Course No. : SEC-xxx	**Credit Hrs : 2(0+2)**	
Course Title : Laboratory Management and Instrumentation		

SYLLABUS

Objectives:

(i) To study the establishment and management of different molecular biology laboratories.

(ii) To impart hands-on training on good laboratory practices, calculation of per cent solutions, molarity, molality, normality; and preparation of buffers.

(iii) To study basic equipments used in Plant molecular biology and cell culture laboratories, record keeping, teamwork, and SOP of different instruments of the labs.

(iv) Safe disposal of laboratory chemicals and reagents as per the biosafety guidelines.

PRACTICAL

Importance of laboratory safety and regulatory compliance. Quality management systems: ISO9001, GLP, GMP, laboratory safety and regulatory compliance. Risk assessment and hazard identification. Inventory management and equipment maintenance. Principles of laboratory inventory management. Equipment calibration and preventive maintenance. Documentation and record-keeping for regulatory compliance. Quality assurance and control. Introduction to quality assurance (QA) and quality control (QC). Quality control checks for laboratory reagents and instruments, Troubleshooting common laboratory errors and deviations.

Spectroscopy and spectrophotometry, applications in quantitative analysis and molecular biology. Chromatography techniques, microscopy and imaging. Molecular biology techniques. Instrumentation project : students design and conduct a small-scale project using one of the laboratory instruments covered in the course. They will collect data, analyze results, and present their findings.

TEACHING SCHEDULE

[Laboratory Management and Instrumentation]

PRACTICAL

Exercise No.	Exercise Title
1-2	General Laboratory Safety Rules and Laboratory Compliance
3-4	Quality Management Systems: ISO 9001, GLP and GMP
5-6	Risk assessment and Hazard identification; Principles of laboratory inventory management.
7	Calibration of Weighing balance, pH meter and Micropipettes
8	Documentation and Record-keeping for Regulatory Compliance.
9	Calculations of Per cent Solutions, Molarity, Molality, Normality etc.
10	Preparation and Quality Control Checks for laboratory Reagents and Standards.
11-13	Determination of the Concentration of DNA, RNA and Proteins in Solutions by Spectrophotometer.
14-15	Separation and Identification of Amino acids/ Sugars by Paper Chromatography/ TLC.
16-17	Observation of Microorganisms: Bacterial cell identification by Gram staining
18-26	Extraction of Plant Genomic DNA, Plasmid DNA and Agarose gel electrophoresis, Restriction Digestion, PCR and Agarose gel electrophoresis of PCR products
27-32	**Instrumentation Project:** DNA isolation from different crops/ microbes/ animal cells/ blood, Chromatography, Spectrometry, PCR-based project etc.

Suggested Readings:

1. Gakhar S K, Miglani M and Ashwani K, 2013, Molecular Biology: A Laboratory Manual, ISBN: 9789382332305.
2. Fulekar MH and Pandey B, 2013, Bioinstrumentation, ISBN: 9789382332398.
3. Green MR and Sambrook J, 2012, Molecular cloning: A Laboratory Manual 4th Ed, Cold, Spring Harbor.
4. Rapley R and Whitehouse D, (Eds), 2015, Molecular Biology and Biotechnology, Royal Society of Chemistry.
5. Kreuzer H and Massey A, 2008, Molecular Biology and Biotechnology: A Guide for Students, 3rd Edn., ASM Press.

ANNEXURE-V

(~ of DICC-Circular No. MAUEB/DICC-Circular/New UG Syllabi/420/24; Dtd. 29.11.2024)

New Undergraduate Degree Syllabus of I-Semester of

B.TECH. (FOOD TECHNOLOGY)

Finalized & Approved by the DICC as per the

ICAR - SIXTH DEANS' COMMITTEE REPORT

Course Curriculum of First Semester

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

FOOD TECHNOLOGY

- UG-Certificate in Food Technology
- UG-Diploma in Food Technology
- UG-Degree: B.Tech. (Food Technology)

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. R.B. Kshirsagar
Associate Dean & Principal, College of Food Technology, VNMKV, Parbhani.

UG Degree Syllabus State Coordinator

with

UG Degree Syllabus Discipline Coordinators &

DICC - UG Degree Syllabus Core Committee

Submitted to the

Directors of Instruction Coordination Committee

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

Course Layout

B.Tech. (Food Technology)

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*/ BOT-111****	Basic Mathematics*/ Basic Botany**	2(2+0)	NG & Need-based
6.	**FT-111**	Fundamentals of Food Processing	3(2+1)	
7.	**FQA-111**	Food Chemistry-I	3(2+1)	
8.	**FQA-112**	General Microbiology	3(2+1)	
9.	**FE-111**	Post Harvest Engineering	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.	**22(11+11) G 4(2+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/ **BOT-111 for PCM student/ PCMB student is NOT required to take any of these Need-based Courses.

B.Tech. (Food Technology): First Semester

Course-wise Syllabus with Teaching Schedules

Semester	**:**	**I**	
Course No.	**:**	**CAC-111**	**Credit Hrs. : 2 (0+2) NG/ 2 Weeks**
Course Title	**:**	***Deeksharambh* (Induction-cum-Foundation Course)**	
Non-Gradial Common Academic Course for the said UG degree with the activities to be conducted during initial two weeks.			

Objectives:

(i) To create a platform for students to help for Cultural Integration of students from different backgrounds,

(ii) To know about the operational framework of academic process in the University, instilling life and social skills,

(iii) To create Social awareness, Ethics and Values, Team work, Leadership, Creativity,

(iv) To identify the traditional values and indigenous cultures along with diverse potentialities both in indigenous and developed scenario.

ACTIVITIES

- Introduction/Orientation and Discussions on operational framework of academic process in University/ College, as well as interactions with Academic and Research Managers of the University.
- Interaction with Alumni, Business Leaders, Perspective Employers, Outstanding Achievers in related fields and people with inspiring life experiences.
- Students shall be made aware about the field of food processing, the industry, production, systems, importance of nutrition, packaging, quality issues involved, shelf life and the legal standards available using simple day-to-day example.
- Students shall be exposed to the job opportunities at various levels like production, product development, entrepreneurship opportunities and research opportunities that exist in this area of food processing technology.
- Group activities to identify the strength and weakness of students and to learn from each other's life experiences.
- Activities to enhance Cultural Integration of students from different backgrounds.
- Field visits to the relevant fields/ establishments.
- Sessions on Personally Development (Instilling Life and Social skills, Social awareness, Ethics and Values, Team work, Leadership etc.) and imbibing the Communication skills.

Note: *The details of the relevant activities will be decided by the parent University in line with the above-mentioned broad activities.*

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 [AEC-111]

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, Fire fighting, 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 and 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 [AEC-112]

Exercise No.	Exercise Topic
1	Listening and Note taking
2	Writing skills- Precis 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 [AEC-112]:

1. **Allport, G W. 1937.** Personality: A Psychological Interpretation. Holt, New York.
2. **Brown, M. and Gyles, B. 1994.** How to Interview and be Interviewed. Sheldon Press, London.
3. **Dale, C. 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, L. 2011.** Communication Skills. Oxford University Press.
6. **Neuliep, J.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.L. and Mondal S. 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/ Title
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	Analyzing 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. and 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. and 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. and 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 *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 *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., and 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.	**:**	**MATH-111***	**Credit Hrs. : 2(2+0) Need-based; G/NG**
Course Title	**:**	**Basic Mathematics**	
***Gradial** Need-based Common Course for **B.Tech. (Biotechnology)**; ***Non-Gradial** Need-based Common Course for **B.Tech. (Agril. Engg.)** & **B.Tech. (Food Technology)**			

SYLLABUS

Objectives:

(i) To study the basic principles and functions in mathematics like limits and continuity,

(ii) To study differentiation and integration,

(iii) To study matrices and determinants.

THEORY

Functions:

Function and types of functions, Limit: Introduction, left-handed and right-handed limits, Algebra of limits, Standard limits. Continuity: Definition of continuity, continuity of algebraic functions. Continuity of trigonometric and exponential functions.

Differentiation:

Differentiation by the first principle, Rules of Differentiation: sum, difference, product and quotient formulae, differentiation using the chain rule, differentiation of functions in parametric and implicit form, logarithmic differentiation, geometrical interpretation of derivative. Successive differentiation, maxima and minima.

Integration:

Definition of indefinite integrals, Integrals of elementary functions (Formulae only), Theorems of integration (without proof), Integration by substitution, integration by partial fractions, integration by parts, Definition of definite Integral with examples, properties of definite integral (without proof).

Matrices and Determinants:

Definition of determinants, example up to Third order determinant, properties of determinant (statements only), Definition of matrix, types of matrices, Algebra of Matrix (addition, subtraction and multiplication), inverse of matrix, Solution of linear equations by Crammer's rule.

Teaching Schedule

THEORY

Lecture No.	Topic	Subtopics/ Key Points	Weightage (%)
1-5	**Functions:**	Definition of Function, Types of functions	15
		Some Basic Functions: Definition and Properties of: Constant Function, Identity Function, Power Function. Polynomial Function, Linear, quadratic and cubic function, Radical Function, Rational Function. Exponential, Logarithmic and Trigonometric Function	
	Limit:	Introduction, Definition of Limit, left-handed and right-handed limits, Algebra of limits	
		Standard limits: Method of Factorization, Rationalization, Limit of Trigonometric, Exponential Logarithmic and Functions. Limit of Infinity	
	Continuity:	Definition of continuity, Continuity of algebraic functions, Continuity of trigonometric and exponential functions.	
6 -15	**Differentiation:**	Definition, Differentiation by the first principle, Derivative of Some standard functions (Formulae only), Rules of Differentiation (Sum, Difference, Product and quotient without proof), Differentiation using the chain rule, Differentiation of functions in parametric and implicit form, Logarithmic Differentiation, Successive differentiation, Maxima and minima	30
16 -25	**Indefinite and Definite Integration**:	Definition of indefinite Integral, Integrals elementary functions (Formulae only) Theorems of integration (without proof) Methods of Integration: Integration by Substitution, Integration by parts, Integration by partial fractions Some special integrals formulae only. Definition of definite Integral with examples Properties of definite integral (Without proof)	30
26 -32	**Determinants and Matrices:**	Definition of determinants, Expansion up to third order determinant, Properties of determinant (statements only) Definition of matrix, Order of Matrix, Types of matrices, Algebra of Matrices, Inverse of matrix by elementary transformations, Solution of linear equations by Crammer's rule	25
		Total=	**100**

Suggested Readings:

1. NCERT, 2012, Mathematics of Class XII, NCERT, India.
2. A Text book 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.

Semester	**:**	**I**		
Course No.	**:**	**BOT-111****	**Credit Hrs. : 2(2+0)**	**Need-based; G/NG**
Course Title	**:**	**Basic Botany**		
Need-based Common Course across 3 UG Degrees: **B.Tech. (Biotech.) - Gradial / B.Sc. (Hons.) A.B.M. - Gradial / B.Tech. (Food Tech.) - Non-Gradial				

SYLLABUS

Objectives: i. To study the basic taxonomy and classification of plants,
ii. To study the features of plant kingdom and morphology,
iii. To study the internal structure of plants.

THEORY

Plant Kingdom and features of each group. Plant taxonomy, Systems of classification. Morphology, Modifications and Functions of Root, Stem, Leaf, Flower and Inflorescence. Pollination and Fertilization. Fruit types. Structure of dicot and monocot seed, and seed germination. Cell structure. Chromosome, DNA and Genes. Cell and tissue types. Internal structure of root, stem and leaf. Characteristics and economic importance of Poaceae, Brassicaceae, Fabaceae, Malvaceae, Rutaceae, Rosaceae, Asteraceae and Solanaceae families.

TEACHING SCHEDULE

THEORY

Lecture No.	Topics	Sub-topics/ Key Points	Weightage (%)
1-3	Plant Kingdom and Features:	Classification of Plant Kingdom (Major plant groups: Bryophytes, Pteridophytes, Gymnosperms, and Angiosperms.) Key distinguishing features/ characteristics of each group with examples. Plantae Kingdom.	8
4-5	Plant Taxonomy and Systems of Classification:	Binomial nomenclature and other systems of classification (in brief)	5
6-7	Plant Cell and Tissue Types:	Basic Structure of a Plant Cell and Tissue, Types of Plant Cells and Tissues; Plant Cell Functions.	8
8-9	Chromosome**:**	Definition and Overview, Chemical Composition; Chromosome Morphology, Types of Chromosomes**.**	8

Continued…

10-11	DNA:	Brief historical overview of DNA discovery, Watson-Crick model of DNA, Chemical composition, Components of a nucleotide, Structures of Purines and Pyrimidines.	8
12	Genes:	Definitions (Gene, Allele, Genotype, Phenotype, Exon, Intron, Codon) and Historical Overview; Structure: Basic layout of a gene- (Exon, Intron, etc.); Types of genes, Codons (Start/ Stop).	8
13-14	Pollination and Fertilization:	Definitions/Terminology, Types, Agents of pollination, Processes/Events, Significances, Barriers to Fertilization, Differences between their types.	10
15-16	Root and Stem:	Morphology, Modifications with examples and Functions	8
17-19	Leaf, Flower and Inflorescence**:**	Morphology, Modifications with examples and Functions	8
20	Fruits:	Types of fruits with examples	3
21-22	Structures of Monocot and Dicot Seeds:	Structure, Diagrams, Differences	5
23-24	Seed Germination:	Definitions, Types, Differences and Stages of seed germination	5
Plant taxonomy-Classification; Characteristics and Economic Importance; Members/ Examples of following Families viz.,			
25-26	Poaceae and Brassicaceae		4
27-28	Fabaceae and Malvaceae		4
29-30	Rutaceae and Rosaceae		4
31-32	Asteraceae and Solanaceae		4
		Total=	**100**

Suggested Readings [BOT-111]:

1. Bendre AM and Kumar A, 1999, Textbook of Practical Botany. Vol. 2, 7th Edn, Rastogi Publications.
2. Bendre AM and Pande PC, 2009, Introduction to Botany, Rastogi Publications.
3. Bhatia KN and Tyagi MP, 2020, Elementary Biology. A Truemen Publication.
4. David M Hillis, H Craig Heller, Sally D Hacker, David W Hall, David E Sadava, 2020. (eBook) Life: The Science of Biology, 12th Edn, Sunderland Publication.
5. Dutta AC, 1995, A Class-Book of Botany, 16th Edn, Oxford University Press.
6. NCERT, 2021. Biology of Class XI. NCERT, India.
7. Pande PC and Jain DK, 2022, A Textbook of Botany Angiosperm. S. Chand Publications.

Semester	**:**	**I**			
Course No.	**:**	**FT-111**	**Credits Hrs.**	**:**	**3(2+1)**
Course Title	**:**	**Fundamentals of Food Processing**			

SYLLABUS

Objectives: (i) To gain an understanding of the perishability of food and causes for food spoilage,
(ii) To have an idea of the basic methods of preservation of food and
(iii) To impart knowledge about non-thermal processing of food.

THEORY

Food: Definition and Functions, Classification of foods, sources, types and perishability of foods; Causes and types of food spoilage; Scope and benefit of food preservation. Food processing: Introduction, levels and techniques; Methods of food preservation; Preservation by salt and sugar: Principle, method and effect on food quality. Preservation by heat treatment: Principle, process and equipment for blanching, canning, pasteurization, sterilization. Preservation by use of low temperature: Principle, methods, equipments. Preservation by drying, dehydration and concentration: Principle, methods, equipments. Preservation by irradiation: Principle, methods, equipments. Preservation by chemicals-antioxidants, mould inhibitors, antibodies, acidulants, Hurdle technology etc. Preservation by fermentation: Principles, methods, equipments. Non-thermal preservation processes: Principles, equipment- Pulsed electric field and pulsed intense light, ultrasound, dielectric heating, ohmic and infrared heating, high pressure processing, microwave processing, Cold Plasma technology, etc. Quality tests and shelf-life of preserved foods.

PRACTICAL

Demonstration of various perishable food items and degree of spoilage; Blanching of selected food items; Preservation of food by heat treatment- Pasteurization; Preservation of food by high concentration of sugar: Jam; Preservation of food by using salt: Pickle; Preservation of food by using acidulants i.e. pickling by acid, vinegar or acetic acid; Preservation of food by using chemical preservatives; Preservation of bread, cake using mold inhibitors; Drying of fruit slices pineapple slices, apple slices in cabinet drier; Drying of green leafy vegetables; Drying of mango/ other pulp by foam-mat drying; Drying of semisolid foods using roller dryers; Drying of foods using freeze drying process; Demonstration of preserving foods under cold vs. freezing process; Processing of foods using fermentation technique, i.e. preparation of sauerkraut; Study on effect of high pressure on microbe; Study on effect of pulse electric field on food.

