

**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**



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*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.                                                                                                                                                                                                      | <b>CAC-111</b>                  | <i>Deeksharambh</i><br>(Induction-cum-Foundation Course)                          | 2(0+2)                          | NG<br>(2 Weeks)    |
| 2.                                                                                                                                                                                                      | <b>AEC-111</b>                  | National Service Scheme (NSS-I) /<br>National Cadet Corps (NCC-I)                 | 1(0+1)                          |                    |
| 3.                                                                                                                                                                                                      | <b>AEC-112</b>                  | Communication Skills                                                              | 2(1+1)                          |                    |
| 4.                                                                                                                                                                                                      | <b>MDC-111</b>                  | Farming-based Livelihood Systems                                                  | 3(2+1)                          |                    |
| 5.                                                                                                                                                                                                      | <b>MATH-111*/<br/>BIO-111**</b> | Introductory Mathematics*/<br>Basic Biology**                                     | 1(1+0)                          | NG &<br>Need-based |
| 6.                                                                                                                                                                                                      | <b>HORT-111</b>                 | Fundamentals of Horticulture                                                      | 3(2+1)                          |                    |
| 7.                                                                                                                                                                                                      | <b>FS-111</b>                   | Plant Propagation and Nursery<br>Management of Fruit and Plantation Crops         | 3(1+2)                          |                    |
| 8.                                                                                                                                                                                                      | <b>FLA-111</b>                  | Commercial Production of Flower Crops                                             | 3(1+2)                          |                    |
| 9.                                                                                                                                                                                                      | <b>IDE-111</b>                  | Sprinkler and Micro Irrigation Systems                                            | 2(1+1)                          |                    |
| 10.                                                                                                                                                                                                     | <b>SEC-111</b>                  | Skill Enhancement Course-I<br>(To be offered from the bouquet of SEC<br>Courses)  | 2(0+2)                          |                    |
| 11.                                                                                                                                                                                                     | <b>SEC-112</b>                  | Skill Enhancement Course-II<br>(To be offered from the bouquet of SEC<br>Courses) | 2(0+2)                          |                    |
| <b>Total Credits Hrs.</b>                                                                                                                                                                               |                                 |                                                                                   | <b>21(8+13) G<br/>3(1+2) NG</b> |                    |
| <b>CAC:</b> Common Academic Course, <b>AEC:</b> Ability Enhancement Course,<br><b>MDC:</b> Multidisciplinary Course, <b>SEC:</b> Skill Enhancement Course,<br><b>G:</b> Gradual, <b>NG:</b> Non-Gradual |                                 |                                                                                   |                                 |                    |
| <b>Note:</b> *MATH-111 for <b>PCB</b> student/ **BIO-111 for <b>PCM</b> student/ <b>PCMB</b> student is NOT<br>required to take any of these Need-based/Deficiency Courses.                             |                                 |                                                                                   |                                 |                    |

**B.Sc. (Hons.) Horticulture : First Semester**  
**Course-wise Syllabus with Teaching Schedules**

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

**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.

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

|                            |                                                        |                           |
|----------------------------|--------------------------------------------------------|---------------------------|
| <b>Course No.:</b> AEC-111 | <b>Course Title:</b> National Service Scheme-I (NSS-I) | <b>Credit Hrs:</b> 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]**

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

|                     |                                              |                     |
|---------------------|----------------------------------------------|---------------------|
| 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             |
| <b>Total=</b> |                                             |                                                                                                                                                                                                       | <b>100</b>    |

|                                             |                             |
|---------------------------------------------|-----------------------------|
| <b>Semester : I</b>                         |                             |
| <b>Course No. : AEC-112</b>                 | <b>Credit Hrs. : 2(1+1)</b> |
| <b>Course Title : Communication Skills</b>  |                             |
| Gradual 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; Précis 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- 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           | 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.

|                                             |          |                                         |                             |
|---------------------------------------------|----------|-----------------------------------------|-----------------------------|
| <b>Semester</b>                             | <b>:</b> | <b>I</b>                                |                             |
| <b>Course No.</b>                           | <b>:</b> | <b>MDC-111</b>                          | <b>Credit Hrs. : 3(2+1)</b> |
| <b>Course Title</b>                         | <b>:</b> | <b>Farming-based Livelihood Systems</b> |                             |
| Gradual 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 21<sup>st</sup> 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]**

| <b>Lecture No.</b> | <b>Topic</b>                                                                               | <b>Sub-topics/ Key Points</b>                                                                                     | <b>Weightage (%)</b> |
|--------------------|--------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------|----------------------|
| 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 21 <sup>st</sup> 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          |
| <b>Total =</b> |                                                                                                       |                                                                                                | <b>100</b> |

## **TEACHING SCHEDULE**

### **PRACTICAL [MDC-111]**

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



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

### **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 3<sup>rd</sup> order, Examples Properties of determinants up to 3<sup>rd</sup> 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 1/3<sup>rd</sup> 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            | <b>Algebra: Progressions</b>   | Arithmetic Progression: Definition, Sum of n terms, Examples.                                                                                                                                                                                             | 10            |
|                |                                | Geometric Progression: Definition, Sum of n terms, Examples. Harmonic Progression: Definitions, Examples.                                                                                                                                                 |               |
| 3-4            | <b>Determinants</b>            | Definition of Determinant, Expansion of determinant up to 3 <sup>rd</sup> order, Examples                                                                                                                                                                 | 10            |
|                |                                | Properties of determinants up to 3 <sup>rd</sup> order (without proof)                                                                                                                                                                                    |               |
| 5-7            | <b>Matrices</b>                | 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           | <b>Differential Calculus</b>   | 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          | <b>Partial differentiation</b> | Definition, Homogeneous function, Euler's theorem, Examples.                                                                                                                                                                                              | 10            |
|                |                                | Maxima and Minima of the functions of the form $y = f(x)$ Examples.                                                                                                                                                                                       |               |
| 13-15          | <b>Integral Calculus</b>       | 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             | <b>Mensuration</b>             | Statement of Simpson's 1/3 <sup>rd</sup> Rule (without Proof). Examples on Simpson's Rule.                                                                                                                                                                | 10            |
| <b>Total =</b> |                                |                                                                                                                                                                                                                                                           | <b>100</b>    |

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

## **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 flowering plants. Seed and Seed germination. Plant systematics- viz., Brassicaceae, Fabaceae and Poaceae. Role of animals in agriculture.

## **TEACHING SCHEDULE**

### **THEORY**

| <b>Lecture No.</b> | <b>Topic</b>                          | <b>Sub-topics/ Key Points</b>                                                                                                              | <b>Weightage (%)</b> |
|--------------------|---------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------|----------------------|
| <b>1</b>           | Introduction to Living World          | Definition of Biology;<br>Composition and Biological Classification of living world.                                                       | 5                    |
| <b>2</b>           | Diversity and Characteristics of Life | Definitions: Diversity, Biodiversity;<br>Characteristics of life;<br>Building blocks of life and relationship between different organisms. | 5                    |
| <b>3</b>           | Origin of Life                        | Theories of Origin of Life;<br>Oparin - Haldane Theory of Chemical origin.                                                                 | 5                    |
| <b>4</b>           | Evolution and Eugenics                | Evidences of Organic Evolution,<br>Theories of Evolution;<br>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 -<br>A) Brassicaceae<br>B) Fabaceae<br>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          |
| <b>Total =</b> |                                       |                                                                                                                                                                                                              | <b>100</b> |

#### **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 James 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.

|                     |                    |                                     |
|---------------------|--------------------|-------------------------------------|
| <b>Semester</b>     | <b>:</b>           | <b>I</b>                            |
| <b>Course No.</b>   | <b>:</b>           | <b>HORT-111</b>                     |
|                     | <b>Credit Hrs.</b> | <b>: 3(2+1)</b>                     |
| <b>Course Title</b> | <b>:</b>           | <b>Fundamentals of Horticulture</b> |

## **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....*

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

## **TEACHING SCHEDULE**

### **PRACTICAL [HORT-111]**

| <b>Exercise No.</b> | <b>Exercise Title</b>                                                                     |
|---------------------|-------------------------------------------------------------------------------------------|
| <b>1</b>            | Identification of various Horticultural crops                                             |
| <b>2</b>            | Tools and implements                                                                      |
| <b>3</b>            | Features of orchard; Planning and layout of orchard                                       |
| <b>4</b>            | Layout of nutrition garden                                                                |
| <b>5</b>            | Preparation of nursery beds for sowing of vegetable/ flower seeds                         |
| <b>6</b>            | Digging of pits for fruit plants                                                          |
| <b>7</b>            | Planting systems for orchard trees                                                        |
| <b>8</b>            | Training and pruning of orchard trees                                                     |
| <b>9</b>            | Calculation of fertilizer doses, preparation of fertilizer mixtures and field application |
| <b>10</b>           | Preparation and application of growth regulators in horticultural crops                   |
| <b>11</b>           | Layout of different irrigation systems in horticultural crops                             |
| <b>12</b>           | Identification and management of nutritional disorder in fruits and vegetable crops       |
| <b>13</b>           | Assessment of bearing habits of horticultural crops                                       |
| <b>14</b>           | Maturity standards & harvesting of horticultural crops                                    |
| <b>15</b>           | 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, 1<sup>st</sup> Edn. IBDC Publishers.
- 7. Kumar, P. 2014.** Principles of Horticulture, 2<sup>nd</sup> Edn. Agrobios India.
- 8. Kunte, Y.N., Kavthalkar, M.P. and Yawalkar, K.S. 2013.** Principles of Horticulture and Fruit Growing, 11<sup>th</sup> Edn. Agri-Hort Publishers.

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

### **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]**

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

*Continued...*

|   |                                                                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |    |
|---|--------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|
| 6 | Use of vegetative propagation methods viz., division, cutting, layering, | <p>Definition of Cutting, Types of cutting: Stem cuttings (Herbaceous, Softwood, Semi-hard wood, Hardwood), Root cutting, Leaf cutting, Leaf bud cutting.</p> <p>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,</p> <p>Definition of Division,</p> <p>Types of specialized plant organs: Bulbs, Corns, Tuber, Runner, Suckers, Offset, Rhizomes etc.</p> | 15 |
| 7 | Budding and Grafting                                                     | <p>Methods of budding: T-budding (Shield budding), Patch budding, Chip budding, Flute budding, I-budding, Forkert budding.</p> <p>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, <i>In-situ</i> grafting, Double grafting, Top working, Stone grafting.</p> <p>Scion-stock relationship (compatibility, closeness of fit, cambial contact etc.)</p>         |    |
| 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                    | <p>Definition of Plant growth regulators,</p> <p>Use of plant growth regulators: Plant propagation- Seed germination, Rooting of cuttings, Rootings of layers, Hastening the growth of rootstocks in nursery, Other roles;</p> <p>Methods of application: Application of powder mixture, Lanolin paste methods, Soaking method, Quick deep methods, Aerosol method, Vapour method.</p>                                                                                                                | 8  |

Continued...

|               |                                                                                             |                                                                                                                                                                                                                                                                                                                                  |            |
|---------------|---------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|
| <b>10</b>     | 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.)<br>Selection of mother trees, Maintenance of mother trees and Budwood certification.                                             | 10         |
| <b>11</b>     | Selection/collection of scion-wood, and Bud wood Certification                              | Selection/Collection of scion-wood and Budwood Certification, Importance of scion mother tress.                                                                                                                                                                                                                                  |            |
| <b>12</b>     | 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          |
| <b>13</b>     | Role of tissue culture techniques:                                                          | Role of tissue culture techniques viz., Micropropagation, Micrografting and Meristem culture.                                                                                                                                                                                                                                    | 4          |
| <b>14</b>     | Management of Insect-Pest and Diseases in Nursery                                           | Important pest and diseases in nursery and their control measures.                                                                                                                                                                                                                                                               | 4          |
| <b>15</b>     | Nursery Registration Act                                                                    | Nursery Registration Act: Rules and regulations and Features of Nursery Act.                                                                                                                                                                                                                                                     | 5          |
| <b>16</b>     | Cost of establishment of a modern nursery.                                                  | Cost of establishment of Greenhouse/ Glasshouses, Plastic houses, Shadenet houses, Lathhouse.                                                                                                                                                                                                                                    | 4          |
| <b>Total=</b> |                                                                                             |                                                                                                                                                                                                                                                                                                                                  | <b>100</b> |

## **TEACHING SCHEDULE**

### **PRACTICAL [FS-111]**

| <b>Exercise No.</b> | <b>Exercise Title</b>                                                                                          |
|---------------------|----------------------------------------------------------------------------------------------------------------|
| <b>1</b>            | Selection of site for plant propagation and nursery management of fruits and Plantation crops.                 |
| <b>2-3</b>          | Preparation of Nursery beds and sowing of seeds                                                                |
| <b>4-5</b>          | Study of different media for plant propagation                                                                 |
| <b>6</b>            | Study of different containers for containerized nursery production                                             |
| <b>7-8</b>          | Seed treatment for breaking seed dormancy including germination and growth of seedlings                        |
| <b>9</b>            | Sowing of seeds, raising and maintenance of rootstock/seedlings                                                |
| <b>10-11</b>        | Potting, repotting, and preparation of plant material for potting                                              |
| <b>12</b>           | Practicing different types of cutting                                                                          |
| <b>13-14</b>        | Practicing different types of layering                                                                         |
| <b>15-16</b>        | Practicing different types of runners, offsets and other specialized plant parts for propagation               |
| <b>17-18</b>        | Practicing different methods of budding                                                                        |
| <b>19-20</b>        | Practicing different grafting methods                                                                          |
| <b>21-22</b>        | Preparation of growth regulators for seed germination and vegetative propagation                               |
| <b>23</b>           | Digging/uprooting, labelling and packaging of field grown nursery plants                                       |
| <b>24</b>           | Use of mist chambers in plant propagation and hardening of plants                                              |
| <b>25</b>           | Study of propagation structures, greenhouse, polyhouse and net house and their maintenance.                    |
| <b>26-27</b>        | Tissue culture media preparation, <i>Ex-plant</i> preparation, <i>in vitro</i> culturing and shoot tip culture |
| <b>28</b>           | Primary and Secondary hardening of Tissue culture plants                                                       |
| <b>29</b>           | Maintenance of nursery records                                                                                 |
| <b>30</b>           | Identification and management of insect-pests and diseases in nursery                                          |
| <b>31</b>           | Project formulation for small and High-tech nurseries                                                          |
| <b>32</b>           | 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.
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|                     |                    |                                              |
|---------------------|--------------------|----------------------------------------------|
| <b>Semester</b>     | <b>:</b>           | <b>I</b>                                     |
| <b>Course No.</b>   | <b>:</b>           | <b>FLA-111</b>                               |
|                     | <b>Credit Hrs.</b> | <b>: 3(1+2)</b>                              |
| <b>Course Title</b> | <b>:</b>           | <b>Commercial Production of Flower Crops</b> |

### **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.<br>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            |
| <b>Total =</b> |                                                 |                                                                                                                                                                                                                                                                                  | <b>100</b>    |

## 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 ( <i>All six crops major pest and diseases control</i> )                                       |
| 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. 2003.** *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 Trade*. New India Publishing Agency, Pitampura, New Delhi.
9. **Relevant e-Readings: <http://ecourses.iasri.res.in/>**



|                     |                    |                                              |
|---------------------|--------------------|----------------------------------------------|
| <b>Semester</b>     | <b>:</b>           | <b>I</b>                                     |
| <b>Course No.</b>   | <b>:</b>           | <b>IDE-111</b>                               |
|                     | <b>Credit Hrs.</b> | <b>: 2(1+1)</b>                              |
| <b>Course Title</b> | <b>:</b>           | <b>Sprinkler and Micro Irrigation System</b> |

## **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            |
| <b>Total=</b> |                                                                                                                                                                |                                                                                                                                                                                                | <b>100</b>    |

## **TEACHING SCHEDULE**

### **PRACTICAL [IDE-111]**

| <b>Exercise No.</b> | <b>Exercise Title</b>                                                                  |
|---------------------|----------------------------------------------------------------------------------------|
| <b>1-2</b>          | Study of different components, design and installation of sprinkler irrigation system. |
| <b>3-4</b>          | Determination of precipitation pattern, discharge and uniformity coefficient.          |
| <b>5-6</b>          | Study of different components, design and installation of drip irrigation system.      |
| <b>6-7</b>          | Determination of pressure discharge relationship and emission uniformity for emitter.  |
| <b>8</b>            | Study of different types of filters and determination of filtration efficiency.        |
| <b>9-10</b>         | Determination of rate of injection and Calibration for chemigation / fertigation.      |
| <b>11-12</b>        | Design of irrigation and fertigation schedule for crops.                               |
| <b>13-14</b>        | Field Visit(s) to micro irrigation system and evaluation of drip system.               |
| <b>15-16</b>        | 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, 4<sup>th</sup> Edn.
  2. **Mane, M.S. and Ayare, B.L. 2019.** Principles of Drip Irrigation. Publ.- Jain Brothers, New Delhi, 4<sup>th</sup> 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- <b>xxx</b>               | Credit Hrs. : 2(0+2) |
| Course Title : <b>Mushroom Cultivation</b> |                      |

### 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 <i>Agaricus bisporus</i> (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 <i>Pleurotus florida</i> (Dhingri) mushroom                                                                    |
| 21    | Cultivation techniques of <i>Volvoriella volvacea</i> (Paddy straw) mushroom                                                             |
| 22    | Cultivation techniques of <i>Calocybe indica</i> (Milky) mushroom                                                                        |
| 23    | Cultivation techniques of <i>Lentunus edodes</i> (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:<br>(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.

|                                                |                             |
|------------------------------------------------|-----------------------------|
| <b>Course No. : SEC-xxx</b>                    | <b>Credit Hrs. : 2(0+2)</b> |
| <b>Course Title : Orchard Floor Management</b> |                             |

### **TEACHING SCHEDULE**

#### **PRACTICAL**

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



**Course Curriculum of Second 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**



**Vasant Rao Naik  
Marathwada Krishi  
Vidyapeeth, Parbhani**



**Dr. Balasaheb Sawant  
Konkan Krishi  
Vidyapeeth, Dapoli**



**Maharashtra Agricultural  
Universities Examination  
Board, Pune**

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

**Course Layout**

**B.Sc. (Hons.) Horticulture**

**Semester: II (New)**

**w.e.f. Academic Year: 2024-25**

| Sr. No.                                                                                                                                                                   | Course No.      | Course Title                                                                              | Credits Hrs.     | Remark (if any) |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|-------------------------------------------------------------------------------------------|------------------|-----------------|
| 1.                                                                                                                                                                        | <b>AEC-123</b>  | National Services Scheme (NSS-II)/<br>National Cadet Corps (NCC-II)                       | 1(0+1)           | --              |
| 2.                                                                                                                                                                        | <b>AEC-124</b>  | Personality Development                                                                   | 2(1+1)           | --              |
| 3.                                                                                                                                                                        | <b>MDC-122</b>  | Entrepreneurship Development and<br>Business Management                                   | 3(2+1)           | --              |
| 4.                                                                                                                                                                        | <b>VAC-121</b>  | Environmental Studies and Disaster<br>Management                                          | 3(2+1)           | --              |
| 5.                                                                                                                                                                        | <b>AGRO-121</b> | Introduction to Major Field Crops                                                         | 3(2+1)           | --              |
| 6.                                                                                                                                                                        | <b>PSMA-121</b> | Commercial Production of Spices and<br>Plantation Crops                                   | 3(2+1)           | --              |
| 7.                                                                                                                                                                        | <b>VS-121</b>   | Plant Propagation and Nursery<br>Management in Vegetables, Flowers<br>and Medicinal crops | 3(1+2)           | --              |
| 8.                                                                                                                                                                        | <b>SEC-123</b>  | Skill Enhancement Course-III<br>(To be offered from the list of SEC Courses)              | 2(0+2)           | --              |
| 9.                                                                                                                                                                        | <b>SEC-124</b>  | Skill Enhancement Course-IV<br>(To be offered from the list of SEC Courses)               | 2(0+2)           | --              |
| <b>Total Credits Hrs.</b>                                                                                                                                                 |                 |                                                                                           | <b>22(10+12)</b> | <b>G</b>        |
| <b>AEC:</b> Ability Enhancement Course, <b>MDC:</b> Multidisciplinary Course,<br><b>SEC:</b> Skill Enhancement Course, <b>VAC-</b> Value-Added Course, <b>G:</b> Gradiual |                 |                                                                                           |                  |                 |
| <b>Post II Semester (Only for Exit option for award of UG-Certificate)</b>                                                                                                |                 |                                                                                           |                  |                 |
| 10.                                                                                                                                                                       | <b>INT-121</b>  | Internship (10 Weeks)                                                                     | 10(0+10)         | --              |

## **B.Sc. (Hons.) Horticulture : Second Semester**

### **Course-wise Syllabus with Teaching Schedules**

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

|                             |                                                           |                           |
|-----------------------------|-----------------------------------------------------------|---------------------------|
| <b>Course No. : AEC-123</b> | <b>Course Title : National Service Scheme-II (NSS-II)</b> | <b>Credit Hrs.:1(0+1)</b> |
|-----------------------------|-----------------------------------------------------------|---------------------------|

### **SYLLABUS**

- Objectives :**
- (i) To evoke social consciousness among students through various activities viz., working together, constructive and creative social work,
  - (ii) To be skilful in executing democratic leadership and developing skill in program,
  - (iii) To be able to seek self-employment, reducing gap between educated and uneducated, increasing awareness and desire to help sections of society.

### **PRACTICAL**

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

## TEACHING SCHEDULE

### PRACTICAL [AEC-123 / NSS-II]

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

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

### **SYLLABUS**

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

### **PRACTICAL**

Arms Drill- Attention, stand at ease, stand easy. Getting on parade. Dismissing and falling out. Ground/take up arms, examine arms. Shoulder from the order and vice-versa, present from the order and vice-versa. Saluting at the shoulder at the halt and on the march. Short/long trail from the order and vice-versa. Guard mounting, Guard of honor, Platoon/Coy Drill. Characteristics of rifle (.22/.303/SLR), ammunition, fire power, stripping, assembling, care, cleaning, and sight setting. Loading, cocking, and unloading. The lying position and holding. Trigger control and firing a shot. Range Procedure and safety precautions. Aiming and alteration of sight. Theory of groups and snap shooting. Firing at moving targets. Miniature range firing. Characteristics of Carbine and LMG. Introduction to map, scales, and conventional signs. Topographical forms and technical terms. The grid system. Relief, contours, and gradients. Cardinal points and finding north. Types of bearings and use of service protractor. Prismatic compass and its use. Setting a map, finding north and own position. Map to ground and ground to map. Knots and lashings, Camouflage and concealment, Explosives and IEDs. Field defenses obstacles, mines and mine lying. Bridging, waterman ship. Field water supplies, tracks and their construction. Judging distance. Description of ground and indication of landmarks. Recognition and description of target. Observation and concealment. Field signals. Section formations. Fire control orders. Fire and movement. Movement with/without arms. Section battle drill. Types of communication, media, latest trends and developments.

## TEACHING SCHEDULE

### PRACTICAL (AEC-123/ NCC-II)

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

|                                             |                                  |                             |
|---------------------------------------------|----------------------------------|-----------------------------|
| <b>Semester</b>                             | <b>: II</b>                      |                             |
| <b>Course No.</b>                           | <b>: AEC-124</b>                 | <b>Credit Hrs. : 2(1+1)</b> |
| <b>Course Title</b>                         | <b>: Personality Development</b> |                             |
| Gradual Common Course across all UG Degrees |                                  |                             |

### **SYLLABUS**

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

#### **THEORY**

Personality: Definition, Nature of personality, Theories of personality and its types. The humanistic approach - Maslow's self-actualization theory, Shaping of personality, Determinants of personality, Myers-Briggs Typology Indicator, Locus of control and performance, Type A and Type B Behaviours, Personality and Organizational Behaviour. Foundations of individual behavior and Factors influencing individual behavior, Models of individual behavior, Perception and Attributes; Factors affecting perception, Attribution theory and Case studies on Perception and Attribution. Learning: Meaning and Definition, Theories and Principles of Learning, Learning and Organizational behavior, Learning and Training, Learning feedback. Attitude and Values, Intelligence- Types of Intelligence, Theories of intelligence, Measurements of intelligence, Factors influencing intelligence, Intelligence and Organizational behavior, Emotional intelligence. Motivation- Theories and Principles, Teamwork and Group dynamics.

#### **PRACTICAL**

MBTI Personality Analysis, Learning Styles and Strategies, Motivational Needs, Firo-B, Interpersonal Communication, Teamwork and Team Building, Group Dynamics, Win-Win Game, Conflict Management, Leadership Styles, Case Studies on Personality and Organizational Behavior.

## TEACHING SCHEDULE

### THEORY [AEC-124]

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



## TEACHING SCHEDULE

### PRACTICAL [AEC-124]

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

#### **Suggested Readings [AEC-124]:**

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

|                     |                    |                                                             |
|---------------------|--------------------|-------------------------------------------------------------|
| <b>Semester</b>     | <b>:</b>           | <b>II</b>                                                   |
| <b>Course No.</b>   | <b>:</b>           | <b>MDC-122</b>                                              |
|                     | <b>Credit Hrs.</b> | <b>: 3(2+1)</b>                                             |
| <b>Course Title</b> | <b>:</b>           | <b>Entrepreneurship Development and Business Management</b> |

### **SYLLABUS**

#### **Objectives:**

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

### **THEORY**

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

### **PRACTICAL**

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

## **TEACHING SCHEDULE**

### **THEORY [MDC-122]**

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

*Continued....*

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

### **TEACHING SCHEDULE**

#### **PRACTICAL [MDC-122]**

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

Continued...

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

### Suggested Readings [MDC-122]:

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

|                                              |          |                                                      |
|----------------------------------------------|----------|------------------------------------------------------|
| <b>Semester</b>                              | <b>:</b> | <b>II</b>                                            |
| <b>Course No.</b>                            | <b>:</b> | <b>VAC-121</b>                                       |
| <b>Credit Hrs.</b>                           | <b>:</b> | <b>3(2+1)</b>                                        |
| <b>Course Title</b>                          | <b>:</b> | <b>Environmental Studies and Disaster Management</b> |
| Gradiual Common Course across all UG Degrees |          |                                                      |

### **SYLLABUS**

- Objectives** :
- (i) To expose and acquire the knowledge on the environment,
  - (ii) To gain the state-of-the-art skill and expertise on management of disasters.

### **THEORY**

Introduction to Environment - Environmental studies - Definition, scope and importance - Multidisciplinary nature of Environmental Studies - Segments of Environment - Spheres of Earth - Lithosphere - Hydrosphere - Atmosphere - Different layers of atmosphere. Natural Resources: Classification - Forest resources. Water resources. Mineral resources, Food resources. Energy resources. Land resources. Soil resources. Ecosystems - Concept of an ecosystem - Structure and function of an ecosystem - Energy flow in the ecosystem. Types of Ecosystems. Biodiversity and its conservation: Introduction, Definition, Types. Biogeographical Classification of India. Importance and Value of Biodiversity. Biodiversity Hotspots. Threats and Conservation of Biodiversity.

Environmental Pollution: Definition, Cause, Effects and Control measures of: (a) Air pollution. (b) Water pollution. (c) Soil pollution. (d) Marine pollution. (e) Noise pollution. (f) Thermal pollution. (g) Light pollution. Solid Waste Management: Classification of solid wastes and management methods, Composting, Incineration, Pyrolysis, Biogas production, Causes, Effects and Control measures of urban and industrial wastes. Social Issues and the Environment: Urban problems related to energy. Water conservation, Rain water harvesting, Watershed management. Environmental Ethics: Issues and possible solutions, Climate change, Global warming, Acid rain, Ozone layer depletion, Nuclear accidents and Holocaust. Environment Protection Act. Air (Prevention and Control of Pollution) Act. Water (Prevention and control of Pollution) Act. Wildlife Protection Act. Forest Conservation Act. Human Population and the Environment: Environment and Human Health: Human Rights, Value Education. Women and Child Welfare. Role of Information Technology in Environment and Human health.