TEACHING SCHEDULE

THEORY [FT-111]

Lecture No.	Topic	Sub-topics/ Key Points	Weightage (%)
1-2	Food	i) Definition and Functions, ii) Classification of foods, sources, iii) Types and perishability of foods iv) Causes and types of food spoilage v) Scope and benefit of food preservation.	10
3-5	Food processing	i) Introduction, levels and techniques ii) Methods of food preservation iii) Preservation by salt and sugar: Principle, method and effect on food quality.	10
6-8	Preservation by heat treatment	Principle, process and equipment for blanching, canning, pasteurization, sterilization.	10
9-12	Preservation by use of low temperature	Principle, methods, equipment.	14
13-14	Preservation by drying, dehydration and concentration	Principle, methods, equipment.	8
15-16	Preservation by irradiation	Principle, methods, equipment.	8
17-19	Preservation by chemicals.	Antioxidants, mould inhibitors, antibodies, acidulants, Hurdle technology etc.	5
20-21	Preservation by fermentation	Principles, methods, equipment.	5
22-25	Quality tests and shelf-life of preserved foods.	Physico-chemical, Sensory attributes shelf-life determination by using two methods i.e. Real time shelf life and Accelerated shelf life.	10
26-32	Non-thermal preservation processes	Principles, equipment – Pulsed electric field and pulsed intense light, ultrasound, dielectric heating, ohmic and infrared heating, high pressure processing, microwave processing, Cold Plasma technology, etc.	20
		Total =	**100**

TEACHING SCHEDULE

PRACTICAL [FT-111]

Exercise No.	Exercise Title
1	Demonstration of various perishable food items and degree of spoilage
2	Blanching of selected food items
3	Preservation of food by heat treatment- Pasteurization
4	Preservation of food by high concentration of sugar: Jam
5	Preservation of food by using salt: Pickle
6	Preservation of food by using acidulants i.e. Pickling by acid, vinegar or acetic acid
7	Preservation of food by using chemical preservatives
8	Preservation of bread and cake using mold inhibitors
9	Drying of fruit slices- pineapple slices and apple slices in cabinet drier
10	Drying of green leafy vegetables
11	Drying of mango/ other pulp by foam-mat drying
12	Drying of semisolid foods using roller dryers
13	Drying of foods using freeze drying process
14	Demonstration of preserving foods under cold vs. freezing process
15	Processing of foods using fermentation technique, i.e. preparation of sauerkraut
16	Study on effect of high pressure on microbe; Study on effect of pulse electric field on food.

Suggested Readings [FT-111]:

1. Brennan, J.G. 2006. Food Processing Handbook. Wiley-VCH Verlag GmbH and Co KGaA, Weinheim, Germany.
2. Desrosier N.W. and Desrosier, J.N. 1977. The Technology of Food Preservation. 4th edn. AVI Publishing Co., Connecticut, USA. Fellows, P. 2000.
3. Food Processing Technology: Principles and Practice. 2nd edn. CRC Press, Boca Raton, FL, USA.
4. Karel, M. and Lund, D.B. 2003. Physical Principles of Food Preservation. 2nd edn. Marcel Dekker, Inc., NY, USA.
5. Lal, G., Siddappa, G.S. and Tandon, G.L. 1959. Preservation of Fruits and Vegetables. ICAR, New Delhi.
6. Potter, N. N. and Hotchkiss, J.H. 1995. Food Science. 5th edn. Chapman and Hall, NY, USA. Rahman, M.S. 2007. Handbook of Food Preservation. 2nd edn. CRC Press, Boca Raton, FL, USA. Stavros Y. 2008.
7. Solving Problems in Food Engineering. Springer Science + Business Media, NY, USA. Tewari, G. and Juneja, V.K. 2007.
8. Advances in Thermal and Non-Thermal Food Preservation. Blackwell Publishing, Ames, Iowa, USA.
9. Zeuthen, P. and Bùgh-Sùrensen, L. 2003. Food Preservation Techniques. CRC Press LLC, Boca Raton, FL, USA.

Semester	**:**	**I**			
Course No.	**:**	**FQA-111**	**Credit Hrs.**	**:**	**3(2+1)**
Course Title	**:**	**Food Chemistry-I**			

SYLLABUS

Objectives:

(i) To learn the chemical aspects of food and bio-materials and its importance in food processing,
(ii) To gain an understanding of various water and macro-molecules and
(iii) To have an idea of about the effect of processing on these biomolecules.

THEORY

Water; Moisture in foods, Role and type of water in foods, Functional properties of water, Water activity and Sorption isotherm, Molecular mobility and Foods stability; Dispersed systems of foods: Physicochemical aspects of food dispersion system (Sol, gel, foam, emulations); Rheology of diphase systems. Carbohydrates; Monosaccharaides, Disaccharides and Polysaccharides, Modification of carbohydrates, Dietary fibers and Carbohydrates digestibility; Enzymatic and Chemical reactions of carbohydrates. Proteins in foods: Proteins-Classification, Structure and Properties; Proteins and Nutrition, Functional properties of proteins; Processing induced, Physical, Chemical and Nutritional changes in protein; Chemical and Enzymatic modification of protein. Lipids in foods: Classification, structure and properties of lipids; Role and use of lipids/fat, Crystallization and Consistency, Chemical aspects of lipids, Lipolysis, Auto-oxidation, Thermal decomposition, Chemistry of frying technology of fat and oil; Oil processing: Refining, Hydrogenations, Inter esterification, Use of oils and Fats in food formulation. Enzymatic and Chemical reactions of fats; Rancidity and its types, Detection techniques, Chemical aspects of lipids, Antioxidants.

PRACTICAL

Determination of moisture content of foods using different methods; Studies of sorption isotherms of different foods; Swelling and Solubility characteristics of starches; Rheological properties of food systems; Determination of crude proteins by Micro-Kjeldhal method; Determination of essential amino acids i.e. lysine, tryptophan, methionine, etc.; Isolation of egg and milk protein; Preparation of protein isolate and Concentrate of proteins; Determination of Acid value, Saponification value and Iodine number of fat/oil; Assay of amylases, Papain and Lipases.

TEACHING SCHEDULE

THEORY [FQA-111]

Lecture No.	Topic	Subtopics/ Key Points	Weightage (%)
1-6	Water	1. Moisture in foods, Role and Types of water in foods, Functional properties of water. 2. Water activity and sorption isotherm, Molecular mobility and Foods stability. 3. Dispersed systems of foods. 4. Physicochemical aspects of food dispersion system (Sol, gel, foam, emulations). 5. Rheology of diphase systems.	20
7-13	Carbohydrates	1. Monosaccharides, Disaccharide and Polysaccharides, 2. Modification of carbohydrates, 3. Dietary fibers and Carbohydrates digestibility. 4. Enzymatic and Chemical reactions of carbohydrates.	20
14-19	Proteins in foods	1. Classification, Structure and Properties, 2. Proteins and Nutrition, 3. Functional properties of proteins, 4. Processing induced Physical, Chemical and Nutritional changes in protein, 5. Chemical and Enzymatic modification of protein.	20
20-26	Lipids in foods	1. Classification, Structure and Properties of lipids. 2. Role and Use of lipids/fat. 3. Crystallization and Consistency. 4. Chemical aspects of lipids, Lipolysis, Auto-oxidation, Thermal decomposition. 5. Chemistry of frying technology of fat and oil. 6. Oil processing: Refining, hydrogenation's, Inter esterification, Use of oils and fats in food formulation.	25
27-32	Enzymes	1. Enzymatic and Chemical reactions of fats, 2. Rancidity and its types, 3. Detection techniques, 4. Chemical aspects of Lipids, Antioxidants.	15
		Total=	**100**

TEACHING SCHEDULE

PRACTICAL [FQA-111]

Exercise No.	Exercise Title
1	Study of laboratory equipments/ apparatus
2	Determination of moisture content of foods using different methods
3	Qualitative test for carbohydrates
4	Qualitative test for amino acids
5	Qualitative test for proteins: (Salting out test, acid precipitation of protein test)
6	Qualitative test for lipids/fats
7	Studies of sorption isotherm of different foods
8	Swelling and solubility characteristics of starches
9	Determination of total sugar and reducing sugar in food
10	Determination of crude proteins by Micro-Kjeldhal method
11	Preparation of protein isolate and concentrate of proteins
12	Test for detection of different oils (Baudouin test, Halphens test)
13	Test for detection of different oils (Hexabromide test)
14	Determination of Acid value of fat/oil
15	Determination of Saponification value and Iodine number of fat/oil
16	Experiments with food enzymes

Suggested Readings [FQA-111] :

1. **Brady, J.W. 2013.** Introductory Food Chemistry. Comstock Publishing Associates, Cornell University Press, Ithaca, USA.
2. **Belitz, H.D., Grosch, W. and Schieberle, P. 2009.** Food Chemistry, 4th edn. Springer-Verlag Berlin Heidelberg.
3. **Fennema, O.R. 1996.** Food Chemistry, 3rd Edn. Marcel Dekker, Inc., New York, USA.
4. **Meyer, L.H. 1974.** Food Chemistry. The AVI Publishing Co Inc., Connecticut, MA, USA.

Semester	**:**	**I**		
Course No.	**:**	**FQA-112**	**Credit Hrs.**	**: 3(2+1)**
Course Title	**:**	**General Microbiology**		

SYLLABUS

Objectives:

(i) To identify the micro-organisms, their structure and growth characteristics and

(ii) To acquaint with techniques for cultivation and preservation and control.

THEORY

Scope and History of Microbiology: (Notable contributions of Leeuwenhoek, Pasteur, Koch, etc.). Place of Microorganisms in Living World; Groups of Microorganisms; Applied area of Microbiology. Classification and Identification of microorganisms; Major Characteristics of Microorganisms, Methods of classification of bacteria. Microscopy: Introduction to microscope; Component of microscope; Types of microscope and Microscopic techniques. Microbial Ultrastructure and Functions: Morphological features; Structures external to cell wall, Cell wall; Structures internal to cell wall. Cultivation and Preservation of microorganisms: Nutritional requirements; Types of media. Physical condition required for the growth; Enumeration methods for microorganisms. Bacterial Metabolism and Growth: Reproduction of bacteria; Growth of bacteria: Growth curve, Continuous culture, Synchronous culture; Methods of isolation of pure cultures; Maintenance and Preservation of pure cultures; Culture collections. Control of microorganisms: Physical and Chemical agents. Bacterial Genetics. Structure and Functions of DNA and RNA; Overview of replication and regulation.

PRACTICAL

Practical Microscopy; Micrometry; Cleaning and sterilization of glassware and acquainting with equipment used in microbiology; Preparation of nutrient agar media and techniques of inoculation; Staining methods (Monochrome staining, Gram staining, Negative staining, Capsule-staining, Flagella staining and Endospore staining); Pure culture techniques (Streak plate/Pour plate/Spread plate); Identification procedures (Morphology and Cultural characteristics); Growth characteristics of fungi: Determination of microbial numbers, Direct plate count, generation time; Factors influencing growth: pH, Temperature, Growth curves for bacteria.

TEACHING SCHEDULE

THEORY [FQA-112]

Lecture No.	Topic	Sub-topics/Key Points	Weightage (%)
1-2	Scope and History of Microbiology	Notable Contributions of Leeuwenhoek, Pasteur, Koch, Edward Jenner, Ignaz Semmelweis, Louis Pasteur Joseph Lister, Paul Ehrlich, Alexander Fleming, etc. in Microbiology. Scope and economic importance of microorganisms, Applied area of Microbiology: Industrial Microbiology, Aquatic and Marine Microbiology, Public health Microbiology, Immunology, Food and Dairy Microbiology.	5
3-4	Place of Microorganisms in Living World;	Overview of the major groups of microorganisms, Role of Microorganisms in Ecosystem and Human Health, Ecosystem: Nutrient cycling, Organic matter decay, Pollution remediation, Climate change Human Health: Digestion, Immune system, Detoxification, Protection, Reproductive health.	5
5-10	Classification and Identification of Microorganisms	Microbial classification, Nomenclature and Identification; Taxonomic groups; General-, Methods of classifying bacteria; Major Characteristics of microorganisms: Cell types (Prokaryotic and Eukaryotic) and Presence of nuclear membrane; Methods of classification of bacteria: Gram stain, Shape, Cell wall composition, Respiration and Nutrition; Other methods for classifying microbes include: Differential staining, Biochemical testing, DNA fingerprinting or DNA base composition, Polymerase Chain Reaction and DNA Chips.	10
11-14	Microscopy	Microscopy and Microscopes: Principles, Simple and Compound microscopes, Phase. i) Introduction to microscope; ii) Types of microscopes: Optical microscopes, Electron microscopes, Scanning probe microscopes, Atomic force microscopes (AFMs), iii) Components of microscope: iv)Microscopic Techniques: Fluorescent microscopy, Electron microscopy (SEM and TEM), Applications, Smears and Staining	10

Continued…

15-17	Microbial Ultrastructure and Functions:	General structure of Prokaryotic and Eukaryotic Cells, Cell wall, Plasma membrane, Protoplasm, Endoplasmic reticulum, Lysosome, Golgi apparatus, Centriole, Cilia, Flagellum, Storage bodies, Ribosomes, Chloroplasts, Mitochondria and Nucleus. Morphology and Fine Structure of Bacteria, Size, Shape, Arrangement and Bacterial structures: Flagella, Pili, Capsule, Sheaths and Stalks.	10
18-21	Cultivation and Preservation of Microorganisms:	Cultivation of Bacteria, Nutritional requirements; Nutritional classification of Bacteria; Phototrophs, Chemotrophs, Autotrophs and Heterotrophs; Obligate parasites. Bacteriological media, Types of media and Physical conditions required for growth, Reproduction of Bacteria- Binary fission, budding. Maintenance and preservation of pure cultures; Methods of isolation of pure cultures: Streak plate, Pour plate and Spin plate methods; Growing the culture, Preserving in glycerol, Cryopreservation, Lyophilization, Maintenance media; Culture collections: Preservation, Distribution, Catalogues.	13
22-25	Bacterial Metabolism and Growth	i) Reproduction of Bacteria: Binary fission, Other Asexual reproduction methods, Genetic recombination, Factors affecting reproduction, Reproduction in different species, Sexual reproduction. ii) Growth of bacteria: Growth curve and phases; Continuous culture: Chemostat, Turbidostat, Perfusion Synchronous culture: Cell synchronization, Growth Kinetics, Quantitative measurement of bacterial growth; Recombination machinery, Meiotic recombination.	12
26-30	Control of Microorganisms	i) Physical agents: Temperature, Radiation, Other energies; ii) Chemical agents: Disinfectants, Antiseptics, Antibiotics, Chemotherapeutic antimicrobial chemicals.	15
31	Bacterial Genetics	Bacterial recombination; Mutation; Gene transfer, Transduction, Homologous recombination, Plasmids, Conjugation, DNA replication.	10
32	Structure and Functions of DNA and RNA	Overview of Replication and Regulation, Structure, Function, Sugar, Bases, Nucleotides, Nitrogen bases and Types of RNA.	10
		Total=	**100**

TEACHING SCHEDULE

PRACTICAL [FQA-112]

Exercise No.	Exercise Title
1	Experiment on Microscopy
2	Experiment on Micrometry
3	Cleaning and sterilization of glassware and acquainting with equipment used in Microbiology
4	Preparation of nutrient agar media and techniques of inoculation
5	Staining methods: Study on Monochrome staining
6	Staining methods: Study on Gram staining, negative staining
7	Staining methods: Study on Capsule-staining
8	Staining methods: Study on Flagella staining
9	Staining methods: Study on Endospore staining
10	Pure culture techniques (Streak plate)
11	Pure culture techniques (Pour plate)
12	Pure culture techniques (Spread plate)
13	Identification procedures (Morphology and Cultural characteristics)
14	Growth characteristics of bacteria: Determination of microbial numbers, direct plate count.
15	Generation time; Factors influencing growth: Effect of pH on growth curves for bacteria.
16	Generation time; Factors influencing growth: Effect of temperature on growth curves for bacteria.

Suggested Readings [FQA-112]:

1. **Pelczar Jr., M.J., Chan, E.C.S. and Krieg, N.R. 1998.** Microbiology. 5thedn. Tata McGraw-Hill Education, New Delhi.
2. **Tortora, G.J., Funke, B.R. and Case, C.L. 2014.** Microbiology: An Introduction. 12thedn. Prentice-Hall, NY, USA.
3. **Willey, J.M., Sherwood, L.M. and Woolverton, C.J. 2013.** Prescott's Microbiology. 9th edn. McGraw-Hill Higher Education, NY, USA.

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Semester	**:**	**I**	
Course No.	**:**	**FE-111**	**Credit Hrs. : 3(2+1)**
Course Title	**:**	**Post Harvest Engineering**	

SYLLABUS

Objectives: (i) To understand the basic post-harvest operations,

(ii) To gain an understanding of various engineering properties and

(iii) To differentiate between different types of material handling systems.

THEORY

Overview of Post-Harvest Technology. Concept and Science, Introduction to different Agricultural crops, their Cropping pattern, Production, Harvesting and Post-harvest losses, Reasons for losses, Importance of loss reduction, Post-Harvest Handling operations. Water Activity; Water binding and its effect on Enzymatic and Non-enzymatic reactions and Food texture, Control of water activity and Moisture. Engineering Properties of Food Materials; Physical, Thermal, Aerodynamic, Optical, Mechanical, Rheological and Electromagnetic properties and their measurement. Cleaning; Cleaning of grains, Washing of fruits and Vegetables, Types of cleaners, Screens, Types of screens, Rotary screens, Vibrating screens, Machinery for cleaning of fruits and vegetables (air cleaners, washers), Cleaning efficiency, Care and Maintenance; Peeling. Sorting, Grading, Methods of grading; Grading- Size grading, Colour grading, Specific gravity grading; Screening, Equipment for grading of fruits and vegetables, Grading efficiency, Care and Maintenance. Magnetic separator, Destoners, Electrostatic separators, Pneumatic separator. Decorticating and Shelling; Principles of working, Design and Constructional details, Operating parameters, Maintenance, etc. of various decorticators/dehullers/shellers, Description of groundnut decorticators, maize shellers, etc. Milling, Polishing, Grinding, Milling equipment, De-huskers, Polishers (abrasion, friction, water jet), Flour milling machines, Pulse milling machines, Grinders, Cutting machines, Oil expellers, Machine efficiency and Power requirement. Materials handling; Introduction to different conveying equipment used for handling of grains; Scope and Importance of material handling devices. Study of different Material Handling systems; Classification, Principles of operation, Conveyor system selection/design; Belt conveyor: Principle, Characteristics, Design, Relationship between belt speed and width, Capacity, Inclined belt conveyors, Idler spacing, Belt tension, Drive tension, Belt tripper; Chain conveyor: Principle of operation, Advantages, Disadvantages, Capacity and Speed, Conveying chain; Screw conveyor: Principle of operation, Capacity, power, Troughs, Loading and Discharge, Inclined and Vertical screw conveyors; Bucket elevator: Principle, Classification, Operation, Advantages, Disadvantages, Capacity, Speed, Bucket pickup, Bucket discharge, Relationship between belt speed, Pickup and Bucket discharge, Buckets types, Power requirement; Pneumatic conveying system: Types, Air/Product separators; Gravity conveyor design considerations, Capacity and Power requirement.

PRACTICAL

Study of cleaners for grains; Study of washers for fruits and vegetables; Study of graders for grains; Study of graders for fruits and vegetables; Study of decorticators; Study of a maize/ sunflower sheller; Study of crop dryers; Study of a RF/MW/tray dryer; Study of hot air dryer and modelling drying kinetics; Study of vacuum dryer and modelling drying kinetics; Study of working principle of spray dryer and spray drying process; Study of drum dryer and liquid food dehydration using drum drying; Study of fluidized bed dryer and drying process; Study of freeze dryer and freeze drying process; Study of different materials handling equipment.

TEACHING SCHEDULE

THEORY [FE-111]

Lecture No.	Topic	Sub-topics/ Key Points	Weightage (%)
1-2	Overview of Post-Harvest Technology	Definition and Overview of Post-Harvest Technology/ Engineering	5
3-5	Concept and Science	Introduction to different agricultural crops, Cropping Pattern, Production, Post harvesting and Post-harvest losses, Reasons for losses, Importance of loss reduction, Post-harvest handling operations.	10
6-8	Water Activity	Water binding, Effects on enzymatic and Non-enzymatic reactions and Food texture, Control of water activity and moisture.	10
9-14	Engineering Properties of Food Materials	Physical, Thermal, Aerodynamic, Optical, Mechanical, Rheological and Electromagnetic properties and their measurement.	10
15-16	Cleaning	Cleaning of grains, Washing of fruits and vegetables, Types of cleaners; Screens, Types of screens- rotary screens, vibrating screens; Machinery for cleaning of fruits and vegetables (air cleaners, washers); Cleaning efficiency; Care and Maintenance; Peeling.	10
17-20	Sorting, Grading and Methods of grading	Size grading, Colour grading, Specific gravity grading; Screening, equipment for grading of fruits and vegetables, Grading efficiency, Care and maintenance, Magnetic Seperator, Destoners, Electrostatic separators, Pneumatic separator	15

Continued…

21-23	Decorticating and Shelling	Working Principle, Design and Constructional details, Operating parameters, Maintenance of various decorticators/ dehullers/ shellers, groundnut decorticators, Maize shellers etc.	10
24-26	Materials Handling	Different conveying equipments used for handling of grains; Scope and importance of material handling devices	10
27-32	Different Material Handling Systems	Classification, Principles of operation, Conveyor system selection/design; Belt conveyor: Principle, Characteristics, Design, Relationship between belt speed and width, capacity, inclined belt conveyors, idler spacing, belt tension, drive tension, belt tripper; Chain conveyor: Principle of operation, Advantages, Disadvantages, Capacity and Speed, Conveying chain; Screw conveyor: Principle of operation, Capacity, Power, Troughs, Loading and Discharge, Inclined and Vertical screw conveyors; Bucket elevator: Principle, Classification, Operation, Advantages, Disadvantages, Capacity, Speed, Bucket pickup, Bucket discharge, Relationship between belt speed, pickup and bucket discharge; Buckets types, power requirement; Pneumatic conveying system: types, air/product separators; Gravity conveyor: design considerations, capacity and power requirement.	20
		Total =	**100**

TEACHING SCHEDULE

PRACTICAL [FE-111]

Exercise No.	Exercise Title
1	Study of cleaners for grains
2	Study of washers for fruits and vegetables
3	Study of graders for grains
4	Study of graders for fruits and vegetables
5	Study of decorticators
6	Study of a maize/ sunflower sheller
7	Study of crop dryers
8	Study of a RF/MW/Tray dryer
9	Study of hot air dryer and modelling drying kinetics
10	Study of vacuum dryer and modelling drying kinetics
11	Study of working principle of spray dryer and spray drying process
12	Study of drum dryer and liquid food dehydration using drum drying
13	Study of fluidized bed dryer and drying process
14	Study of freeze dryer and freeze-drying process
15	Study of different materials handling equipment (Belt conveyors and Screw Conveyors)
16	Study of different materials handling equipment (Pneumatic conveyors)

Suggested Readings [FE-111]:

1. **Boumans, G. 1985.** Grain Handling and Storage. Elsevier Science Publishers, Amsterdam, The Netherlands.
2. **Brennan, J.G. 2006.** Food Processing Handbook. Wiley-VCH Verlag GmbH and Co. KGaA, Weinheim, Germany.
3. **Chakraverty, A. 2008.** Post Harvest Technology of Cereals, Pulses and Oilseeds, 3rd edn. Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi.
4. **Chakraverty, A. and Singh, R.P. 2014.** Post Harvest Technology and Food Process Engineering. CRC Press, Boca Raton, FL, USA.

List/ Bouquet of Skill Enhancement Courses (SECs)

Discipline/ Department	Sr. No.	Course No.	Course Title	Credits (Hrs.)
Food Technology	**1**	FT/SEC	Introduction to Drying Technology and Dryers	2(0+2)
	2	FT/SEC	Introduction to Processing of Extruded Foods	2(0+2)
	3	FT/SEC	Introduction to Milling (Rice, Dal, Spices, etc.)	2(0+2)
Food Quality Assurance	**1**	FQA/SEC	Introduction to Food Safety and Sanitation	2(0+2)
	2	FQA/SEC	Introduction to Good Laboratory Practices	2(0+2)
	3	FQA/SEC	Basic Food Analysis Laboratory Techniques	2(0+2)
Food Engineering	**1**	FE/SEC	Introduction to Electrical and Control Systems in Food Industry	2(0+2)
	2	FE/SEC	Introduction to Mechanical Systems in Food Industry	2(0+2)
	3	FE/SEC	Introduction to AutoCAD	2(0+2)
Food Plant Operations	**1**	FPO/SEC	Maintenance of Food Processing Equipment	2(0+2)
	2	FPO/SEC	Introduction to Bottling and Canning Line	2(0+2)
	3	FPO/SEC	Introduction to Manufacturing of Bakery Products	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.

In case of unavailability of said detailed course-wise syllabus 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 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]

Skill Enhancement Courses (SECs): Detailed Syllabi

Food Technology

Semester	**:**	**I**			
Course No.	**:**	**SEC-xxx**	**Credit Hrs.**	**:**	**2(0+2)**
Course Title	**:**	**Introduction to Drying Technology and Dryers**			

TEACHING SCHEDULE

PRACTICAL

Exercise No.	Exercise Topic/ Title
1	Introduction to drying process and its mechanism
2	Understanding of different methods for moisture estimation
3	Determination of moisture content with oven method
4	Determination of drying characteristics and study of kinetics
5	Prediction of moisture sorption isotherms
6	Determination of equilibrium moisture content of grain
7	Introduction to different dryings theories and its importance
8	Introduction to different methods of drying (Contact, Convective and Radiation).
9	Principle and Operational mechanism involved in Cabinet and Tunnel Drying
10	Principle and Operational mechanism involved in Spray Drying
11	Principle and Operational mechanism involved in Roller/ Drum Drying
12	Principle and Operational mechanism involved in fluidized bed drying
13	Principle and Operational mechanism involved in foam-mat drying
14	Principle and Operational mechanism involved in microwave drying
15	Principle and Operational mechanism involved in vacuum oven drying
16	Principle and Operational mechanism involved in solar drying
17	Principle and Operational mechanism involved in refractance window drying of foods

18	Study of pretreatment methods for drying and dehydration
19	Study of operational principle and working of freeze dryer
20	Study of Rehydration/ Reconstitution properties of dehydrated foods
21	Drying of fruit slices in cabinet drier
22	Drying of green leafy vegetables
23	Drying of mango/ other pulp by foam-mat drying
24	Drying of foods using roller dryer and Spray dryer
25	Drying of foods using freeze drying process
26	Preparation of Mango Leather
27	Preparation of Osmo-Dehydrated Food Products (Candied Fruits, Glazed Fruits)
28	Preparation of dehydrated raisins
29	Study of packaging, labelling and FSSAI Regulations of Dehydrated products
30	Industrial Visit(s) to different dehydration Units
31	Case study on fruits and vegetable drying

Semester	**:**	**I**		
Course No.	**:**	**SEC-xxx**	**Credit Hrs.**	**: 2(0+2)**
Course Title	**:**	**Introduction to Processing of Extruded Foods**		

TEACHING SCHEDULE

PRACTICAL

Exercise No.	Exercise Topic/ Title
1	Introduction and market survey of extruded products
2	Introduction of food extruders components and their functions
3	Principle and operational mechanism involved in cold and hot extruder (Single and Twin-Screw Extruder)
4	Preparation of spaghetti pasta
5	Preparation of penne pasta
6	Preparation of noodles
7	Preparation of vermicelli
8	Preparation of instant noodles
9	Quality evaluation of pasta products
10	Demonstration of extrusion products (extruded snacks/ breakfast cereal/ texturized vegetable protein)
11	Preparation of traditional extruded products (sev/ chakli)
12	Evaluation of physical properties of expanded snacks
13	Evaluation of water and milk hydration properties of breakfast cereal
14	Evaluation of functional properties of expanded snacks
15	Evaluation of functional properties of texturized vegetable protein
16	Preparation of plant-based meat analogue by using extruder
17	Preparation of cereal, pulses based ready-to-eat snack food by extrusion cooking
18	Preparation of extruded confectionary product
19	Effect of feed moisture content on extrudate food product characteristic
20	Studies on development of weaning food by extrusion technology
21	Texture profile analysis of extruded product

22	Preparation of dietary fiber rich extruded product
23	Quality evaluation of commercially available extruded food products
24	Packaging of Extruded products
25	Quality evaluation of different extruded products
26	Determination of techno-economic feasibility of prepared extruded product
27	Sensory evaluation of prepared extruded products
28	Labelling and FSSAI Regulations of different extruded products
29-30	Visit to Commercial Extrusion Unit

Semester	**:**	**I**		
Course No.	**:**	**SEC-xxx**	**Credit Hrs.**	**: 2(0+2)**
Course Title	**:**	**Introduction to Milling (Rice, Dal, Spices, etc.)**		

TEACHING SCHEDULE

PRACTICAL

Exercise No.	Exercise Topic/ Title
1	Introduction and market survey of milled rice, dal and spices
2	Determination of Physical Properties of rice grain, dal and spices
3	To study the defects in grains and milled rice, dal and spices by physical observation
4	Determination of moisture content in different milled product
5	Studies on traditional methods of milling of dal and rice grains
6	Cleaning of rice, dal and spices for milling
7	Studies on different dehusking and deshelling equipments involved in the milling of paddy grains
8	Principles and Operational mechanism of rice mills
9	Determination of Head Rice Yield (HRY), Milled Rice Yield (MRY) and % Brokens
10	Determination of polishing quality of paddy
11	Studies on different by-products of paddy milling
12	Studies on different methods and pretreatments involved in pulse milling
13	Studies on Dry milling and Wet milling of pulses for production of dal
14	Principles and Operational mechanism of Dal Mills
15	Cleaning and inspection for effective grading and sieving of grains based on size and grade
16	Demonstration of the procedure of cleaning of unprocessed whole spices
17	Principles and Operational mechanism of Spice Mills
18	Manufacture of Dalia from cereals and legumes

19	Production process of rice from paddy
20	Study on Mini Dal Mill
21	Studies on utilization of by-products from dal milling industry
22	Preparation of turmeric powder
23	Preparation of curry powder
24	Recipe formulation and preparation of different spice mix powders (Turmeric, Chilli, Onion, Ginger etc.)
25	Sieve analysis of milled products for particle size distribution
26	Milling yield calculation for different grains
27	Packaging and storage techniques for milled products
28	Techno-economic feasibility of prepared spice powder and milled dal
29	Case study on spice powder processing industries
30	To study milling quality of rice, dal and spices
31	Study of packaging, labelling and FSSAI Regulations of Dehydrated products
32	Visit to Commercial Rice mill, Dal mill and Spice industry.

Food Quality Assurance

Semester	**:**	**I**			
Course No.	**:**	**SEC-xxx**	**Credit Hrs.**	**:**	**2(0+2)**
Course Title	**:**	**Introduction to Food Safety and Sanitation**			

TEACHING SCHEDULE

PRACTICAL

Exercise No.	Exercise Topic/ Title
1-2	Understanding Food Safety and Sanitation: Concept, Terms and Importance
3-4	Developing the process flow for the food establishment including all the inputs, outputs and interim loops
5-6	Data collection for identification of biological, chemical and physical hazards
7-8	Hazard Analysis using FMEA Technique for Risk Assessment
8	Demonstration of Correct method of washing hands
9	Assessment of personal hygiene
10-11	Identifying the Key Focus Areas for GHP and GMP
12-13	Identifying Gaps in its Implementation; Closure Plans for Identified Gaps
14-15	Importance of temperature control and Demonstrating proper cooking, cooling and reheating temperatures using thermometers
16-17	Introduction to HACCP
18-19	Development of OPRP (Operational Pre-requisite Programme) and Development of HACCP Plan (Critical Limits including Rationale for Limits)
20-21	Monitoring Procedure, Correction and Corrective Measures
22-23	Introduction to Cleaning agents and Techniques for Sanitizing surfaces
24-25	Hands-on Demonstration of using Chemical Sanitizers correctly
26-27	To recognize signs of pest infestations and methods of control
28-29	Demonstration of segregation of waste
30-31	To study proper disposal methods for different types of waste
31-32	Practice identifying common food allergens and labelling

Semester	**:**	**I**		
Course No.	**:**	**SEC-xxx**	**Credit Hrs.**	**: 2(0+2)**
Course Title	**:**	**Introduction to Good Laboratory Practice**		

TEACHING SCHEDULE

PRACTICAL

Exercise No.	Exercise Topic/ Title
1-2	Introduction and Importance of Good Laboratory Practices
3-4	Practical session on identifying hazards and using appropriate Personal Protective Equipment
5-6	Hands-on practice with common lab equipment (e.g., microscopes, pipettes, balances, centrifuges etc.)
7-8	Equipment calibration techniques and How to properly maintain instruments
9-10	Techniques for cleaning, drying and sterilizing lab glassware to prevent contamination
11-12	Autoclave operation for Sterilization, Calibration of balances, pH meters and Spectrophotometers
13-14	Sample collection techniques for biological, chemical, or environmental samples
15-16	Correct labelling and storage procedures to maintain integrity
17-18	Proper segregation and disposal of hazardous and non-hazardous lab waste
19-20	Understanding chemical compatibility and safe disposal practices
21-22	Performing basic quality control tests like titration, pH measurement and UV-Vis Spectrophotometry to assess the purity and quality of samples
23-25	Aseptic techniques for handling microbial cultures, preparing agar plates and transferring cultures
26-28	Detecting, recording and reporting errors or deviations in experimental work
29-30	Writing and following SOPs for basic lab techniques like, solution preparation or instrument usage

Semester	**:**	**I**			
Course No.	**:**	**SEC-xxx**	**Credit Hrs.**	**:**	**2(0+2)**
Course Title	**:**	**Basic Food Analysis Laboratory Techniques**			

TEACHING SCHEDULE

PRACTICAL

Exercise No.	Exercise Topic/ Title
1-2	Sampling plan; Sample collection and preparation for analysis
3-4	Sensory evaluation techniques of food products
5-6	Quality evaluation of food products for color and taste of marketed products
7-8	Determination of moisture content in food samples
9-10	Water analysis
11-12	Determination of ash content in food samples
12-13	Determination of crude fat in food samples
14-15	Determination of crude protein in food samples by Kjeldahl method
15-16	Determination of crude fibre in food samples
17	Qualitative tests for sugars
18-19	Qualitative tests for proteins, Colorimetric estimation of protein concentration
20-21	Estimation of total and reducing sugars
22-23	Measuring the pH of various food samples like fruits, dairy, and beverages
24-25	Determining the acidity in food samples by titrating with a base
26-27	Determination of Total Soluble Solids and Vitamin C in food samples
28	Determination of Salt Content in food samples
29-30	Estimation of chlorophyll and carotenoids in food samples
31	Estimation of Macro and Micro Minerals
32	Visit to NABL-Accredited Food Laboratory

Food Engineering

Semester	**:**	**I**			
Course No.	**:**	**SEC-xxx**	**Credit Hrs.**	**:**	**2(0+2)**
Course Title	**:**	**Introduction to Electrical and Control Systems in Food Industry**			