## VAC-121.....

Disaster Management– Disaster: Definition - Types - Natural Disasters: Floods, drought, cyclone, earthquakes, landslides, avalanches, volcanic eruptions, heat and cold waves. Man-made Disasters: Nuclear disasters, chemical disasters, biological disasters, building fire, coal fire, forest fire, oil fire, road accidents, rail accidents, air accidents, sea accidents. International and National strategy for disaster reduction. Concept of disaster management, National disaster management framework; Financial arrangements; Role of NGOs, Community-based organizations and media in disaster management. Central, state, district and local administration in disaster control; Armed Forces in disaster response; Police and other organizations in disaster management.

### PRACTICAL

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

## TEACHING SCHEDULE

### THEORY [VAC-121]

| Lecture No. | Topic                                    | Sub-topics/ Key Points                                                                                                         | Weightage (%) |
|-------------|------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------|---------------|
| 1           | Introduction to Environmental Studies    | Definition, Scope and Importance; Multidisciplinary nature                                                                     | 4             |
| 2           | Segments of Environment                  | Spheres of Earth – Lithosphere, Hydrosphere, Atmosphere and Different Layers of Atmosphere.                                    | 4             |
| 3-5         | Natural Resources                        | Classification of resources; Forest, water, mineral, food, energy, land, and soil resources                                    | 10            |
| 6-7         | Concept of an Ecosystem                  | Concept, Structure, Function and Energy flow in ecosystems                                                                     | 5             |
| 8-9         | Types of Ecosystems                      | Terrestrial, Aquatic, Agro-ecosystems, Forest ecosystems and Human-modified ecosystems                                         | 5             |
| 10-12       | Biodiversity and its Conservation        | Importance, Value, Types, Bio-geographical classification, Hotspots, Threats, Conservation strategies                          | 8             |
| 13-16       | Environmental Pollution                  | Definition, Causes, Effects, Control measures: Air, Water, Soil, Marine, Noise, Thermal and Light pollution                    | 12            |
| 17-18       | Solid Waste Management                   | Classification of solid wastes; Management methods like, Composting, Incineration, Pyrolysis, Biogas production                | 6             |
| 19          | Urban and Industrial waste               | Causes, Effects and Control measures of Urban and Industrial waste                                                             | 4             |
| 20          | Social Issues Related to the Environment | Urban energy problems, Water conservation, Rainwater harvesting, Watershed management                                          | 4             |
| 21-22       | Environmental Ethics                     | Issues, Possible solutions, Climate change, Global warming, Acid rain, Ozone layer depletion, Nuclear accidents and Holocaust. | 6             |
| 23          | Environment Protection Laws              | Environment Protection Act, Air and Water (Pollution) Acts, Wildlife Protection Act, Forest Conservation Act                   | 4             |

*Continued....*



|                |                                               |                                                                                                                                                                |            |
|----------------|-----------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|
| 24-25          | Human Population and Environment              | Environment and human health, Human rights, Value education, Women and child welfare, Role of IT in environment and health                                     | 5          |
| 26-28          | Introduction to Disaster Management           | Definition, Types of natural and man-made disasters; Floods, Droughts, Cyclones, Earthquakes, Landslides, Fires                                                | 10         |
| 29-30          | Disaster Management Framework                 | National and International strategies, disaster response framework, Financial arrangements, Role of NGOs and media                                             | 5          |
| 31             | Central and Local Administration in Disasters | Role of Central, State, District and Local Administrations;<br>Coordination in disaster response                                                               | 4          |
| 32             | Disaster Response Organizations               | Central, State, District and Local Administrations in Disaster Control;<br>Role of Armed Forces, Police and Other organizations in disaster response & control | 4          |
| <b>Total =</b> |                                               |                                                                                                                                                                | <b>100</b> |

### **TEACHING SCHEDULE**

#### **PRACTICAL [VAC-121]**

| Exercise No. | Exercise Title                                                                                                                                             |
|--------------|------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1            | Visit to a local area to document environmental assets: River /Forest / Grassland / Hill / Mountain.                                                       |
| 2            | Visit to Biogas production, Windmill, Hydro/Solar power generation units                                                                                   |
| 3            | To assess floral and faunal diversity in farming systems.                                                                                                  |
| 4            | Assessment of biodiversity in farming system.                                                                                                              |
| 5            | Floral and faunal diversity assessment in polluted and unpolluted system.                                                                                  |
| 6            | Visit to Local Polluted Site - Urban/Rural/Industrial/Agricultural to study the common plants, insects and birds. Environmental sampling and preservation. |
| 7            | Water quality analysis: pH and electrical conductivity (EC) in water samples.                                                                              |

Continued...

|    |                                                                                             |
|----|---------------------------------------------------------------------------------------------|
| 8  | Estimation of total dissolved solids (TDS) in water samples                                 |
| 9  | Estimation of acidity and alkalinity in water samples.                                      |
| 10 | Estimation of water hardness in water samples.                                              |
| 11 | Determination of dissolved oxygen (DO) and biological oxygen demand (BOD) in water samples. |
| 12 | Performing COD estimation on water samples.                                                 |
| 13 | Enumeration of <i>E. coli</i> in water samples to check for contamination.                  |
| 14 | Assessment of Suspended Particulate Matter (SPM) in an environmental sample.                |
| 15 | Study of simple ecosystem – Visit to Pond/River/Hills.                                      |
| 16 | Visit to areas affected by natural disaster.                                                |

### Suggested Readings (VAC-121):

1. **De, A.K. 2010.** Environmental Chemistry. Published by New Age International Publishers, New Delhi. ISBN:139788122426175.384 pp.
2. **Dhar Chakrabarti, P.G. 2011.** Disaster Management - India's Risk Management Policy Frameworks and Key Challenges. Published by Centre for Social Markets (India), Bangaluru. 36 pp.
3. **Erach Bharucha,** Text Book for Environmental Studies. University Grants Commission, New Delhi.
4. **Parthiban, K.T., Vennila, S., Prasanthrajan, M. and Umesh Kanna, S. 2023.** Forest, Environment, Biodiversity and Sustainable development. Narendra Publishing House, New Delhi, India.
5. **Prasanthrajan, M. and Mahendran, P.P. 2008.** A Text Book on Ecology and Environmental Science.1<sup>st</sup> Edn. ISBN 8183211046. Agrotech Publishing Academy, Udaipur - 313 002.
6. **Prasanthrajan, M. 2018.** Objective Environmental Studies and Disaster Management, ISBN 9789387893825. Scientific Publishers, Jodhpur, India. 146 pp.
7. **Sharma, P.D. 2009.** Ecology and Environment, Rastogi Publications, Meerut, India.
8. **Tyler Miller and Scot Spoolman. 2009.** Living in the Environment (Concepts, Connections, and Solutions). Brooks/Cole, Cengage Learning Publication, Belmont, USA.

|                     |          |                                          |
|---------------------|----------|------------------------------------------|
| <b>Semester</b>     | <b>:</b> | <b>II</b>                                |
| <b>Course No.</b>   | <b>:</b> | <b>AGRO-121</b>                          |
| <b>Credit Hrs.</b>  | <b>:</b> | <b>3(2+1)</b>                            |
| <b>Course Title</b> | <b>:</b> | <b>Introduction to Major Field Crops</b> |

## **SYLLABUS**

### **Objectives:**

- (i) To provide in-depth understanding about crop response to variable agronomic factors.
- (ii) To inculcate the skill of raising field crops with appropriate agronomic practices for higher productivity.

### **THEORY**

Classification and Distribution of field crops, Definition, Concept and Principles of Multiple cropping, Mixed cropping, Intercropping, Relay and Alley cropping, Crop rotation. Economic importance, Soil and Climatic requirement, Varieties, Cultural practices for raising major cereals (Rice, Wheat, Maize), Pulses (Gram, Soybean, Arhar, Moong), Oilseeds (Rapeseed and Mustard, Sunflower, Groundnut), Cash crops (Cotton, Sugarcane) and Fodder crops (Sorghum, Bajra, Berseem, Oats). Principles and Practices of green manuring.

### **PRACTICAL**

Identification of crop plants, seeds, weeds. Preparation of cropping schemes. Methods of sowing, fertilizer and herbicide applications in field crops. Calculation of fertilizer and herbicide doses.

## TEACHING SCHEDULE

### THEORY [AGRO-121]

| Lecture No. | Topic                                                    | Sub-topics/ Key Points                                                                                                                                                                                                                                                      | Weightage (%) |
|-------------|----------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|
| 1           | Definition of Agronomy, Scope and Importance of Agronomy | Definitions of Agriculture and Agronomy, Brief historical sketch of Agriculture and Scope and Importance of Agronomy                                                                                                                                                        | 4             |
| 2           | Agro-climatic Zones of India and Maharashtra             | Agro-climatic zones of India, Agro-climatic zones of Maharashtra.                                                                                                                                                                                                           | 2             |
| 3-4         | Classification and Distribution of Field Crops           | Based on ontogeny (Life cycle), Based economic use (Agronomic), Scientific or Botanical classification, Based on season, Based on climatic condition, Classification based on photosynthesis, Classification based on length of photoperiod required for floral initiation. | 4             |
| 5           | Tillage                                                  | Definition of Tillage, Tillage and Classification of Tillage                                                                                                                                                                                                                | 2             |
| 6           | Methods of Sowing                                        | Broadcasting, Dibbling, Sowing behind the country plough or putting seed behind plough furrow, Seed drilling/line sowing, Planting, Nursery transplanting                                                                                                                   | 2             |
| 7-8         | Cropping System                                          | Definition of Cropping system, Cropping pattern, Cropping scheme, Classification of cropping system- Monoculture, Multiple cropping, Fallow in rotation, Parallel and Sequential multiple cropping.                                                                         | 4             |
| 9           | Crop Rotation                                            | Definition, Principles of Crop rotation, Characteristics of good rotation, Advantages and Disadvantages                                                                                                                                                                     | 2             |
| 10-11       | Manures and Fertilizers                                  | Classification of manures, Bulky and Concentrated organic manures                                                                                                                                                                                                           | 2             |
|             |                                                          | Classification of fertilizers, Nitrogenous, Phosphatic and Potassic fertilizer                                                                                                                                                                                              | 2             |
| 12          | Methods of Fertilizer Application                        | Broadcasting, Placement, Band placement, Pellet application, Fertigation etc.                                                                                                                                                                                               | 2             |
| 13          | Principles and Practices of Green Manuring               | Characteristic of green manuring crop, Classification of green manuring                                                                                                                                                                                                     | 4             |

Continued...

**AGRO-121....**

|               |                             |                                                                  |            |
|---------------|-----------------------------|------------------------------------------------------------------|------------|
| <b>14-18</b>  | Cultivation of Cereals      | Rice, Maize, Sorghum, Pearl millet and Minor millets             | 20         |
| <b>19-23</b>  | Cultivation of Pulses       | Pigeon pea, Greengram, Blackgram, Chickpea, Horsegram and Cowpea | 20         |
| <b>24-28</b>  | Cultivation of Oilseeds     | Groundnut, Sunflower, Rapeseed, Mustard and Soybean              | 10         |
| <b>29-30</b>  | Cultivation of Cash Crops   | Cotton and Sugarcane                                             | 10         |
| <b>31-32</b>  | Cultivation of Fodder Crops | Sorghum, Bajra, Berseem and Oats                                 | 10         |
| <b>Total=</b> |                             |                                                                  | <b>100</b> |

**TEACHING SCHEDULE****PRACTICAL [AGRO-121]**

| <b>Exercise No.</b> | <b>Exercise Title</b>                                                                                                             |
|---------------------|-----------------------------------------------------------------------------------------------------------------------------------|
| <b>1</b>            | Acquaintance of College Farm                                                                                                      |
| <b>2</b>            | Identification of seeds of field crops and preparation of Crop Herbarium.                                                         |
| <b>3</b>            | Study of tillage implements: Primary and secondary tillage implements.                                                            |
| <b>4</b>            | Preparation of cropping scheme.                                                                                                   |
| <b>5</b>            | Practice of puddling and paddy transplanting <b>or</b> other intercultural operation(s) in relevant major regional field crop(s). |
| <b>6</b>            | Study of different methods of sowing, seeding implements and working with them.                                                   |
| <b>7</b>            | Determination of purity and germination percentage of seed.                                                                       |
| <b>8</b>            | Calculation of plant population for different field crops.                                                                        |
| <b>9</b>            | Identification and classification of manures and fertilizers.                                                                     |
| <b>10</b>           | Calculation of fertilizer doses for different field crops.                                                                        |
| <b>11</b>           | Methods of fertilizer application.                                                                                                |
| <b>12</b>           | Identification of weeds and preparation of Weed Herbarium.                                                                        |
| <b>13</b>           | Preparations of herbicide spray solutions.                                                                                        |
| <b>14</b>           | Participation in ongoing field operations and actual working in field for raising crops.                                          |
| <b>15</b>           | Preparation of compost and FYM.                                                                                                   |
| <b>16</b>           | Preparation of calendar of operations of different field crops.                                                                   |

**Suggested Readings [AGRO-121]:**

1. **Anonymous, 2023.** Package of Practices for *Kharif* Crops.
2. **Anonymous, 2023.** Package of Practices for *Rabi* Crops.
3. **Reddy, T.Y. and Reddy, G.H.S. 2020.** Principles of Agronomy, Kalyani Publishers, Ludhiana.
4. **Singh Chidda, 2020.** Modern Techniques of Raising Field Crops, Oxford and IBH Publication.

|                     |          |                                                             |
|---------------------|----------|-------------------------------------------------------------|
| <b>Semester</b>     | <b>:</b> | <b>II</b>                                                   |
| <b>Course No.</b>   | <b>:</b> | <b>PSMA-121</b>                                             |
|                     |          | <b>Credit Hrs. : 3(2+1)</b>                                 |
| <b>Course Title</b> | <b>:</b> | <b>Commercial Production of Spices and Plantation Crops</b> |

### **SYLLABUS**

**Objectives:** To inculcate the skill of raising spices and plantation crops with appropriate knowledge of agronomic practices for higher productivity.

#### **THEORY**

Present status and Importance of Spice crops, Soil and Climate requirements, Commercial varieties, Site selection, Layout, Sowing time and Methods, Nutritional and Irrigation requirements, Intercropping, Weed control, Physiological disorders, Harvesting, Post-harvest management and Plant protection measures of the following crops: Black pepper, Turmeric, Ginger, Garlic, Clove, Cinnamon, Fenugreek, Cumin, Ajowain, Coriander, Fennel, Cardamom, Vanilla, Betelvine and Celery. Area, Production and Export potential of plantation crops, Varietal wealth, Cultivation systems, Multitier cropping, High density planting, Nutritional and Irrigation requirements, Weed management, Training and Pruning, Physiological disorders, Maturity indices, Harvesting, Post-harvest management and Plant protection measures of the following crops: Coffee, Tea, Cashew, Rubber, Coconut, Arecanut, Cocoa and Oil palm. State-level Recommendations, National Varieties and Recommendations.

#### **PRACTICAL**

Identification of seeds and plants, Propagation, Nursery raising, Field layout, Planting methods, Cultural practices, Harvesting and Handling, Visit to fields and marketing centers.

## TEACHING SCHEDULE

### THEORY [PSMA-121]

| Lecture No. | Topic                                                        | Sub-topics/ Key Points                                                                                                                                                                                                                                                                              | Weightage (%) |
|-------------|--------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|
| 1-2         | Present status and Importance of Spices and Plantation crops | Introduction, Brief history, Scope and Importance, Present status of Spice and Plantation industry, Constraint faced in production of Spice and Plantation                                                                                                                                          | 5             |
| 3-4         | Black pepper                                                 | Soil and Climate requirements, Commercial varieties, Site selection, Layout, Sowing time and Methods, Nutritional and Irrigation requirements, Intercropping, Weed control, Physiological disorders, Harvesting, Post-harvest management and Plant protection measures                              | 10            |
| 5-6         | Turmeric                                                     | Soil and Climate requirements, Commercial varieties, Site selection, Layout, Sowing time and Methods, Nutritional and Irrigation requirements, Intercropping, Weed control, Physiological disorders, Harvesting, Post-harvest management and Plant protection measures                              | 10            |
| 7-8         | Ginger, Garlic                                               | Soil and Climate requirements, Commercial varieties, Site selection, Layout, Sowing time and Methods, Nutritional and Irrigation requirements, Intercropping, Weed control, Physiological disorders, Harvesting, Post-harvest management and Plant protection measures                              | 7.5           |
| 9-10        | Clove and Cinnamon                                           | Soil and Climate requirements, Commercial varieties, Site selection, Layout, Sowing time and Methods, Nutritional and Irrigation requirements, Intercropping, Weed control, Physiological disorders, Harvesting, Post-harvest management and Plant protection measures                              | 7.5           |
| 11-14       | Fenugreek, Cumin Ajwain, Coriander Fennel, Celery            | Soil and Climate requirements, Commercial varieties, Site selection, Layout, Sowing time and Methods, Nutritional and Irrigation requirements, Intercropping, Weed control, Physiological disorders, Harvesting, Post-harvest management and Plant protection measures (Tabular Format Information) | 7.5           |

*Continued...*

|         |                                                                       |                                                                                                                                                                                                                                                                                                               |     |
|---------|-----------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|
| 15-16   | Cardamom<br>(Small and Large)                                         | Soil and Climate requirements, Commercial varieties, Site selection, Layout, Sowing time and Methods, Nutritional and Irrigation requirements, Intercropping, Weed control, Physiological disorders, Harvesting, Post-harvest management and Plant protection measures                                        | 5   |
| 17-18   | Vanilla, Betelvine                                                    | Soil and Climate requirements, Commercial varieties, Site selection, Layout, Sowing time and Methods, Nutritional and Irrigation requirements, Intercropping, Weed control, Physiological disorders, Harvesting, Post-harvest management and Plant protection measures                                        | 5   |
| 19-22   | Tea, Coffee, Rubber                                                   | Area, Production and Export, Soil and Climate, Commercial varieties, Cultivation systems, High density planting, Nutritional and Irrigation requirements, Weed management, Training and Pruning, Physiological disorders, Maturity indices, Harvesting, Post-harvest management and Plant protection measures | 7.5 |
| 23-25   | Cashew                                                                | Area, Production and Export, Soil and Climate, Commercial varieties, Cultivation systems, High density planting, Nutritional and Irrigation requirements, Weed management, Training and Pruning, Physiological disorders, Maturity indices, Harvesting, Post-harvest management and Plant protection crops.   | 10  |
| 26-28   | Coconut                                                               | Area, Production and Export, Soil and Climate, Commercial varieties, Cultivation systems, High density planting, Nutritional and Irrigation requirements, Weed management, Training and Pruning, Physiological disorders, Maturity indices, Harvesting, Post-harvest management and Plant protection crops.   | 10  |
| 29-31   | Cocoa, Oil palm, Arecanut                                             | Area, Production and Export, Soil and Climate, Commercial varieties, Cultivation systems, High density planting, Nutritional and Irrigation requirements, Weed management, Training and Pruning, Physiological disorders, Maturity indices, Harvesting, Post-harvest management and Plant protection crops.   | 10  |
| 32      | JOINT AGRESCO Recommendations, National Varieties and Recommendations |                                                                                                                                                                                                                                                                                                               | 05  |
| Total = |                                                                       |                                                                                                                                                                                                                                                                                                               | 100 |



## TEACHING SCHEDULE

### PRACTICAL [PSMA-121]

| Exercise No. | Exercise Title                                                   |
|--------------|------------------------------------------------------------------|
| 1            | Identification of plantation crops.                              |
| 2            | Identification of spice crops.                                   |
| 3            | Propagation techniques in plantation crops.                      |
| 4            | Propagation techniques in spice crops.                           |
| 5            | Nursery techniques in plantation crops.                          |
| 6            | Nursery techniques in spice crops.                               |
| 7            | Field layout for spices and plantation crops.                    |
| 8            | Planting methods for spices and plantation crops.                |
| 9            | Cultural practices in plantation crops.                          |
| 10           | Cultural practices in spice crops.                               |
| 11           | Maturity standards and harvesting of spice and plantation crops. |
| 12           | Post-harvest management of spices.                               |
| 13           | Post-harvest management of plantation.                           |
| 14           | Study of methods of extraction of oils and oleoresins.           |
| 15           | Visit to market (Market study).                                  |
| 16           | Visit to commercial spice and plantation farms.                  |

#### Suggested Readings [PSMA-121]:

1. **Kumar, N. 2018.** Introduction to Spices, Plantation Crops, Medicinal and Aromatic Plants, Oxford and IBH Publishing Co. Pvt. Ltd, New Delhi.
2. **Peter, K.V. 2002.** Plantation Crops, National Book Trust, India, New Delhi.
3. **Pruthi, J.S. 1998.** Major Spices of India Crop Management and Post Harvest Technology, ICAR, Krishi Anusandhan Bhavan, Pusa, New Delhi.

|                     |                                                                                              |                             |
|---------------------|----------------------------------------------------------------------------------------------|-----------------------------|
| <b>Semester</b>     | <b>: II</b>                                                                                  |                             |
| <b>Course No.</b>   | <b>: VS-121</b>                                                                              | <b>Credit Hrs. : 3(1+2)</b> |
| <b>Course Title</b> | <b>: Plant Propagation and Nursery Management in Vegetables, Flowers and Medicinal crops</b> |                             |

## **SYLLABUS**

### **Objectives:**

- (i) To study the biology and types of propagation, tissue culture and physiology of seed, seed storage and dormancy.
- (ii) To gain knowledge of nursery management, nursery establishment and nursery techniques for plant propagation.
- (iii) To study propagation from specialized structures in major vegetable crops, flower crops, medicinal and aromatic plants.

### **THEORY**

Nursery management practices for vegetables, flowers and medicinal crops, Biology of plant propagation, Sexual and Asexual plant propagation, physiology of seed, seed storage and dormancy, physiology of cutting, layering, grafting, budding. Tissue culture, Maintenance of elite germplasm and mother stock. Propagation from specialized modified plant parts, crop specific plant propagation practices in commercial vegetables and flowers. Nursery techniques and crop specific propagation methods of medicinal crops.

### **PRACTICAL**

Identification of planting material, commercial varieties of vegetable, flowers and medicinal crops. Propagation and multiplication, seed production. Potting, repotting and maintenance of houseplants. Practices in manuring, drip and fertigation, foliar nutrition, growth regulator application, pinching, disbudding, staking. Harvesting techniques. Crop-specific plant propagation practices. Visit to local nurseries and florist centers. Marketing requirements and strategies for sale of important crops.

## TEACHING SCHEDULE

### THEORY [VS-121]

| Lecture No. | Topic                                                                                              | Sub-topics/ Key Points                                                                                                                                                                  | Weightage (%) |
|-------------|----------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|
| 1           | Plant propagation: Vegetables, Flowers and Medicinal crops                                         | Definition- Plant propagation, Need of Plant propagation, its significance, Generating uniformity in production of genetically pure and biotic stress-free plant propagating material.  | 10            |
| 2           | Sexual and Asexual Methods of Plant propagation                                                    | Definitions, Aim of propagation, Methods of propagation: Sexual and Asexual, its merits and demerits.                                                                                   | 10            |
| 3           | Physiology of Seed and Seed Storage                                                                | Definitions; Seed germination, Seedling emergence, Environmental factors: Temperature, Moisture, Oxygen and Light. Seed storage, Types of seed storage, Factors affecting seed storage. | 05            |
| 4           | Seed Dormancy                                                                                      | Definition of Seed dormancy, Types of Seed dormancy: Exogenous (due to the external factors) Endogenous (physiological factors). Factors affecting seed dormancy                        | 10            |
| 5           | Treatments to overcome Seed Dormancy in Vegetables, Flowers and Medicinal crops                    | Seed treatments/ Methods of breaking Seed dormancy: Scarification methods: Mechanical scarification, Acid scarification, Hot water treatment; Stratification method: Chilling treatment |               |
| 6           | Nursery Management Practices and Components of Nursery for Vegetables, Flowers and Medicinal crops | Definition of Nursery, Importance and Role, Site selection and Layout of nursery, Types of Nursery: On the basis of duration, plant produced and structure used                         | 05            |
| 7           | Propagation Structures in Nursery Production                                                       | Detail information of propagation structures in nursery production: Mist chamber, Humidifiers, Greenhouses, Glasshouses, Cold frames, Hot beds and Polyhouses                           | 05            |

*Continued...*

|        |                                                                                               |                                                                                                                                                                                                                                            |     |
|--------|-----------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|
| 8      | Growing Medium used for Nursery Plants and Containers used                                    | Objectives and Features of growing media, Different propagating media, Soil and Soilless media. Features of ideal containers, Types of plant containers: Clay pots, Pro-trays, Micro-bags, Polythene bags, etc.                            | 05  |
| 9      | Biology of Plant Propagation                                                                  | Relating to life cycles in plants, Genes impact on propagation, Cell division: Mitosis and Meiosis, etc.                                                                                                                                   | 05  |
| 10     | Vegetative Propagation Method: Propagation from Specialized Modified Plant Parts and Cuttings | Separation and Division of plant parts. Def'n- Bulbs, Corms, Tuber, Runners, Suckers, Offset, Rhizomes, etc. Def'n- Cutting, Types of cuttings: Stem cutting (hardwood, semi-hard wood, softwood, herbaceous), Leaf cutting, Root cutting. | 10  |
| 11     | Vegetative Propagation Method: Layering                                                       | Def'n- Layering, Types of Layering, Merits and Demerits, Limitations                                                                                                                                                                       | 05  |
| 12     | Vegetative Propagation Method: Grafting and Budding                                           | Definitions, Types of grafting and budding, Use of rootstock for vegetable grafting                                                                                                                                                        | 05  |
| 13     | Plant Tissue Culture Techniques                                                               | Role of Tissue Culture Techniques, its Methods viz., Micropropagation, Micro-grafting and Meristem culture, Embryo culture, etc.                                                                                                           | 05  |
| 14     | Maintenance of Elite Germplasm and Mother Stock                                               | Evaluation, Maintenance and Conservation of elite germplasm and mother stock for further use in propagation of Vegetable, Flower and Medicinal plants                                                                                      | 05  |
| 15     | Use of Growth Regulators in Plant Propagation, Plant Protection Measures in Nursery           | Def'n- Plant growth regulators and their role in sexual and asexual propagation (in brief)                                                                                                                                                 | 05  |
|        |                                                                                               | Insect-pest and disease control and Precautionary measures in nursery                                                                                                                                                                      | 05  |
| 16     | JOINT AGRESCO - State Recommendations, National Varieties and Recommendations                 |                                                                                                                                                                                                                                            | 05  |
| Total= |                                                                                               |                                                                                                                                                                                                                                            | 100 |

## TEACHING SCHEDULE

### PRACTICAL [VS-121]

| Exercise No. | Exercise Title                                                                                     |
|--------------|----------------------------------------------------------------------------------------------------|
| 1            | Identification of planting material used in vegetable, flower and medicinal crops.                 |
| 2            | Identification of different garden tools and implements used for propagation.                      |
| 3            | Location and site selection for layout of nursery.                                                 |
| 4            | Study of various soil and soilless media for plant propagation.                                    |
| 5-6          | Preparation of nursery beds and sowing of seeds.                                                   |
| 7            | Study of seed germination, raising of rootstock/ seedlings.                                        |
| 8            | Study of different propagation structures in nursery production.                                   |
| 9            | Potting, reporting and preparation of plant material for potting                                   |
| 10-11        | Seed treatments for breaking seed dormancy, including germination and growth of seedlings.         |
| 12           | Methods of irrigation.                                                                             |
| 13           | Methods of propagation: sexual and asexual, its merits and demerits.                               |
| 14           | Practicing different cutting methods in vegetables, flowers and medicinal plants.                  |
| 15           | Practicing different grafting methods in vegetables, flowers and medicinal plants.                 |
| 16           | Practicing different budding methods in vegetables, flowers and medicinal plants.                  |
| 17           | Practicing different layering methods in vegetables, flowers and medicinal plants.                 |
| 18           | Practicing different types of runners, offsets and other specialized plant organs for propagation. |
| 19           | Preparation of growth regulators for seed germination and vegetative propagation                   |
| 20           | Use of mist chamber in plant propagation and hardening of plants.                                  |
| 21           | Digging/uprooting, labeling and packing of nursery plant.                                          |
| 22           | Use of plant protection measures in nursery.                                                       |
| 23           | Crop-specific plant propagation practices.                                                         |
| 24           | Study of drenching, foliar application of nutrients and fertigation.                               |
| 25           | Application of manures and fertilizer mixtures.                                                    |
| 26           | Raising, maintenance and cost of different nursery structures.                                     |
| 27           | Maintenance of nursery record.                                                                     |
| 28           | Marketing requirements and strategies for sale of important crops.                                 |
| 29           | Visit to Local Nurseries and Florist Centres.                                                      |
| 30           | Visit to Plant Tissue Culture Laboratory.                                                          |
| 31           | Cost of establishment of propagation structures.                                                   |
| 32           | Accreditation of Nursery.                                                                          |

### Suggested Readings [VS-121]:

1. **Hartmann and Kester.** Plant Propagation: Principles and Practices.
2. **Tarai Ranjan Kumar.** Plant Propagation and Nursery Management.

## B.Sc. (Hons.) Horticulture

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

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

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

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

**Skill Enhancement Courses (SECs): Detailed Syllabi**  
*[in continuation of the SECs syllabi given under I semester curriculum]*

|                     |          |                            |
|---------------------|----------|----------------------------|
| <b>Semester</b>     | <b>:</b> | <b>II</b>                  |
| <b>Course No.</b>   | <b>:</b> | <b>SEC-xxx</b>             |
| <b>Credit Hrs.</b>  | <b>:</b> | <b>2(0+2)</b>              |
| <b>Course Title</b> | <b>:</b> | <b>Landscape Gardening</b> |

**SYLLABUS**

**Objectives:**

- (i) To impart skill in identification of ornamental plants,
- (ii) To impart skills in preparation of garden designs.

**TEACHING SCHEDULE**

**PRACTICAL [SEC-xxx]**

| <b>Exercise No.</b> | <b>Exercise Title</b>                                                                 |
|---------------------|---------------------------------------------------------------------------------------|
| <b>1-2</b>          | Identification and use of garden tools and equipments.                                |
| <b>3</b>            | Study of growth characters, identification and classification of ornamental trees.    |
| <b>4</b>            | Study of growth characters, identification and classification of ornamental shrubs.   |
| <b>5</b>            | Study of growth characters, identification and classification of ornamental climbers. |
| <b>6</b>            | Study of growth characters, identification and classification of ground covers.       |
| <b>7</b>            | Study of growth characters, identification and classification of indoor plants.       |
| <b>8-10</b>         | Making and maintenance of edge and hedge.                                             |
| <b>11-13</b>        | Making and maintenance of topiary.                                                    |
| <b>14-15</b>        | Establishment and maintenance of a lawn.                                              |
| <b>16-17</b>        | Bonsai making.                                                                        |
| <b>18</b>           | Art principles of landscaping.                                                        |
| <b>19-20</b>        | Planning, designing and layout of Formal gardens.                                     |

*Continued...*

### *Landscape Gardening...*

|       |                                                                                                     |
|-------|-----------------------------------------------------------------------------------------------------|
| 21-22 | Planning, designing and layout of Informal gardens.                                                 |
| 23-24 | Planning, designing and establishment of garden features.                                           |
| 25-26 | Landscape design process: Landscape drafting tools and dimensioning, graphic symbols and notations. |
| 27    | Site analysis and landscape designing of Residential building.                                      |
| 28    | Site analysis and landscape designing of Public buildings.                                          |
| 29    | Site analysis and landscape designing of Religious places.                                          |
| 30    | Landscape planning of Roads and Roundabouts.                                                        |
| 31    | Visit to Community Parks.                                                                           |
| 32    | Visit to Institutional Gardens.                                                                     |

#### **Suggested Readings [SEC-xxx]:**

1. **G.S. Randhawa and A.K. Mukhopadhyay.** Floriculture in India. Allied Publisher Pvt. Ltd.
  2. **J.S. Arora.** Introductory Ornamental Horticulture. Kalyani Publishers.
  3. **A.K. Tiwari.** Fundamentals of Ornamental Horticulture and Landscape Gardening. NIPA.
  4. **J.E. Ingels.** Landscaping Principles and Practices. Delmer Cengage Learning.
-



|                     |          |                                 |
|---------------------|----------|---------------------------------|
| <b>Semester</b>     | <b>:</b> | <b>II</b>                       |
| <b>Course No.</b>   | <b>:</b> | <b>SEC-<del>xxx</del></b>       |
| <b>Credit Hrs.</b>  | <b>:</b> | <b>2(0+2)</b>                   |
| <b>Course Title</b> | <b>:</b> | <b>Turf and Turf Management</b> |

### **SYLLABUS**

**Objectives:**

- (i) To impart hands-on training on practical aspects of turf management practices.
- (ii) To impart entrepreneurial skills in turf establishment.

### **TEACHING SCHEDULE**

#### **PRACTICAL [SEC-~~xxx~~]**

| <b>Exercise No.</b> | <b>Exercise Title</b>                                    |
|---------------------|----------------------------------------------------------|
| <b>1-2</b>          | Site analysis for turf establishment.                    |
| <b>3-4</b>          | Field preparation and layout for turf making.            |
| <b>5-6</b>          | Identification and classification of turf grasses.       |
| <b>7-9</b>          | Turf establishment methods.                              |
| <b>10</b>           | Sod production.                                          |
| <b>11</b>           | Turf irrigation management.                              |
| <b>12</b>           | Nutrient management in turf grasses.                     |
| <b>13-14</b>        | Special practices in turf management.                    |
| <b>15</b>           | Rejuvenation of old and withered turf.                   |
| <b>16</b>           | Equipments for turf management.                          |
| <b>17-18</b>        | Selection and maintenance of grasses for Golf course.    |
| <b>19-20</b>        | Selection and maintenance of grasses for Cricket ground. |
| <b>21-22</b>        | Turfing for Roof top gardens.                            |
| <b>23</b>           | Applications and use of Turf growth regulators (TGRs).   |
| <b>24</b>           | Identification of seasonal turf grass weeds.             |
| <b>25</b>           | Integrated approaches for turf weed management.          |

*Continued...*

### *Turf and Turf Management ...*

|       |                                                                                |
|-------|--------------------------------------------------------------------------------|
| 26    | Identification and management of turf grass diseases.                          |
| 27    | Identification and management of turf grass insect-pests.                      |
| 28    | Identification and management of turf grass abiotic stress and disorders.      |
| 29    | Identification and management of turf grass nutrient deficiencies.             |
| 30-32 | Visits to Commercial/ Institutional/ School/ Religious gardens and Golf court. |

### **Suggested Readings [SEC-xxx]:**

1. **G.S. Randhawa and A.K. Mukhopadhyay.** Floriculture in India. Allied Publisher Pvt. Ltd.
  2. **J.S. Arora.** Introductory Ornamental Horticulture. Kalyani Publishers.
  3. **A.K. Tiwari.** Fundamentals of Ornamental Horticulture and Landscape Gardening. NIPA.
  4. **J.E. Ingels.** Landscaping Principles and Practices. Delmer Cengage Learning.
-

**Course Curriculum of Third 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



Vasant Rao 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 Coordination Committee**

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

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

**Course Layout**  
**B.Sc. (Hons.) Horticulture**

Semester: III (New)

w.e.f. Academic Year: 2025-26

| Sr. No.                                                                                                                                                                                                                                      | Course No.            | Course Title                                                                            | Credits Hrs.        | Remark    |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------|-----------------------------------------------------------------------------------------|---------------------|-----------|
| 1.                                                                                                                                                                                                                                           | <b>AEC-235</b>        | Physical Education, First Aid, Yoga Practices and Meditation                            | 2(0+2)              | --        |
| 2.                                                                                                                                                                                                                                           | <b>MDC-233</b>        | Agricultural Marketing and Trade                                                        | 3(2+1)              | --        |
| 3.                                                                                                                                                                                                                                           | <b>VS-232</b>         | Commercial Vegetable Production                                                         | 4(3+1)              | --        |
| 4.                                                                                                                                                                                                                                           | <b>SSAC-231</b>       | Fundamentals of Soil Science                                                            | 3(2+1)              | --        |
| 5.                                                                                                                                                                                                                                           | <b>FS-232</b>         | Commercial Fruit Production                                                             | 4(3+1)              | --        |
| 6.                                                                                                                                                                                                                                           | <b>PATH-231</b>       | Disease Management of Horticultural Crops                                               | 3(2+1)              | --        |
| 7.                                                                                                                                                                                                                                           | <b>SEC-235</b>        | Skill Enhancement Course-V <sup>#</sup><br>(To be offered from the list of SEC Courses) | 2(0+2)              | --        |
| 8.                                                                                                                                                                                                                                           | <b>OC-1/ OC-2/...</b> | Online Course(s)/ MOOCs <sup>†</sup>                                                    | As opted by student | <b>NG</b> |
| <b>Total Credits Hrs.=</b>                                                                                                                                                                                                                   |                       |                                                                                         | <b>21(12+9)</b>     | <b>G</b>  |
| <b>AEC:</b> Ability Enhancement Course, <b>MDC:</b> Multidisciplinary Course,<br><b>SEC:</b> Skill Enhancement Course, <b>OC:</b> Online Course, <b>G:</b> Gradual, <b>NG:</b> Non-gradual                                                   |                       |                                                                                         |                     |           |
| <sup>†</sup> <b>Note:</b> It is mandatory for each Student to complete <b>total 10 credits</b> (Non-gradual) of <b>Online Courses</b> from available resources across III to VIII semesters under the guidance of assigned Faculty/ Advisor. |                       |                                                                                         |                     |           |

## B.Sc.(Hons.) Horticulture : Third Semester

### Course-wise Syllabus with Teaching Schedules

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

### SYLLABUS

- Objectives** :
- (i) To make the students aware about Physical Education, First Aid and Yoga Practices,
  - (ii) To disseminate the knowledge and skill how to perform physical training, perform first aid and increase stamina and general wellbeing through Yoga.

### PRACTICAL

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

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

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

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

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

### **TEACHING SCHEDULE**

#### **PRACTICAL [AEC-235]**

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

*Continued...*

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

Continued...

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

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|                                                                                                                                                       |                                           |                    |                 |
|-------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------|--------------------|-----------------|
| <b>Semester</b>                                                                                                                                       | <b>: III</b>                              |                    |                 |
| <b>Course No.</b>                                                                                                                                     | <b>: MDC-233</b>                          | <b>Credit Hrs.</b> | <b>: 3(2+1)</b> |
| <b>Course Title</b>                                                                                                                                   | <b>: Agricultural Marketing and Trade</b> |                    |                 |
| Gradual Common Course among 3 UG Degrees (with different Course Nos.) viz.,<br><b>B.Sc. (Hons.) Horti. / B.Tech. (Food Tech.) / B.Sc. (Hons.) ABM</b> |                                           |                    |                 |

## **SYLLABUS**

### **Objectives:**

- (i) To understand the fundamentals of Agricultural Marketing and Trade,
- (ii) To analyse the factors influencing supply and demand in agricultural markets,
- (iii) To explore different marketing channels and strategies in Agriculture,
- (iv) To examine the role of Government Policies and Regulations in agricultural markets.

## **THEORY**

Agricultural Marketing: Concepts and Definitions of Market, Marketing, Agricultural Marketing, Market structure, Marketing mix and Market segmentation, Classification and Characteristics of Agricultural markets; Demand, Supply and Producer's surplus of agri-commodities: Nature and Determinants of demand and supply of farm products, Producer's surplus – Meaning and its types, Marketable and Marketed surplus, Factors affecting marketable surplus of agri-commodities; Pricing and promotion strategies: Pricing considerations and approaches – Cost-based and Competition-based pricing; Market promotion – advertising, Personal selling, Sales promotion and Publicity– their meaning and merits and demerits; Marketing process and Functions: Marketing process concentration, dispersion and equalization; Exchange functions – buying and selling; physical functions – storage, transport and processing; Facilitating functions – packaging, branding, grading, quality control and labeling (Agmark); Market functionaries and marketing channels: Types and importance of agencies involved in agricultural marketing; meaning and Definition of Marketing Channel; Number of channel levels; Marketing channels for different farm products; Integration, Efficiency, Costs and Price spread: Meaning, Definitions and Types of market integration; Marketing efficiency; Marketing costs, margins and price spread; Factors affecting cost of marketing; Reasons for higher marketing costs of farm commodities; Ways of reducing marketing costs; Role of Govt. in agricultural marketing: Public sector institutions- NAFED, TRIFED, NCDC, APEDA, CWC, SWC, FCI, CACP, DMI – their objectives and functions;

Cooperative marketing in India; Risk in marketing: Types of risk in marketing; Speculation and hedging; An overview of futures trading; Agricultural prices and policy: Meaning and functions of price; Administered prices; Need for agricultural price policy; Trade: Concept of International Trade and its need, Theories of absolute and comparative advantage. Present status and prospects of international trade in agri-commodities; WTO; Agreement on Agriculture (AoA) and its implications on Indian Agriculture; IPR. Role of APMC and its relevance in the present-day context.

### **PRACTICAL [MDC-233]**

Plotting and study of demand and supply curves and calculation of elasticities; Study of relationship between market arrivals and prices of some selected commodities; Computation of marketable and marketed surplus of important commodities; Study of price behaviour over time for some selected commodities; Construction of index numbers; Visit to a local market to study various marketing functions performed by different agencies, Identification of marketing channels for selected commodity; Collection of data regarding marketing costs, margins and price spread and Presentation of report in the class; Visit to market institutions - NAFED, SWC, CWC, Cooperative Marketing Society etc.- To study their organization and functioning. Application of principles of comparative advantage of International Trade.

## TEACHING SCHEDULE

### THEORY [MDC-233]

| Lecture No. | Topic                                                     | Sub-topics / Key Points                                                                                                                                                                                                                                                                                           | Weightage (%) |
|-------------|-----------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|
| 1           | Market and Marketing                                      | Meaning – Definitions – Components of market – Market structure – Meaning – Components – Market conduct – Market performance                                                                                                                                                                                      | 4             |
| 2           | Agricultural Marketing                                    | Meaning – Definition – Scope – Subject matter – Importance of Agricultural Marketing in economic development.                                                                                                                                                                                                     | 6             |
| 3           |                                                           | Market structure, Marketing mix and Market segmentation                                                                                                                                                                                                                                                           |               |
| 4           | Classification and Characteristics of Agricultural Market | Classification of markets – On the basis of Location, Area of coverage, Time span, Volume of transaction, Nature of transaction, Number of commodities, Degree of competition, Nature of commodities, Stage of marketing, Extent of public intervention, Type of population served, Accrual of marketing margins. | 4             |
| 5           | Demand and Supply                                         | Demand, Supply and Producer's surplus of agri-commodities:<br>Nature and Determinants of demand and Supply of farm products,                                                                                                                                                                                      | 4             |
| 6           | Producer's Surplus                                        | Meaning- Marketable surplus- Marketed surplus- Importance- Factors influencing marketable surplus of agri-commodities                                                                                                                                                                                             | 4             |
| 7 - 8       | Pricing and promotion strategies                          | Pricing and promotion strategies;<br>Pricing Considerations and Approaches – Cost-based and Competition-based pricing                                                                                                                                                                                             | 6             |
| 9           | Market Promotion                                          | Advertising, Personal selling, Sales promotion and Publicity – their Meaning and Merits & Demerits;                                                                                                                                                                                                               | 4             |
| 10          | Marketing Process and Functions                           | Marketing Process Concentration, Dispersion and Equalization                                                                                                                                                                                                                                                      | 12            |
| 11          |                                                           | Marketing functions – Meaning -Exchange functions – Buying and Selling                                                                                                                                                                                                                                            |               |
| 12          |                                                           | Physical Functions – Storage, Transport and Processing                                                                                                                                                                                                                                                            |               |
| 13          |                                                           | Facilitating Functions – Packaging, Branding, Grading, Quality control and Labeling (AGMARK)                                                                                                                                                                                                                      |               |
| 14          | Market Functionaries and Marketing Channels               | Types and Importance of agencies involved in Agricultural Marketing;                                                                                                                                                                                                                                              | 8             |
| 15 - 16     |                                                           | Meaning and Definition of Marketing Channel;<br>Number of channel levels;<br>Marketing channels for different farm products;                                                                                                                                                                                      |               |

Continued...

|                |                                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |            |
|----------------|-----------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|
| 17             | Market Integration                      | Definition-Types of Market integration- Horizontal, Vertical and Conglomeration-                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 4          |
| 18             | Marketing Efficiency                    | Meaning- Definitions- Technical or Physical or Operational efficiency- Pricing or Allocative efficiency                                                                                                                                                                                                                                                                                                                                                                                                                                    | 4          |
| 19             | Marketing Cost                          | Marketing Cost- Margins- Price spread- Factors affecting the costs of marketing- Reasons for higher marketing costs of agricultural commodities- Ways of reducing marketing costs for farm products                                                                                                                                                                                                                                                                                                                                        | 4          |
| 20             | Role of Govt. in Agricultural Marketing | Govt. in Agricultural Marketing- Remedial measures Regulated markets-Definition- Important features of Regulated markets, Functions, Progress and Defects                                                                                                                                                                                                                                                                                                                                                                                  | 4          |
| 21 - 22        | Public Sector Institutions              | Objectives and Functions of: ~<br>National Agricultural Cooperative Marketing Federation (NAFED)-<br>Tribal Cooperative Marketing Development Federation (TRIFED)-<br>National Cooperative Development Corporation (NCDC)-<br>Agricultural and Processed Food Products Export Development Authority (APEDA)-<br>Central Warehousing Corporation (CWC)-<br>State Warehousing Corporations (SWC)-<br>Food Corporation of India (FCI)-<br>Commission for Agricultural Cost and Prices (CACP)-<br>Directorate of Marketing & Inspection (DMI)- | 6          |
| 23             | Cooperative Marketing                   | Meaning- Structure- Functions of Cooperative Marketing Societies-                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 2          |
| 24             | Risk in Marketing                       | Types of Risk in Marketing-                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 6          |
| 25             |                                         | Speculation & Hedging-;<br>An overview of Futures trading-                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |            |
| 26             | Agricultural Prices and Policy          | Meaning and Functions of Price; Administered prices; Need for Agricultural Price Policy                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 4          |
| 27 - 28        | International Trade                     | Concept of International Trade and its Need, International trade- Definition- International vs. Interregional trade- Free trade vs. Protection-                                                                                                                                                                                                                                                                                                                                                                                            | 10         |
| 29             |                                         | Theories of Absolute and Comparative Advantage                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |            |
| 30             |                                         | Present status and Prospects of international trade in Agri-commodities; GATT and WTO                                                                                                                                                                                                                                                                                                                                                                                                                                                      |            |
| 31             |                                         | Agreement on Agriculture (AoA) and its implications on Indian Agriculture; Intellectual Property Rights (IPR)                                                                                                                                                                                                                                                                                                                                                                                                                              |            |
| 32             | APMC                                    | Role of APMC and its relevance in the present-day context                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 4          |
| <b>Total =</b> |                                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | <b>100</b> |

## TEACHING SCHEDULE

### PRACTICAL [MDC-233]

| Exercise No. | Exercise Title                                                                                                  |
|--------------|-----------------------------------------------------------------------------------------------------------------|
| 1            | Plotting and Study of demand and supply curves.                                                                 |
| 2            | Calculation of price and income elasticity of demand.                                                           |
| 3            | Study of the relationship between market arrivals and prices of selected commodities.                           |
| 4            | Computation of marketable and marketed surplus of important commodities.                                        |
| 5            | Study of price behaviour (seasonal indices) over time for selected commodities.                                 |
| 6            | Construction of simple and weighted price index numbers.                                                        |
| 7            | Visit to the local market to study different marketing functions performed by different Agencies.               |
| 8            | Study and Identification of marketing channels for selected commodities.                                        |
| 9            | Collection of data and estimation of marketing cost, marketing margin and price spread of selected commodities. |
| 10           | Introduction to different Public Agricultural Marketing Web Portals- (AgMarkNet, MSAMB).                        |
| 11           | Visit to NAFED –Organisational and Functional Study.                                                            |
| 12           | Visit to SWC/CWC- Study of Warehousing Operations.                                                              |
| 13           | Visit to Co-operative Marketing Society –Functional analysis.                                                   |
| 14           | Visit to Local Processing Unit.                                                                                 |
| 15           | Application of Absolute Advantage Theory in International Trade.                                                |
| 16           | Application of Comparative Advantage Theory in International Trade.                                             |

### Suggested Readings [MDC-233]:

1. Acharya S.S. and Agarwal N.L. 2006. Agricultural Marketing in India, Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi.
2. Chinna S.S. 2005. Agricultural Economics and Indian Agriculture. Kalyani Pub, New Delhi.
3. Dominic Salvatore, Micro Economic Theory.
4. Kohls Richard L. and Uhl Josheph N. 2002. Marketing of Agricultural Products, Prentice-Hall of India Private Ltd., New Delhi.
5. Kotler and Armstrong. 2005. Principles of Marketing, Pearson Prentice-Hall.
6. Lekhi R. K. and Joginder Singh. 2006. Agricultural Economics. Kalyani Publishers, Delhi.
7. Memoria C.B., Joshi R.L. and Mulla N.I. 2003. Principles and Practice of Marketing in India, Kitab Mahal, New Delhi.
8. Pandey Mukesh and Tewari Deepali. 2004. Rural and Agricultural Marketing, International Book Distributing Co. Ltd, New Delhi.
9. Sharma R. 2005. Export Management, Laxmi Narain Agarwal, Agra.

|                     |                    |                                     |
|---------------------|--------------------|-------------------------------------|
| <b>Semester</b>     | <b>:</b>           | <b>III</b>                          |
| <b>Course No.</b>   | <b>:</b>           | <b>SSAC-231</b>                     |
|                     | <b>Credit Hrs.</b> | <b>: 3(2+1)</b>                     |
| <b>Course Title</b> | <b>:</b>           | <b>Fundamentals of Soil Science</b> |

### **SYLLABUS**

**Objectives:** To make the students aware about the importance of soil in relation to soil formation, texture, structure, water, temperature, aeration, nutrient availability, Soil Microbiology and soil survey.

### **THEORY**

Composition of earth's crust, Soil as a Natural body - Major components. Eluviation, Illuviation formation of various soils. Physical parameters; Texture - Definition, Methods of textural analysis, Stock's law, Assumption, Limitations, Textural classes, Use of textural triangle; Absolute Specific gravity / Particle density, Definition, Apparent Specific Gravity / Bulk density - Factors influencing, Field bulk density. Relation between BD (Bulk Density), AD - Practical problems. Pore space - Definition, Factors affecting Capillary and Non-capillary porosity, Soil colour - Definition, its Significance, Colour variable, Value hue and Chroma. Munsell colour chart, Factors influencing, Parent material, Soil moisture, Organic matter, Soil structure- Definition, Classification, Clay prism like structure, Factors influencing genesis of soil structure, Soil consistency, Plasticity, Atterberg's constants. Soil air, Air capacity, Composition, Factors influencing, Amount of air space, Soil air renewal, Soil temperature - Sources and Distribution of heat, Factors influencing, Measurement, Chemical properties, Soil colloids, Organic, Humus, Inorganic, Secondary silicate, Clay, Hydrous oxides. Ion exchange, Cation-Anion importance, Soil water, Forms, Hygroscopic, Capillary and Gravitational, Soil moisture constants, Hygroscopic coefficient, Wilting point, Field capacity, Moisture equivalent, Maximum water holding capacity, Energy concepts, PF scale, Measurement, Gravimetric - Electric and Tensiometer methods - Pressure plate and Pressure membrane apparatus - Neutronprobe - Soil water movement- Classification - Aerial photography - Satellite of soil features - their Interpretation; Soil orders; Land capability classification; Soil of different eco-systems and their properties, Rock and Minerals classification, Pedogenic process. Objectives of Soil Science research institute in India (NBSS and LUP, ISSS, LTFE and NSSTL). Management of Soil crusting, Soil compaction and Soil compression. Soil Biology benefits and harmful effects. Methods and Objective of Soil survey, Remote sensing application in soil and plant Studies, Soil degradation.

## **PRACTICAL [SSAC-231]**

Collection and preparation of soil samples, Estimation of moisture, EC, pH and Bulk density. Textural analysis of soil by Robinson's pipette method. Description of soil profile in the field. Quantification of minerals and their abundance. Determination of Soil colour using Munsell chart. Estimation of water holding capacity and Hydraulic conductivity of soils. Estimation of Infiltration rate using Double Ring Infiltrometer method. Estimation of soil moisture using gypsum block and neutron probe method. Soil compaction measurement with Penetrometer. Determination of pore space of soil. Determination of field capacity and permanent wilting point of soil. Determination of soil water potential characteristic curves by tensiometer and pressure plate apparatus. Aggregate size distribution analysis of soil. Air capacity of soil by field method. Nursery raising/ procurement and transplanting, Management and maintenance of the crop, Post-harvest handling, Quality control and marketing.