TEACHING SCHEDULE

PRACTICAL

Exercise No.	Exercise Topic/ Title
1-2	Build simple electrical circuits using resistors, capacitors and inductors
3	Measurement of voltage, current and resistance using a multimeter
4-5	Explore different types of sensors used in food processing
6-7	Performing calibration exercises with EC/ pH meter. Study of different types of motors (AC, DC, Stepper) and their applications
8-9	Developing a motor control circuit for a conveyor system
10-11	Programming simple control sequences using PLC software
12	Creating a basic ladder logic diagram for a conveyor belt system
13	Simulating PID control for a temperature control system
14-15	Designing a simple HMI using software tools (like Factory Talk or Win CC)
16-17	Integrating the HMI with PLC for monitoring and control
18-19	Setting-up a small SCADA system for monitoring a food processing operation
20-21	Understanding data logging and visualization techniques
22	Learning about industrial communication protocols (Modbus, Ethernet/IP)
23	Creating a simple network setup to connect PLCs and HMIs
25	Building and analyze a control loop for a food processing scenario (e.g. Pasteurization)
26	Understanding feedback mechanisms and their importance in control systems
27	To diagnose and troubleshoot faulty electrical circuits
28	To develop systematic approaches to identify common issues
29	To measure and analyze energy consumption in a small-scale food processing set-up
30	To explore energy-saving practices and technologies in the industry
31	Safety Protocols in Electrical Systems
32	Visit of food industry for practical exposure of electrical and control system

Semester	**:**	**I**			
Course No.	**:**	**SEC-xxx**	**Credit Hrs.**	**:**	**2(0+2)**
Course Title	**:**	**Introduction to Mechanical Systems in Food Industry**			

TEACHING SCHEDULE

PRACTICAL

Exercise No.	Exercise Topic/ Title
1-2	Introduction to mechanical system and its application in food industry
3-4	To identify and understand the function of basic mechanical components (gears, belts, pulleys, bearings) used in food machinery
5-6	To study different materials used in food machinery and their properties
7-8	To practice the assembly and disassembly of simple food processing machines (e.g., mixers, blenders)
9-10	To measure and analyze vibration in food processing equipment
11-12	To learn how to identify issues such as misalignment or imbalance
13-14	To perform routine maintenance tasks on mechanical systems (lubrication, belt tensioning)
15-16	To conduct troubleshooting exercises to identify and fix common mechanical failures
17	Study of principles, construction and working of Cleaning equipments
18	Study of principles, construction and working of Sorting/grading equipments
19	Study of principles, construction and working of Washing equipments
20	Study of principles, construction and working of Handling equipments
21	Study of principles, construction and working of Food packaging machines
22-23	To conduct tests to evaluate corrosion resistance and suitability for food contact
24-25	To explore the use of robotic systems for tasks such as packing or palletizing
26-27	To implement quality control measures in a mechanical process (e.g., measuring dimensions of food products)
28-29	To create basic mechanical drawings using CAD software
30-31	Project work to enlist various mechanical parts and its functionality in different food processing industries
32	Visit of Food Industry to identify mechanical systems in food processing

Semester	**:**	**I**		
Course No.	**:**	**SEC-xxx**	**Credit Hrs.**	**: 2(0+2)**
Course Title	**:**	**Introduction to AutoCAD**		

TEACHING SCHEDULE

PRACTICAL

Exercise No.	Exercise Topic/ Title
1-2	Introduction to AutoCAD and its application in the food processing industry
3-4	Familiarization with the AutoCAD interface: toolbars, menus, and command line
4-5	Practice using drawing tools to create geometric shapes
6-7	Experiment with drawing precision using grid and snap features
8	Learning to modify objects using commands such as move, copy, rotate, scale and mirror
9	To perform exercises on editing shapes and lines in an existing drawing
10	To create and manage layers in a drawing
11	To assign different colours and line types to layers for better organization
12	To add linear, radial and angular dimensions to drawings
13-14	To practice dimensioning techniques and understand best practices for clarity
15	To insert text and annotations into a drawing
16	To explore styles and formatting options for clarity and presentation
17-18	To draw a complete 2D engineering drawing of an equipment
19	Introduction to 3D modelling: create basic 3D shapes (cubes, cylinders)
20-21	To practice using 3D viewing tools and rendering techniques
22-23	Setting-up a layout for printing: scaling, title blocks and viewports
24-25	Understanding the file types and compatibility issues (DWG, DXF) to save the AutoCAD files
26	To attach and manage external references in a drawing
27-28	To develop a detailed plan (floor plan, mechanical part) incorporating multiple elements
29-30	To create isometric drawings to represent three-dimensional objects in two dimensions
31-32	To practice isometric dimensioning and labeling

Food Plant Operations

Semester	**:**	**I**			
Course No.	**:**	**SEC-xxx**	**Credit Hrs.**	**:**	**2(0+2)**
Course Title	**:**	**Maintenance of Food Processing Equipment**			

TEACHING SCHEDULE

PRACTICAL

Exercise No.	Exercise Topic/ Title
1-2	Hands-on identification of various types of food processing equipment
3-4	Creation of customized preventive maintenance checklists for different equipment
5-6	Simulated execution of a preventive maintenance routine
7	Understanding the types of lubricants used in food processing
8	Practicing proper lubrication techniques on machinery
9-10	Learning about different cleaning agents and their appropriate use
11-12	Conducting cleaning protocols on equipment in compliance with food safety standards
13-14	Practical exercises in electrical troubleshooting, including circuit testing and voltage measurement
15-16	Dismantling and reassembling parts of common food processing equipment
17-18	Simulated troubleshooting of common equipment malfunctions
19-20	Simulating the documentation of maintenance activities and creating maintenance logs
21	Study of maintenance of cleaning equipment
22-23	Study of care and maintenance of Sorting/Grading equipment
24-25	Study of care and maintenance of Milling equipment
26-27	Study of and care and maintenance of Drying equipment
28-29	Study of care and maintenance of Material Handling equipment
30-31	Study of care and maintenance of Packaging equipment
32	Study of care and maintenance of Storage units

Semester	**:**	**I**			
Course No.	**:**	**SEC-xxx**	**Credit Hrs.**	**:**	**2(0+2)**
Course Title	**:**	**Introduction to Bottling and Canning Line**			

TEACHING SCHEDULE

PRACTICAL

Exercise No.	Exercise Topic/ Title
1-2	Introduction to bottling and canning process
3	Study of sorting and grading equipments
4	Study of washing equipments
5	Study of peeling methods and equipments
6	Study of cutting equipments
7	To perform the blanching of fruits and vegetables
8	To check the adequacy of blanching process
9-10	Study of different types of bottles and cans, including materials and sizes
11	Study of different filling techniques (gravity, pressure, vacuum)
12	Practical session on filling bottles/cans accurately
13	Cutout analysis of cans
14	Hands-on practice on in-bottle sterilization
15	Hands-on practice with various sealing methods (screw caps, corks, can lids)
16	Testing seal integrity using various methods
17	Practical session on labeling machinery operation
18	Coding and printing best practices for product information
19	Conduct quality checks on filled and sealed products
20	Discuss common quality issues and troubleshooting techniques
21	Study of domestic carbonator and carbonation process
22	Learn proper cleaning and sanitation protocols for equipment
23-24	Hands-on cleaning sessions for different parts of the line
25	Basic maintenance tasks for key equipments
26	Troubleshooting common problems in bottling and canning lines
27	Workshop on regulations affecting bottling and canning
28	Product Handling and Storage
29	Practical session on proper storage techniques
30-31	Study of packaging, labelling and FSSAI Regulations of beverages and canned products
32	Visit to Beverage and Canning Industry

Semester	**:**	**I**		
Course No.	**:**	**SEC-xxx**	**Credit Hrs.**	**: 2(0+2)**
Course Title	**:**	**Introduction to Manufacturing of Bakery Products**		

TEACHING SCHEDULE

PRACTICAL

Exercise No.	Exercise Topic
1-2	Introduction and market survey of bakery products
3-4	Study of different methods of preparation of bakery product (Bread, Biscuit, Cake and Cookies etc.)
5-6	Determination of Gluten Content in wheat flour
7-8	Determination of Sedimentation value of wheat flour
9-10	Determination of Pelshenke value of wheat flour
11-12	Determination of water and oil absorption of flour
13-14	Determination of emulsion capacity and stability of flour
15-16	Determination of foaming capacity and stability of flour
17-18	Determination of alkaline water retention capacity of flour
19-20	Preparation and quality evaluation of composite formulation of wheat-based cookies
21-22	Preparation and quality evaluation of millet-based cookie formulations
23-24	Preparation and quality evaluation of crackers
25-26	Preparation and quality evaluation of unleavened flat breads
27-28	Preparation and quality evaluation of leavened breads (White bread, Brown Bread)
29	Preparation and quality evaluation of cake/muffin
30	Preparation and quality evaluation of baked cereal bar
31	Study of packaging, labelling and FSSAI Regulations of bakery products
32	Visit a Commercial Bakery Unit

ANNEXURE-VI

(~ of DICC-Circular No. MAUEB/DICC-Circular/New UG Syllabi/420/24; Dtd. 29.11.2024)

New Undergraduate Degree Syllabus of I-Semester of

B.Sc. (Hons.) Agri-Business Management

Finalized & Approved by the DICC as per the

ICAR - SIXTH DEANS' COMMITTEE REPORT

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

- UG-Certificate in Agri-Business Management
- UG-Diploma in Agri-Business Management
- UG-Degree: B.Sc. (Hons.) Agri-Business Management

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. V.A. Shinde
Professor & Ex-Head (Ag. Econ.), 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 Coordination Committee

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

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

B.Sc. (Hons.) Agri-Business Management

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*/ BOT-111****	Basic Mathematics*/ Basic Botany**	2(2+0)	Need-based
6.	**ABM-111**	Introduction to Agribusiness Management	2(2+0)	
7.	**ECON-111**	Fundamentals of Agricultural Economics	2(2+0)	
8.	**AGRO-111**	Introduction to Agronomy and Crop Production Technology	2(1+1)	
9.	**GPB-111**	Introduction to Genetics and Plant Breeding	2(1+1)	
10.	**PATH-111**	Management of Plant Diseases	2(1+1)	
11.	**SEC-111**	Skill Enhancement Course-I *(To be offered from the bouquet of SEC Courses)*	2(0+2)	
12.	**SEC-112**	Skill Enhancement Course-II *(To be offered from the bouquet of SEC Courses)*	2(0+2)	
		Total Credits Hrs.	**22(12+10) G 2(0+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/ **BOT-111 for **PCM** student / **PCMB** students should opt any one choice-based course viz., MATH-111 or BOT-111 for completion of the mandatory gradial credits.

B.Sc. (Hons.) A.B.M. : First Semester

Course-wise Syllabus with Teaching Schedules

Semester	**:**	**I**	
Course No.	**:**	**CAC-111**	**Credit Hrs. : 2 (0+2) NG/ 2 Weeks**
Course Title	**:**	***Deeksharambh* (Induction-cum-Foundation Course)**	
Non-Gradial Common Academic Course for the said UG degree with the activities to be conducted during initial two weeks.			

Objectives:

(i) To create a platform for students to help for cultural Integration of students from different backgrounds,

(ii) To know about the operational framework of academic process in university, instilling life and social skills,

(iii) To create Social awareness, Ethics and Values, Team work, Leadership, Creativity,

(iv) To identify the traditional values and indigenous cultures along with diverse potentialities both in indigenous and developed scenario.

ACTIVITIES

- Introduction/ Orientation and Discussions on operational framework of academic process in University/ College, as well as interactions with Academic and Research Managers of the University.
- Interaction with Alumni, Business Leaders, Perspective Employers, Outstanding Achievers in related fields and people with inspiring life experiences.
- Group activities to identify the strength and weakness of students and to learn from each other's life experiences.
- Activities to enhance Cultural Integration of students from different backgrounds.
- Field visits to the relevant fields/ establishments.
- Sessions on Personality Development (Instilling Life and Social skills, Social awareness, Ethics and Values, Team work, Leadership etc.) and imbibing the Communication skills.

Note: *The details of the relevant activities will be decided by the parent University in line with the above-mentioned broad activities.*

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/ Title	Weightage (%)
1	Orientation, History, Objectives, Principles, Symbols, Badge	10
2	Regular Programmes under NSS	10
3	Organizational 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, Analyzing 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, Fire-fighting, 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/ Titles	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: précis 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		Précis 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 [AEC-112]

Exercise No.	Exercise Topic/ Title
1	Listening and Note taking
2	Writing skills- Précis 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 patterns 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 lifestyle.

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/ Titles
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*. (2016)**. *Region Specific Synthesized Integrated Farming System Models for Improved Production, Profitability and Nutrition (Series-1).* Bulletin, ICAR-Indian Institute of Farming Systems Research, Modipuram, Meerut (U.P.).
    - **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 (New)**	
Course No.	**: MATH-111***	**Credit Hrs. : 2(2+0) Need-based; G**
Course Title	**: Basic Mathematics**	
***Gradial** Need-based Course only for **B.Sc. (Hons.) Agri-Business Management**		

SYLLABUS

Objectives:

(i) To introduce the basic principles and functions in Mathematics,
(ii) To study differentiation and integration,
(iii) To study matrices and determinants.

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), Derivative of Standard Functions: Algebraic Function, Trigonometric, Logarithmic and Exponential Functions (Formulae only), Examples. Increasing and Decreasing Functions, Growth rate, Average cost, Marginal cost, and Marginal revenue. Examples.

Partial Differentiation: Definition, Homogeneous function, Euler's theorem, Examples. Maxima and Minima of the functions of the form y = f (x) and y = f (x1, x2), 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).

Mathematical Models: Agricultural systems - Mathematical models - Classification of mathematical models- Fitting of Linear, Quadratic and Exponential models to experimental data.

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.

TEACHING SCHEDULE

THEORY [MATH-111]

Lecture No.	Topic	Sub-topics/ Key Points	Weightage (%)
1 - 3	**Algebra: Progressions**	Arithmetic Progression: Definition, Sum of n terms, Examples.	10
		Geometric Progression: Definition, Sum of n terms, Examples. Harmonic Progression: Definitions, Examples.	
3 - 6	**Determinants**	Definition of Determinant, Expansion of determinant up to 3^{rd} order, Examples.	10
		Properties of determinants up to 3^{rd} order (without proof)	
6 - 12	**Matrices**	Definition- Matrices, Order of Matrix, Types of Matrices	20
		Algebra of Matrices: Addition, Subtraction, Multiplication, Examples.	
		Transpose of Matrix and it's Properties (without proof)	
		Inverse of Matrix up to 3^{rd} order by Adjoint method, Examples.	
13 - 20	**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), 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.	
21 - 23	**Partial Differentiation**	Definition, Homogeneous function, Euler's theorem, Examples.	10
		Maxima and Minima of the functions of the form- y = f (x) and y = f (x1, x2), Examples.	
24 - 30	**Integral Calculus**	Definitions 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).	
31 - 32	**Mathematical Models**	Agricultural systems - Mathematical models - classification of mathematical models- Fitting of Linear, Quadratic and Exponential models to experimental data.	10
		Total =	**100**

Semester	**:**	**I**		
Course No.	**:**	**BOT-111****	**Credit Hrs. : 2(2+0)**	**Need-based; G/NG**
Course Title	**:**	**Basic Botany**		
Need-based Common Course among 3 UG Degrees: **B.Tech. (Biotech.) - Gradial / B.Sc. (Hons.) A.B.M. - Gradial / B.Tech. (Food Tech.) - Non-Gradial				

SYLLABUS

Objectives:
i. To study the basic taxonomy and classification of plants,
ii. To study the features of plant kingdom and morphology,
iii. To study the internal structures of plants.

THEORY

Plant Kingdom and Features of each group. Plant taxonomy, Systems of classification. Morphology, Modifications and Functions of Root, Stem, Leaf, Flower and Inflorescence. Pollination and Fertilization. Fruit types. Structure of dicot and monocot seed, and seed germination. Cell structure. Chromosome, DNA and Genes. Cell and tissue types. Internal structure of root, stem and leaf. Characteristics and economic importance of Poaceae, Brassicaceae, Fabaceae, Malvaceae, Rutaceae, Rosaceae, Asteraceae and Solanaceae families.

TEACHING SCHEDULE

THEORY [BOT-111]

Lecture No.	Topics	Sub-topics/ Key Points	Weightage (%)
1-3	**Plant Kingdom and Features:**	Classification of Plant Kingdom (Major plant groups: Bryophytes, Pteridophytes, Gymnosperms, and Angiosperms.) Key distinguishing features/ Characteristics of each group with examples. Plantae Kingdom.	8
4-5	**Plant Taxonomy and Systems of Classification:**	Binomial nomenclature and other systems of classification (in brief)	5
6-7	**Plant Cell and Tissue Types:**	Basic Structure of a Plant Cell and Tissue, Types of Plant Cells and Tissues; Plant Cell Functions.	8
8-9	**Chromosome:**	Definition and Overview, Chemical Composition; Chromosome Morphology, Types of Chromosomes.	8

Continued…

10-11	**DNA:**	Brief historical overview of DNA discovery, Watson-Crick model of DNA, Chemical composition, Components of a nucleotide, Structures of Purines and Pyrimidines.	8
12	**Genes:**	Definitions (Gene, Allele, Genotype, Phenotype, Exon, Intron, Codon) and Historical Overview; Structure: Basic layout of a gene- (Exon, Intron, etc.); Types of genes, Codons (Start/ Stop).	8
13-14	**Pollination and Fertilization:**	Definitions/Terminology, Types, Agents of pollination, Processes/Events, Significances, Barriers to Fertilization, Differences between their types.	10
15-16	**Root and Stem:**	Morphology, Modifications with examples and Functions	8
17-19	**Leaf, Flower and Inflorescence:**	Morphology, Modifications with examples and Functions	8
20	**Fruits:**	Types of fruits with examples	3
21-22	**Structures of Monocot and Dicot Seeds:**	Structure, Diagrams, Differences	5
23-24	**Seed Germination:**	Definitions, Types, Differences and Stages of seed germination	5
Plant taxonomy-Classification; Characteristics and Economic Importance; Members/ Examples of following Families viz.,			
25-26	Poaceae and Brassicaceae		4
27-28	Fabaceae and Malvaceae		4
29-30	Rutaceae and Rosaceae		4
31-32	Asteraceae and Solanaceae		4
		Total=	**100**

Suggested Readings [BOT-111]:

1. Bendre AM and Kumar A, 1999, Textbook of Practical Botany. Vol. 2, 7th Edn, Rastogi Publications.
2. Bendre AM and Pande PC, 2009, Introduction to Botany, Rastogi Publications.
3. Bhatia KN and Tyagi MP, 2020, Elementary Biology. A Truemen Publication.
4. David M Hillis, H Craig Heller, Sally D Hacker, David W Hall, David E Sadava, 2020. (eBook) Life: The Science of Biology, 12th Edn, Sunderland Publication.
5. Dutta AC, 1995, A Class-Book of Botany, 16th Edn, Oxford University Press.
6. NCERT, 2021. Biology of Class XI. NCERT, India.
7. Pande PC and Jain DK, 2022, A Textbook of Botany Angiosperm. S. Chand Publications.