## TEACHING SCHEDULE

### THEORY [SSAC-231]

| Lecture No. | Topic                                                                   | Sub-topics/ Key Points                                                                                                                                                                                | Weightage (%) |
|-------------|-------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|
| 1 - 2       | Composition of Earth's Crust, Soil as a Natural Body - Major Components | History and Development of Soil Science, its Scope and Importance. Soil as natural body, Pedological and Edaphological concept of soil                                                                | 4             |
| 3 - 5       | Rock and Minerals Classification                                        | Definition, Classification, Properties                                                                                                                                                                | 6             |
| 6 - 7       | Processes and Factors of Soils Formation                                | Eluviation, Illuviation formation of various soils, Pedogenic process, Development of soil profile and Components. Soils of India and Maharashtra                                                     | 10            |
| 8 - 12      | Soil Physical Properties                                                | Physical parameters; Texture - Definitions, Methods of textural analysis, Stock's Law, Assumption, Limitations, Textural classes, Use of textural triangle                                            | 4             |
|             |                                                                         | Absolute Specific gravity / Particle density, Definitions, Apparent Specific gravity / Bulk density - Factors influencing, Field bulk density. Relation between BD (Bulk Density), Practical problems | 4             |
|             |                                                                         | Pore space - Definition, Factors affecting capillary and non-capillary porosity                                                                                                                       | 2             |
|             |                                                                         | Soil structure, Definition, Classification, Clay prism like structure, Factors influencing genesis of soil structure                                                                                  | 4             |
|             |                                                                         | Soil consistency, Plasticity, Atterberg's constants                                                                                                                                                   | 2             |
| 13          | Soil Colour                                                             | Definition, its Significance, Colour variable, Value, Hue and Chroma, Munsell colour chart, Factors influencing, Parent material, Soil moisture, Organic matter                                       | 4             |
| 14          | Soil Air                                                                | Air capacity, Composition, Factors influencing, Amount of air space, Soil air renewal, Effect on plant growth                                                                                         | 4             |

Continued...



|         |                                                                            |                                                                                                                                                                                                                                                                                                                                                                                      |            |
|---------|----------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|
| 15      | Soil Temperature                                                           | Soil temperature, Sources and Distribution of heat, Factors influencing, Measurement                                                                                                                                                                                                                                                                                                 | 4          |
| 16 - 17 | Soil Colloids                                                              | Chemical properties, Soil colloids, Organic, Humus, Inorganic, Secondary Silicate, Clay, Hydrous oxides                                                                                                                                                                                                                                                                              | 4          |
| 18      | Ion Exchange                                                               | Mechanisms, Capacity, Cation-Anion importance                                                                                                                                                                                                                                                                                                                                        | 4          |
| 19 - 20 | Soil Water                                                                 | Forms, Hygroscopic, Capillary and Gravitational, Soil moisture constants, Hygroscopic Coefficient, Wilting point, Field capacity, Moisture equivalent, Maximum water holding capacity, Energy concepts, PF scale, Measurement, Gravimetric - Electric and Tensiometer methods - Pressure plate and Pressure membrane apparatus - Neutronprobe - Soil water movement - Classification | 8          |
| 21      | Aerial Photography<br>Satellite of Soil Features<br>- Their Interpretation | Characteristics, Factors influence, Classification of aerial photography                                                                                                                                                                                                                                                                                                             | 4          |
| 22 - 23 | Soil Taxonomy                                                              | Salient features of Soil Taxonomy<br>Soil orders, Land capability classification                                                                                                                                                                                                                                                                                                     | 4          |
| 24      | Soil Survey                                                                | Methods and Objective of soil survey, Types and Importance                                                                                                                                                                                                                                                                                                                           | 4          |
| 25      | Soil of Different<br>Eco-systems and Their<br>Properties                   | Different eco-systems and their properties                                                                                                                                                                                                                                                                                                                                           | 4          |
| 26      | Objectives of Soil<br>Science Research<br>Institute in INDIA               | NBSS and LUP, ISSS, LTFE and NSSTL                                                                                                                                                                                                                                                                                                                                                   | 4          |
| 27 - 28 | Management of Soil<br>Crusting, Soil<br>Compaction and Soil<br>Compression | Kind, Characteristics, Causes, Management of these soils                                                                                                                                                                                                                                                                                                                             | 4          |
| 29      | Soil Biology                                                               | Soil Macro- and Microorganism, Their Beneficial and Harmful effects on soil and plant                                                                                                                                                                                                                                                                                                | 4          |
| 30 - 31 | Remote Sensing<br>Application in Soil and<br>Plant Studies                 | Definition, Utility, Principles / Stages and Application in Agriculture                                                                                                                                                                                                                                                                                                              | 4          |
| 32      | Soil Degradation                                                           | Types, Causes, Effects and Managements                                                                                                                                                                                                                                                                                                                                               | 4          |
|         |                                                                            | <b>Total=</b>                                                                                                                                                                                                                                                                                                                                                                        | <b>100</b> |

## TEACHING SCHEDULE

### PRACTICAL [SSAC-231]

| Exercise No. | Exercise Topic/ Title                                                                                    |
|--------------|----------------------------------------------------------------------------------------------------------|
| 1            | Practical collection and preparation of soil samples.                                                    |
| 2            | Estimation of moisture, EC, pH and bulk density.                                                         |
| 3            | Estimation of bulk density of soil.                                                                      |
| 4            | Textural analysis of soil by international pipette method.                                               |
| 5            | Description of soil profile in the field.                                                                |
| 6            | Quantification of minerals and their abundance.                                                          |
| 7            | Determination of Soil colour using Munsell Chart.                                                        |
| 8            | Estimation of Water holding capacity and Hydraulic conductivity of soils.                                |
| 9            | Estimation of infiltration rate using Double ring infiltrometer method.                                  |
| 10           | Estimation of soil moisture using Gypsum block and Neutron probe method.                                 |
| 11           | Soil compaction measurement with Penetrometer.                                                           |
| 12           | Determination of pore space of soil.                                                                     |
| 13           | Determination of Field capacity and Permanent wilting point of soil.                                     |
| 14           | Determination of soil water potential characteristic curves by Tensiometer and Pressure plate apparatus. |
| 15           | Aggregate size distribution analysis of soil.                                                            |
| 16           | Air capacity of soil by Field method.                                                                    |

### Suggested Readings [SSAC-231]:

1. **Das D.K.** 2011. Introductory Soil Science. Third Revised Edition Kalyani Publishers. Ludhiana.
2. Fundamentals of Soil Science by Indian Society of Soil Science. Second Revised Edition 2009. Indian Society of Soil Science. New Delhi.
3. **Nyle C Brady and Weil Ray R.** 2016. The Nature and Properties of Soils. 15<sup>th</sup> Edition. Prentice Hall of India Pvt Ltd. New Delhi.
4. **Sharma Pradeep K.** 2017. Introduction to Soil Physics. First Edition, Westville Publishing House, New Delhi. Report of ICAR- Sixth Deans' Committee, P 888.
5. **Saha A.K.** 2008. Text Book of Soil Physics. Reprinted. Kalyani Publishers. Ludhiana.
6. **Sehgal J.A.** 2005. Textbook of Paedology Concepts and Applications. Kalyani Publishers.

|                     |                                      |                             |
|---------------------|--------------------------------------|-----------------------------|
| <b>Semester</b>     | <b>: III</b>                         |                             |
| <b>Course No.</b>   | <b>: FS-232</b>                      | <b>Credit Hrs. : 4(3+1)</b> |
| <b>Course Title</b> | <b>: Commercial Fruit Production</b> |                             |

### **SYLLABUS**

**Objectives :** To acquaint the students with the cultivation techniques for commercially important tropical, sub-tropical and temperate fruit crops.

#### **THEORY**

Area, Production and Export potential, Varieties, Soil and Climate requirements, Propagation techniques, Planting density and Systems, Training and Pruning, High Density Planting, Ultra-High-Density Planting, Mechanization, Management of water, Nutrient and Weeds, Physiological disorders, Special production problems, Insect-Pests, Diseases and their Control measures. Post-harvest technology, Harvest indices, Harvesting methods, Grading, Packaging and Storage of the following crops: Mango, Banana, Citrus, Guava, Litchi, Grapes, Papaya, Pineapple, Ber, Aonla, Pomegranate, Sapota, Jamun, Date palm, Apple, Pear, Peach, Plum, Cherry, Almond, Apricot, Walnut, Kiwi fruit, Hazelnut, Chestnut, Pecan nut and Strawberry. Plantation crops - Oil Palm and Palmyrah palm.

#### **PRACTICAL**

Description and identification of varieties. Training and pruning, Application of manure, fertilizer and irrigation, Weed control, Maturity standards, Harvesting, Handling, Grading and Packaging of fruits. Visit to commercial orchards.

## TEACHING SCHEDULE

| THEORY [FS-232] |                                                                  |                                                                                                                                                                                                                                                                                                                                        |               |
|-----------------|------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|
| Lecture No.     | Topic                                                            | Sub-topics/ Key Points                                                                                                                                                                                                                                                                                                                 | Weightage (%) |
| 1 - 2           | Area, Production and Export Potential Fruit and Plantation Crops | Introduction, brief History, Origin and Distribution and Present status, Constraint faced in production of fruit crops and plantation crops                                                                                                                                                                                            | 7             |
| 3               | Planting Density and Systems                                     | High-Density Planting, Ultra High-Density Planting and Square, Rectangle, Diagonal, Hexagonal, Contour etc. Planting systems in fruit crops                                                                                                                                                                                            | 5             |
| 4               | Mechanization in Fruit and Plantation Crops                      | Scope and Importance of Mechanization in fruit and plantation crops. Advantages and Disadvantages of Mechanization in fruit and plantation crops                                                                                                                                                                                       | 5             |
| 5 - 7           | Mango                                                            | Varieties, Soil and Climate requirements, Propagation techniques, Training and Pruning, Management of water, Nutrient and Weeds, Physiological disorders, Special production problems, Insect-Pests, Diseases and their Control measures. Post-harvest technology, Harvest indices, Harvesting methods, Grading, Packaging and Storage | 7             |
| 8 - 10          | Banana and Papaya                                                |                                                                                                                                                                                                                                                                                                                                        | 7             |
| 11 - 14         | Citrus (Mandarin, Sweet orange, Lime, Lemon, Pummelo)            |                                                                                                                                                                                                                                                                                                                                        | 7             |
| 15 - 18         | Guava and Litchi                                                 |                                                                                                                                                                                                                                                                                                                                        | 7             |
| 19 - 21         | Grapes and Strawberry                                            |                                                                                                                                                                                                                                                                                                                                        | 7             |
| 22 - 25         | Pineapple, Kiwi and Pomegranate                                  |                                                                                                                                                                                                                                                                                                                                        | 7             |
| 26 - 28         | Ber, Aonla and Date palm                                         |                                                                                                                                                                                                                                                                                                                                        | 7             |
| 29 - 31         | Sapota and Jamun                                                 |                                                                                                                                                                                                                                                                                                                                        | 6             |
| 32 - 34         | Apple, Pear and Peach                                            |                                                                                                                                                                                                                                                                                                                                        | 7             |
| 35 - 37         | Plum, Apricot and Cherry                                         |                                                                                                                                                                                                                                                                                                                                        | 7             |
| 38 - 39         | Almond and Hazelnut                                              |                                                                                                                                                                                                                                                                                                                                        | 3             |
| 40 - 42         | Chest Nut, Pecan Nut and Walnut                                  |                                                                                                                                                                                                                                                                                                                                        | 5             |
| 43 - 44         | Palmyra palm and Oil palm                                        |                                                                                                                                                                                                                                                                                                                                        | 2             |
| 45 - 46         | Post-Harvest Technology followed in fruit and plantation crops   | Importance, Major causes of losses, units of operation for post-harvest management in fruits and plantation crops                                                                                                                                                                                                                      | 4             |
| 47 - 48         | Summarized Revision                                              |                                                                                                                                                                                                                                                                                                                                        |               |
| Total =         |                                                                  |                                                                                                                                                                                                                                                                                                                                        | 100           |

## TEACHING SCHEDULE

### PRACTICAL [FS-232]

| Exercise No. | Exercise Title                                          |
|--------------|---------------------------------------------------------|
| 1 - 2        | Description and identification of varieties.            |
| 3 - 4        | Study of Training and pruning in different fruit crops. |
| 5 - 6        | Application of manure and fertilizers in fruit crops.   |
| 7 - 8        | Study of irrigation systems in different fruit crops.   |
| 9            | Study of Weed control in different fruit crops.         |
| 10 -11       | Maturity standards of different fruits crops.           |
| 12 - 13      | Harvesting and handling of different fruits crops.      |
| 14 - 15      | Grading and packaging of fruits crops.                  |
| 16           | Visit to commercial orchards.                           |

#### Suggested Readings [FS-232]:

1. Bal J. S. Fruit Growing.
  2. Chattopadhyay T K. A Textbook on Pomology Vol I-IV.
  3. George Acquaah. Horticulture Principles and Practices.
  4. ICAR. Handbook of Horticulture, Vol- I and II.
  5. Singh Ranjit. Fruits. New Book Trust, New Delhi, 303 p.
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|                     |          |                                        |
|---------------------|----------|----------------------------------------|
| <b>Semester</b>     | <b>:</b> | <b>III</b>                             |
| <b>Course No.</b>   | <b>:</b> | <b>VS-232</b>                          |
| <b>Credit Hrs.</b>  | <b>:</b> | <b>4(3+1)</b>                          |
| <b>Course Title</b> | <b>:</b> | <b>Commercial Vegetable Production</b> |

### **SYLLABUS**

**Objectives:** Student shall gain expertise on commercial cultivation of vegetable crops.

#### **THEORY**

Importance of Olericulture. Vegetable gardens. Vegetable classification, Area, Production and Varieties. Package of practices of Tomato, Brinjal, Chillies, Capsicum, Moringa, Okra. Cucurbitaceous vegetables- Cucumber, Ridge gourd, Ash gourd, Snake gourd, Bottle gourd, Bitter gourd, Sponge gourd, Pumpkin, Melons. Cole crops - Cabbage, Cauliflower, Knol-khol. Bulb crops - Onion and Garlic. Beans and Peas - French beans, Cluster beans, Dolichos beans, Peas, Cowpea. Tuber crops - Potato, Sweet potato, Tapioca, Colocasia, Yams. Root crops - Carrot, Radish, Turnip, Beet root. Leafy vegetables – Broccoli, Lettuce, Spinach, Chinese cabbage and Asparagus.

#### **PRACTICAL**

Identification of vegetable crops and seeds; Planning, layout and maintenance of kitchen garden; Direct sowing of vegetables, Bed preparation and method of nursery sowing; Transplanting of vegetable seedlings; Method of fertilizer application and calculation of different fertilizer doses; Intercultural operations in vegetable crops, Harvesting, grading and packaging of vegetable crops, Economics of vegetable crops, Visit to commercial vegetable farms.

## TEACHING SCHEDULE

### THEORY [VS-232]

| Lecture No. | Topic                                                                                                                                                  | Sub-topics/ Key Points                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Weightage (%) |
|-------------|--------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|
| 1 - 2       | Importance of Olericulture                                                                                                                             | Scope and Importance of Olericulture, Nutritional importance, Medicinal importance                                                                                                                                                                                                                                                                                                                                                                                                                                    | 8             |
| 3 - 5       | Vegetable Gardens                                                                                                                                      | Kitchen, Market, Truck, Vegetable Garden for processing, for seed production, floating garden, etc.                                                                                                                                                                                                                                                                                                                                                                                                                   | 7             |
| 6 - 9       | Vegetable Classification                                                                                                                               | Botanical classification, Cultural, Hardiness, Parts used, Season of cultivation, etc.                                                                                                                                                                                                                                                                                                                                                                                                                                | 7             |
| 10 - 13     | Solanaceous Vegetables: (Tomato, Brinjal, Chilli, Capsicum)                                                                                            | Area, Production, Economic importance and Export potential, Description of varieties and hybrid, Climate and Soil requirements, Seed rate, Preparation of field, Nursery practices; Transplanting of vegetable crops and Planting for directly sown/transplanted vegetable crops. Spacing, Planting systems, Water and Weed management; Nutrient management and Deficiencies, Use of chemicals and growth regulators. Cropping systems, Harvest, Yield, Post-harvest handling, Economics and Marketing of given crops | 10            |
| 14 - 15     | Moringaceae and Malvaceae Vegetables (Moringa and Okra)                                                                                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 8             |
| 16 - 24     | Cucurbitaceous Vegetables: (Cucumber, Ridge gourd, Ash gourd, Snake gourd, Bottle gourd, Bitter gourd, Sponge gourd, Pumpkin, Water melon, Musk melon) |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 10            |
| 25 - 27     | Cole Crops: (Cabbage, Cauliflower, Knol-khol)                                                                                                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 8             |
| 28 - 29     | Bulb Crops: (Onion, Garlic)                                                                                                                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 8             |
| 30 - 34     | Beans and Peas: (French beans, Cluster beans, Dolichos Beans, Peas, Cowpea)                                                                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 6             |
| 35 - 39     | Tuber Crops: (Potato, Sweet potato, Tapioca, Colocasia, Yams)                                                                                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 8             |
| 40 - 42     | Root Crops: (Carrot, Radish, Turnip, Beet root)                                                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 8             |
| 43 - 45     | Leafy Vegetables: (Amaranthus, Coriander, Fenugreek, Mustard)                                                                                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 6             |
| 46 - 48     | Exotic Vegetables: (Broccoli, Lettuce, Spinach, Chinese cabbage, Asparagus)                                                                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 6             |
| Total=      |                                                                                                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 100           |

## TEACHING SCHEDULE

### PRACTICAL [VS-232]

| Exercise No. | Exercise Title                                                                                     |
|--------------|----------------------------------------------------------------------------------------------------|
| 1            | Identification of Tropical and Subtropical vegetable crops.                                        |
| 2            | Identification of Temperate vegetable crops.                                                       |
| 3            | Identification of Tuber crops.                                                                     |
| 4            | Raising vegetable seedlings of improved varieties.                                                 |
| 5            | Field preparation and layout for vegetable and tuber crops.                                        |
| 6            | Seed treatment and sowing of vegetable and tuber crops.                                            |
| 7            | Planting and transplanting of vegetables and tuber crops.                                          |
| 8            | Integrated weed management in vegetable and tuber crops.                                           |
| 9            | Methods of irrigation.                                                                             |
| 10           | Use of plant growth Regulators in vegetable production.                                            |
| 11 - 12      | Identification of nutritional deficiencies in vegetable crops and tuber crops along with remedies. |
| 13           | Identification of physiological disorders in vegetable and tuber crops.                            |
| 14           | Harvesting indices and maturity standards in vegetable and tuber crops.                            |
| 15           | Packaging and storage of vegetable and tuber crops.                                                |
| 16           | Visit to commercial vegetable and tuber production plot.                                           |

#### Suggested Readings [VS-232]:

1. **Bose and Som.** 2003. Vegetable Crops. Vol I, II and III. Naya Prakash.
2. **Dhaliwal M.S.** 2014. Handbook of Vegetable Crops. Kalyani Publishers.
3. **Fageria M.S., Choudhary B.R. and Dhaka.** Vegetable Crop Production Technology, Vol-II. Kalyani Publishers.
4. **Hazara and Som.** 2015. Technology for Vegetable Production and Improvements. Naya Prakash.
5. **ICAR** 2019. Handbook of Horticulture. Vol-1 and 2, ICAR, New Delhi.



|                     |          |                                                  |
|---------------------|----------|--------------------------------------------------|
| <b>Semester</b>     | <b>:</b> | <b>III</b>                                       |
| <b>Course No.</b>   | <b>:</b> | <b>PATH-231</b>                                  |
| <b>Credit Hrs.</b>  | <b>:</b> | <b>3(2+1)</b>                                    |
| <b>Course Title</b> | <b>:</b> | <b>Disease Management of Horticultural crops</b> |

### **SYLLABUS**

#### **Objectives:**

- (i) To study the basics Plant Pathology,
- (ii) To identify various pathogen structures and diagnose the diseases of horticultural crops in field,
- (iii) To understand the disease cycle and epidemiology of various diseases of horticultural crops,
- (iv) To give an overview of various disease management methods (Cultural, Physical Biological, Chemical).

### **THEORY**

Etiology, Symptoms, Mode of spread, Epidemiology and Integrated Management of the diseases of Fruits, Plantation, Medicinal, Aromatic, Vegetables, Ornamental and Spice crops viz. Mango, Litchi, Banana, Grape, Citrus, Guava, Sapota, Papaya, Jack fruit, Pineapple, Pomegranate, Ber, Apple, Pear, Peach, Plum, Almond, Walnut, Strawberry, Tomato, Brinjal, Chilli, Bhindi, Cabbage, Cauliflower, Radish, Knol-khol, Pea, Beans, Beet root, Onion, Garlic, Fenugreek, Ginger, Potato, Areca nut, Coconut, Oil palm, Coffee, Tea, Cocoa, Cashew, Rubber, Turmeric, Pepper, Cumin, Cardamom, Nutmeg, Coriander, Clove, Cinnamon, Jasmine, Rose, Crossed, Tuberose, Gerbera, Anthurium, Geranium, Marigold, Gladiolus. Important post-harvest diseases of Fruit, Plantation, Medicinal, Aromatic, Vegetables, Ornamental and Spice crops and their management. Etiology, Symptoms and Integrated management of important plant parasitic nematodes of Fruits - (Tropical, Sub-tropical and Temperate) Vegetables, Tuber, Ornamental, Spice and Plantation crops.

### **PRACTICAL**

Observations of disease symptoms, Identification of casual organisms and Host-Parasite relationship of important diseases of Fruits, Plantation, Medicinal, Aromatic, Vegetables, Ornamental and Spice crops. Collection and preservation of diseased plant specimen.

## TEACHING SCHEDULE

### THEORY [PATH-231]

| Lecture No.                                                                                                                                                | Topics with Sub-topics/ Key Points                                                                                                                                                                            | Weightage (%) |
|------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|
| Fundamentals of Plant Pathology                                                                                                                            |                                                                                                                                                                                                               | 20            |
| 1                                                                                                                                                          | Introduction, Scope, Importance and Objectives of Plant Pathology; Different Concepts and Terminologies used in Plant Pathology                                                                               | 8             |
|                                                                                                                                                            | Historical Development of Plant Pathology                                                                                                                                                                     |               |
| 2                                                                                                                                                          | Causes of Plant diseases (Biotic- Fungi, Bacteria, Actinomycetes, Mycoplasma, Protozoa, Algae etc.; Mesobiotic- Virus, Viroid and Abiotic Factors); General Characters of plant pathogens, Symptoms and Signs | 8             |
| 3                                                                                                                                                          | Survival, Perpetuation and Dissemination of plant pathogens/ diseases                                                                                                                                         | 4             |
|                                                                                                                                                            | Pathogenicity; Disease triangle; Infection process and Avenues of Penetration                                                                                                                                 |               |
| 4                                                                                                                                                          | Principles of Plant Disease Management; Classification of Fungicides                                                                                                                                          |               |
| Etiology, Symptoms, Mode of spread and Integrated Management of Diseases in respect of following Fruit, Vegetable, Plantation, Spice and Ornamental Crops: |                                                                                                                                                                                                               |               |
| Fruit Crops viz;                                                                                                                                           |                                                                                                                                                                                                               | 30            |
| 5 - 6                                                                                                                                                      | Mango: Powdery mildew, Anthracnose, Die-back, Gummosis, Pink disease, Malformation, Red rust, Loranthus                                                                                                       | 6             |
| 7 - 8                                                                                                                                                      | Banana: Panama wilt, Anthracnose, Leaf spot, (Sigatoka), Erwinia rot, Infectious chlorosis, Bunchy top, Cigar end rot                                                                                         |               |
| 9 - 10                                                                                                                                                     | Grape: Downy mildew, Powdery mildew, Anthracnose, Bacterial canker, Fan leaf.<br>Pomegranate: Oily spot, Anthracnose                                                                                          | 6             |
| 11 - 12                                                                                                                                                    | Citrus: Gummosis, Anthracnose, Ganoderma root rot, Powdery mildew, Canker, Greening. Tristeza, Exocortis, Khaira                                                                                              | 6             |
| 13                                                                                                                                                         | Guava: Wilt, Canker<br>Sapota: Fruit rot<br>Litchi: Anthracnose, Fruit rot                                                                                                                                    | 4             |
| 14                                                                                                                                                         | Papaya: Foot rot, Powdery mildew, Anthracnose, Mosaic, Leaf curl, Ring spot                                                                                                                                   | 3             |
| 15                                                                                                                                                         | Jackfruit: Die-back, Fruit rot<br>Pineapple: Heart rot, Base rot, Wilt<br>Strawberry: Leaf spot, Anthracnose, Wilt<br>Ber: Powdery mildew                                                                     |               |
| 16                                                                                                                                                         | Apple: Scab, Fire blight, Mosaic                                                                                                                                                                              | 5             |

Continued...

| Vegetable Crops viz;  |                                                                                                                                                                                      | 30  |
|-----------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|
| 17 - 18               | Tomato: Damping off, Early and Late blight, Wilts: Fusarial, Verticillium, Bacterial, Virus: Mosaic, Spotted wilt virus                                                              | 10  |
| 19                    | Potato: Early and Late blight, Scab, Bacterial ring rot, Viruses: X, Y, Roll, Rugose, Crinkle                                                                                        |     |
| 20                    | Brinjal: Bacterial wilt, Phomopsis blight, Rust, Little leaf                                                                                                                         |     |
| 21                    | Chili: Powdery mildew, Anthracnose / Ripe fruit rot, <i>Churda Murda</i> ,                                                                                                           |     |
| 22                    | Ladies finger (Bhendi/Okra): Powdery mildew, Yellow vein mosaic                                                                                                                      | 2   |
| 23                    | Cabbage/Cauliflower: Club root, Downy mildew, Powdery mildew                                                                                                                         | 8   |
| 24                    | Radish: White rust,<br>Knol-khol: Major disease,<br>Beet root: Major disease                                                                                                         |     |
| 25                    | Pea: Powdery mildew, Wilt, Enation and Necrosis virus<br>Beans: Powdery mildew in Cluster and other Beans, Bacterial and <i>Alternaria</i> blight, Anthracnose, Bean mosaic diseases | 6   |
| 26                    | Onion: <i>Alternaria</i> blight, Smudge, Downey mildew<br>Garlic: Major disease                                                                                                      | 4   |
| Plantation Crops viz; |                                                                                                                                                                                      | 10  |
| 27                    | Arecanut: Koleroga<br>Coconut: Root wilt, Stem bleeding, Bud rot, Cadang-Cadang, Lethal yellow                                                                                       | 6   |
| 28                    | Coffee: Rust<br>Tea: Blister blight<br>Betelvine: <i>Phytophthora</i> wilt, <i>Sclerotium</i> root rot<br>Cocoa: Anthracnose, Witches broom                                          | 4   |
| Spice Crops viz;      |                                                                                                                                                                                      | 05  |
| 29                    | Pepper: <i>Phytophthora</i> foot rot, Anthracnose, Slow wilt<br>Ginger: Rhizome rot<br>Turmeric: Leaf spot, Rhizome rot<br>Cardamom: Major diseases<br>Nutmeg: Die-back, wilt        | 05  |
| 30                    | Coriander: Powdery mildew, Stem gall<br>Clove: Die-back, <i>Colletotrichum</i><br>Cinnamon: Leaf spot, Die-back<br>Cumin: Wilt, Powdery mildew                                       |     |
| Ornamental Crops viz; |                                                                                                                                                                                      | 05  |
| 31                    | Rose: Powdery mildew, Rust, Die-back, Stem canker<br>Chrysanthemum: Leaf spot, Powdery mildew<br>Merigold: <i>Alternaria</i> spot / Blight<br>Jasmine: Rust, Anthracnose             | 05  |
| 32                    | Gladiolus, Carnation: Major diseases<br>Gerbera: Powdery mildew, Leaf blight<br>Crossandra: Wilt<br>Geranium: Major diseases                                                         |     |
| Total=                |                                                                                                                                                                                      | 100 |

## TEACHING SCHEDULE

### PRACTICAL [PATH-231]

| Exercise No.                                                                                                                                                                                                           | Exercise Title                                                                                                                                                                      |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1                                                                                                                                                                                                                      | Study of microscope and acquaintance with various laboratory equipments.                                                                                                            |
| 2                                                                                                                                                                                                                      | Study of different plant disease symptoms.                                                                                                                                          |
| 3                                                                                                                                                                                                                      | Preparation of culture media.                                                                                                                                                       |
| 4                                                                                                                                                                                                                      | Isolation and purification of plant pathogens.                                                                                                                                      |
| 5                                                                                                                                                                                                                      | Preparation of Bordeaux mixture.                                                                                                                                                    |
| 6                                                                                                                                                                                                                      | Methods of applications of fungicides.                                                                                                                                              |
| <b>Observations of Disease symptoms;<br/>Identification of causal organisms and Host-parasite relationship;<br/>Collection and Preservation of Diseased Plant Specimens of important diseases of following crops ~</b> |                                                                                                                                                                                     |
| 7 - 9                                                                                                                                                                                                                  | Identification, specimen collection and management of major diseases of Fruit crops: Mango, Banana, Citrus, Grape, Guava, Sapota, Papaya, Pomegranate, Strawberry, Pineapple, etc   |
| 10 - 13                                                                                                                                                                                                                | Identification, specimen collection and management of major diseases of Vegetable crops: Solanaceous, Cucurbitaceous, Cole crops, Root vegetables, Peas and Beans, Bulb crops, etc. |
| 14                                                                                                                                                                                                                     | Identification, specimen collection and management of major diseases of Plantation crops: Coconut, Arecanut, Cocoa, Coffee, etc.                                                    |
| 15                                                                                                                                                                                                                     | Identification, specimen collection and management of major diseases of Spices crops: Black pepper, Nutmeg, Clove, Cardamom, Turmeric, Ginger, etc.                                 |
| 16                                                                                                                                                                                                                     | Identification, specimen collection and management of major diseases of Ornamental crops: Rose, Gladiolus, Marigold, Chrysanthemum, etc.                                            |

#### **Suggested Readings [PATH-231]:**

1. **Gupta S.K. and Thind T.S.** 2018. Disease Problems in Vegetable Production. Scientific Publishers India, P.586.
2. **Gupta S.K., Sharma R.C. and Sharma M.** 2017. Diseases of Vegetable. Ornamental and Spice crops. Scientific Publishers India.
3. **Mehrotra R.S. and Aggarwal A.** 2003. Plant Pathology. 2<sup>nd</sup> Edn. Tata McGraw Hill Publication Com Ltd, P.846.
4. **Pathak V.N.** 1989. Diseases of Fruit Crops. Oxford and IBH Publication Comp. New Delhi, P. 309.
5. **Rangaswami G. and Mahadevan A.** 2002. Diseases of Crop Plants in India. 4<sup>th</sup> Edition. Prentice Hall of India Pvt. Ltd. New Delhi, P. 536.
6. **Singh R.S.** 1987. Diseases of Vegetable Crops. 2<sup>nd</sup> Edition. Oxford and IBH Publication. Comp. New Delhi, P. 362.
7. **Singh R.S.** 2018. Plant Diseases. 10<sup>th</sup> Edn. Oxford and IBH Publication. New Delhi, P. 821.
8. **Singh R.S.** 2018. Diseases of Fruit Crops. 2<sup>nd</sup> Edn. Med Tech. New Delhi, P. 281.

## B.Sc. (Hons.) Horticulture

**#List/ Bouquet of Skill Enhancement Courses (SECs)**  
**[in continuation of the SECs' Syllabi prescribed under I and II semesters]**

| Sr. No. | Course No. | Course Title                                                       | Credit Hrs. |
|---------|------------|--------------------------------------------------------------------|-------------|
| 1.      | SEC-xxx    | Mushroom Cultivation                                               | 2(0+2)      |
| 2.      | SEC-xxx    | Apiculture                                                         | 2(0+2)      |
| 3.      | SEC-xxx    | Orchard Floor Management                                           | 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 Micro-Irrigation 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)      |
| 19.     | SEC-xxx    | Horti-Tourism                                                      | 2(0+2)      |

- Note:** (i) Skill Enhancement Courses can be added/offered as per the facilities and resources available at the respective universities/colleges based on the relevance to the region and the UG degree subject.
- (ii) The host University/ College may also choose suitable SEC courses from those listed under other UG degree programs.
- (iii) Above list/ bouquet of SEC courses is an indicative list and subject to modification as applicable therein.
- (iv) In case of unavailability of the detailed course-wise syllabus/ teaching schedules of any of above SEC courses, the same can be primarily developed and followed at College/ University level in the current academic year. However, the same can be obtained from the respective UG Degree Coordinator/ Discipline Coordinators and can be followed w.e.f. AY, 2025-26.

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



Vasant Rao 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 Coordination Committee**

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

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

**Course Layout**

**B.Sc. (Hons.) Horticulture**

**Semester: IV (New)**

**w.e.f. Academic Year: 2025-26**

| Sr. No.                                                                                                                                                                                                                                     | Course No.          | Course Title                                                                              | Credit Hrs.         | Remark   |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------|-------------------------------------------------------------------------------------------|---------------------|----------|
| 1.                                                                                                                                                                                                                                          | <b>VAC-242</b>      | Agricultural Informatics and Artificial Intelligence                                      | 3(2+1)              | --       |
| 2.                                                                                                                                                                                                                                          | <b>HORT-242</b>     | Precision Farming and Protected Cultivation                                               | 3(2+1)              | --       |
| 3.                                                                                                                                                                                                                                          | <b>VS-243</b>       | Seed Production of Vegetable, Tuber and Spice Crops                                       | 3(2+1)              | --       |
| 4.                                                                                                                                                                                                                                          | <b>FMP-241</b>      | Farm Power and Machinery for Horticulture                                                 | 3(2+1)              | --       |
| 5.                                                                                                                                                                                                                                          | <b>HORT-243</b>     | Urban and Peri-Urban Horticulture                                                         | 2(1+1)              | --       |
| 6.                                                                                                                                                                                                                                          | <b>ENTO-241</b>     | Pest Management of Horticultural Crops                                                    | 3(2+1)              | --       |
| 7.                                                                                                                                                                                                                                          | <b>AGRO-242</b>     | Introductory Agrometeorology and Climate Change                                           | 2(1+1)              | --       |
| 8.                                                                                                                                                                                                                                          | <b>SEC-246</b>      | Skill Enhancement Courses-VI <sup>#</sup><br>(To be offered from the list of SEC Courses) | 2(0+2)              | --       |
| 9.                                                                                                                                                                                                                                          | <b>OC-1/OC-2/..</b> | Online Courses/ MOOCs <sup>†</sup>                                                        | As opted by student | NG       |
| <b>Total Credit Hrs.=</b>                                                                                                                                                                                                                   |                     |                                                                                           | <b>21(12+9)</b>     | <b>G</b> |
| VAC: Value-added Course, SEC: Skill Enhancement Course, OC: Online Course,<br>G: Gradual, NG: Non-gradual                                                                                                                                   |                     |                                                                                           |                     |          |
| <b>Post-IV Semester (Only for Exit option for award of UG-Diploma)</b>                                                                                                                                                                      |                     |                                                                                           |                     |          |
| 10.                                                                                                                                                                                                                                         | <b>INT-242</b>      | Internship (10-Week)                                                                      | 10(0+10)            | NG       |
| <sup>†</sup> <b>Note:</b> It is mandatory for each Student to complete <b>total 10 credits</b> (Non-gradual) of <b>Online Courses</b> from available resources across III to VIII semesters under the guidance of assigned Faculty/Advisor. |                     |                                                                                           |                     |          |

## B.Sc. (Hons.) Horticulture : Fourth Semester

### Course-wise Syllabus with Teaching Schedules

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

### SYLLABUS

- Objectives :**
- (i) To acquaint students with the basics of computer applications in Agriculture, multimedia, database management, application of mobile app and decision-making processes etc.,
  - (ii) To provide basic knowledge of computer with applications in Agriculture,
  - (iii) To make the students familiar with Agricultural-Informatics, its components and applications in Agriculture and Artificial Intelligence.

### **THEORY**

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

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

## **PRACTICAL**

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

## TEACHING SCHEDULE

### THEORY [VAC-242]

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

*Continued...*

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

Continued...

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

## TEACHING SCHEDULE

### PRACTICAL [VAC-242]

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

### Suggested Readings [VAC-242]:

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

➤ **Online Resources: (VAC-242)**

- <https://en.wikipedia.org/wiki/Computer>
- <https://www.javatpoint.com/computer>
- <https://iasri.icar.gov.in/>
- [https://www.nrsc.gov.in/EO\\_Agr\\_Objective?language\\_content\\_entity=en](https://www.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://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](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://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](https://apps.mgov.gov.in/apps_by_category;jsessionid=8206D0DAE69F48FB50962462A8922C23?name=Agriculture)

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

1. DSSAT (Decision Support System for Agrotechnology Transfer)
  - Purpose: A comprehensive crop modeling tool.
  - Use: Simulates plant growth, development, and yield for various crops under different management and environmental conditions.
  - Download: <https://dssat.net/>
2. APSIM (Agricultural Production Systems Simulator)
  - Purpose: A powerful plant simulation tool.
  - Use: Models the effects of environmental variables like soil, climate, and management strategies on plant growth and crop yield.
  - Download: <https://www.apsim.info/>
3. Open Sim Root
  - Purpose: A root growth modeling software.
  - Use: Helps understand plant root growth processes, interactions with soil, and how they respond to environmental conditions.
  - Download: Available as open-source software via research platforms like Git Hub.  
<https://gitlab.com/rootmodels/OpenSimRoot>
4. Virtual Plant
  - Purpose: A tool for visualizing and modeling plant metabolic and regulatory networks.
  - Use: Helps in understanding complex plant processes such as gene regulation, metabolic pathways, and how they respond to environmental conditions.
  - Download: <https://sourceforge.net/projects/virtualplant/>
5. R Studio (with Bioconductor and Plant Modeling Libraries)
  - Purpose: A programming environment for statistical computing.
  - Use: Using plant modeling libraries like plant and photosynthesis, researchers can model plant growth, carbon assimilation, and nutrient cycling.
  - Download: <https://posit.co/downloads/>
6. WOFOST (World Food Studies)
  - Purpose: A plant process and crop growth simulation model developed by the FAO.
  - Use: Helps in understanding crop development, photosynthesis, and biomass accumulation under different environmental and management conditions.
  - Download: <https://www.wur.nl/en/research-results/research-institutes/environmental-research/facilities-tools/software-models-and-databases/wofost/downloads-wofost.htm>
7. Green Lab
  - Purpose: A plant growth model focused on plant architecture and functional growth processes.
  - Use: Simulates plant organ development and growth processes, integrating functional and structural aspects of plant behavior.
  - Download: [https://greenlab.cirad.fr/GLUVED/html/P3\\_Tools/Tool\\_simul\\_003.html](https://greenlab.cirad.fr/GLUVED/html/P3_Tools/Tool_simul_003.html)

|                                                                   |                             |
|-------------------------------------------------------------------|-----------------------------|
| <b>Semester</b> : IV                                              |                             |
| <b>Course No.</b> : HORT-242                                      | <b>Credit Hrs.</b> : 3(2+1) |
| <b>Course Title</b> : Precision Farming and Protected Cultivation |                             |

### **SYLLABUS**

**Objectives:** The students will learn about the basic of cultivation of plants under protected conditions.

#### **THEORY**

Precision Farming - Laser levelling, Mechanized direct seed sowing; Seedling and sapling transplanting, Site specific input application. Protected cultivation technology: Introduction, Techniques of protected cultivation, Types of greenhouses, Plant response to greenhouse environment, Planning and design of greenhouses, Design criteria of greenhouse for cooling and heating purposes. Greenhouse equipment, Materials of construction for traditional and low-cost greenhouses. Irrigation systems used in protected cultivation, Typical applications, Passive solar greenhouse, Hot air greenhouse heating systems, Greenhouse drying. Cost estimation and Economic analysis. Choice of crops for cultivation under protected structures, problems/ constraints of greenhouse cultivation and future strategies. Growing media, Soil culture, Type of soil required, Drainage, Flooding and Leaching, Soil pasteurization in peat moss and mixtures, Rock wool and other inert media, Nutrient Film Technique (NFT)/ Hydroponics.

#### **PRACTICAL**

Laser leveling procedure and Field visit. Study and field visit for mechanized direct seed sowing and transplanting. Study of different types of greenhouses based on shape, construction and cladding materials. Studies on different environment control parameters in greenhouses. Estimation of drying rate of agricultural products inside greenhouse. Testing of soil and water to study its suitability for growing crops in protected structures. The study of fertigation requirements for greenhouse crops and estimation of EC and pH in the fertigation solution. The study of various growing media used in raising of greenhouse crops and their preparation and pasteurization/sterilization. Visit to commercial protected cultivation structures. Economics of protected cultivation.



## **TEACHING SCHEDULE**

### **THEORY [HORT-242]**

| <b>Lecture No.</b> | <b>Topics</b>                                                                                                                                  | <b>Sub-topics / Key Points</b>                                                                                                                                                                                                                                                             | <b>Weightage (%)</b> |
|--------------------|------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------|
| <b>1</b>           | Introduction to Precision Farming                                                                                                              | Definition, Importance, Scope, History and Needs of Precision Farming                                                                                                                                                                                                                      | 6                    |
| <b>2 - 4</b>       | Laser Levelling, Mechanized, Direct Seed Sowing, Seedling and Sapling transplanting; Mapping of Soils and Plant Attributes                     | Components of laser levelling, Mechanism benefits of land levelling. Introduction of Direct Seed, Seedling and Sapling Transplanting; Advantages; Definitions, Scientific methods of Soil mapping, Traditional and Digital soil mapping.                                                   | 10                   |
| <b>5 - 7</b>       | Protected Cultivation Technology                                                                                                               | Introduction, Concepts and Applications of Protected Cultivation; Structures such as - Greenhouses, Polyhouses or Net houses. Types of G.H. based on Shape, Utility, Construction and Cladding materials. Principles and Tools of Site-specific Input Application; Benefits and Challenges | 10                   |
| <b>8 - 11</b>      | Plant Response to Greenhouse Environment, Planning and Design of Greenhouses, Design Criteria of Green Houses for Cooling and Heating Purposes | Light, Temperature, R.H, Ventilation and CO <sub>2</sub> , Selecting a Site, Orientation, Interior layout, Structural design loads, Foundations, Frames, Cladding materials, Roof slope and How interior components can influence the greenhouse environment                               | 10                   |
| <b>12 - 13</b>     | Greenhouse Equipments, Material of Construction for Traditional and Low-Cost Greenhouses                                                       | Commercial lightings, Cooling and ventilation, Fan and Pad system, Slant wall fans, Power vent doors, Environmental controls, CO <sub>2</sub> generators, Electrical panels, Greenhouse coverings accessories, Film polycarbonate shade cloth                                              | 10                   |
| <b>14 - 16</b>     | Different Types of Irrigation Systems Used in Greenhouses and their Typical Applications                                                       | Rules of watering, Hand watering, Perimeter, Overhead sprinklers, Boom watering, Drip irrigation, Mister and Foggers                                                                                                                                                                       | 6                    |

***Continued...***

|                |                                                                                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                |            |
|----------------|----------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|
| 17 - 19        | Passive Solar Greenhouses:<br>Hot Air Greenhouse, Heating Systems and Greenhouse Drying                                                | Concept of Passive solar system, Basic principles, Solar heat storage, Orientation, Solar heat absorption, Features of Typical passive solar G.H. Methods of heat transfer - Convection, Conduction and Radiation. Heating systems: Unit heater system, Central heating system, Radiant heater system and Solar heating systems. Drying of Agril. produce inside G.H.: Greenhouse dryer, Types of solar dryer. | 10         |
| 20 - 21        | Estimation of Cost and Economic Analysis of Protected Cultivation                                                                      | Computation of individual cost components, Components of cost analysis, Cost estimation for G.H. construction                                                                                                                                                                                                                                                                                                  | 6          |
| 22 - 24        | Choice of Crops for Cultivation under Protected Structures: their Constrains/ Problems of Greenhouse Cultivation and Future Strategies | Major crops grown under Protected Cultivation: Capsicum, Cucumber, Tomato, Cabbage, Cauliflower, Broccoli, Chinese cabbage, Spinach, Lettuce etc. Environmental constraints, Technical, Labour-related, Economic and Marketing constraints. Future Strategies: Policy initiatives, R & D initiatives, Marketing initiatives, Farmer level initiatives                                                          | 8          |
| 25             | Growing Media                                                                                                                          | Characteristics of Ideal Growing Media; Soil culture, Type of soil required (in brief)                                                                                                                                                                                                                                                                                                                         | 2          |
| 26 - 27        | Drainage, Flooding and Leaching                                                                                                        | Drainage: Benefits of drainage, Types of drainage systems; Leaching: Concept, Nitrogen and Phosphorous leaching and their control measures                                                                                                                                                                                                                                                                     | 8          |
| 28 - 31        | Soil Pasteurization in Peat Moss and Mixtures, Rock Wool and Other Inert Medias                                                        | Methods of disinfection like, Solarization, Steam, Chemical and Biological control, Soil pasteurization, Fumigation and Solarization                                                                                                                                                                                                                                                                           | 8          |
| 32             | Hydroponics and Nutrient Film Technique (NFT)                                                                                          | Introduction, Need, Mechanism of Hydroponics and Concept of NFT, Uses/ Applications, NFT system flow rate and Channel slope                                                                                                                                                                                                                                                                                    | 6          |
| <b>Total =</b> |                                                                                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                | <b>100</b> |

## TEACHING SCHEDULE

### PRACTICAL [HORT-242]

| Exercise No. | Exercise Title                                                                                                              |
|--------------|-----------------------------------------------------------------------------------------------------------------------------|
| 1            | To study laser levelling procedure by field visit.                                                                          |
| 2            | To study mechanized, direct seed sowing, seedling and sapling transplanting by field visit.                                 |
| 3 - 6        | To study different types of greenhouses based on shapes, construction and cladding material.                                |
| 7            | Studies on different environment control parameters in greenhouses.                                                         |
| 8            | To estimate drying rate of agricultural products in shade greenhouses.                                                      |
| 9            | Testing of soil and water to study its suitability for growing crops in protected structures.                               |
| 10           | Study of fertigation requirements for greenhouse crops.                                                                     |
| 11           | Estimation of E.C and pH in the fertigation solution.                                                                       |
| 12           | Study of various growing medias used in raising of greenhouse crops and their preparation and pasteurization/sterilization. |
| 13 - 14      | Visit to commercial protected cultivation structures.                                                                       |
| 15           | Estimation of economics of protected cultivation.                                                                           |
| 16           | Revision                                                                                                                    |

#### Suggested Readings [HORT-242]:

1. Brahma, S. 2019. Precision Farming and Protected Cultivation. NIPA, New Delhi.
2. Michael, A.M. 2008. Irrigation Theory and Practices. Vikas Publishing House Pvt. Ltd., New Delhi.
3. Kumar, S. 2002. Precision Farming and Protected Cultivation: Concepts and Applications. Narendra Publishing House, New Delhi.

|                                                                           |                             |  |
|---------------------------------------------------------------------------|-----------------------------|--|
| <b>Semester</b> : IV                                                      |                             |  |
| <b>Course No.</b> : VS-243                                                | <b>Credit Hrs.</b> : 3(2+1) |  |
| <b>Course Title</b> : Seed Production of Vegetable, Tuber and Spice Crops |                             |  |

## **SYLLABUS**

### **Objectives:**

- i) Students will acquire skill for certification and storage of seed production of vegetable, tuber and spice crops,
- ii) Students will be trained for on-farm operations of different seed multiplication activities of vegetable, tuber and spice crops.

### **THEORY**

Introduction and History of seed industry in India. Definition of Seed, Classes- Types of seed. Differences between Grain and Seed. Importance and Scope of vegetable seed production in India. Principles of vegetable seed production. Role of temperature, humidity and light in vegetable seed production, Land requirements, Climate, Season, Planting time, Nursery management, Seed rate, Rouging, Seed extraction and Storage, Packaging and Labelling of Cole crops, Root vegetables, Solanaceous vegetables, Cucurbits, Okra, Leafy vegetables, Bulb crops, Tuber crops like Potato, Spice crops like Coriander, Fenugreek, Leguminous vegetables and Exotic vegetables. Seed germination and purity analysis. Seed priming and pelleting, Field and seed standards. Seed drying and extraction. Seed legislation.

### **PRACTICAL**

Study of seed structure, colour, size, shape and texture. Field inspection of seed crops. Practices in rouging. Harvesting and seed extraction. Germination and purity analysis. Methods of seed production, Seed certification in cole crops, root vegetables, bulb crops, solanaceous vegetables, cucurbits, okra, leafy vegetables, leguminous vegetables and exotic vegetables. Seed processing machines. Visit to seed production units.

## TEACHING SCHEDULE

### THEORY [VS-243]

| Lecture No. | Topic                                                           | Sub-topics / Key Points                                                                                                                                                                                                                                                                                                                                                                                      | Weightage (%) |
|-------------|-----------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|
| 1 - 2       | Introduction and History of Seed Industry in India              | Seed: Definitions, Classes -Types of Seed. Differences between Grain and Seed; Introduction to seed production and History of seed industry of vegetables, tuber and spice crops in India.                                                                                                                                                                                                                   | 8             |
| 3 - 4       | Importance, Scope and Principles of Seed Production             | Importance and Scope of Vegetable Seed Production in India. Principles of Seed Production in Vegetable, Tuber and Spice crops.                                                                                                                                                                                                                                                                               | 8             |
| 5           | Role of Climate in Seed Production                              | Role of Temperature, Humidity and Light in Vegetable Seed Production,                                                                                                                                                                                                                                                                                                                                        | 4             |
| 6 - 8       | Cole Crops: Cabbage, Cauliflower, Knol-khol, Sprouting Broccoli | Crop-wise Seed Production Technology of Vegetables, Tubers and Spices - (Propagation methods, Isolation distance, Rouging, Maintenance of Genetic Purity); Crop-wise Seed Quality Management - (Planting material, Harvesting, Processing, Seed standards); Land Requirements, Climate, Season, Planting Time, Nursery Management, Seed Rate, Rouging, Seed Extraction and Storage, Packaging and Labelling. | 8             |
| 9 - 10      | Root Vegetables: Radish, Carrot                                 |                                                                                                                                                                                                                                                                                                                                                                                                              | 4             |
| 11 - 13     | Solanaceous Crops: Tomato, Chilli, Brinjal, Bell pepper         |                                                                                                                                                                                                                                                                                                                                                                                                              | 8             |
| 14 - 15     | Cucurbits: Cucumber, Bitter gourds, Pumpkin, Watermelon         |                                                                                                                                                                                                                                                                                                                                                                                                              | 8             |
| 16          | Malvaceous crop: Okra                                           |                                                                                                                                                                                                                                                                                                                                                                                                              | 7             |
| 17 - 18     | Leafy Vegetables: Fenugreek, Amaranthus, Palak                  |                                                                                                                                                                                                                                                                                                                                                                                                              | 4             |
| 19 - 20     | Bulb Crops: Onion, Garlic                                       |                                                                                                                                                                                                                                                                                                                                                                                                              | 7             |
| 21 - 22     | Tuber crops: Potato, Sweet potato                               |                                                                                                                                                                                                                                                                                                                                                                                                              | 4             |
| 23          | Seed Spice Crops: Coriander, Fenugreek                          |                                                                                                                                                                                                                                                                                                                                                                                                              | 4             |
| 24 - 25     | Leguminous Vegetables: Pea, French bean, Dolichos bean          |                                                                                                                                                                                                                                                                                                                                                                                                              | 4             |
| 26          | Exotic Vegetables: Lettuces, Pak Choi, Asparagus, Cherry Tomato |                                                                                                                                                                                                                                                                                                                                                                                                              | 4             |
| 27          | Seed Germination and Purity Analysis                            | Definitions; Principles and Methods of seed germination testing (Dormancy, Viability, Standard germination tests); Seed purity analysis and Quality evaluation ( <i>in brief</i> )                                                                                                                                                                                                                           | 4             |
| 28          | Seed Priming and Seed Pelleting                                 | Definitions, Importance/ Advantages, Methods of Seed Priming and Seed Pelleting, Materials ( <i>in brief</i> )                                                                                                                                                                                                                                                                                               | 4             |

*Continued...*

|                |                                                         |                                                                                                     |            |
|----------------|---------------------------------------------------------|-----------------------------------------------------------------------------------------------------|------------|
| 29             | Field and Seed Standards                                | Field and Seed Standards (Isolation distance, rouging, crop inspection stages, Certification norms) | 4          |
| 30 - 31        | Seed Extraction, Drying, Processing and Storage of Seed | Use of various methods to extract, dry, process and storage of vegetable seeds                      | 4          |
| 32             | Seed Legislation                                        | Enacting of Seed Act/ Rules; Seed Control Order ( <i>Overview in brief</i> )                        | 2          |
| <b>Total =</b> |                                                         |                                                                                                     | <b>100</b> |

### TEACHING SCHEDULE

#### PRACTICAL [VS-243]

| Exercise No. | Exercise Title                                                                                |
|--------------|-----------------------------------------------------------------------------------------------|
| 1            | To study of seed structure, colour, size, shape and texture.                                  |
| 2            | To study objectives and practices of field inspection of seed crops.                          |
| 3            | To study objectives and practices in rouging.                                                 |
| 4            | To examine seed sampling techniques and types of seed samples.                                |
| 5            | To study seed testing techniques for determination of percent germination, viability, purity. |
| 6            | To study seed classes or types on the basis of physical and genetical purity.                 |
| 7            | To study harvesting, extraction, processing, drying of seeds.                                 |
| 8            | To study packaging, labelling and storage of seeds.                                           |
| 9            | To study methods of seed production in cole crops.                                            |
| 10           | To study Methods of seed production in root vegetables.                                       |
| 11           | To study Methods of seed production in bulb crops.                                            |
| 12           | To study methods of seed production in solanaceous crops.                                     |
| 13           | To study methods of seed production in cucurbitaceous crops.                                  |
| 14           | To study methods of seed production in leafy vegetables and exotic vegetables.                |
| 15           | To study methods of seed production in leguminous vegetables.                                 |
| 16           | To visit to seed production units.                                                            |

#### Suggested Readings [VS-243]:

1. Arya Singh P. 2003. Vegetable Seed Production Principles. Kalyani Publishers. Ludhiana.
2. Hazra P. and Som M.G. 2009. Vegetable Seed Production and Hybrid Technology. Kalyani Publishers, Ludhiana.
3. Kulkarni G.N. 2002. Principles of Seed Technology. Kalyani Publishers, Ludhiana.
4. Ram H.H., Upadhyay R., Dubey R. K. and Mandal B.C. 2017. Vegetable Seed Production Principles and Practices. Kalyani Publishers, Ludhiana.
5. Singh, S.P. 2001. Seed Production of Commercial Vegetables. Agrotech Publishing, Udaipur.

|                                                                 |                             |
|-----------------------------------------------------------------|-----------------------------|
| <b>Semester</b> : IV                                            |                             |
| <b>Course No.</b> : FMP-241                                     | <b>Credit Hrs.</b> : 3(2+1) |
| <b>Course Title</b> : Farm Power and Machinery for Horticulture |                             |

### **SYLLABUS**

**Objectives:** To acquaint students of the tools available at his disposal for doing the work in Horticulture (Mechanical power sources: Engines/tractors; Machines and tools for harvesting the horticultural produce: Tillage equipment, Planting equipment, Plant care equipment).

#### **THEORY**

Basic concepts of various forms of energy; Tractors, Power tillers and their Types and Uses. Introduction about IC Engines: Basic principles of operation of compression, ignition and spark ignition engines; Two stroke and Four stroke engines; Crank system, Valve system, Fuel supply system, Cooling and Lubrication systems; Power transmission systems; Broad understanding of performance and efficiency. Tillage: Objectives, Method of ploughing. Primary tillage implements: Construction and Function of improved indigenous ploughs, Mould board ploughs, Disc and Rotary ploughs, Offset rotavators. Secondary tillage implements construction and function of cultivators, harrows, levellers, ridgers and bund formers. Adjustments affecting performance in tillage equipment. Calculation of bite length of rotavator. Post-hole digger. Introduction about planting and transplanting equipment: Potato planters, Small seed planter, Nursery sowing machinery, Vegetable transplanters, Plastic mulch and Drip laying machinery. Introduction about intercultural machinery. Sprayers: Types, Working principle, Manual and Tractor operated, Gun-type and Boom type. Special purpose sprayers: Aeroblast sprayers, Electrostatic sprayers, Sprayer calibration and Nozzle spacing. Safety features and Safe use, Shrub cutters, Pick positioner; Grafting, Pruning and Training tools and Equipment; Sweep, Rotary Weeders, Tractor operated pruners. Crop harvesting equipment: Potato Diggers, Fruit-pluckers, Seed extraction machine.

#### **PRACTICAL**

Calculation of force, power and energy. IC engines – showing the components of dismantled engines. Familiarization with engine systems. Primary and secondary tillage implements: hitching, adjustments and operations. Operation of post-hole digger. Operation of planting and transplanting machinery. Operation of vegetable transplanter, plastic mulch and drip laying machinery. Operation of Inter-culture equipment including off-set rotavator in orchard; calibration of plant protection equipment, Calculation of dilution ratio and Operation; Operation of power weeder, shrub cutter. Operation of crop harvesting equipment and seed extraction machine. Operation of shrub cutters, fruit-pluckers, pick positioner.