Semester	**:**	**I**		
Course No.	**:**	**ABM-111**	**Credit Hrs.** **:**	**2(2+0)**
Course Title	**:**	**Introduction to Agri-Business Management**		

SYLLABUS

Objectives:

(i) To gain a comprehensive understanding of agribusiness structures, functions, a and dynamics;

(ii) To develop essential management skills applicable to agricultural enterprises;

(iii) To explore strategies for optimizing production efficiency and maximizing profitability in agribusiness; and

(iv) To prepare for diverse careers in farm management, agricultural marketing, finance, and consulting.

THEORY

Indian Agriculture: Place of Agriculture in Indian Economy, Trends in the structure of Indian Economy Role of Agriculture in Economic Development in India. Trends in agricultural production and productivity, cropping pattern size of farms and farm efficiency. Functions of Management: Planning, organizing, staffing, motivation and control and Principles of Management. Indian Agriculture; Impact of Liberalization, Privatization and Globalization on Agribusiness sector. Agribusiness Management: Definition, Importance, Scope of Agribusiness Management, Nature and Functions. Agribusiness input and output services, Agricultural credit and foreign trade, Planning and Organizing agribusiness. New trends in Agribusiness: Contract farming, Types and Scope of contract farming, Working of Contracts, Contract Models, Organic Farming, Genetically Modified Food, Farmer Producers' Organizations (FPO) Case Studies.

TEACHING SCHEDULE

THEORY [ABM-111]

Lecture No.	Topic	Sub-topics/ Key Points	Weightage (%)
1-3	Indian Agriculture	Place of Agriculture in Indian Economy, Trends in the structure of Indian Economy, Role of Agriculture in Economic Development in India	10
4		Trends in Agricultural Production and Productivity	6
5		Cropping pattern, Size of farms and Farm efficiency	
6	Functions of Management-Planning	Meaning, Importance and Characteristics	4
7	Directing	Meaning, Importance and Principles	4
8	Organizing	Meaning, Nature/ Characteristics, Purpose	4
9	Staffing	Meaning, Objectives, Importance, Process of Selection	4
10	Controlling	Meaning, Nature, Characteristics and Importance	4
11-13	Principles of Management	Principles of Management-Meaning, Evolution, Features, Levels of Management, Roles of Manager, Managerial Skills	12
14-15	Indian Agriculture	Impact of Liberalization, Privatization, Globalization on Agribusiness sector	6
16-18	Agri-business Management	Definition, Importance, Scope, Nature, Functions of Agri-business Management	6
19-20	Agri-business	Input services, Output services	6
21	Agricultural Credit	Trends of Agricultural Credit in India, Agricultural Credit Policy	6
22	Agricultural Foreign Trade	Importance, Policy, Trade Organizations	

Continued…

23-24	Planning and Organizing Agri-business	Business Planning; Market Analysis, Financial Planning, Legal considerations, Organizational Structure, Financial & Risk Management	4
25-28	New Trends in Agri-business	Contract farming, Definitions, Types and Scope of contract farming, Working of contracts, Contract models	12
29	Organic Farming	Characteristics of Organic Farming, Principles of Organic Farming	2
30	Genetically Modified Food	Definition, Examples, Indian Scenario	4
31 -32	Farmer Producers' Organizations (FPO)	Definition, Introduction, Importance, Organisation, Functions; Case Studies (Two only)	6
		Total=	**100**

Suggested Readings [ABM-111]:

1. A Handbook of Agribusiness- S.C. Gaur and D. Singh
2. A Textbook of Agri-business Management- Sanket S. Kadam, Universal Prakashan, Pune.
3. Indian Agriculture and Agri-business Management, Dr. Smita Diwase, Krishi Resource Management Network.
4. Farm Business Management: The Fundamentals of Good Practice by Peter L Nuthall.
5. Fundamentals of Agribusiness Finance by Ralph W. Battles and Robert C. Thompson.
6. Objective Agri-business Management by S.R. Panigrahy.
7. Agri-business: Management, Marketing, Human Resource Development, Communication, and Technology by Robert H. Usry and Lanny W. Hass
8. Agri-business and Market Management by Amod Sharma.

Semester	**:**	**I**		
Course No.	**:**	**ECON-111**	**Credits Hrs. :**	**2(2+0)**
Course Title	**:**	**Fundamentals of Agricultural Economics**		

SYLLABUS

Objectives:

(i) To understand the fundamental principles of economics as they apply to Agriculture,

(ii) To analyze the economic factors influencing agricultural production, distribution and consumption,

(iii) To explore the role of government policies and international trade in shaping the agricultural economy,

(iv) To develop critical thinking skills to evaluate and address economic challenges and opportunities in Agriculture.

THEORY

Agricultural Economics: Meaning, Definition, Characteristics of Agriculture, Nature and Scope of Agricultural Economics, Distinction between Agriculture and Industry, Role of Agriculture in economic development, Role of Government Interventions in Agricultural development. Planning and Agricultural Development: Meaning and Objectives, Economic planning, Benefits of planning, Agricultural development during different Five-year Plans in India, Measures of reorganization of agriculture and NITI Aayog. Factors of production: Meaning of land and its Characteristics, Labour concept, Characteristics of labour and Efficiency of labour, Capital concept and its Characteristics, Forms of capital in Agriculture and Process of capital formation, Organization of business firms, Forms of business organizations and their characteristics. Land reforms: Land reforms and Land tenure systems, Concepts of agricultural land holdings in India. Theory of production: Meaning, Definition, Types of production functions, Laws of Diminishing Marginal Returns and Elasticity of production. Scale of production: Meaning, Classification and Economies of scale. Theory of costs: Meaning, Definitions and Different types of costs and their Measurement. Revenue concept: Total revenue, Average revenue, Marginal revenue and Profit maximization.

TEACHING SCHEDULE

THEORY [ECON-111]

Lecture No.	Topic	Sub-topics/ Key Points	Weightage (%)
1-2	Agricultural Economics	Meaning, Definition, Characteristics of Agriculture, Nature and Scope of Agricultural Economics	10
3	Distinction between Agriculture and Industry	Distinction between Agriculture and Industry	2
4-5	Role of Agriculture	Role of Agriculture in economic development, Role of Government interventions in agricultural development	8
6-7	Planning and Agricultural Development	Meaning and Objectives, Economic planning, Benefits/ Importance of planning,	4
8-11	Agricultural Development during different Five-Year Plans in India	Plan period, Outlay Share, Growth rates and Achievements in the field of Agriculture in brief	8
12-13	Measures of Reorganization of Agriculture	Measures of reorganization of Agriculture	2
14-16	NITI Aayog	History of Planning Commission, NITI Aayog, Organization, Working, Role for Agricultural development	8
17-20	Factors of Production	Meaning of land and its characteristics, Labour concept, Characteristics of labour and Efficiency of labour, Capital concept and its characteristics, Forms of capital in Agriculture and Process of capital formation, Organization of business firms, Forms of business organizations and their characteristics.	10
21-22	Land Reforms	Land reforms, Land tenure systems, Concepts of agricultural land holdings in India	8
23-24	Theory of Production	Meaning, Definition, Types of Production functions	8

Continued…

25-26	Laws of Diminishing Marginal Returns and Elasticity of Production	Laws of Diminishing Marginal Returns and Elasticity of production	8
27-28	Scale of Production	Meaning, Classification and Economies of scale	10
29-30	Theory of Costs	Meaning, Definitions and Different types of costs and their measurement	10
31-32	Revenue Concept	Total revenue, Average revenue and Marginal revenue and Profit maximization	4
		Total=	**100**

Suggested Readings [ECON-111]:

1. Agriculture Economics by Shubha Reddy.
2. Finance by Shubha Reddy.
3. Economic of farm production and management by V.T. Raju and V.S. Rao.
4. Agricultural marketing in India by S.S. Acharya and N.L. Aggarwal.
5. Modern Microeconomics by Koutsoyiannis.

Semester	**:**	**I**		
Course No.	**:**	**AGRO-111**	**Credits Hrs. :**	**2(1+1)**
Course Title	**:**	**Introduction to Agronomy and Crop Production Technology**		

SYLLABUS

Objectives :

(i) To understand the principles of Agronomy and Crop Production Technology,

(ii) To learn about crop growth and development, including factors influencing yield and quality,

(iii) To explore sustainable and efficient farming practices to enhance crop productivity while minimizing environmental impact,

(iv) To gain practical knowledge of crop management techniques, including soil fertility, pest control and irrigation.

THEORY

Agriculture, Agronomy and their Scope, Tillage and Tilth, Crop density and Geometry, Factors affecting growth and development, Crops and Cropping systems, Crop rotation and its principles, Manures and Fertilizers, Irrigation, Water resources, Crop water requirement, Water Use Efficiency, Irrigation-scheduling criteria and methods, Quality of irrigation water, drainage. Weeds - Importance, Classification, Crop weed competition, Concepts of weed management- Principles and methods, Herbicides. Origin, Geographical distribution, Economic importance, Soil and Climatic requirements, Varieties, Cultural practices and Yield of *Kharif* crops viz., Rice, Maize, Sorghum, Minor millets, Pigeon pea, Mungbean, Groundnut and Soybean. *Rabi* crops viz., Sorghum, Wheat, Chickpea, Rapeseed and Mustard, Sunflower; and Sugarcane, Cotton, Tobacco, Chilli.

PRACTICAL

Identification of crops, seeds, fertilizers, herbicides and tillage implements, Identification of weeds in crops, Methods of herbicide and fertilizer application, Numerical exercises on fertilizer requirement, plant population, herbicides and water requirement, Methods of irrigation. Methods of sowing of different crop. Nutrient function and deficiency. Top dressing and foliar feeding of nutrients. Study of yield contributing characters and yield calculation of important crops. Visit to research centres of related crops.

TEACHING SCHEDULE

THEORY [AGRO-111]

Lecture No.	Topic	Sub-topics/ Key Points	Weightage (%)
1	Agriculture, Agronomy	Definitions: Agriculture, Agronomy, Scope. Tillage: Definition, Objects of tillage, Types of tillage, Tilth: Definition and Characteristics of ideal tilth.	8
2	Crop Density and Geometry	Crop density and Geometry concept, Factors affecting growth and crop development, Cropping systems-types, Crop rotation- Concept and its Principles.	6
3	Manures and Fertilizers, Role of plant nutrients	Manures and Fertilizers - Meaning, Classification of manures and fertilizers, Role of plant nutrients.	8
4	Irrigation, Water resources	Irrigation meaning, Water resources of India, Crop water requirements, Water use efficiency: Concept, Irrigation efficiencies: Def'ns/Concept.	6
5	Criteria and Methods of irrigation	Criteria for scheduling of irrigation, Methods of irrigation, Advantages and Disadvantages.	8
6	Water quality parameters and Drainage	Quality of irrigation water. Drainage: Concept and importance, Types of drainage, Factors affecting drainage.	4
7	Weeds	Weed- Definition, Importance, Merits and Demerits, Classification of weeds, Meaning of crop-weed competition.	6
8	Concept of Weed Management	Principles and Methods of weed management viz., Cultural, Mechanical, Chemical, Biological Weed control methods and IWM concept, Classification of herbicides.	8
9-12	Production Technology of *Kharif* crops	Origin, Geographical distribution, Economic importance, Soil and Climatic requirements, Varieties, Cultural practices and Yield of: Rice, Maize, Sorghum, Minor millets, Pigeon pea, Mung bean, Groundnut and Soybean.	6

Continued…

13-16	Production technology of *Rabi* crops	Origin, Geographical distribution, Economic importance, Soil and Climatic requirements, Varieties, Cultural practices and Yield of: Sorghum, Wheat, Chickpea, Rapeseed, Mustard and Sunflower.	4
17	Sugarcane Production Technology	Origin, Geographical distribution, Economic importance, Soil and Climatic requirements, Varieties, Cultural practices and Yield	8
18	Production Technology of Chilli	Origin, Geographical distribution, Economic importance, Soil and Climatic requirements, Varieties, Cultural practices and Yield	6
19	Production Technology of Tobacco and Cotton	Origin, Geographical distribution, Economic importance, Soil and Climatic requirements, Varieties, Cultural practices and Yield	4
		Total=	**100**

TEACHING SCHEDULE

PRACTICAL [AGRO-111]

Exercise No.	Exercise Title
1	Identification of crops and seeds.
2	Identification of fertilizers.
3	Identification of herbicides.
4	Identification of tillage implements.
5	Identification of weeds in crops.
6	Study methods of herbicide and fertilizer application.
7	Numerical exercises on fertilizer requirement.
8	Numerical exercises on calculation of plant population.
9	Numerical exercises on calculation of herbicide requirement.
10	Numerical exercises on calculation of water requirement.
11	Study of different methods of irrigation.
12	Study of methods of sowing of different crops.
13	Study of nutrient functions and deficiencies.
14	Study of top dressing and foliar feeding of nutrients.
15	Study of yield contributing characters and yield calculation of important crops.
16	Visit to Research Centers of related crops.

Suggested Readings [AGRO-111]:

1. Principles of Agronomy by T.Y. Reddy and G.H. Sankara Reddi:

   Relevance: This book provides a comprehensive overview of agronomic principles, including crop production techniques, soil management, and crop physiology.

2. Fundamentals of Crop Production by Stephen R. Kaffka and Larry L. Strand:

   Relevance: This textbook covers the basics of crop production, including plant growth and development, crop management practices, and environmental factors affecting crop yield.

3. Introduction to Agricultural Engineering Technology: A Problem-Solving Approach by Harry L. Field and John B. Solie:

   Relevance: This book offers insights into the technological aspects of agronomy, including machinery, irrigation systems and precision agriculture techniques.

4. Crop Production: Evolution, History, and Technology by C. Wayne Smith and Julian R. Betters:

   Relevance: This book explores the history and evolution of crop production technologies, providing a broader context for understanding modern agronomic practices.

Semester	**:**	**I**		
Course No.	**:**	**GPB-111**	**Credits Hrs. :**	**2(1+1)**
Course Title	**:**	**Introduction to Genetics and Plant Breeding**		

SYLLABUS

Objectives:

(i) To understand the principles of Genetics and their application in Plant Breeding,

(ii) To learn about breeding techniques used to improve crop traits such as yield, its quality and disease resistance,

(iii) To explore the importance of genetic diversity and its role in crop improvement and adaptation to changing environments,

(iv) To develop skills to evaluate and select superior plant genotypes for breeding programs aimed at enhancing agricultural productivity and sustainability.

THEORY

History of Genetics and Plant Breeding, Study of Chromosome- Structure and Functions, Cell Division, Mendel's Laws of inheritance, Modes of inheritance- Monogenic, Polygenic, Cytoplasmic. Modes of reproduction and their significance in Plant Breeding, Modes of Pollination, Self incompatibility, Male sterility and their significance in Plant Breeding, Breeding for Self-pollinated crops- Mass, Pure line, Pedigree method and Bulk method; Breeding for Cross-pollinated crops- Ear to row method, Backcross method, Development of Synthetics, Development of Composites and Hybrids; Vegetative Propagated Crops viz., Clonal selection.

PRACTICAL

Study of Microscopy, Simple and compound microscopes, Mendelian ratios- Monohybrid, Dihybrid and Problems related to segregation and independent assortment, Study of floral biology and structure of a model flower, Study of floral structure and biology of important cereals, Study of floral structure and biology of important pulses and oil seeds, Study of floral structure and biology of important commercial crops, Study of Plant Breeder's kit, Selfing and crossing techniques, Male sterility: A, B and R lines and their utility, Pollen, fertility study and its importance, Study of germplasm of various crops, Problems in hybrid seed production, Layout of field experiments, Principles, data recording and elementary statistics and analysis of data, Visit to different crop breeding schemes.

TEACHING SCHEDULE

THEORY [GPB-111]

Lecture No.	Topic	Sub-topics/ Key Points	Weightage (%)
1	**History of Genetics and Plant Breeding**	Definitions: Genetics, Plant Breeding, Domestication, Plant introduction; History/ Milestones/ Major Contributions in/of Genetics and Plant Breeding.	5
2	**Study of Chromosome**	Structure of chromosomes: Nucleosome-solenoid model. Types of chromosomes: Based on position of centromere, Autosomes and Sex chromosomes, Special chromosomes (in brief). Structural aberrations: (deletions, duplications, inversions and translocations); Polyploidy in plants: (Numerical aberrations: Autopolyploidy and Allopolyploidy). Definitions: Chromosome, Karyotype. Functions of chromosomes in inheritance.	10
3	**Cell Division**	Mitosis: Stages and Significance in growth and asexual reproduction; Meiosis: Stages and Significance in genetic diversity.	10
4	**Mendel's Laws of Inheritance**	Law of Segregation: Statement, Explanation and Example with pea plants. Law of Independent Assortment: Statement, Explanation and examples. Reasons for Mendel's Success, Exceptions to Mendelism; [Definitions: Gene, Allele, Dominant and Recessive alleles, Epistasis, Genotype, Phenotype, Monohybrid cross, Dihybrid cross, Back cross, Test cross].	5
5	**Modes of Reproduction**	Sexual and Asexual modes of reproduction; Definitions, Their significance in Plant Breeding	5
6	**Modes of Pollination**	Self-pollination: Definitions, Characteristics, Promoting Mechanisms and Examples. Cross-pollination: Definitions, Characteristics, Promoting Mechanisms and Examples. Often-cross pollination: Definitions and Examples. Pollinators in brief:(insects, animals, wind, water)	5

Continued…

7	**Self Incompatibility**	Definition, Mechanisms of self-incompatibility; Types of self-incompatibility/ SI Systems: (sporophytic, gametophytic) with Examples. Role / Use of SI in Plant Breeding.	10
8-9	**Male Sterility**	Definitions of male sterility systems in plants. Types of male sterility: (Cytoplasmic, genetic, CGMS and Environmental) Significance in Plant Breeding: Utilization/ Role of male sterility in developing hybrid crops and hybrid seed production.	10
10-11	**Breeding for Self-pollinated Crops**	Breeding Objectives for self-pollinated crops with examples. Definitions, Principles/Concept, Purpose, Method/Steps involved, Advantages, Applications of following breeding methods: Mass Selection: Pure Line Selection: Pedigree Method: Bulk Method:	10
12-13	**Breeding for Cross-pollinated Crops**	Breeding Objectives for cross-pollinated crops with examples. Definitions, Principles/Concept, Purpose, Method/Steps involved, Advantages, Applications of following breeding methods: Ear-to-Row Method: Backcross Method: Development of Synthetics: Development of Composites: Development of Hybrids:	10
14	**Breeding for Vegetatively Propagated Crops**	Breeding Objectives for vegetatively propagated crops. Clonal Selection: Definitions, Principles, Steps, and importance, Merits & Demerits. Examples of vegetative propagating crops; Role of clonal selection in crop improvement.	10
15-16	**Mutation**	Mutation (Definition); Introduction; Characteristics; Classification/Kinds/Types of Mutation. Mutagenic agents/Mutagen (Definition), Types of mutagens (Physical, Chemical- with e.g.), and Induction (method of mutagenesis). Role of Mutation in Plant Breeding.	10
		Total=	**100**

TEACHING SCHEDULE

PRACTICAL [GPB-111]

Exercise No.	Exercise Title
1	Study of Microscopy, Simple and Compound microscope
2	Monohybrid - Mendelian ratios and Problems solving.
3	Dihybrid - Mendelian ratios and Problems related to Segregation and Independent Assortment
4	Study of floral biology and structure of a model flower
5	Study of floral structure and biology of important cereals
6	Study of floral structure and biology of important pulses and oilseeds
7	Study of floral structure and biology of important commercial crops
8	Study of Plant Breeder's Kit
9	Selfing and Crossing techniques
10	Male sterility: A, B and R lines and their utility
11	Pollen fertility study and its importance
12	Study of germplasm of various major crops
13	Problems in hybrid seed production
14	Layout of field experiments
15	Principles, Data recording and Elementary statistics and Analysis of data
16	Visit to different crop breeding schemes/stations.

Suggested Readings [GPB-111]:

1. An Introduction to Genetic Analysis, Suzuki *et. al*.
2. Principles of Genetics, E.J. Gardner, M.J. Simmons, D.P. Snustad, Wiley India (P) Ltd.
3. Genetics, P.K. Gupta, Rastogi Publication, Meerut.
4. Fundamentals of Genetics, B.D. Singh, Kalyani Publication, New Delhi.
5. Genetics, M.W. Strickberger, Peerson Education, New Delhi.
6. Elements of Genetics, Phundan Singh, Kalyani Publication, New Delhi.
7. Genetics, Sushant Elrod and William Stansfield, McGraw Hill Publishing Company Limited, New Delhi.
8. Plant Breeding Principles and Methods, B.D. Singh, Kalyani Publication, New Delhi.
9. Essentials of Plant Breeding, Phundan Singh, Kalyani Publication New Delhi.
10. Principles and Practices Plant Breeding, J.R. Sharma, McGraw Hill Publishing Company Limited, New Delhi.
11. Plant Breeding Theory and Practices, V.L. Chopra, Oxford and IBH, Publishing Company, New Delhi.

Semester	**:**	**I**		
Course No.	**:**	**PATH-111**	**Credits Hrs. :**	**2(1+1)**
Course Title	**:**	**Management of Plant Diseases**		

SYLLABUS

Objectives:

(i) To understand the Biology, Epidemiology and Ecology of plant diseases,

(ii) To learn effective strategies for disease prevention, diagnosis and management in agricultural systems,

(iii) To explore Integrated Disease Management approaches, including cultural, chemical and biological control methods,

(iv) To develop skills to mitigate the impact of plant diseases on crop yield, quality and sustainability.

THEORY

Economic significance of post-harvest diseases and seed-borne diseases. Historical development in Seed Pathology and Post-harvest diseases. Objectives of Seed Pathology and Post-harvest diseases. Study of important Post-harvest Diseases (transport, storage and market) of perishables and grains etc. Important post-harvest diseases. Storage/Field fungi responsible for production of toxins and their effects on consumption. Mycotoxins and Aflatoxin. Identification and detection of plant pathogens carried through seeds, vegetatively propagating material. Seed processing, treatment and storage. Seed transmission, Seed contamination, accompanying pathogens, false seed transmission. Processing, seed treatment, seed packaging, packaging materials. Functional requirement to packing materials. Epidemiology, Factors affecting disease development, Assessment of disease severity and crop losses. Principles of plant disease management viz., Avoidance, Exclusion, Eradication, Protection, Immunization-HPR and Biological control. Pesticides, Classification of fungicides. Modes of application. Management of post-harvest diseases. Biotechnological approaches of diseases management. IPR and related issues. IDM concepts and importance. IDM module for important post-harvest diseases.

PRACTICAL

Study of post-harvest disease symptoms caused by fungi, bacteria, virus, nematodes etc. Methods of diagnosis of various post-harvest diseases. Methods of estimation of disease severity and losses; Seed health testing techniques. Methods of detection and identification of seed-borne pathogens; Isolation of biocontrol agents; Testing the efficacy of biocontrol agents by dual culture technique. Mass multiplication and methods of application of bioagents. Study of fungicides, bactericides, nematicides and their formulations. Study of pesticide compatibility and their safe-use. Study of plant protection equipments. Bioassay of fungicides; Seed treatment techniques for the control of seed-borne diseases; Biocontrol of post-harvest diseases. Study of seed packaging and storage techniques. Visit to vegetable and fruit markets, biopesticide/pesticide firms. Visit to processing warehouse and testing laboratories.

TEACHING SCHEDULE

THEORY [PATH-111]

Lecture No.	Topic with Sub-topics/ Key Points	Weightage (%)
1	Economic significance of post-harvest diseases and seed-borne diseases.	5
2	Historical developments in Seed Pathology and Post-harvest diseases.	5
3	Objectives of Seed Pathology and Post-harvest diseases.	5
4	Study of important Post-harvest Diseases (transport, storage & market) of vegetables, fruits, oil seeds etc.	5
5	Important post-harvest diseases. Storage/Field fungi responsible for production of toxins and their effects on consumption. Mycotoxins and Aflatoxin.	10
6	Identification and detection of plant pathogens carried through seeds, vegetatively propagating material. Seed processing, treatment and storage.	5
7	Seed transmission, Seed contamination, Accompanying pathogens, False seed transmission.	5
8	Processing, Seed treatment, Seed packaging, Packaging materials.	10
9	Functional requirement of packing materials.	5
10	Epidemiology, Factors affecting disease development, Assessment of disease severity and crop losses.	5
11	Principles of plant disease management viz., Avoidance, Exclusion, Eradication, Protection, Immunization- HPR and Biological control.	10
12	Pesticides. Classification of Fungicides.	5
13	Modes of application of Fungicides	5
14	Management of Post-harvest diseases	10
15	Biotechnological approaches of diseases management. IPR related Issues.	5
16	IDM concepts and importance. IDM module for important post-harvest diseases.	5
	Total=	**100**

TEACHING SCHEDULE

PRACTICAL [PATH-111]

Exercise No.	Exercise Title
1-2	Study of post-harvest disease symptoms caused by fungi, bacteria, virus, nematodes etc.
3	Methods of diagnosis of various post-harvest diseases.
4	Methods of estimation of disease severity and losses; Seed health testing techniques.
5	Methods of detection and identification of seed-borne pathogens.
6	Isolation of biocontrol agents; Testing the efficacy of biocontrol agents by dual culture technique.
7	Mass multiplication and methods of application of bioagents.
8	Study of fungicides, bactericides, nematicides and their formulations.
9	Study of pesticide compatibility and their safe-use.
10	Study of plant protection equipments.
11-12	Bioassay of fungicides; Seed treatment techniques for the control of seed-borne diseases.
13	Biocontrol of post-harvest diseases.
14	Study of seed packaging and storage techniques.
15-16	Visit to vegetable and fruit markets, biopesticide/ pesticide firms, processing warehouse and testing laboratories.

Suggested Readings [PATH-111]:

1. Pathak, V.N. Essentials of Plant Pathology. Prakash Publ., Jaipur
2. Agrios, G.N. 2010. Plant Pathology. Academic Press.
3. Kamat, M.N. Introductory Plant Pathology. Prakash Publ., Jaipur
4. Singh R.S. 2008. Plant Diseases. 8th Edn. Oxford & IBH. Publ. Co.
5. Singh R.S. 2013. Introduction to Principles of Plant Pathology. Oxford and IBH Publ. Co.
6. Alexopoulos, Mims and Blackwel. Introductory Mycology.
7. Mehrotra, R.S. and Aggarwal, A. 2007. Plant Pathology. 7th Edn. Tata McGraw Hill Publ. Co. Ltd.
8. Verma, J.P. 1998. The Bacteria. Malhotra Publ. House, New Delhi.
9. Goto, M. 1990. Fundamentals of Plant Bacteriology. Academic Press, New York.
10. Dhingra, O.D. and Sinclair, J.B. 1986. Basic Plant Pathology Methods. CRC Press, London, Tokyo.
11. Nene, Y.L. and Thapliyal, P.N. 1993. Fungicides in Plant Disease Control. 3rd Edn. Oxford and IBH, New Delhi.
12. Vyas, S.C. 1993. Handbook of Systemic Fungicides. Vols. I-III. Tata McGraw Hill, New Delhi.

#List/ Bouquet of Skill Enhancement Courses (SECs)

Sr. No.	Course No.	Course Title	Credit Hrs.
1.	**SEC-xxx**	Computer Applications in Agriculture	2(0+2)
2.	**SEC-xxx**	Production Technology for Bioagents and Biofertilizers	2(0+2)
3.	**SEC-xxx**	Seed Production and Seed Testing	2(0+2)
4.	**SEC-xxx**	Livestock Production and Management	2(0+2)
5.	**SEC-xxx**	Poultry Production Technology	2(0+2)
6.	**SEC-xxx**	Development of Agri-business Proposal	2(0+2)
.	**SEC-xxx**	*(To be added)*	2(0+2)
.	**SEC-xxx**	*(To be added)*	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.

In case of unavailability of said detailed course-wise syllabus of above or new SEC courses, the same 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]

ANNEXURE-VII

(~ of DICC-Circular No. MAUEB/DICC-Circular/New UG Syllabi/420/24; Dtd. 29.11.2024)

New Undergraduate Degree Syllabus of I-Semester of

B.Sc. (Hons.) Forestry

Finalized & Approved by the DICC as per the

ICAR - SIXTH DEANS' COMMITTEE REPORT

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

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

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.S. Harne
Associate Dean, College of Forestry, Dr.PDKV, Akola.
UG Degree Syllabus State Coordinator

with

UG Degree Syllabus Discipline Coordinators &

DICC - UG Degree Syllabus Core Committee

Submitted to the

Directors of Instruction Coordination Committee

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

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

FORESTRY

Course Layout

B.Sc. (Hons.) Forestry

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.	**FRM-111**	Introduction to Forest Resources	3(2+1)	
7.	**FBT-111**	Forest Plant Biology	3(2+1)	
8.	**SAF-111**	Silviculture- Principles and Practices	3(2+1)	
9.	**SAF-112**	Agroforestry Systems and Management	3(2+1)	
10.	**SEC-111**	Skill Enhancement Course-I *(To be offered from the bouquet of SEC Courses)*	4(0+4)	
		Total Credits Hrs.	**22(11+11) 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 Courses.

B.Sc. (Hons.) Forestry: First Semester

Course-wise Syllabus with Teaching Schedules

Semester	**:**	**I**	
Course No.	**:**	**CAC-111**	**Credit Hrs. : 2 (0+2) NG/ 2 Weeks**
Course Title	**:**	***Deeksharambh* (Induction-cum-Foundation Course)**	
Non-Gradial Common Academic Course for the said UG degree with the activities to be conducted during initial two weeks.			

Objectives:

(i) To create a platform for students to help for Cultural Integration of students from different backgrounds,

(ii) To know about the operational framework of academic process in university, instilling life and social skills,

(iii) To create Social awareness, Ethics and Values, Team work, Leadership, Creativity,

(iv) To identify the traditional values and indigenous cultures along with diverse potentialities both in indigenous and developed scenario.

ACTIVITIES

- Introduction/Orientation and Discussions on operational framework of academic process in University/College, as well as interactions with Academic and Research Managers of the University.
- Interaction with Alumni, Business Leaders, Perspective Employers, Outstanding Achievers in related fields and people with inspiring life experiences.
- Group activities to identify the strength and weakness of students and to learn from each other's life experiences.
- Activities to enhance Cultural Integration of students from different backgrounds.
- Field visits to the relevant fields/ establishments.
- Sessions on Personality Development (Instilling Life and Social skills, Social awareness, Ethics and Values, Team work, Leadership etc.) and imbibing the Communication skills.

Note: *The details of the relevant activities will be decided by the parent University in line with the above-mentioned broad activities.*

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

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 [AEC-111 : NSS-I]

Exercise No.	Exercise Topic/ Title	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, Fire fighting, 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 : NCC-I]

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**		

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: précis 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 [AEC-112]:

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. TataMcGraw Hill, N. 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/ Title
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. and 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. and 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. and 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 *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 *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., and 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. : MATH-111*	**Credit Hrs. : 1(1+0)**	**Need-based; NG**
Course Title : Introductory Mathematics		
*Need-based, Non-Gradial Common Course among 5 UG Degrees viz., **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 3rdorder, Examples

Properties of determinants up to 3rdorder (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 1/3rdRule (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 [MATH-111]

Lecture No.	Topic	Subtopics/ Key Points	Weightage (%)
1-2	Algebra: Progressions	Arithmetic Progression: Definition, Sum of n terms, Examples.	10
		GeometricProgression: Definition, Sum of n terms, Examples. Harmonic Progression: Definitions, Examples.	
3-4	Determinants	Definition of Determinant, Expansion of determinant up to 3rdorder, 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.	
013-15	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 [BIO-111]

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.

Semester	**:**	**I**			
Course No.	**:**	**FRM 111**	**Credit Hrs.**	**:**	**3(2 +1)**
Course Title	**:**	**Introduction to Forest Resources**			

SYLLABUS

Objectives: (i) To impart knowledge about the basic concepts of Forestry,

(ii) To familiarize the students about developments in the field of Forestry.

THEORY

Forests: definitions, role, benefits; direct and indirect. History of Forestry- Forestry: definitions, divisions and interrelationships. Classification of forests- Forest types. Agricultural lands and forests- Agroforestry systems; Differences in nutrient cycling, diversity etc. Social Forestry, Joint forest management; programmes and objectives. Important acts and policies related to Indian forests. Global warming; Forestry options for mitigation and adaptation- Carbon sequestration. Introduction to World forests- Geographical distribution of forests and their classification- Factors influencing world distribution of forests- Productivity potential and increment of world forests. Forest resources and forestry practices in different regions of the world; Western Europe, North America, Central Africa, Australia, Central America, Russia, Japan and China. General problems of forest development and economy. Forest-based industries in the developed and developing countries. Trade patterns of forest based raw materials. Recent trends in Forestry development in the world. National and International Organizations in Forestry. Important events/dates related to forests and environment - Themes and Philosophy.

PRACTICAL

Identification of important farm grown trees. Identification of tree seeds and seedlings. Visit to various forest types viz., thorn forest, dry deciduous forests, moist deciduous forests, Shola grassland ecosystem, semi-evergreen forests and wet evergreen forests to study the factors of locality and species composition. Visit to different Forest plantations, Agroforestry plantations and other Woodlots. Identification of wood and non-wood forest products. Visit to forest-based institutes and industries.