## TEACHING SCHEDULE

### THEORY [FMP-241]

| Lecture No. | Topic                                                                 | Sub-topics/ Key Points                                                                                                                                                           | Weightage (%) |
|-------------|-----------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|
| 1           | Basic Concepts of Various Forms of Energy                             | Introduction and Scope of Farm Mechanization; Forms and sources of energy in Agriculture; Merits & Demerits of various forms of energy                                           | 10            |
| 2 - 3       | Tractors and Power Tillers                                            | Types/ Classification and Uses; Selection of tractor, Operation of power tiller                                                                                                  |               |
| 4 - 7       | Introduction about IC Engines                                         | Basic Principles of Operation of Compression; Ignition and Spark Ignition Engines; Two-Stroke and Four-Stroke Engines;<br>Engine components, Engine terminology and examples     | 20            |
| 8 - 9       | Internal Combustion Engine Components, Systems and Power Transmission | Crank System: Components and construction, Working principle;<br>Valve System: Types of valves and valve mechanisms, its operation;<br>Fuel Supply System: in CI and SI engines. | 10            |
| 10          |                                                                       | Cooling and Lubrication Systems: Air cooling and Water cooling, Types of lubrication system                                                                                      |               |
| 11          |                                                                       | Power Transmission Systems: Working of Clutch, Gearbox and Differential                                                                                                          |               |
| 12          | Broad Understanding of Performance and Efficiency                     | Engine performance parameters, Factors influencing engine performance                                                                                                            |               |
| 13          | Tillage                                                               | Definition, Objectives, Classification/ Methods                                                                                                                                  | 20            |
| 14 - 16     | Primary Tillage Implements                                            | Construction and Functions of improved indigenous ploughs, Mould board ploughs, Disc and Rotary ploughs, Offset rotavators.                                                      |               |
| 17 - 19     | Secondary Tillage Implements                                          | Types, Construction and Functions of Cultivators, Harrows, Levellers, Ridgers and Bund formers, Post-hole digger                                                                 |               |
| 20          | Adjustments Affecting Performance in Tillage Equipment &              | Adjustments in Mould board plough and Disc plough                                                                                                                                |               |
| 21          | Calculations                                                          | Calculation of Bite Length of Rotavator                                                                                                                                          |               |

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|                |                                                         |                                                                                                                                                                                                                                                                                                                                                                                                                                      |            |
|----------------|---------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|
| 22 - 24        | Introduction about Planting and Transplanting Equipment | Potato Planters, Small Seed Planter, Nursery Sowing Machinery, Vegetable Transplanters, Plastic Mulch and Drip Laying Machinery; Sowing equipment, Seed drill calibration                                                                                                                                                                                                                                                            | 10         |
| 25             | Intercultural Machinery & Sprayers                      | Introduction about Intercultural Machinery (in brief); Sprayers: Types and Working Principles of various sprayers; Manual and Tractor-operated, Gun-type and Boom type                                                                                                                                                                                                                                                               | 10         |
| 26 - 27        | Special Purpose Sprayers & their Safety                 | Working Principle of Aeroblast and Electrostatic sprayers; Sprayer calibration and Nozzle spacing; Examples                                                                                                                                                                                                                                                                                                                          |            |
| 28             |                                                         | Safety Features and Safe Use of Sprayer                                                                                                                                                                                                                                                                                                                                                                                              |            |
| 29 - 31        | Horticultural Tools/ Implements/ Equipment              | Shrub Cutters: Types, Construction and working principle, Applications. Pick Positioner: Purpose, design and operational features. Grafting Tools: Types and design of grafting tools, Methods of grafting and tool use (in brief). Pruning Tools: Types and working of pruning tools. Training Tools: Training systems and supporting structures, Tools used. Sweep, Rotary Weeders, Tractor-operated Pruners: Purpose and Features | 20         |
| 32             | Horticultural Crops Harvesting Tools/ Equipment         | Potato diggers, Fruit-pluckers, Seed extraction machine: Purpose, Types and Advantages                                                                                                                                                                                                                                                                                                                                               |            |
| <b>Total =</b> |                                                         |                                                                                                                                                                                                                                                                                                                                                                                                                                      | <b>100</b> |

## TEACHING SCHEDULE

### PRACTICAL [FMP-241]

| Exercise No. | Exercise Title                                                                             |
|--------------|--------------------------------------------------------------------------------------------|
| 1            | Calculation of Force, Power and Energy.                                                    |
| 2 - 3        | Identification of various engine components (Both CI and SI engines).                      |
| 4 - 5        | Familiarization with engine systems (Cooling, Lubrication, Fuel supply).                   |
| 6            | Introduction of primary and secondary tillage implements.                                  |
| 7            | Adjustments in operations of Mould board plough and Disc plough.                           |
| 8            | Familiarization with operation and components of post-hole digger.                         |
| 9            | Familiarization with operation and components of planting and transplanting machinery.     |
| 10           | Operation of vegetable transplanter, plastic mulch and drip laying machinery.              |
| 11           | Operation of Inter-culture equipment including offset rotavator in orchard.                |
| 12           | Calibration of plant protection equipment and calculation of dilution ratio and operation. |
| 13           | Operation of power weeder and shrub cutter.                                                |
| 14           | Operation of crop harvesting equipment and seed extraction machine.                        |
| 15           | Operation of shrub cutters, fruit-pluckers and pick positioner.                            |

#### **Suggested Readings [FMP-241]:**

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

|                     |                                            |                             |
|---------------------|--------------------------------------------|-----------------------------|
| <b>Semester</b>     | <b>: IV</b>                                |                             |
| <b>Course No.</b>   | <b>: HORT-243</b>                          | <b>Credit Hrs. : 2(1+1)</b> |
| <b>Course Title</b> | <b>: Urban and Peri-Urban Horticulture</b> |                             |

## **SYLLABUS**

### **Objectives:**

- i) To acquaint the students about the urban and peri-urban horticulture and its types,
- ii) To impart the knowledge about the cultivation practices of horticultural crops in urban and peri-urban areas.

### **THEORY**

Introduction to Urban and Peri-urban Horticulture: Definition, Importance, Characteristics and Scope. Types of Urban and Peri-urban gardens and their characteristics: Terrace gardening, Vegetable gardening, Container gardening, Rooftop gardens, Community gardens, Vertical gardens, Hydroponics and Aeroponics. Selection of site, Planting material, Media (soil and soilless) preparation and Nutrient management for cultivation of vegetables, herbs, fruits, flowers and ornamental plants. Protected cultivation in urban and peri-urban areas. Making and maintenance of lawns. Interior and exterior landscaping in urban and peri-urban households. Water and Waste management, Waste water recycling and its Use in landscaping. Insect - pest and Disease management in Urban Horticulture.

### **PRACTICAL**

Site selection and layout of various urban and peri-urban gardens. Preparation of growing media and potting mixtures. Types of containers, nursery raising and planting for rooftop gardens. Irrigation and nutritional management in urban and peri-urban horticulture. Visit to fruit nutrition garden, vegetable kitchen garden and public gardens.

## TEACHING SCHEDULE

### THEORY [HORT-243]

| Lecture No.   | Topic                                                     | Sub-topics / Key Points                                                                                                                                                             | Weightage (%) |
|---------------|-----------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|
| 1 - 2         | Scope and Importance of Urban and Peri-urban Horticulture | Urban and Peri-urban Horticulture: Introduction, Definitions, Importance and Scope                                                                                                  | 10            |
| 3 - 4         | Types of Urban and Peri-urban Horticulture                | Types of urban and peri-urban gardens and their characteristics; Terrace garden, Container gardening, Rooftop gardens, Community gardens                                            | 10            |
| 5             |                                                           | Vegetable gardening                                                                                                                                                                 | 10            |
| 6             |                                                           | Vertical gardens                                                                                                                                                                    | 5             |
| 7 - 8         |                                                           | Hydroponics and Aeroponics                                                                                                                                                          | 10            |
| 9             | Site Selection                                            | Selection of site, Criteria, (Climatic and environmental factors, Physical and infrastructural considerations, Accessibility)                                                       | 10            |
| 10            | Planting Material, Planting Media                         | Types and quality of planting material; Planting media and substrates, Media (Types- Soil and Soilless), Media preparation and management, Characteristics of ideal media, Examples | 10            |
| 11            | Nutrient Management                                       | Nutrient management for cultivation of vegetables, herbs, fruits, flowers and ornamental plants                                                                                     | 5             |
| 12            | Protected Cultivation in Urban and Peri-urban Households  | Types of protected structures/ greenhouse for households; Crop selection and management practices; Advantages and constraints                                                       | 10            |
| 13            | Lawn                                                      | Types of lawn grasses and selection; Making and Maintenance                                                                                                                         | 10            |
| 14            | Interior and Exterior Landscaping                         | Definitions; Principles and Elements of landscaping; Plants and Materials                                                                                                           | 5             |
| 15            | Water and Waste Management                                | Water use and irrigation management; Waste water recycling, Solid and organic waste management; their re-use in landscaping ( <i>in brief</i> )                                     | 2             |
| 16            | Insect-Pests and Disease Management                       | Identification and Management ( <i>in brief</i> )                                                                                                                                   | 3             |
| <b>Total=</b> |                                                           |                                                                                                                                                                                     | <b>100</b>    |

## **TEACHING SCHEDULE**

### **PRACTICAL [HORT-243]**

| <b>Exercise No.</b> | <b>Exercise Title</b>                                                               |
|---------------------|-------------------------------------------------------------------------------------|
| <b>1 - 2</b>        | Site selection and layout of various urban and peri-urban garden.                   |
| <b>3 - 4</b>        | Preparation of growing media and potting mixtures.                                  |
| <b>5</b>            | Study of types of containers.                                                       |
| <b>6</b>            | Nursery raising and planting for rooftop gardens.                                   |
| <b>7</b>            | Irrigation management in urban and peri-urban horticulture.                         |
| <b>8</b>            | Nutritional management in urban and peri-urban horticulture.                        |
| <b>9 - 11</b>       | Study of Terrace garden, Container gardening, Rooftop garden and Community gardens. |
| <b>12</b>           | Study of Vegetable gardening.                                                       |
| <b>13</b>           | Study of Vertical gardens.                                                          |
| <b>14 - 15</b>      | Study of Hydroponics and Aeroponics.                                                |
| <b>16</b>           | Visit to Fruit nutrition garden, Vegetable kitchen garden and Public gardens.       |

### **Suggested Readings [HORT-243]:**

1. Singh A., Patel, N.L. and Ahlawat, T.R. 2016. Handbook of Urban and Peri-urban Horticulture; Publisher: Ambica; 1<sup>st</sup> Edn.
  2. Sumangla, H.P, Malhotra, S.K. and Chowdappa, P. 2013. Urban and Peri-urban Horticulture- A Perspective.
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|                     |                                                 |                    |                 |
|---------------------|-------------------------------------------------|--------------------|-----------------|
| <b>Semester</b>     | <b>: IV</b>                                     |                    |                 |
| <b>Course No.</b>   | <b>: ENTO-241</b>                               | <b>Credit Hrs.</b> | <b>: 3(2+1)</b> |
| <b>Course Title</b> | <b>: Pest Management of Horticultural Crops</b> |                    |                 |

### **SYLLABUS**

#### **Objectives:**

- i) To study the methods of pest control, recent technologies for insect pest management and IPM,
- ii) To study distribution, host range, bio-ecology, injury, integrated management of important insect pests affecting horticultural crops,
- iii) To analyze insecticides' residue problems in fruits, vegetables, plantation, ornamental spice, medicinal and aromatic crops.

### **THEORY**

Classification of insect pests. Dynamics of EIL and ETL. Methods of Pest control- Host plant resistance, Cultural, Mechanical, Physical, Legislative, Biological and Chemical control. Recent technologies for insect-pest management. IPM- Importance and Principles. Scientific name, Order, Family, Host range, Distribution, Biology, Ecology, Nature of damage and Management of important insect-pests of various fruits (Tropical, Sub-tropical and Temperate), vegetable, ornamental, plantation, spice, medicinal, aromatic crops and under-protected conditions. Pest surveillance. Storage insects- Scientific name, Order, Family, Host range, Distribution, Biology, Ecology, Nature of damage and Management of important insect-pests attacking stored fruit, vegetable, plantation, ornamental, spice, medicinal and aromatic crops produced and their processed products. Insecticide formulations, types of formulations. First-aid and antidote Insecticides residue problems in fruit, vegetable, plantation, ornamental, spice, medicinal and aromatic crops and their maximum residue limits (MRLs). Waiting periods for insecticides on various crops.

### **PRACTICAL**

Identification of insect-pests of various fruit, vegetable, plantation, ornamental, spice, medicinal and aromatic crops in field and their produce during storage and their symptoms of damage. Identification of biocontrol agents and natural enemies. Insecticide formulations. Pesticide application appliances. Calculation of insecticide quantity for preparing spray material.

## TEACHING SCHEDULE

### THEORY [ENTO-241]

| Lecture No.                                                                                                                                                                                                                                                                        | Topic                          | Sub-topics / Key Points                                                                                                                       | Weightage (%) |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------|---------------|
| 1                                                                                                                                                                                                                                                                                  | Classification of Insect-Pests | Classification of insect-pests and Concept of economic damage. Population dynamics of EIL, ETL                                                | 20            |
| 2                                                                                                                                                                                                                                                                                  | Methods of Pest Control        | Methods of Pest Control- Host-plant resistance, Cultural, Mechanical, Physical, Legislative, Biological and Chemical                          |               |
| 3                                                                                                                                                                                                                                                                                  | Recent Technologies            | Use of Drone for Insect-Pest Management; Use of AI in Pest Management                                                                         |               |
| 4                                                                                                                                                                                                                                                                                  | IPM                            | IPM- Definition, Importance and Principles, Advantages of IPM                                                                                 |               |
| <b>Scientific name, Order, Family, Host range, Distribution, Bio-Ecology, Nature of damage and Integrated Management of following important Insect-pests of various fruit, vegetable, ornamental, plantation, spice, medicinal, aromatic crops and under-protected conditions:</b> |                                |                                                                                                                                               |               |
| <b>Fruit Crops (Tropical, Sub-tropical and Temperate):</b>                                                                                                                                                                                                                         |                                |                                                                                                                                               |               |
| 5                                                                                                                                                                                                                                                                                  | Citrus                         | Lemon butterfly, White fly, Black fly, Leaf miner, Fruit sucking moth, Citrus psylla, Citrus aphids, Mealy bug, Citrus thrips, Scale insects  | 20            |
| 6                                                                                                                                                                                                                                                                                  | Mango                          | Mango stem borer, Mango stone weevil, Mango fruit fly, Mealy bugs, Mango hoppers, Shoot borer, Thrips, Slug caterpillar, Midge fly, Leaf gall |               |
| 7                                                                                                                                                                                                                                                                                  | Grapevine                      | Flea beetle/ Udadya beetle, Thrips, Stem Girdler, Mealy bug                                                                                   |               |
|                                                                                                                                                                                                                                                                                    | Strawberry                     | Aphid, Thrips, Fruit borer                                                                                                                    |               |
| 8                                                                                                                                                                                                                                                                                  | Guava                          | Fruit fly, Spiraling white fly, Bark-eating caterpillar, Fruit borers, Green scale, Mealy bug                                                 |               |
|                                                                                                                                                                                                                                                                                    | Custard apple                  | Mealy bug, Fruit fly                                                                                                                          |               |
| 9                                                                                                                                                                                                                                                                                  | Banana                         | Root stock weevil/ Rhizome weevil, Pseudostem borer, Fruit rust thrips, Aphids, Tingid or Lace wing bug, Leaf-eating caterpillar, Skipper     |               |
|                                                                                                                                                                                                                                                                                    | Papaya                         | Papaya mealy bugs, White fly, Green peach aphid, Ash weevils                                                                                  |               |
| 10                                                                                                                                                                                                                                                                                 | Sapota                         | Chiku moth/ Sapota leaf webber, Sapota seed borer, Fruit fly, Stem borer, Hairy caterpillar, Leaf folder, Bud borer                           |               |
| 11                                                                                                                                                                                                                                                                                 | Coconut                        | Rhinoceros beetle, Black-headed caterpillar, Red palm weevil, Rugose spiralling whitefly                                                      |               |
| 12                                                                                                                                                                                                                                                                                 | Arecanut                       | Spindle bug                                                                                                                                   |               |
|                                                                                                                                                                                                                                                                                    | Cashew nut                     | Inflorescence caterpillar, Tea mosquito bug, Cashew stem and root borer, Thrips, Apple and Nut borer                                          |               |
| 13                                                                                                                                                                                                                                                                                 | Apple                          | Codling moth, Wooly aphid, Apple leaf blotch miner                                                                                            |               |
|                                                                                                                                                                                                                                                                                    | Fig                            | Jassids, Stem borer                                                                                                                           |               |

Continued....

|                                  |                                                                   |                                                                                                                                                                                                      |    |
|----------------------------------|-------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|
| 14                               | Ber                                                               | Ber fruit borer, Ber fruit fly                                                                                                                                                                       |    |
|                                  | Aonla                                                             | Bark borer, Seed borer                                                                                                                                                                               |    |
|                                  | Dragon fruit                                                      | Fruit fly, Mealy bug, White grub, Scale insect                                                                                                                                                       |    |
| 15                               | Pomegranate                                                       | Anar caterpillar, Fruit sucking moth ( <i>Eudocima fullonica</i> , <i>Eudocima materna</i> , <i>Achoea janata</i> L.), Thrips, Shot hole borer, Bark-eating caterpillar, Mealy bug, Whitefly, Aphids |    |
| Vegetable Crops:                 |                                                                   |                                                                                                                                                                                                      | 20 |
| 16                               | Brinjal                                                           | Brinjal shoot and fruit borer, Jassids/ Leaf hopper, Aphids, White fly, Hadda beetle, Brinjal leaf roller, Lace wing bug, Stem borer                                                                 |    |
| 17                               | Okra                                                              | Shoot & fruit borer, Leafhoppers, Aphids, White fly, Leaf Roller, <i>Helicoverpa</i> , Flea beetle, Leaf miner                                                                                       |    |
| 18                               | Tomato                                                            | Fruit borer, Leaf miner- <i>Liriomyza</i> and <i>Tuta absoluta</i> , Aphids, Thrips, White Fly                                                                                                       |    |
|                                  | Chilli                                                            | Thrips, Fruit borer ( <i>Helicoverpa</i> )                                                                                                                                                           |    |
| 19                               | Potato                                                            | Potato tuber moth, Cutworm, Thrips, Jassids                                                                                                                                                          |    |
|                                  | Sweet potato                                                      | Sweet potato weevil, Sweet potato leaf eating caterpillar/ Sphinx caterpillar                                                                                                                        |    |
| 20                               | Cruciferous crops- (Cauliflower, Cabbage, Broccoli and Knol-khol) | Diamond back moth, Aphids, Painted bug, Cabbage butterfly, Leaf eating caterpillar, Flea beetle, Head borer and Mustard saw fly                                                                      |    |
| 21                               | Cucurbitaceous vegetables                                         | Fruit fly, Aphids, Leaf miner, whitefly, Thrips, Pumpkin beetle, Blister beetle                                                                                                                      |    |
| 22                               | Colocassia and Moringa                                            | Leaf eating caterpillar, Webworm, Stem borer, Spodoptera, Aphids, Budworm                                                                                                                            |    |
| Plantation Crop and Spice Crops: |                                                                   |                                                                                                                                                                                                      | 20 |
| 23                               | Turmeric and Ginger                                               | Rhizome fly, Shoot borer, Rhizome Scale, Leaf roller, Thrips                                                                                                                                         |    |
|                                  | Onion and Garlic                                                  | Onion and Garlic thrips, Bulb fly                                                                                                                                                                    |    |
|                                  | Coriander                                                         | Aphids                                                                                                                                                                                               |    |
|                                  | Curry leaf                                                        | Scale insect, Psylla, Lemon butterfly                                                                                                                                                                |    |
|                                  | Black pepper                                                      | Pollu beetle/ Flea beetle, Mealy bug                                                                                                                                                                 |    |
|                                  | Cardamom                                                          | Thrips, Shoot and capsule borer                                                                                                                                                                      |    |
| Flower Crops:                    |                                                                   |                                                                                                                                                                                                      |    |
| 24                               | Tube rose, Rose, Gerbera, Carnation                               | Thrips, White fly, Bud borer, Leaf miner, Mealy bug                                                                                                                                                  |    |
| Ornamental Crops:                |                                                                   |                                                                                                                                                                                                      |    |
| 25                               | Ornamental crops                                                  | Mealy bug, Scale insects                                                                                                                                                                             |    |
| Plantation Cash Crops:           |                                                                   |                                                                                                                                                                                                      |    |
| 26                               | Tea                                                               | Tea green leaf hopper, Tea mosquito bug                                                                                                                                                              |    |
|                                  | Coffee                                                            | Coffee seed borer, Coffee berry borer                                                                                                                                                                |    |
| Medicinal and Aromatic Crops:    |                                                                   |                                                                                                                                                                                                      |    |
| 27                               | Medicinal crops-                                                  | Betelvine, Safed Musali, Shatavari, Ashwagandha, Alo vera (their Major insect-pests only)                                                                                                            |    |
|                                  | Aromatic plants-                                                  | Camphor, Citronella, Geranium, Lemon grass, Jasmine (their Major insect-pests only)                                                                                                                  |    |

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|                |                                                                                                           |                                                                                                                                                                                                                                                                                                      |            |
|----------------|-----------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|
| 28             | <b>Storage Insect-Pest of Horticultural Crops</b>                                                         | Indian meal moth, Red rust floor beetle, Dried fruit borer, Khapra beetle, Resin moth, Fig and almond moth, Saw toothed moth, Saw tooth grain beetle                                                                                                                                                 | 20         |
| 29             | <b>Pest Surveillance</b>                                                                                  | Pest surveillance, Types of surveillance and Importance                                                                                                                                                                                                                                              |            |
| 30 - 32        | <b>Insecticides Residue Problems in Fruit, Vegetable, Plantation, Spice, Medicinal and Aromatic Crops</b> | <div>Insecticide formulation, Different types of formulations. First-aid and antidote</div> <div>Insecticides residue problems in fruit vegetables plantation, spice, medicinal and aromatic crops and their Maximum residue limits (MRLs); Waiting periods for insecticides on various crops.</div> |            |
| <b>Total =</b> |                                                                                                           |                                                                                                                                                                                                                                                                                                      | <b>100</b> |

## TEACHING SCHEDULE

### PRACTICAL [ENTO-241]

| Exercise No. | Exercise Title                                                                                 |
|--------------|------------------------------------------------------------------------------------------------|
| 1            | Identification of insect-pests of various tropical fruit crops.                                |
| 2            | Identification of insect-pests of various subtropical fruit crops.                             |
| 3            | Identification of insect-pests of temperate fruits.                                            |
| 4 - 5        | Identification of insect-pests of vegetables.                                                  |
| 6            | Identification of insect-pests of ornamental crops.                                            |
| 7            | Identification of insect-pests of various spices and aromatic crops.                           |
| 8            | Identification of insect-pests of plantation crops.                                            |
| 9            | Identification of storage insect-pests of horticultural crops.                                 |
| 10           | Polyphagous and non-insect pests such as rat, snail slug and squirrel with their management.   |
| 11           | Maximum Residue Limits (MRLs) waiting periods of insecticides on various horticultural crops.  |
| 12           | Identification of parasitoids and predator, types and their role in pest management.           |
| 13           | Insecticide formulation, types and different types of formulation.<br>First-aid and antidotes. |
| 14           | Pesticide appliances such as sprayers dusters, tractor-mounted sprayers, drone.                |
| 15           | Calculation of insecticide quantity for preparing spray material.                              |
| 16           | Guidelines for export fruits such as mango, grape and pomegranate.                             |

### **Suggested Readings [ENTO-241]:**

- 1) Atwal A.S. and Dhaliwal G.S. Agricultural Pests of South Asia and their Management.
- 2) David, B.V. and Rammurthy, V.V. Elements of Economic Entomology.
- 3) Pedigo L.P. Entomology and Pest Management.
- 4) Venu Gopal Rao. Insect Pest Management.
- 5) Pradhan, S. Insect Pests of Crops.
- 6) Awasthi, V.B. Introduction of General and Applied Entomology.
- 7) Shrivastav, K.P. A Textbook of Applied Entomology-Vol I and II.
- 8) David, V. and Ananthkrishan. Elements Economic Entomology.

|                                                                       |                             |  |
|-----------------------------------------------------------------------|-----------------------------|--|
| <b>Semester</b> : IV                                                  |                             |  |
| <b>Course No.</b> : AGRO-242                                          | <b>Credit Hrs.</b> : 2(1+1) |  |
| <b>Course Title</b> : Introductory Agrometeorology and Climate Change |                             |  |

### **SYLLABUS**

**Objectives:** To train the students with respect to management the climate aberration for sustainable crop production.

#### **THEORY**

Agrometeorology – Definition, Scope. Earth atmosphere - its Composition, Extent and Structure. Atmospheric weather variables. Elements and Factors of weather and climate. Atmospheric pressure. Wind, Types, Daily and Seasonal variation. Cyclone, Anticyclone. Land and Sea breeze. Solar radiation - Solar constant, Depletion, Short and Long wave, Thermal radiation, Net radiation, Albedo. Atmospheric temperature, Inversion, Lapse rate, Daily and Seasonal variations, Vertical profile. Energy balance of earth. Atmospheric humidity, Saturation, Vapor pressure, Condensation. Dew, Fog, Mist, Frost. Precipitation, Process, Types. Cloud formation and Classification. Artificial rainmaking. Monsoon - Mechanism and Importance in Indian Agriculture. Weather hazards. Agriculture and Weather relations. Modifications of microclimate. Climatic normal for crop and livestock production. Weather forecasting- Types and Applications. Climate change and Impacts on Agriculture.

#### **PRACTICAL**

Visit to Agrometeorological observatory. Site selection of observatory and Exposure of instruments and Weather data recording. Measurement of total, short and long wave radiations and their estimation using Planck's intensity law. Measurement of albedo and sunshine duration, computation of radiation intensity using BSS. Measurement of maximum and minimum air temperatures, tabulation, trend and variation analysis. Measurement of soil temperature and computation of soil heat flux. Determination of vapor pressure and relative humidity. Determination of dew point temperature. Measurement of atmospheric pressure and analysis of atmospheric conditions. Measurement of wind speed and wind direction, preparation of wind rose. Measurement, tabulation and critical analysis of rainfall. Computation of drought indices. Measurement of open pan-evaporation and evapotranspiration. Computation of PET and AET.

## TEACHING SCHEDULE

### THEORY [AGRO-242]

| Lecture No.    | Topic                                                                | Sub-topics / Key Points                                                                                                                                                                               | Weightage (%) |
|----------------|----------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|
| 1              | Agrometeorology                                                      | Definition, Different terminologies and Scope of Meteorology in General and Agrometeorology                                                                                                           | 10            |
| 2              | Weather and Climate                                                  | Distinguish between Weather and Climate, Elements and Factors affecting weather and climate                                                                                                           | 5             |
| 3              | Earth Atmosphere                                                     | Composition and Structure of Atmosphere                                                                                                                                                               | 5             |
| 4              | Solar Radiation                                                      | Definition, Terminologies, Solar constant, Heat balance, Albedo, Greenhouse effect, Role of radiation in Agriculture and Factors affecting solar radiation                                            | 5             |
| 5              | Atmospheric Temperature                                              | Definition, Factors affecting atmospheric temperature, Vertical and Horizontal temperature variation and Role of temperature in crop production                                                       | 5             |
| 6              | Soil Temperature                                                     | Factors affecting soil temperature, Temperature variation and Importance of soil temperature                                                                                                          | 5             |
| 7              | Atmospheric Pressure                                                 | Definition, Vertical and Horizontal pressure variation                                                                                                                                                | 5             |
| 8              | Wind                                                                 | Wind, Types, Daily and Seasonal variation. Cyclone, Anticyclone. Land and Sea breeze                                                                                                                  | 5             |
| 9              | Atmospheric Humidity                                                 | Different terminologies and Importance of humidity in Agriculture                                                                                                                                     | 5             |
| 10             | Condensation and Precipitation                                       | Forms of condensation. Dew, Fog, Mist, Frost. etc. Precipitation process, Forms of precipitation, Monsoon mechanism and Importance in Indian Agriculture                                              | 10            |
| 11             | Cloud                                                                | WMO Cloud classification, Cloud formation and Artificial rain-making                                                                                                                                  | 5             |
| 12             | Weather Hazards                                                      | Drought, its Type and Mitigation, Agriculture and Weather relations.<br>Modifications of microclimate and climatic normal for crop and livestock production                                           | 5             |
| 13             | Weather Forecasting                                                  | Methods, Types and Applications                                                                                                                                                                       | 5             |
| 14             | Climate Change                                                       | Climate change - Causes. Global warming - Causes, Effect of climate change on Horticulture. Past and Future changes in greenhouse gases within the atmosphere                                         | 10            |
| 15             | Plants Sense and Respond to Changes in CO <sub>2</sub> Concentration | Plants sense and respond to changes in CO <sub>2</sub> concentration, Measurement of short-term effects and mechanisms underlying the observed responses in C <sub>3</sub> and C <sub>4</sub> species | 10            |
| 16             | Remote Sensing                                                       | Crop weather calendar, Different drought monitoring index, NDVI and Crop modelling                                                                                                                    | 5             |
| <b>Total =</b> |                                                                      |                                                                                                                                                                                                       | <b>100</b>    |

## TEACHING SCHEDULE

### PRACTICAL [AGRO-242]

| Exercise No. | Exercise Title                                                                                    |
|--------------|---------------------------------------------------------------------------------------------------|
| 1            | Site selection for Agromet Observatory and Plan of layout of Standard Meteorological Observatory. |
| 2            | Study of meteorological instruments and methods of recording observation.                         |
| 3            | Measurement of atmospheric temperature.                                                           |
| 4            | Measurement and recording of soil temperature.                                                    |
| 5            | Measurement of rainfall.                                                                          |
| 6            | Measurement of wind velocity with the help of cup counter anemometer.                             |
| 7            | Study of wind vane and drawing of wind rose.                                                      |
| 8            | Measurement of sunshine duration and solar radiation.                                             |
| 9            | Measurement of evaporation (atmospheric/ soil).                                                   |
| 10           | Measurement of bright sunshine hours with the help of Campbell stokes sunshine recorder.          |
| 11           | Measurement of relative humidity.                                                                 |
| 12           | Measurement of atmospheric pressure.                                                              |
| 13           | Measurement of dew.                                                                               |
| 14           | Visit to IMD Meteorological Observatory.                                                          |
| 15           | Preparation of synoptic charts and weather reports, symbols etc.                                  |
| 16           | Study of Automatic Weather Station (AWS).                                                         |

### **Suggested Readings [AGRO-242]:**

1. Avi, H.S. 1985. Introduction to Agrometeorology. Oxford and IBH Publishing Co., New Delhi.
2. Lenka, D. 2006. Climate, Weather and Crops in India. Kalyani Publishers, New Delhi.
3. Mavi, H.S. and Tupper, G.J. 2005. Agrometeorology – Principles and Applications of Climate Studies in Agriculture. International Book Publishing Co., Lucknow.
4. Mavi, H.S. 1994. Introduction to Agrometeorology. Oxford and IBH Publishing Co. Pvt. Ltd. New Delhi.
5. Nanjappa, H.V. and Ramachandrappa, B.K. 2007. Manual on Practical Agricultural Meteorology. Agrobios India. Jodhpur.
6. Pattersen, S. 1958. Introduction to Meteorology. Mc. Graw Hill Book Co. Inc., New York.
7. Prasad Rao, G.S.L.H.V. 2008. Agricultural Meteorology. Prentice Hall of India Pvt. Ltd., New Delhi.
8. Srivastava, A.K. and Tyagi, P.K. 2011. Practical Agricultural Meteorology. New Delhi Publishing Agency, New Delhi.
9. Yellamanda Reddy, T. and Sankara Reddi, G.H. 2010. Principles of Agronomy. Kalyani Publishers, New Delhi.

**#List/ Bouquet of Skill Enhancement Courses (SECs)**  
[in continuation of the SECs' Syllabi prescribed under I, II and III semesters]

| Sr. No. | Course No.      | Course Title                                                       | Credit Hrs. |
|---------|-----------------|--------------------------------------------------------------------|-------------|
| 1.      | SEC- <b>xxx</b> | Mushroom Cultivation                                               | 2(0+2)      |
| 2.      | SEC- <b>xxx</b> | Apiculture                                                         | 2(0+2)      |
| 3.      | SEC- <b>xxx</b> | Orchard Floor Management                                           | 2(0+2)      |
| 4.      | SEC- <b>xxx</b> | Landscape Gardening                                                | 2(0+2)      |
| 5.      | SEC- <b>xxx</b> | Packing and Packaging of Horticultural Crops                       | 2(0+2)      |
| 6.      | SEC- <b>xxx</b> | Farm Machinery                                                     | 2(0+2)      |
| 7.      | SEC- <b>xxx</b> | Introduction to Forestry                                           | 2(0+2)      |
| 8.      | SEC- <b>xxx</b> | Installation, Operation and Maintenance of Micro-Irrigation System | 2(0+2)      |
| 9.      | SEC- <b>xxx</b> | Computer Programming and Data Structures                           | 2(0+2)      |
| 10.     | SEC- <b>xxx</b> | Turf and Turf Management                                           | 2(0+2)      |
| 11.     | SEC- <b>xxx</b> | Post-Harvest Management of Horticulture Crops                      | 2(0+2)      |
| 12.     | SEC- <b>xxx</b> | Nursery Production in Horticulture Crops                           | 2(0+2)      |
| 13.     | SEC- <b>xxx</b> | Seed Production Techniques in Vegetables Crops                     | 2(0+2)      |
| 14.     | SEC- <b>xxx</b> | Sericulture                                                        | 2(0+2)      |
| 15.     | SEC- <b>xxx</b> | Dairy Management                                                   | 2(0+2)      |
| 16.     | SEC- <b>xxx</b> | Ornamental Fishery                                                 | 2(0+2)      |
| 17.     | SEC- <b>xxx</b> | Poultry Management                                                 | 2(0+2)      |
| 18.     | SEC- <b>xxx</b> | Biofertilizers and Biopesticides                                   | 2(0+2)      |
| 19.     | SEC- <b>xxx</b> | Horti-Tourism                                                      | 2(0+2)      |

- Note:** (i) Skill Enhancement Courses can be added/offered as per the facilities and resources available at the respective universities/colleges based on the relevance to the region and the UG degree subject.
- (ii) The host University/ College may also choose suitable SEC courses from those listed under other UG degree programs.
- (iii) Above list/ bouquet of SEC courses is an indicative list and subject to modification as applicable therein.
- (iv) In case of unavailability of the detailed course-wise syllabus/ teaching schedules of any of above SEC courses, the same can be primarily developed and followed at College/ University level in the current academic year. However, the same can be obtained from the respective UG Degree Coordinator/ Discipline Coordinators and can be followed w.e.f. AY, 2025-26.

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|                                                          |                      |
|----------------------------------------------------------|----------------------|
| Course No. : SEC- <b>xxx</b>                             | Credit Hrs. : 2(0+2) |
| Course Title : Nursery Production in Horticultural Crops |                      |

### **SYLLABUS**

#### **Objectives:**

- i) To impart skills in different methods of plant propagation.
- ii) To impart skills in various nursery management activities.

### **PRACTICAL**

Layout of model nursery, Tools and Equipment - Identification and Application. Different methods of breaking seed dormancy- Stratification, Scarification and Use of Plant Growth Regulators. Extraction and storage of healthy seeds, Seed bed preparation, Identification and Raising of root stocks for different fruit plants, Soil solarization, Preparation of potting mixtures. Selection of healthy scion wood, Practices in different methods of plant propagation like cutting, layering, budding and grafting in fruit plants. Micropropagation - Explant preparation, Media preparation, Culturing-Meristem tip culture, Axillary bud culture, Micro-grafting and Hardening of plants. Nursery management practices i.e. Weed control, Irrigation, Nutrition, Removal of sprouts etc. Protection of nursery plants against adverse climatic conditions. Protected structures. Diagnosis and control of important diseases and pests in the nursery, Lifting and Packing of nursery plants, Visit to commercial tissue culture laboratories and accredited nurseries.

## **TEACHING SCHEDULE**

### **PRACTICAL [SEC-xxx]**

| <b>Exercise No.</b> | <b>Exercise Title</b>                                                                                  |
|---------------------|--------------------------------------------------------------------------------------------------------|
| <b>1 - 2</b>        | Study and Layout of Model Nursery.                                                                     |
| <b>3 - 4</b>        | Identification and application of nursery tools and equipment.                                         |
| <b>5</b>            | Study of methods of extraction and storage of healthy seeds.                                           |
| <b>6</b>            | Study of seed bed preparation.                                                                         |
| <b>7 - 8</b>        | Identification and raising of rootstocks for different fruit plants.                                   |
| <b>9</b>            | Study of soil solarization and preparation of potting mixtures.                                        |
| <b>10 - 11</b>      | Study of selection of healthy scion wood.                                                              |
| <b>12 - 13</b>      | Practices in different methods of plant propagation like, cutting and layering in fruit plants.        |
| <b>14 - 15</b>      | Practices in different methods of plant propagation like, budding and grafting in fruit plants.        |
| <b>16 - 17</b>      | Study of Micropropagation - explant preparation and media preparation.                                 |
| <b>18 - 19</b>      | Study of Micropropagation - culturing - meristem tip culture, axillary bud culture and micro-grafting. |
| <b>20</b>           | Study of hardening of micropropagated plants.                                                          |
| <b>21</b>           | Study of different nursery management practices i.e. weed control and irrigation.                      |
| <b>22</b>           | Study of different nursery management practices i.e. nutrition and removal of sprouts etc.             |
| <b>23</b>           | Study of protection of nursery plants against adverse climatic conditions.                             |
| <b>24</b>           | Study of different protected structures used in nursery.                                               |
| <b>25 -26</b>       | Diagnosis and control of important diseases and pests in the nursery.                                  |
| <b>27</b>           | Lifting and packing of nursery plants.                                                                 |
| <b>28</b>           | Visit to Commercial Tissue Culture Laboratories.                                                       |
| <b>29 - 30</b>      | Visit to Accredited Nurseries.                                                                         |



**Course Curriculum of Fifth 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



Vasantao Naik  
Marathwada Krishi  
Vidyapeeth, Parbhani



Dr. Balasaheb Sawant  
Konkan Krishi  
Vidyapeeth, Dapoli



Maharashtra Agricultural  
Universities Examination  
Board, Pune

*Compiled & Submitted by*

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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, 2026-27 ~

**Course Curriculum of Fifth Semester as per the  
ICAR-Sixth Deans' Committee Report for Academic Programme in  
HORTICULTURE**

**Course Layout**

**B.Sc. (Hons.) Horticulture**

**Semester: V (New)**

**w.e.f. Academic Year: 2026-27**

| Sr. No.                                                                                                                                                                                                                                      | Course No.            | Course Title                                             | Credit Hrs.                | Remark          |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------|----------------------------------------------------------|----------------------------|-----------------|
| 1.                                                                                                                                                                                                                                           | <b>GPB-351</b>        | Fundamentals of Plant Breeding                           | 3(2+1)                     | -               |
| 2.                                                                                                                                                                                                                                           | <b>HORT-354</b>       | Growth and Development of Horticultural Crops            | 3(2+1)                     | -               |
| 3.                                                                                                                                                                                                                                           | <b>SSAC-352</b>       | Soil Fertility and Nutrient Management                   | 3(2+1)                     | -               |
| 4.                                                                                                                                                                                                                                           | <b>PATH-352</b>       | General Microbiology                                     | 3(2+1)                     | -               |
| 5.                                                                                                                                                                                                                                           | <b>IT-351</b>         | Information and Communication Technology in Horticulture | 3(1+2)                     | -               |
| 6.                                                                                                                                                                                                                                           | <b>PP-351</b>         | Introductory Crop Physiology                             | 2(1+1)                     | -               |
| 7.                                                                                                                                                                                                                                           | <b>STAT-351</b>       | Basic Statistics and Experimental Designs                | 3(2+1)                     | -               |
| 8.                                                                                                                                                                                                                                           | <b>EDT-351</b>        | Educational Tour                                         | 2(0+2)                     | NG              |
| 9.                                                                                                                                                                                                                                           | <b>OC-1/ OC-2/...</b> | Online Course(s)/ MOOCs <sup>†</sup>                     | As opted by student        | NG              |
| <b>Total Credit Hrs.=</b>                                                                                                                                                                                                                    |                       |                                                          | <b>20(12+8)<br/>2(0+2)</b> | <b>G<br/>NG</b> |
| <b>OC: Online Course, G: Gradual, NG: Non-gradual</b>                                                                                                                                                                                        |                       |                                                          |                            |                 |
| <sup>†</sup> <b>Note:</b> It is mandatory for each Student to complete <b>total 10 credits</b> (Non-gradual) of <b>Online Courses</b> from available resources across III to VIII semesters under the guidance of assigned Faculty/ Advisor. |                       |                                                          |                            |                 |

## B.Sc. (Hons.) Horticulture : Fifth Semester

### Course-wise Syllabus with Teaching Schedules

|                     |                                         |                             |
|---------------------|-----------------------------------------|-----------------------------|
| <b>Semester</b>     | <b>: V</b>                              |                             |
| <b>Course No.</b>   | <b>: GPB-351</b>                        | <b>Credit Hrs. : 3(2+1)</b> |
| <b>Course Title</b> | <b>: Fundamentals of Plant Breeding</b> |                             |

#### SYLLABUS

**Objectives** : To acquaint students with plant breeding techniques, from conventional selection methods to advanced molecular approaches, for developing high-yielding, biotic and abiotic stress-resistant crop varieties to ensure food security.

#### **THEORY**

Historical development, Concept, Nature and Role of Plant Breeding. Major achievements and Future prospects. Genetics in relation to Plant Breeding. Modes of reproduction. Male sterility - Genetic consequences and Cultivar options. Domestication, Acclimatization and Introduction. Centres of origin/diversity. Components of Genetic variation, Heritability and Genetic advance. Genetic basis and breeding methods in self-pollinated crops - Mass and Pure line selection, Hybridization techniques and handling of segregating population. Multiline concept. Concepts of Population Genetics and Hardy-Weinberg Law. Genetic basis and methods of breeding cross-pollinated crops. Modes of selection. Population improvement schemes - Ear to Row method, Modified Ear-to-Row, Recurrent selection schemes. Heterosis and Inbreeding depression. Development of Inbred lines and Hybrids, Composite and Synthetic varieties. Breeding methods in Asexually propagated crops - Clonal selection. Wide hybridization and Pre-breeding. Polyploidy in relation to Plant Breeding. Mutation Breeding - Methods and Uses. Breeding for important Biotic and Abiotic stresses. Introduction to Biotechnological tools - DNA markers and Marker Assisted Selection. Participatory Plant Breeding. Plant Breeders' and Farmers' Rights.

#### **PRACTICAL**

Plant Breeder's kit. Study of germplasm of various crops. Study of floral structure of self-pollinated and cross-pollinated crops. Emasculation and Hybridization techniques in self- and cross-pollinated crops. Consequences of inbreeding on genetic structure of resulting populations. Study of male sterility system. Handling of segregation populations. Maintenance of breeding records and data collection. Methods of calculating mean, range, variance, standard deviation, heritability. Designs used in Plant Breeding experiments, analysis of Randomized Block Design. Working out the mode of pollination in a given crop and extent of natural out-crossing. Prediction of performance of Double Cross Hybrids.

## TEACHING SCHEDULE

### THEORY [GPB-351]

| Lecture No. | Topic                                                                   | Sub-topics / Key Points                                                                                                                                                                                                                                                                      | Weightage (%) |
|-------------|-------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|
| 1 - 2       | <b>Plant Breeding: Concept, Historical Development and Role</b>         | Definition, Aims and general Objectives of Plant Breeding; History of Plant Breeding (Early domestication; Mendelian era; Rise of Scientific Breeding), Landmarks of Plant Breeding; Eminent Global and Indian Plant Breeders, Role in food security; Genetics in relation to Plant Breeding | 3             |
| 3 - 4       | <b>Major Achievements and Future Prospects in Plant Breeding</b>        | Green Revolution; Hybrid crops; Disease-resistant varieties, Climate-smart Breeding; Genomic selection; Speed Breeding                                                                                                                                                                       | 3             |
| 5 - 6       | <b>Genetics in relation to Plant Breeding (Basics)</b>                  | Definitions- Genes, Alleles, Genotype vs. Phenotype; Dominance types, Segregation, Ratios; Punnett squares, Practical examples.                                                                                                                                                              | 3             |
| 7 - 8       | <b>Modes of Reproduction; Floral Biology and Pollination</b>            | Selfing, Cross-pollination, Mixed mating, Apomixis; Breeding implications<br>Flower structure, Pollination mechanisms & Pollinators, Emasculation and Controlled pollination                                                                                                                 | 5             |
| 9 - 10      | <b>Male Sterility Systems and Cultivar Options using Male Sterility</b> | Definitions, Types- GMS, CMS, CGMS, Thermosensitive MS, Photosensitive MS, Transgenic MS, Genetic consequences; Maintainer/Restorer concepts; Seed production options- Hybrid systems, Three-line and Two-line systems.                                                                      | 8             |
| 11          | <b>Domestication, Acclimatization and Introduction</b>                  | Domestication and Crop Evolution: Definitions, Process of domestication; Genetic bottlenecks; Domestication traits                                                                                                                                                                           | 4             |
|             |                                                                         | Acclimatization and Introduction: Definitions, Quarantine, Adaptation testing, Introduction pathways                                                                                                                                                                                         |               |
| 12          | <b>Centres of Origin / Diversity</b>                                    | Vavilov's Centres, Importance for germplasm conservation ( <i>In Situ/ Ex situ</i> ) in brief.                                                                                                                                                                                               | 3             |
| 13          | <b>Components of Genetic Variation</b>                                  | Components of Genetic Variation: Additive, Dominance, Epistasis, G x E; Partitioning variance                                                                                                                                                                                                | 8             |
| 14          | <b>Heritability and Genetic Advance</b>                                 | Heritability: Definition, Concept and Types- Narrow and Broad sense heritability; Methods of estimating, Factors affecting heritability; Selection differential; Expected gain                                                                                                               |               |
| 15          | <b>Breeding Methods for Self-pollinated Crop</b>                        | Mass selection; Pure-line selection; Genetic basis; Principles and Examples                                                                                                                                                                                                                  | 10            |
| 16          |                                                                         | Pedigree method; Bulk method; Single-Seed Descent; Handling segregating populations                                                                                                                                                                                                          |               |

Continued...

|         |                                                               |                                                                                                                                                                                                                                    |   |
|---------|---------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|
| 17 - 18 | <b>Hybridization Techniques and Multiline Concept</b>         | Controlled crosses, Emasculation, Backcrossing, Use of male sterility; Multiline Concept & Varieties; Disease management; Maintenance and Deployment                                                                               | 5 |
| 19      | <b>Concepts of Population Genetics and Hardy-Weinberg Law</b> | Concept of Population Genetics- Definitions- Hardy-Weinberg Law/Equilibrium: Statement, its validity, Random mating population, Gene/Allele and Genotypic frequencies, Forces of evolution; Factors affecting gene frequency.      | 5 |
| 20      | <b>Breeding Methods for Cross-pollinated Crops</b>            | Mass selection, Recurrent selection, Family selection concepts                                                                                                                                                                     | 5 |
| 21      |                                                               | Population improvement: Ear-to-Row, Modified Ear-to-Row, Half-sib/ Full-sib selection schemes                                                                                                                                      |   |
| 22      | <b>Recurrent Selection Schemes</b>                            | Phenotypic and Genotypic Recurrent Selection; Reciprocal Recurrent Selection                                                                                                                                                       | 5 |
| 23      | <b>Modes of Selection</b>                                     | Individual, Family, Progeny selection; Selection intensity and Accuracy                                                                                                                                                            |   |
| 24 - 25 | <b>Heterosis and Inbreeding Depression</b>                    | Genetic basis of Heterosis; Causes and Measurement; Managing inbreeding depression                                                                                                                                                 | 5 |
|         | <b>Development of Inbred Lines and Hybrids</b>                | Inbreeding methods, Line development, Hybrid testing and Seed production                                                                                                                                                           |   |
| 26      | <b>Composite and Synthetic Varieties</b>                      | Concepts, Definitions, Development procedures, Advantages and Limitations                                                                                                                                                          | 3 |
| 27      | <b>Breeding Methods in Asexually Propagated Crops</b>         | Clonal selection, Virus indexing, Maintenance of clonal fidelity                                                                                                                                                                   | 4 |
| 28      | <b>Wide Hybridization and Pre-breeding</b>                    | Introgression from wild relatives, Bridge crosses, Linkage drag management                                                                                                                                                         | 3 |
| 29      | <b>Polyploidy in relation to Plant Breeding</b>               | Polyploidy: Definitions of Haploid, Monoploid, Diploid, Polyploid, Genome, Heteroploidy, Aneuploidy, Euploidy; Types of Aneuploidy & Polyploidy, their applications in crop improvement                                            | 5 |
| 30      | <b>Mutation Breeding- Methods and Uses</b>                    | Definitions; Need (Conditions in which it is rewarding) & Usefulness; Mutation induction (Physical & Chemical Mutagens); Procedure for seed and vegetatively propagated crops, applications, its merits, demerits and achievements | 5 |

Continued...

|                |                                                                                                                                                           |                                                                                                                                                                                                                                                                                                                                                                                                               |            |
|----------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|
| 31 - 32        | <b>Breeding for Important Biotic &amp; Abiotic Stresses;<br/>Biotech Tools;<br/>Participatory Plant Breeding;<br/>Plant Breeders' and Farmer's Rights</b> | Breeding for Biotic (Disease/Insect) & Abiotic (Drought/Salinity) Resistance:<br>Introduction, Mechanisms & sources of resistance, Types of genetic resistance;<br>Breeding methods/ approaches and Practical achievements;<br>Introduction to Biotechnological Tools (DNA Markers & MAS) in brief;<br>Participatory Plant Breeding (Concept, Objectives; Types) in brief;<br>PBR/ Farmers' Rights (in brief) | 8          |
| <b>Total =</b> |                                                                                                                                                           |                                                                                                                                                                                                                                                                                                                                                                                                               | <b>100</b> |

### TEACHING SCHEDULE

#### PRACTICAL [GPB-351]

| Exercise No. | Exercise Title                                                                           |
|--------------|------------------------------------------------------------------------------------------|
| 1            | Study and Use of Plant Breeder's Kit.                                                    |
| 2            | Study of germplasms of various crops (Morphological diversity).                          |
| 3            | Study of floral structures of self-pollinated crops.                                     |
| 4            | Study of floral structures of cross-pollinated crops.                                    |
| 5            | Emasculation techniques in self-pollinated crops.                                        |
| 6            | Hybridization techniques in cross-pollinated crops.                                      |
| 7            | Consequences of inbreeding on genetic structure of populations.                          |
| 8            | Study of male sterility systems in crop plants.                                          |
| 9            | Handling and maintenance of segregating populations.                                     |
| 10           | Maintenance of breeding records and methods of data collection.                          |
| 11           | Calculation of mean, range, variance and standard deviation.                             |
| 12           | Estimation of heritability in Plant Breeding experiments.                                |
| 13           | Study of experimental designs used in Plant Breeding.                                    |
| 14           | Analysis of Randomized Block Design (RBD).                                               |
| 15           | Determination of mode of pollination and extent of natural out-crossing in a given crop. |
| 16           | Estimation of yield potential in Double-cross hybrids.                                   |

### **Suggested Readings [GPB-351]:**

1. **Chahal, G.S. and Gosal, S.S.** 2001. Principles and Procedures of Plant Breeding. Narosa Publishing House, New Delhi.
  2. **Fehr, W.R.** 1987 Principles of Cultivar Development - Theory and Practice. Macmillan Publishing Company, New York, USA
  3. **Poehlman, J.M. and Sleper, D.A.** 1995. Breeding Field Crops. Iowa State University Press, Ames, Iowa, USA.
  4. **Singh, B.D.** 2011. A Text Book in Plant Breeding, Kalyani Publishers, Ludhiana.
  5. **Singh, B.D.** 2008. Plant Breeding - Principles and Methods. Kalyani Publication, New Delhi.
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|                                                                     |                             |
|---------------------------------------------------------------------|-----------------------------|
| <b>Semester</b> : V                                                 |                             |
| <b>Course No.</b> : HORT-354                                        | <b>Credit Hrs.</b> : 3(2+1) |
| <b>Course Title</b> : Growth and Development of Horticultural Crops |                             |

## **SYLLABUS**

### **Objectives:**

- (i) To understand the Physiology of canopy management, flowering, fruit setting and seed development in horticultural crops.
- (ii) To impart basic knowledge on the natural phytohormones and their specific functions in controlling the growth and developments.
- (iii) To understand the usage of synthetic growth regulators and their applications for overall manipulation of growth and development in horticultural crops.

### **THEORY**

Growth and Development- Definitions, Components, Photosynthetic productivity, Canopy photosynthesis and Productivity, Leaf Area Index (LAI) - Optimum LAI in horticultural crops, Canopy development; Different stages of growth, Growth curves, Crop development and Dynamics (Case studies of annual/perennial horticultural crops), Growth analysis in horticultural crops. Plant bio-regulators- Auxin, Gibberellin, Cytokinin, Ethylene, Inhibitors and Retardants, Basic functions, Biosynthesis, Role in crop growth and development, Propagation, Flowering, Fruit setting, Fruit thinning, fruit development, Fruit drop and Fruit ripening. Flowering-factors affecting flowering, Physiology of flowering, Photoperiodism - Long day, Short day and Day neutral plants, Vernalization and its application in Horticulture, Pruning and Training, Physiological basis of training and pruning, Source and Sink relationship, Translocation of assimilates. Physiology of seed development and maturation, Seed dormancy and Bud dormancy, Causes and Breaking methods in horticultural crops. Physiology of fruit growth and development, Fruit setting, Factors affecting fruit set and development, Physiology of ripening of fruits-Climatic and Non-climacteric fruits. Physiology of fruits under post-harvest storage.

### **PRACTICAL**

Estimation of photosynthetic potential of horticultural crops, Leaf Area Index, Growth analysis parameters including Harvest index, Bioassay of plant hormones, Identification of synthetic plant hormones and Growth retardants, Preparations of hormonal solution and Induction of rooting in cuttings, Ripening of fruits and Control of flower and fruit drop. Important physiological disorders and their remedial measures in fruits and vegetables, Seed dormancy, Seed germination and Breaking seed dormancy with chemicals and growth regulators.