TEACHING SCHEDULE

THEORY [FRM-111]

Lecture No.	Topic	Sub-topics/ Key Points	Weightage (%)
1	Introduction to Forests	Definition, Scope, Importance of forests	10
2	Forest Benefits	Direct and indirect benefits of forests	
3-4	Introduction to Forestry	Definition of Forestry, Divisions, Interrelationships	10
5	History of Forestry in India	Ancient Forestry, Medieval Forestry, Modern Forestry, Pre-Independence, Post-Independence	10
6-7	Classification of Forests	Forest types and Classification based on Climatic zones and Vegetation (High forest, Coppice forest, Virgin forest, Pure forest, Mixed forest, Even and Uneven aged stands)	
8-9	Introduction to World Forest	Geographical distribution, Vegetation forms, Forest Classification, Major forest types.	10
10-11	Factors influencing World Forest Distribution	Climate, Soil topography, Human activities, Productivity potential and increment of World forest	
12-14	Forest Resources and Forest Practices in different regions of World and India	Forest resources of World, Analysis of practices in Western Europe, North America, Central Africa, Australia, Central America, Russia, South Asia, Japan, China and India	10
15-16	Agricultural Lands and Forests	Land use, Agroforestry System- Definition, Scope/ Importance, Classification	10
17-18	Benefits of Agroforestry systems	Benefits, Nutrient cycling, Biodiversity, Soil health etc.	
19-21	Social Forestry and Joint Forest Management	Definition/ Concept, Objectives, Benefits, Programs of Social Forestry and JFM in India and Community Participation in Social Forestry and JFM in India.	5
22-23	Forest Acts and Policies in India	Key Acts and Policies related to Indian forests; Forest Policies (1984; 1952; 1988; JFM 1990): Overview, Objectives, Salient features	5
24-25	Global Warming and Forests	Role of Forestry in Climate change mitigation, Carbon sequestration, Forestry options for mitigation and adaptation strategy	5
26-27	Forest-based Industries	Overview of major forest-based industries, Forest-based industries in developed and developing countries.	5

Continued…

28	Trade Patterns of Forest Products	Analysis of raw material trade, Trade pattern (Domestic/ International), Market dynamic, Trade regulation	5
29	Problems in Forest Development	Economic challenges; Social and Environmental issues affecting forest growth and development.	5
30	Trends in Forestry Development	Recent global trends and innovations in Forestry and Sustainable Forestry practices	5
31	National and International Organizations	Roles and functions of ICFRE Institutions, MOEF and CC, BNHS, FAO, CGIAR, UNEP, IUCN, WWF, ITTO etc.	5
32	Important Events and Dates in Forestry and Environment	Key dates, Themes and Environmental philosophies in Forestry and Environment	
		Total =	**100**

TEACHING SCHEDULE

PRACTICAL [FRM-111]

Exercise No.	Exercise Title
1	Tree identification tools and methods
2-3	Identification of important farm grown trees
4-5	Collection and Identification of tree seeds
6	Identification of tree seedlings in Forest Nursery
7-8	Visit to local Saw Mill for Collection and Identification of wood samples of different trees
9-10	Identification of wood and non-wood forest products
11-12	Visit to various forest types viz., thorn forest, dry deciduous forests, moist deciduous forests, Shola grassland ecosystem, semi-evergreen forests and wet evergreen forests
13-14	Study of the factors of locality and species composition in local forest area
15	Visit to different Forest plantations, Agroforestry plantations and other Woodlots.
16	Visit to forest-based institutes and industries for practical exposure: (Production units: Plywood, Furniture, Silk, Paper and pulp, Charcoal making, Kattha, Honey)

Suggested Readings:

1. Beazley, M. 1981. The International Book of Forest. London.
2. Champion and Seth. 1968. Forest Types of India.
3. Grebner, D.L., Bettinger, P. and Siry, J.P. 2012. Introduction to Forestry and Natural Resources. Academic Press. 508p (Google eBook).
4. Khanna, L.S. 1989. Principles and Practice of Silviculture. Khanna Bandhu, New Delhi.
5. Dwivedi, A.P. 1995. Principles and Practices of Silviculture.

Semester	**:**	**I**	
Course No.	**:**	**FBT-111**	**Credit Hrs : 3(2+1)**
Course Title	**:**	**Forest Plant Biology**	

SYLLABUS

Objective: To inculcate the fundamentals of botany and taxonomy of gymnosperms and angiosperms.

THEORY

Plant classification and systematics. Botanical Nomenclature- ICBN (International Code of Botanical Nomenclature) - Rules and Codes of ICBN, Binomial and Polynomials. Systems of classification - Natural, Artificial and Phylogenetic classification. Principles of systematics. Demerits and merits of plant classification as given by Engler and Prantl, Hutchinson, Bentham and Hooker, Angiosperm Phylogenic Group (APG) and Other modern classifications. Morphology as a tool for tree identification: Field characters- Branching pattern, Leaf, Fruit and Bark. Role of reproductive characters- Flower types, Floral formulas and floral diagrams. Reproductive morphology of plants with reference to description and identification of reproductive parts- General form of woody trunk and deviations like, buttresses, flutes, crooks, etc. Morphology and description of bark of common Indian trees- Types of exfoliation patterns in bark. Methods of Floristic survey and need for botanical explorations. Herbarium techniques- Collection, processing and preservation of plant material. General study of Herbarium, Arboretum, Palmetum, Fruticetum, Bambusetum and Xylarium. Origin, geographical distribution, phylogenetic position, taxonomic description and economic importance of the flora of families of Gymnosperms viz., Pinaceae, Taxaceae, Conifereae. Origin, geographical distribution, phylogenetic position, taxonomic description and economic importance of the flora for the families of Angiosperms viz., Annonaceae, Magnoliaceae, Rhizophoraceae, Ebenaceae, Sapotaceae, Caesalpiniaceae, Santalaceae, Mimosaceae, Elaeagnaceae, Fabaceae, Meliaceae, Salicaceae, Lauraceae, Apocynaceae and Betulaceae. Origin, geographical distribution, phylogenetic position, taxonomic description and economic importance of the flora for the families of Angiosperms viz., Fagaceae, Moraceae, Tiliaceae, Euphorbiaceae, Dipterocarpaceae, Bixaceae, Cupressaceae, Guttiferae (Clusiaceae), Myrtaceae, Rubiaceae, Sterculiaceae, Bignoniaceae and Combretaceae, Verbenaceae, Malvaceae, Poeceae, Leguminoseae and Malvaceae.

PRACTICAL

Morphological description of plant parts with special reference to identification. Study on types of leaves, phyllotaxy and venation; Inflorescence; Bark with suitable examples. Methods of plant collections and herbarium preparation. Laboratory and field identification of important forestry species using vegetative and reproductive characteristics of Magnoliaceae, Ebenaceae, Fabaceae, Meliaceae, Salicaceae, Tiliaceae, Taxaceae, Pinaceae, Myrtaceae, Rubiaceae, Sterculiaceae, Bignoniaceae and Combretaceae, Verbenaceae, Malvaceae, Poeceae, Leguminoseae and Malvaceae. Visit to Botanical Garden and Arboretum for identification of trees.

TEACHING SCHEDULE

THEORY [FBT-111]

Lecture No.	Topic	Sub-topics/ Key Points	Weightage (%)
1-2	**Plant Classification and Systematics** **Botanical Nomenclature-ICBN:**	Definitions of Plant Classification-Scope of forest Plant Biology-Principles of Forest Plant Biology-Rules and Code of ICBN-Rules of plant nomenclature-Main groups of plants-Characteristics of Phanerogams-Gymnosperms, Angiosperms, Monocotyledons- Dicotyledons, Identification- Classification- Binomial system of Nomenclature and its Basis, Polynomials.	7
3-5	**Systems of Classification: Natural, Artificial and Phylogenetic classification. Principles of systematic. Angiosperm Phylogenic Group (APG) and Other modern classifications.**	Concept of characters in plant classification- Principles and Systems of classification of plants- Types with suitable examples- Flow chart of classification systems- Merits and Demerits of various plant classification systems- as given by Engler Prantl, Hutchinson, Bentham and Hooker, Angiosperm Phylogeny Group (APG) & other Modern system; Their Principles, Merit and Demerits-Cladogram of Angiosperms.	8
6-8	**Morphology as a Tool for Tree Identification:** **Field Characters-** **Role of Reproductive Characters-**	Tools for tree identification: Morphological characteristics of trees-Branching pattern, Fruit and Bark; Habit, leaf arrangement, stipules, inflorescence, number of petals, position of ovary, placentation, shape of pollen and its character states, morphology of leaf, description of different types of leaves, colour of young and old leaves in some species as regular features of identification, Phyllotaxy, venation, Significance of morphology and field characters, Role of reproductive characters: Flower types, floral formulas and floral diagrams of economically important tree species.	10

Continued…

9-11	**Reproductive Morphology of plants with reference to description and identification of reproductive parts:**	Detail description of reproductive morphology, its Characteristics - Significance- Examples- Diagrams- General form of woody trunk and deviations like, buttresses, flutes, crooks etc. Examples of some economic important forest tree species.	10
12-13	**Morphology and Description of Bark of Common Indian Trees:**	Types of exfoliation patterns in bark- Advantages- Disadvantages- Suitable Examples- Methods of Floristic survey and need of botanical explorations-	8
14-15	**Herbarium Techniques:**	Collection, processing and preservation of plant material. General study of Herbarium Techniques: Definitions, Techniques, Procedure in detail, Description, Diagrams, Examples of ~ Herbarium, Arboretum, Palmetum, Fruticetum, Bambusetum and Xylarium.	8
Origin, Geographical distribution, Phylogenetic position, Taxonomic description and Economic importance of the Flora of Families of Angiosperms: Descriptions, Short notes, Economic importance, Phenological characteristics, Examples, Formula and Diagrams of following Families -			
16-17	Pinaceae, Taxaceae and Conifereae.		7
18-19	Annonaceae, Magnoliaceae, Rhizophoraceae and Ebenaceae		7
20-21	Sapotaceae, Caesalpiniaceae, Santalaceae, Mimosaceae and Elaeagnaceae		7
22-24	Fabaceae, Meliaceae, Salicaceae, Lauraceae, Apocyanaceae and Betulaceae		7
25-27	Fagaceae, Moraceae, Tiliaceae, Euphorbiaceae and Dipterocarpaceae		7
28-30	Bixaceae, Cupressaceae, Guttiferae (Clusiaceae) and Myrtaceae		7
31-32	Rubiaceae, Sterculiaceae, Verbenaceae, Malvaceae, Poeceae, Leguminoseae and Malvaceae. Bignoniaceae and Combretaceae		7

TEACHING SCHEDULE

PRACTICAL [FBT-111]

Exercise No.	Exercise Title
1	Study the morphological description of plant parts with special reference to identification.
2	Study on types of leaves, phyllotaxy and venation
3	Study on types of inflorescence, Bark with suitable examples
4	Study on methods of plant collections and herbarium preparation
5	Study the laboratory and field identification of important forestry species using vegetative and reproductive characteristics of Magnoliaceae and Ebenaceae
6	Study the laboratory and field identification of important forestry species using vegetative and reproductive characteristics of Fabaceae and Meliaceae
7	Study the laboratory and field identification of important forestry species using vegetative and reproductive characteristics of Salicaceae and Tiliaceae
8	Study the laboratory and field identification of important forestry species using vegetative and reproductive characteristics of Taxaceae and Pinaceae
9	Study the laboratory and field identification of important forestry species using vegetative and reproductive characteristics of Myrtaceae and Rubiaceae
10	Study the laboratory and field identification of important forestry species using vegetative and reproductive characteristics of Sterculiaceae
11	Study the laboratory and field identification of important forestry species using vegetative and reproductive characteristics of Bignoniaceae and Combretaceae
12	Study the laboratory and field identification of important forestry species using vegetative and reproductive characteristics of Verbenaceae
13	Study the laboratory and field identification of important forestry species using vegetative and reproductive characteristics of Malvaceae
14	Study the laboratory and field identification of important forestry species using vegetative and reproductive characteristics of Poeceae
15	Study the laboratory and field identification of important forestry species using vegetative and reproductive characteristics of Leguminoseae
16	Visit to Botanical Garden and Arboretum for identification of trees.

Suggested Readings [FBT-111]:

1. Mishra, S.R. 2010. Textbook of Dendrology. Discovery Publishing House Pvt. Ltd.
2. Bhatnagar, S.P. and Alok Moitra. 2000. Gymnosperms. New age International (P) Ltd.
3. Datta, S.C. 1999. Systematic Botany. New Age International (p) Ltd. Publ. New Delhi, India.
4. Dasgupta, S.1998. Systematic Botany for Foresters. Khana Bandhu Publ., New Delhi, India.
5. R. Naqshi. 1993. An Introduction to Botanical Nomenclature. Scientific Publishers. Jodhpur.
6. Ashok Kumar 2001. Botany in Forestry and Environment. Kumar Media (P) Ltd. Gandhinagar, Gujarat.
7. Charles Mc Cann. 1966. 100 Beautiful Trees of India. D. B. Taraporevala Sons & Co. Pvt. Ltd. Mumbai. (Available online PDF)
8. D. Brandis. Revised by R. D. Jakarti. 2010. Indian Trees. Dehradun.
9. D. N. Tewari 1992. Tropical Forestry in India. International Book Distributors, Dehradun.
10. Eric A. Bourdo Jr. 2001. The Illustrated Books of Trees. A Visual Guide to 250 species. Published by Salamander Books Pvt. Ltd. London. (Available online PDF)
11. Father H. Santapau. 1966. Common Trees. (Available online PDF)
12. Gurucharan Singh. 2000. Plant Systematics. Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi.
13. K. C. Sahni. 2000. The Book of Indian Trees. Bombay Natural History Society, Mumbai.
14. M. S. Randhawa. 1957. Flowering Trees in India. Sree Saraswati Press Ltd., Kolkatta.
15. N. L. Bor 1990. Manual of Indian Forest Botany. Periodical Expert Book Agency, New Delhi.
16. Pradip Krishnen 2013. Jungle Trees of Central India. Published by Penguin Books India Pvt. Ltd., New Delhi.
17. R. N. Parker. 1933. Forty Common Indian Trees and How to Know Them. (online PDF).
18. S. K. Jain and R. R. Rao. 1977. Handbook of Field and Herbarium Methods. Today and Tomorrow's Printers and Publishers, New Delhi.
19. S. N. Pandey and S. P. Mishra. 2008. Taxonomy of Angiosperms. Ane Books India, New Delhi.
20. S. R. Mishra. 2010. Textbook of Dendrology. Discovery Publishing House Pvt. Ltd., New Delhi.

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Semester	**:**	**I**			
Course No.	**:**	**SAF-111**	**Credit Hrs.**	**:**	**3(2+1)**
Course Title	**:**	**Silviculture - Principles and Practices**			

SYLLABUS

Objectives: i) To develop basic understanding on forest and factors influencing forest growth and development
ii) To develop skill for the artificial and natural regeneration of forest
iii) Exposing students to develop skill on raising and maintaining plantation
iv) To impart knowledge on tending operations followed in forest with preliminary information on succession in forest.

THEORY

Definition and classification of Forest and Forestry- Branches of forestry and their relationships- Trees and their distinguishing features. Forest Reproduction- Flowering, fruiting and seeding behaviour. Site factors- Climatic, edaphic, physiographic, biotic and their interactions. Classification of Climatic Factors- Role of light, temperature, rainfall, snow, wind, humidity and evapo-transpiration in relation to forest vegetation. Bioclimatic and Micro climate effects. Edaphic factors- Influence of biological agencies, parent rock, topography on the soil formation- Soil profile- Physical and chemical properties, mineral nutrient. Physiographic factors- influence of altitude, latitude, aspect and slope on vegetation. Biotic factors- Influence of plants, insects, wild animals, man and domestic animals on vegetation. Forest types of India- Basis and systems of classification- Major groups- Revised classification of forest types of India- Tropical, Montane sub-tropical, Montane temperate, Sub-alpine and Alpine- Sub groups- Types- Species composition and distribution. Forest types of Maharashtra. Regeneration of forests- Objectives, Ecology of regeneration- Natural and Artificial regeneration. Natural regeneration- Seed production, seed dispersal, germination and establishment. Requirement for natural regeneration. Dieback in seedling with examples. Advance growth, coppice- Root sucker. Regeneration survey- Natural regeneration supplemented by artificial regeneration. Artificial regeneration- Object of artificial regeneration- Advantages. Factors governing the choice of regeneration techniques. Choice of species and factors that govern. Sowing v/s Planting- Preparation of planting material- Field planting and techniques- Plant protection and sanitation measures- Forest nutrition and irrigation in trees.

PRACTICAL

Study about habits of plants and developmental stages of tree growth and its structure. Study about tree morphology- Stem, crown and root characters. Assessment of forest composition. Study about stand structure. Assessment of natural regeneration. Planting pattern and planting technique for afforestation and reforestation. Exercise on Seed and nursery practices. Planting pattern and planting technique for afforestation and reforestation. Field preparation, marking, alignment and stacking, pit making and planting. Plant protection and sanitation measures. Study of afforestation and reforestation success.

TEACHING SCHEDULE

THEORY [SAF-111]

Lecture No.	Topic	Sub-topics/Key Points	Weightage (%)
1-2	Forest and Forestry- Classification, Branches, Distinguishing features of tree.	Definitions, Classification of forest- Basis of origin of forest, Classification of Forestry- Based on objectives- Protection forestry, Commercial forestry, Social forestry, Farm forestry, Extension forestry, Mixed forestry. Branches of Forestry and their relationships with Silviculture: Forest Protection, Forest Mensuration, Forest Management, Forest Products and Utilization, Distinguishing features- General appearance of tree Crown, Flowers, Stem, Roots.	5
3-4	Forest Reproduction - Flowering, Pollination, Fruiting and Seeding behaviour.	Sexual reproduction. Flowering-Time of flowering, Unisexual and bisexual flowers- Monoecious, Dioecious and Polygamous. Pollination- Anemophilly, Zoophilly and Entomophilly. Flowering of Bamboo- Gregarious and sporadic. Fruiting and seeding behaviour- Angiosperm and gymnosperm	5
5-6	Factors of Locality/ Site Factors: Climatic factors	Classification of Climatic Factors- Role of light, temperature, rainfall, snow, wind, humidity and evapotranspiration in relation to forest vegetation. Bioclimatic and Microclimate effects.	10
7-8	Edaphic factors	Influence of biological agencies, parent rock, topography on soil formation- Soil profile- Physical and chemical properties, mineral nutrient.	5
9-10	Physiographic factors	Definition- Altitude, Latitude, Aspect and Slope of site and Description of factors affecting vegetation formation.	5
11-12	Biotic factors	Effect of plants, insects, wild animals, man on forest vegetation.	5

Continued…

13-14	Forest types of India: Basis and Systems of Classification – Major and Subgroups.	Important/ Major 16 Groups as per revised classification of Champion and Seth. Major groups- Tropical, Montane sub-tropical, Montane temperate, Sub-alpine and Alpine-Subgroup- Types- Species composition and distribution.	5
15-16	Forest types of Maharashtra	Distribution of vegetation under different forest types in Maharashtra.	5
17-19	Regeneration of forests: Natural regeneration	Objectives, Methods: Natural (NR) and Artificial regeneration (AR). NR- Seed production, seed dispersal, germination and establishment. Requirement for NR. Factors affecting / Problems associated with NR.	10
20-21	Dieback phenomenon in seedling	Die back in Shorea, Dipterocarpus. Advance growth, coppice- Root sucker.	5
22-24	Regeneration survey	Categories of regeneration- Established seedling, Whippy un-established seedling, Recruits (New emergence). NR supplemented by AR. Success of regeneration for future production of forest.	10
25-26	Artificial regeneration	AR: Object, Advantages, Factors governing choice of regeneration techniques. Planting techniques and planting method.	5
27-28	Choice of species for regeneration	Factors governing regeneration- Climate, micro-climate, soil condition, stages of succession, objects of management, consumer requirement and growth rate, cost, Use of indigenous and exotics tree, ease of plantation.	10
29-30	Sowing v/s Planting: Preparation of planting material – Field planting and techniques -	Advantages and disadvantages of sowing, Advantages and disadvantages of planting, Condition of site, species to be raised. Field planting and techniques: Kinds of sowing- Broadcast, Line sowing, Strip and dibbling method. Planting methods- bare root planting, polythene, container and bricks. Planting pattern- Square, rectangular, quincunx.	10
31-32	Plant protection	Sanitation, Management of pest and diseases, Forest irrigation, Drainage and Fertility maintenance of plantation site.	5
		Total =	**100**

TEACHING SCHEDULE

PRACTICAL [SAF-111]

Exercise No.	Exercise Title
1	Identification of different trees species in university campus.
2	Study of flowering, fruiting, seed forming and leaf shedding in important trees species in University campus.
3	Study of growth and developmental stages in tree.
4	Study on Tree morphology- Stem, crown and root characters.
5	Study of composition of trees in different Forest Types of India.
6	Stand structure and Crown development.
7	Factors affecting natural regeneration in forest.
8	Methods of Natural regeneration.
9	Study on natural regeneration survey in forest.
10	Field preparation and Lay-out for plantation.
11	Planting pattern for plantation.
12	Planting techniques for plantation.
13	Afforestation, reforestation techniques for difficult sites.
14	Study of Seed and Nursery practices for important forest trees
15	Study of different types of pits for plantation.
16	Study on plant protection and sanitation measures in plantation.

Suggested Readings:

1. Parthiban, K.T, R.J. Sudhagar, S. Umesh Kanna, S. Vennila, I. Sekar and K. Baranidharan. 2016. Forestry: A Subjective Guide for IFS Aspirants. Scientific Publishers - Competition Tutor, Jodhpur (ISBN No.: 9789386102096)
2. Dwivedi, A. P. 2006. A Text book of Silviculture. International Book Distributors, Dehra Dun. 505 p.
3. Khanna, L.S. 2000. Principles and practice of Silviculture. Milton Book Company, Dehra Dun. 473
4. Champion, H.G. and S.K. Seth. 1968. A revised survey of the forest types of India. Manager of Publication, Delhi.
5. Haig, I.T., M.A. Huberman and U. Aung Din. 1986. Tropical Silviculture. Periodical Experts Book Agency, New Delhi. Vol. 1, p. 190.
6. David M. Smith. 1989. The Practice of Silviculture. EBD Educational Pvt. Ltd., Dehradun. P.526
7. Luna, R. K. 1989. Plantation forestry in India. International Book Distributors, Dehradun. P. 476

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Semester	**:**	**I**			
Course No.	**:**	**SAF-112**	**Credit Hrs.**	**:**	**3(2+1)**
Course Title	**:**	**Agroforestry Systems and Management**			

SYLLABUS

Objectives: i) To develop basic understanding on Agroforestry in different agro-climatic zones.
ii) To develop skill on various Agroforestry systems and carbon sequestration in Agroforestry systems.
iii) Exposing students to develop skill on Industrial Agroforestry

THEORY

Agroforestry systems in different agro climatic zones- Tropical agroforestry, Temperate agroforestry, arid and semi-arid agroforestry and humid agroforestry- components, production and management techniques. Alley cropping- functional and structural attributes of alley cropping, soil management, choice of species- productivity of various Agroforestry systems. High-density short rotation plantation systems- choice of species, design, development and management. Silvicultural woodlots/energy plantations- choice of species, design, development and management. Different types of agroforestry systems- Silvi-agriculture, shelterbelts and windbreaks- design, aerodynamics and management, Silvopastoral systems- live fences; fodder trees and protein banks and Agri-silvopastoral systems- home gardens, hedge rows, Multistorey system and their mangement; Special systems- Apisilviculture, Silvisericulture, Aquaforestry etc. Agroforestry for wasteland development. Canopy management- Lopping, pruning, pollarding, and hedging. Diagnosis and design methods and approaches. Biophysical and ecological functions of agroforestry: Nutrient cycling and role of agroforestry in soil and water conservation- micro-site enrichment by trees, N fixation, improvement in soil physico-chemical properties and soil organic matter status, litter and fine root dynamics, nutrient pumping; beneficial effects of species mixture- rhizosphere and phillosphere effects. Carbon sequestration- Climate change mitigation and phytoremediation. Adverse effects of trees on soils - competition, allelopathy- Causes and mechanisms. Industrial Agroforestry- scope and potential in India- major wood based industries- People's participation, rural entrepreneurship through Agroforestry and industrial linkages- contract farming- types and systems- successful contract farming models- timber transit rules for farm grown trees- Financial and socio-economic analysis of Agroforestry systems. Evaluation of tangible and intangible benefits- Agroforestry research and development in India- National Agroforestry Policy 2014- objectives and strategies.

PRACTICAL

Study characteristics of trees/shrubs/grasses for agroforestry- Designing and development of multifunctional agroforestry model- Survey agroforestry practices in local/ adjoining areas- Visit to prominent Agroforestry systems, other plantation crop combinations, Homegardens, other integrated multitier agroforestry systems and study their structural and functional attributes- Establishment and management of fodder bank- Studies on Integrated Farming System- Establishment and assessment of Industrial agroforestry plantations- Volume and biomass estimation- Carbon sequestration assessment- Crown measurement, light interception, leaf area index measurements in agroforestry systems. Annual crops/grass growth measurements and yield estimation- Determination of cost and returns of various agroforestry systems.

TEACHING SCHEDULE

THEORY [SAF-112]

Lecture No.	Topic	Sub-topics/Key Points	Weightage (%)
1	Agroforestry systems in different Agro-climatic zones of India	Definitions of Agroforestry, Sustainable Agriculture, Concept, Benefits, scope and limitation of Agroforestry system, Agroforestry systems exist in different agro-climatic zones, Definition of Tropical-Temperate, Arid and Semi-Arid. Components of Agroforestry.	2.5
2	Components, production and management techniques	Production and management techniques of Silviculral crop, agricultural crop and Livestock and others	2.5
3-4	Alley cropping- functional and structural attributes of alley cropping	Definition of alley cropping (Hedge-row intercropping), Concept, purpose and function in soil conservation, its structure (Design, position and spacing and choice of species for hedge-row) of alley cropping,	5
5-6	High-density short rotation plantation (HDRS) systems	Definition- high density, short rotation, plantation, Suitable/choice of tree species for HDSR, Design, development and management of HDRS.	5
7-8	Silvicultural woodlots/energy plantations - choice of species, design, development and management	Definition of Woodlots and Energy Plantation, Selection of choice of tree species for woodlots and energy plantation (Properties/Characteristics of fuel wood species). Its design and management. Role of Agroforestry (woody component) in energy production.	5
9-10	Different types of Agroforestry systems – Definition silvi-agriculture – shelterbelts and windbreaks - design, aerodynamics and management	Types or classification of Agroforestry system, Agrisilviculture-Silvi/vo pasture- Agrisilvi/agrovo pastoral and other systems.	5
11-12	Silvopastoral systems - live fences; fodder trees and protein banks Agri-silvopastoral systems – home gardens, hedge rows, Multistorey system and their mangement; Special systems - Apisilviculture, silvisericulture, aquaforestry etc.	Definition of silvopastoral, Pasture, live fence, fodder trees and protein banks. Definition of Agri-silvopastoral systems – home gardens, hedge-rows, Multistorey system. Structure and Management of home garden and hedge-rows.Other Systems Entomoforestry and Aquaforestry (Special System) : Definition : Apiculture/Apisilviculture, Silvisericulture, Apiculture	10
13-14	Agroforestry for wasteland development. Canopy management	Concept, Problematic Soil/Difficult Soil. Canopy management in Agroforestry system through Lopping, pruning, pollarding, and hedging. Its definition and concepts.	10

Continued…

15-16	Diagnosis and Design Methods and Approaches. Biophysical and Ecological Functions of Agroforestry	Basic logic/stages of Agroforestry D&D, Major Key features of Diagnosis and design (D & D), Procedure of Agroforestry Diagnosis and Design. Macro and Micro D & D. Criteria for good Agroforestry design.	5
17-19	Nutrient Cycling and Role of Agroforestry in Soil and Water Conservation	Definition of Nutrient cycling and role of Agroforestry in soil and water conservation - micro-site enrichment by trees, N fixation, improvement in soil physico-chemical properties and soil organic matter status, litter and fine root dynamics, nutrient pumping; beneficial effects of species mixture - rhizosphere and phyllosphere effects.	5
20-22	Carbon Sequestration-Climate change mitigation and Phytoremediation	Definition and concept, Climate change mitigation through Agroforestry and phytoremediation.	10
23-24	Adverse effects of trees on soils - Competition, Allelopathy	Adverse effects (Negative effects) of trees on soils - competition, allelopathy – Causes and mechanisms.	10
25-26	Industrial Agroforestry	Industrial Agroforestry – Scope and potential in India – Major wood-based industries: Paper and Pulp Industry, Plywood Industry, Matchbox industry, Charcoal Industry. Tannin and Turpentine Industry, Medicinal Plant based industry, Tendu patta Industry, Gum and Resin Industry, Lac Industry etc.	10
27-29	People's participation, Rural Entrepreneurship through Agroforestry and Industrial Linkages	Involvement of local People's participation, Rural entrepreneurship through Agroforestry. Industrial linkages: Contract farming – types and systems – successful contract farming models – timber transit rules for farm grown trees	5
29-30	Financial and Socio-economic Analysis of Agroforestry systems. Evaluation of tangible and intangible benefits.	Socio-economic study of Agroforestry, Social benefits from Agroforestry, Benefits-Cost Ratio (Cost-Benefits Analysis) in Agroforestry system, Definition of Cost and Output	5
31-32	Agroforestry Research and Development in India - National Agroforestry Policy, 2014 - Objectives and strategies.	Overview of Agroforestry research and its development in India and at International Level, National Agroforestry Policy, 2014 – Objectives and Strategies.	5
		Total =	**100**

TEACHING SCHEDULE

PRACTICAL [SAF-111]

Exercise No.	Exercise Title
1	Study of characteristics of multi-purpose trees species/shrubs/grasses for Agroforestry
2	Study on designing and development of multifunctional Agroforestry Models – i) Productive Model (Food, Fodder, Fuel wood), ii) Protective model (Wind-break, Shelter-belt, Soil Conservation)
3	Survey of different Agroforestry practices in local/ adjoining areas.
4	Visit to prominent Agroforestry systems, other plantation crop combinations in campus
5	Study of Multilayer Agroforestry (homegarden, woody hedgerow) practice in adjoining area
6	Study of Integrated Multitier Agroforestry Systems and study of their structural and functional attributes
7	Establishment and management of Fodder Bank (Protein Bank) in University premises
8	Visit to study components of Integrated Farming System (IFS) centre in the University area
9	Establishment and Assessment of Industrial Agroforestry plantations such as, Paper industry etc.
10	Estimation of Tree volume of tree component in Agroforestry
11	Assessment of Tree biomass and Carbon sequestration in Agroforestry
12	Study on Crown measurement of tree component in Agroforestry system
13	Study on light interception, leaf area index measurements in Agroforestry systems
14	Annual crops/grass growth measurements and yield estimation
15	Determination of Benefit-Cost ratio of any Agroforestry system exist on farmers field
16	Measurements of annual crops/ grass growth attributes and its yield estimation under Agroforestry Model in local area

Suggested Readings:

1. Parthiban, K.T. and A. Keerthika. 2021. A Textbook of Agroforestry – Principles, Practices and Application. Agro Bios (India), Jodhpur. (ISBN: 9788197377689)
2. Nair P. K. Ramachandran. 1993. An Introduction to Agroforestry. Springer Dordrecht (ISBN: 978-0-7923-2134-7)
3. Chundawat D.S and S.K. Gautham. 2017. Textbook of Agroforestry. Oxford & IBH Publishing, (ISBN:9788120408326)
4. Parthiban, K.T. and R. Seenivasan. 2017. Plantation and Agroforestry: Pulpwood Value Chain Approach. Published by Scientific Publisher, Jodhpur. Pp: 517.
5. Parthiban, K.T., R. Umarani, S. Umesh Kanna, I. Sekar, P. Rajendran, and P. Durairasu. 2014. Industrial Agroforestry Perspective and Prospectives. Scientific Publisher. Jodhpur. Pp.396
6. Parthiban, K.T., *et al.,* 2018. Multifunctional Agroforestry – Ecosystem services. Narendra Publishers. New Delhi. Pp: 419.
7. Divya M. P. and K. T. Parthiban. 2005. A Textbook on Social Forestry and Agroforestry. Satish Serial Publishing, New Delhi (ISBN: 9384988952)

List/ Bouquet of Skill Enhancement Courses (SECs):

Sr. No.	Course No.	Course Title	Credit Hrs.
1.	**SEC-xxx**	Commercial Seedling Production	4(0+4)
2.	**SEC-xxx**	Ecotourism	4(0+4)
3.	**SEC-xxx**	Commercial Forestry	4(0+4)
4.	**SEC-xxx**	Ornithology	4(0+4)
5.	**SEC-xxx**	Design and Development of Wood Products	4(0+4)
6.	**SEC-xxx**	Landscape Management and Restoration	4(0+4)
7.	**SEC-xxx**	Farm and Agroforestry Management	4(0+4)
8.	**SEC-xxx**	Biofertilizers and Biopesticides Production	4(0+4)
9.	**SEC-xxx**	Para-taxonomy	2(0+2)
10.	**SEC-xxx**	Tree Seed Production Technology and Certification	2(0+2)
11.	**SEC-xxx**	Herpetology	2(0+2)
12.	**SEC-xxx**	Wildlife Photography	2(0+2)
13.	**SEC-xxx**	Forest Machine Learning Technology	2(0+2)
14.	**SEC-xxx**	Production Technology of Tuber crops	2(0+2)
15.	**SEC-xxx**	Apiculture	2(0+2)
16.	**SEC-xxx**	Plantation Crops Production and Management	2(0+2)
17.	**SEC-xxx**	Sericulture	2(0+2)
18.	**SEC-xxx**	Butterfly Garden	2(0+2)
19.	**SEC-xxx**	Forest Certification	2(0+2)
20.	**SEC-xxx**	Human Wildlife Conflict	2(0+2)
21.	**SEC-xxx**	Sawmill 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.

In case of unavailability of said detailed course-wise syllabus 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 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]

ANNEXURE-VIII

(~ of DICC-Circular No. MAUEB/DICC-Circular/New UG Syllabi/420/24; Dtd. 29.11.2024)

New Undergraduate Degree Syllabus of I-Semester of

B.F.Sc. (Hons.)

Finalized & Approved by the DICC as per the

ICAR - SIXTH DEANS' COMMITTEE REPORT

Being Circulated Separately

Course Curriculum of First Semester

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

FISHERIES SCIENCE

- UG-Certificate in Fisheries Science
- UG-Diploma in Fisheries Science
- UG-Degree: B.F.Sc. (Hons.)

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. D.I. Pathan

Professor & Academic Officer, College of Fisheries, Shirgaon (Dr.BSKKV)

UG Degree Syllabus State Coordinator

with

UG Degree Syllabus Discipline Coordinators &

DICC - UG Degree Syllabus Core Committee

Submitted to the

Directors of Instruction Coordination Committee

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

ANNEXURE-IX

(~ of DICC-Circular No. MAUEB/DICC-Circular/New UG Syllabi/420/24; Dtd. 29.11.2024)

New Undergraduate Degree Syllabus of I-Semester of

B.Sc. (Hons.) Community Science

Finalized & Approved by the DICC as per the

ICAR - SIXTH DEANS' COMMITTEE REPORT

Being Circulated Separately

Course Curriculum of First Semester

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

COMMUNITY SCIENCE

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

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. Jaya Bangale

Associate Dean & Principal, College of Community Science, VNMKV, Parbhani.

UG Degree Syllabus State Coordinator

with

UG Degree Syllabus Discipline Coordinators &

DICC - UG Degree Syllabus Core Committee

Submitted to the

Directors of Instruction Coordination Committee

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