## TEACHING SCHEDULE

### THEORY [HORT-354]

| Lecture No. | Topics                                        | Sub-topics / Key Points                                                                                                                                                               | Weightage (%) |
|-------------|-----------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|
| 1           | <b>Growth and Development</b>                 | Definition, Components of growth and Phases of growth in horticultural crops                                                                                                          | 10            |
| 2 - 3       | <b>Canopy Photosynthesis and Productivity</b> | Canopy photosynthesis and productivity of horticultural crops, C3 and C4 plants and comparison                                                                                        | 5             |
| 4           | <b>LAI</b>                                    | Leaf Area Index (LAI) - Optimum LAI in horticultural crops, Canopy development                                                                                                        | 5             |
| 5 - 6       | <b>Different Stages of Growth</b>             | Growth curves, Crop development and Dynamics                                                                                                                                          | 10            |
| 7           |                                               | Case studies of annual/perennial horticultural crops, Growth analysis in horticultural crops                                                                                          |               |
| 8 - 10      | <b>Plant Bio-regulators</b>                   | Definition, Classification of Bio-regulators - Auxin, Gibberellin, Cytokinin, Ethylene inhibitors and Retardants, their basic functions                                               | 15            |
| 11          |                                               | Advance Plant Bio-regulators in horticultural crops                                                                                                                                   |               |
| 12 - 14     | <b>Biosynthesis of Bio-regulators</b>         | Biosynthesis of Bio-regulators and their Role in crop growth and development, Propagation, Flowering, Fruit setting, Fruit thinning, Fruit development, Fruit drop and Fruit ripening | 5             |
| 15 - 16     | <b>Flowering</b>                              | Factors affecting flowering, Physiology of flowering                                                                                                                                  | 5             |
| 17 - 18     | <b>Photoperiodism</b>                         | Photoperiodism definition, Long day, Short day and Day neutral plants classification and Examples of horticultural crops                                                              | 10            |
| 19 - 20     | <b>Vernalization</b>                          | Vernalization concept and its Application in Horticulture                                                                                                                             |               |
| 21 - 23     | <b>Pruning and Training</b>                   | Pruning and Training Physiological basis                                                                                                                                              | 10            |
| 24          |                                               | Physiological basis of training and pruning in Horticultural crops - Fruit, vegetables, Flowers etc.                                                                                  |               |
| 25 - 26     | <b>Translocation of Assimilates</b>           | Translocation of assimilates, Theories of translocation of organic solute, Source and Sink relationship                                                                               | 5             |
| 27 - 28     | <b>Physiology of Seed Development</b>         | Physiology of Seed development and Maturation, Seed dormancy and Bud dormancy, Causes and Breaking methods in horticultural crops                                                     | 5             |

*Continued...*

|         |                            |                                                                                                        |     |
|---------|----------------------------|--------------------------------------------------------------------------------------------------------|-----|
| 29 - 30 | Physiology of Fruit Growth | Physiology of fruit growth and development, Fruit setting, Factors affecting fruit set and development | 5   |
| 31      |                            | Physiology of ripening of fruits- Climatic and Non-climacteric fruits                                  | 5   |
| 32      |                            | Physiology of fruits under post-harvest storage                                                        | 5   |
| Total = |                            |                                                                                                        | 100 |

### TEACHING SCHEDULE

#### PRACTICAL [HORT-354]

| Exercise No. | Exercise Title                                                                                                        |
|--------------|-----------------------------------------------------------------------------------------------------------------------|
| 1            | Estimation of photosynthetic potential of horticultural crops by IRGA.                                                |
| 2            | Estimation of leaf area and leaf area index in horticultural crops.                                                   |
| 3            | Studies on growth analysis- Measurement of growth by using Arc indicator and Auxanometer.                             |
| 4            | Measurement of growth by different growth analysis equations.                                                         |
| 5            | Determination of harvest index in different horticultural crops.                                                      |
| 6            | Studies on preparation of hormonal solutions.                                                                         |
| 7            | Identification and use of synthetic plant hormones and growth retardants; Bioassay of plant hormone.                  |
| 8            | Studies on PGR in induction of rooting in cutting in horticultural crops.                                             |
| 9            | Study of role of PGR in fruit ripening.                                                                               |
| 10           | Study of role of PGR in control of flower drops.                                                                      |
| 11           | Studies of important physiological disorders and their remedial measures in fruits and vegetables–I - Macroelements.  |
| 12           | Studies of important physiological disorders and their remedial measures in fruits and vegetables–II - Microelements. |
| 13           | Study of Seed Dormancy - Causes and methods of breaking dormancy with chemicals and growth regulators.                |
| 14           | Study of Seed Viability testing.                                                                                      |
| 15           | Study of Seed Germination - Types of seed germination and factors affecting seed germination.                         |
| 16           | Study of Seed Germination - Methods of seed germination testing.                                                      |

### **Suggested Readings [HORT-354]:**

1. **Jain, V.K.** 2006. Fundamentals of Plant Physiology (Ninth Edition). S. Chand and Co., New Delhi, India.
  2. **Mohr, H. and Schopfer, P.** 1995. Plant Physiology. Springer-Verlag, Berlin, Germany.
  3. **Marini, R.P.** 2009. Physiology of Pruning Fruit Trees. Virginia Cooperative Extension, Virginia Polytechnic Institute and State University, Blacksburg, Virginia, USA. Available at: Virginia Tech Extension Publication (*as online resource*).
  4. **Salisbury, F.B. and Ross, C.W.** 1992. Plant Physiology (Fourth Edition). Wadsworth Publishing Co., California, USA.
  5. **Taiz, L. and Zeiger, E.** 2003. Plant Physiology (Third Edition). Sinaure Associates, Inc., Publishers, Massachusetts, USA.
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|                     |                                                 |                             |
|---------------------|-------------------------------------------------|-----------------------------|
| <b>Semester</b>     | <b>: V</b>                                      |                             |
| <b>Course No.</b>   | <b>: SSAC-352</b>                               | <b>Credit Hrs. : 3(2+1)</b> |
| <b>Course Title</b> | <b>: Soil Fertility and Nutrient Management</b> |                             |

### **SYLLABUS**

**Objectives:** To acquaint students with the basic knowledge of soil fertility and nutrient management, as to understand the key factors affecting plant growth and development.

#### **THEORY**

Plant nutrients - Classification and Sources; Essential and Beneficial elements, Criteria of Essentiality, Forms of nutrients in soil, Mechanisms of nutrient transport to plants, Factors affecting availability of major, secondary and micro-nutrients to plants. Measures to overcome deficiency and toxicities. Soil fertility- Different approaches for soil fertility evaluation; Soil testing for available nutrients; Critical levels of different nutrients in soil. Plant analysis- Total and Rapid tissue tests, Critical levels of nutrients in plants; DRIS method; Deficiency symptoms - Indicator plants. Biological method of soil fertility evaluation. Soil test - based fertilizer recommendations to crops. Site-specific and Plant need-based nutrient management. Factors influencing Nutrient Use Efficiency (NUE) in respect of N, P, K, S, Fe and Zn fertilizers. Source, Method and Scheduling of nutrients for different soils and crops grown under rainfed and irrigated conditions. Integrated plant nutrient supply system and its management. Soil quality in relation to Sustainable Agriculture - acid, salt affected and calcareous soils, Characteristics, Nutrient availabilities, Reclamation- Mechanical, Chemical and Biological methods.

#### **PRACTICAL**

Analytical Instruments- Principles, Calibration and Applications; Estimation of available Nitrogen, Available Phosphorus, Available potassium and Available Sulphur in soil; Estimation of exchangeable Calcium and Magnesium in soil, Estimation of available micronutrients in soils; Preparation of plant samples for analysis; Estimation of Nitrogen, Phosphorus and Potassium in plants.

## **TEACHING SCHEDULE**

### **THEORY [SSAC-352]**

| <b>Lecture No.</b> | <b>Topic</b>                                         | <b>Sub-topics / Key Points</b>                                                                                                                                                                                                                     | <b>Weightage (%)</b> |
|--------------------|------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------|
| <b>1 - 2</b>       | Plant Nutrients - Classification and Sources         | Definitions of Soil Fertility;<br>History of Soil Fertility and Plant Nutrition;<br>Criteria of Essentiality of Nutrients;<br>Classification of essential nutrients.                                                                               | 8                    |
| <b>3 - 5</b>       | Essential and Beneficial Elements                    | Essential and Beneficial Nutrients and their Role;<br>Deficiency and Toxicity symptoms of essential plant nutrients.<br>Measures to overcome deficiency and toxicities;<br>Forms of nutrients in soil;<br>Mobility of nutrients in soil and plant. | 10                   |
| <b>6 - 7</b>       | Mechanism of Nutrient Uptake and Transport to Plants | Mechanism of nutrient uptake and Transport to plants: Factors affecting nutrient (major, secondary & micronutrients) availability to plants                                                                                                        | 6                    |
| <b>8 - 10</b>      | Manures and Fertilizers                              | Introduction and Importance of Manures and Fertilizers;<br>Preparation and Properties of Major Manures: FYM, Compost, Vermicompost, Green manuring, Oil cakes.                                                                                     | 6                    |
| <b>11 - 12</b>     | Soil Fertility Evaluation                            | Different approaches for soil fertility evaluation:<br>Soil testing for available nutrients;<br>Critical levels of different nutrients in soil.                                                                                                    | 8                    |
| <b>13 - 14</b>     | Plant Analysis                                       | Total plant analysis and Rapid plant tissue tests,<br>Critical levels of nutrients in plants;<br>DRIS method; Indicator plants.                                                                                                                    | 8                    |
| <b>15 - 16</b>     | Soil Fertilizer Recommendations to Crops             | Different fertilizer recommendation approaches (in detail);<br>Site-specific and Plant need-based nutrient management.                                                                                                                             | 6                    |
| <b>17 - 18</b>     | Nutrient Use Efficiency (NUE)                        | Definition and Factors influencing Nutrient Use Efficiency (NUE) in respect of N, P, K, S, Fe and Zn fertilizers.                                                                                                                                  | 6                    |

*Continued...*

|                |                                         |                                                                                                                                                |            |
|----------------|-----------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------|------------|
| <b>19 - 20</b> | Chemical Fertilizers                    | Definition and their Classification<br>N, P and K Fertilizers.<br>Secondary and Micronutrient Fertilizers                                      | 6          |
| <b>21 - 22</b> | Complex Fertilizers                     | Definition and Classification;<br>Liquid fertilizers and Nanofertilizers                                                                       | 6          |
| <b>23 - 24</b> | Integrated Plant Nutrient Management    | Integrated nutrient management (INM);<br>Concept, Components and Importance                                                                    | 6          |
| <b>25 - 26</b> | Acid Soils                              | Characteristics, Nutrient availabilities,<br>Reclamation- Mechanical, Chemical and<br>Biological methods                                       | 6          |
| <b>27 - 28</b> | Salt Affected Soils<br>(Saline / Sodic) | Characteristics, Nutrient availabilities,<br>Reclamation- Mechanical, Chemical and<br>Biological methods                                       | 6          |
| <b>29 - 30</b> | Calcareous Soils                        | Characteristics, Nutrient availabilities,<br>Reclamation- Mechanical, Chemical and<br>Biological methods                                       | 6          |
| <b>31 - 32</b> | Nutrient Applications                   | Sources, Methods and Scheduling of<br>nutrients applications for different soils<br>and crops grown under Rainfed and<br>Irrigated conditions. | 6          |
| <b>Total =</b> |                                         |                                                                                                                                                | <b>100</b> |

## TEACHING SCHEDULE

### PRACTICAL [SSAC-352]

| Exercise No. | Exercise Title                                                                          |
|--------------|-----------------------------------------------------------------------------------------|
| 1            | Introduction of analytical instruments and their principles.                            |
| 2            | Calibration and applications of Colorimetry and Flame photometry.                       |
| 3            | Determination of organic Carbon content from soil.                                      |
| 4            | Estimation of available Nitrogen in soil by Alkaline permanganate method.               |
| 5            | Estimation of available Phosphorus in soil.                                             |
| 6            | Estimation of available Potassium in soil by Flame photometric method.                  |
| 7            | Estimation of available Sulphur in soil by Turbidimetric method.                        |
| 8 - 9        | Estimation of exchangeable Calcium and Magnesium in soil by Versenate titration method. |
| 10           | Estimation of DTPA extractable micronutrients (Fe, Mn, Zn and Cu) from soil.            |
| 11           | Preparation of plant samples for analysis.                                              |
| 12           | Estimation of total Nitrogen in plant by micro-Kjeldhal method.                         |
| 13           | Estimation of total Phosphorus in plant sample by Vanadomolybdate method.               |
| 14           | Estimation of total Potassium from plant sample by Flame photometric method.            |
| 15           | Estimation of Sulphur concentration in plant sample.                                    |
| 16           | Estimation of total micronutrients (Fe, Mn, Cu and Zn) from plant sample.               |

### **Suggested Readings [SSAC-352]:**

1. Aggarwal, J.P. Yawalkar, K.S. and Bokde, S. 2011. Manures and Fertilizers. 11<sup>th</sup> Edn. Agri Horticultural Publishing House, Nagpur.
2. Basak Ranjan Kumar 2016. Fertilizers- A Text Book, Fourth Edition. Kalyani Publishers. Ludhiana.
3. Brady, N.C. 1999. Nature and Properties of Soils, 10<sup>th</sup> Edition.
4. Das, P.C. 2015. Manures and Fertilizers, Third Edition Kalyani Publishers. Ludhiana.
5. Goswami, N.N. 2009. Fundamentals of Soil Science, 2<sup>nd</sup> Edition. ISSS, New Delhi.
6. Kanwar, J.S. Soil Fertility - Theory and Practice, ICAR, New Delhi.
7. Soil Science an Introduction, 2015. Indian Society of Soil Science. New Delhi.
8. Tisdale, S.L. Nelson, W.L. and Beaton, J.D. 1985. Soil Fertility and Fertilizers, 4<sup>th</sup> Edition. MacMillan Publishing Company, New York.

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|--------------------------------------------|-----------------------------|
| <b>Semester : V</b>                        |                             |
| <b>Course No. : PATH-352</b>               | <b>Credit Hrs. : 3(2+1)</b> |
| <b>Course Title : General Microbiology</b> |                             |

## **SYLLABUS**

**Objectives:** To provide knowledge about general concepts of Microbiology.

### **THEORY**

Evolution and Scope of Microbiology. History of Microbiology. Microbial classification, Nomenclature and Identification. Taxonomic groups. General methods of classifying bacteria. Microscopy and Microscopes: Smears and Staining. Morphology and Fine structure of bacteria. Cultivation of bacteria, Nutritional requirements. Nutritional classification of bacteria; Phototrophs, Chemotrophs, Autotrophs and Heterotrophs; Obligate parasites; Bacteriological media, Growth of bacteria; Reproduction of bacteria; Introduction to fungi, algae, protozoa and virus. Microbiology of water and Food nutrient transport phenomenon: Passive diffusion, Facilitated diffusion; Group translocation, Active transport. Metabolism in bacteria - ATP generation, Microbial Genetics; Bacterial recombination; Bacterial conjugation, transduction; Bacterial transformation; Mutations: Types of mutations, Mutagenesis; Mutation rate, Repair of mutations; Phenotypes of bacterial mutants; Designation of bacterial mutants; Destruction of microorganisms: Physical agents and Chemical agents; Chemotherapeutic agents and Chemotherapy; Characteristics of antibiotics; Mode of action of antibiotics; Pure culture: Methods of isolation of pure cultures; Maintenance and preservation of pure cultures; Culture collections.

### **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 [PATH-352]

| Lecture No. | Topic                                                            | Sub-topics/ Key Points                                                                                                                                                                                                                                                     | Weightage (%) |
|-------------|------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|
| 1 - 2       | <b>Evolution and Scope of Microbiology</b>                       | Introduction; Definition; Concept, Origin and evolution of Microbiology;<br>Spontaneous generation conflict,<br>Germ theory of diseases.<br>Scope of Microbiology: Pure and applied branches; Role and applications in agriculture & allied areas                          | 5             |
| 3 - 4       | <b>History of Microbiology</b>                                   | Development of Microbiology in India and Composition of microbial world;<br>Major milestones and Contributions of eminent Scientists.                                                                                                                                      | 5             |
| 5 - 6       | <b>Microbial Classification, Nomenclature and Identification</b> | Major Classification systems;<br>General methods of Classifying Bacteria;<br>Microbial Nomenclature and Taxonomic Hierarchy (Groups);<br>Identification and Characterization of Microorganisms (Morphological, cultural, physiological, biochemical and molecular methods) | 5             |
| 7 - 8       | <b>Microscopy and Microscopes; Smears and Staining</b>           | Principles, Types and Components of Microscopy; Specimen preparation: The bright field microscope, Fixation methods, Precautions;<br>Staining Techniques- Dyes and Simple staining and Differential staining.                                                              | 8             |
| 9 - 11      | <b>Introduction to Microorganisms</b>                            | Prokaryotic, Eukaryotic and Mesobiotic microorganisms (Introduction to Fungi, Protozoa, Algae, Bacteria, Actinomycetes, BGA, Mycoplasma, Virus, Bacteriophage, Viroids, etc.) their properties with harmful and beneficial roles                                           | 10            |
| 12 - 15     | <b>Morphology and Fine Structure of Bacteria</b>                 | General Morphology and Classification based on Shape and Arrangement, Cell grouping,<br>Structure and Functions of Bacterial Cell Components (Internal and External Organelles), Fine Structure and Ultrastructure of Bacterial Cell                                       | 10            |

Continued...

|                |                                                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |            |
|----------------|----------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|
| 16 - 18        | <b>Cultivation of Bacteria and Nutritional Requirements</b>          | Nutritional Requirements of Bacteria; Culture Media and Types of Media for Bacterial Cultivation- Bacteriological Media, Growth of Bacteria (Growth Curve and Phases, Physical and Chemical Factors Influencing the Growth); Methods and Conditions for Cultivation of Bacteria.                                                                                                                                                                                                                                                                           | 10         |
| 19 - 20        | <b>Nutritional Classification of Bacteria</b>                        | Definitions and suitable Examples: Types of Nutritional Groups- Phototrophs, Chemotrophs, Autotrophs, Lithotrophs, Organotrophs and Heterotrophs- Obligate parasites.                                                                                                                                                                                                                                                                                                                                                                                      | 8          |
| 21 - 23        | <b>Reproduction of Bacteria and Bacterial Metabolism</b>             | Modes of Reproduction: Asexual and Sexual reproduction, Group recombination, Microbial Genetics (in brief); Bacterial Conjugation, Transduction, Transformation.<br>Bacterial Metabolism: Definition, Anabolic and Catabolic processes; ATP/Energy generation and metabolic pathways; Aerobic and Anaerobic respiration and significance                                                                                                                                                                                                                   | 10         |
| 24             | <b>Bacterial Mutations</b>                                           | Definitions; Types of Mutation, Mutagenesis, Mutation rate, Repair of mutations, Phenotypes of Bacterial Mutants, Designation of Bacterial Mutants.                                                                                                                                                                                                                                                                                                                                                                                                        | 6          |
| 25 - 27        | <b>Microbiology of Water and Food; Nutrient Transport Phenomenon</b> | Microbiology of Water and Food: Microbial flora associated with water and food; Beneficial and harmful microorganisms; Significance in contamination, spoilage and public health.<br>Structure and functions of microbial cell membrane;<br>Passive diffusion & Facilitated diffusion (Definitions, mechanism, characteristics, differences, factors, examples);<br>Active Transport Mechanism (Definition, transport proteins/carriers, significance) in brief.<br>Group Translocation [Concept, Phosphotransferase system (PTS), significance] in brief. | 6          |
| 28 - 29        | <b>Destruction of Microorganism</b>                                  | Physical and Chemical methods and agents, Chemotherapeutic agents and Chemotherapy                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 6          |
| 30             | <b>Antibiotics</b>                                                   | Definition; Characteristics of Antibiotics and Modes of Action of Antibiotics                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 5          |
| 31 - 32        | <b>Pure Culture</b>                                                  | Methods of isolation; Maintenance and Preservation of pure cultures; Culture collections                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 6          |
| <b>Total =</b> |                                                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | <b>100</b> |

## TEACHING SCHEDULE

### PRACTICAL [PATH-352]

| Exercise No. | Exercise Title                                                           |
|--------------|--------------------------------------------------------------------------|
| 1            | Study of Microscopes and Microscopy Techniques.                          |
| 2            | Acquaintance and use of equipments used in Microbiology Laboratory.      |
| 3            | Methods of sterilization.                                                |
| 4            | Preparation of nutrient agar medium and techniques of inoculation.       |
| 5            | Staining methods: Simple staining and Differential staining.             |
| 6            | Gram staining.                                                           |
| 7            | Pure culture techniques (Streak plate/ Pour plate/ Spread plate).        |
| 8            | Identification procedure (Morphology and Cultural characteristics).      |
| 9            | Study of growth characteristics of fungi.                                |
| 10           | Isolation of <i>Rhizobium</i> .                                          |
| 11           | Isolation of <i>Azospirillum</i> .                                       |
| 12           | Isolation of <i>Azotobacter</i> .                                        |
| 13           | Isolation of Phosphate solubilizing micro-organisms.                     |
| 14           | Isolation of Potassium solubilizing micro-organisms.                     |
| 15           | Determination of microbial numbers, direct plate count, generation time. |
| 16           | Factors influencing growth; pH, Temperature, growth curve for bacteria.  |

### Suggested Readings [PATH-352]:

1. **Dubey, R.C. and Maheshwari, D.K.** 2013, A Textbook of Microbiology, S. Chand Publishing, New Delhi.
2. **Gerard, J.T., Berdell, R.F. and Christine L.C.** 2014, Microbiology: An Introduction. 12<sup>th</sup> Edn., Prentice- Hall, NY, USA.
3. **Johanne, M.W., Linda, M.S. and Woolverton, C.J.** 2013. Prescott's Microbiology 9<sup>th</sup> Edn., McGraw-Hill Higher Education, NY., USA.
4. **Pelzar, M.J., Chan ECS. and Noel, R.K.** 1998, Microbiology 5<sup>th</sup> Edn. Tata McGraw-Hill Education, New Delhi.
5. **Purohit, S.S.**, 2001, Microbiology - Fundamental and Applications, Agrobios, New Delhi.
6. **Sherma, P.D.**, 1999, Microbiology, Rastogi Publications, Meerut, India.
7. **Tauro, P., Kapoor, K.K. and Yadav, K.S.** 2002, Introduction to Microbiology, New Age International (P) Ltd. Pub., New Delhi, India.

|                                                                                |                             |
|--------------------------------------------------------------------------------|-----------------------------|
| <b>Semester : V</b>                                                            |                             |
| <b>Course No. : IT-351</b>                                                     | <b>Credit Hrs. : 3(1+2)</b> |
| <b>Course Title : Information and Communication Technology in Horticulture</b> |                             |

### **SYLLABUS**

**Objective:** To learn the basics of computing and its practical use in communication.

#### **THEORY**

IT and its Importance. IT Tools, IT-Enabled services and their Impact on society; Introduction to Computers, Hardware and Software; Input and Output devices; Word and Character representation; Features of machine language, Assembly language, High-level language and their Advantages and Disadvantages; Operating Systems, Definition and Types, Applications of Word Processing/ Spreadsheet /Presentation/ Databases for document creation and Editing, Data presentation, Interpretation and Graph creation, Statistical analysis, Mathematical expressions, Database concepts and Types, uses of DBMS in Horticulture; Introduction to Local Area Network (LAN), Wide Area Network (WAN), Internet and World Wide Web, HTML and IP and Video conferencing, Introduction to e-Horticulture, Concepts and Applications, Use of ICT in Horticulture.

#### **PRACTICAL**

Practice with latest operating system for creating Files, Folders, File management. Use of Word Processing/ Spreadsheet/ Presentation/ Databases with latest software packages; Creating a spreadsheet, Use of statistical tools, Writing expressions, Creating graphs, Analysis of scientific data. Creating database, Preparing queries and Reports, Creation and Operation of E-mail account; Demonstration of Agri-information system using Mobile Apps. Internet applications: Web browsing, Handling of audio-visual equipment. Planning, Preparation, Presentation of posters, charts. Introduction of Geospatial Technology of generating valuable information for Agriculture. Hands on Decision Support System. Preparation of contingent crop planning.

## TEACHING SCHEDULE

### THEORY [IT-351]

| Lecture No. | Topic                                      | Sub-topics/ Key Points                                                                                                                                                      | Weightage (%) |
|-------------|--------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|
| 1           | IT and its Importance                      | IT tools;<br>IT-enabled services and their impact on society                                                                                                                | 8             |
| 2           | Introduction to Computers                  | Input and Output devices                                                                                                                                                    | 7             |
| 3           | Computer Hardware and Software             | Fundamental of Hardware and Software;<br>Types of Software & Hardware                                                                                                       | 10            |
| 4 - 5       | Introduction to Machine Language           | Word and Character representation                                                                                                                                           | 10            |
| 6 - 7       | Computer Languages                         | Features of Machine language, Assembly language;<br>High-level language and their advantages and disadvantages                                                              | 10            |
| 8           | Operating Systems                          | Definition and Types (in brief)                                                                                                                                             | 4             |
| 9 - 10      | Word Processing; Spreadsheet; Presentation | Applications and Features of Word processing, Spreadsheet & Presentation                                                                                                    | 10            |
| 11 - 13     | Document Creation and Editing              | Creation of Word document, Spreadsheet, Presentation and Databases;<br>Data presentation, Interpretation and Graph creation; Statistical analysis, Mathematical expressions | 15            |
| 14          | Database                                   | Concepts and Types of Databases;<br>Uses of DBMS in Horticulture                                                                                                            | 10            |
| 15          | Computer Network                           | Types of Network;<br>Introduction to Local Area Network (LAN), Wide Area Network (WAN), Internet and World Wide Web, HTML and IP, and Video Conferencing                    | 10            |
| 16          | Introduction to e-Horticulture             | Concepts and Applications;<br>Use of ICT in Horticulture.                                                                                                                   | 6             |
| Total =     |                                            |                                                                                                                                                                             | 100           |

## TEACHING SCHEDULE

### PRACTICAL [IT-351]

| Exercise No. | Exercise Title                                                                            |
|--------------|-------------------------------------------------------------------------------------------|
| 1 - 2        | Practice with latest operating system for creating Files, Folders, File Management.       |
| 3 - 5        | Creation of document in Word Processing.                                                  |
| 6 - 8        | Introduction to Spreadsheet.                                                              |
| 9 - 11       | Features and preparation of Presentation.                                                 |
| 12 - 14      | Introduction with Databases with latest software packages.                                |
| 15 - 17      | Creation of spreadsheet with use of statistical tools.                                    |
| 18 - 19      | Use of writing expressions, creating graphs, analysis of scientific data in spreadsheet.  |
| 20 - 21      | Creating Database, preparing queries and reports.                                         |
| 22           | Creation and operation of E-mail account.                                                 |
| 23 - 24      | Demonstration of Agri-information system using Mobile Apps.                               |
| 25 - 26      | Internet applications: Web browsing.                                                      |
| 27           | Handling of audio-visual equipment.                                                       |
| 28 - 29      | Planning, preparation, presentation of posters, charts.                                   |
| 30           | Introduction of Geospatial Technology of generating valuable information for Agriculture. |
| 31 - 32      | Hands-on Decision Support System;<br>Preparation of Contingent crop planning.             |

### **Suggested Readings [IT-351]:**

1. **Comer Douglas E.** 2018. The Internet Book: Everything You Need to Know About Computer Networking and How the Internet Works. Chapman and Hall/CRC.
2. **Crowther, R., Joe, L., Ash Blue and Wanish, G.** 2014. HTML5 in Action. Manning.
3. **Pradeep, K. Sinha and Priti Sinha,** Computer Fundamentals, III Edition, BPB Publications, B-14, Connaught Place, New Delhi – 110 001.
4. **Rajaraman, V.** 2013. Fundamentals of Computers, V<sup>th</sup> Edition. PHI.
5. **Ray, G.L.** Extension communication and Management. Kalyani Publishers.
6. **Mane, M.S.** Introduction to Computer Application. Shri Rajlaxmi Prakashan.

|                     |                    |                                     |
|---------------------|--------------------|-------------------------------------|
| <b>Semester</b>     | <b>:</b>           | <b>V</b>                            |
| <b>Course No.</b>   | <b>:</b>           | <b>PP-351</b>                       |
|                     | <b>Credit Hrs.</b> | <b>: 2(1+1)</b>                     |
| <b>Course Title</b> | <b>:</b>           | <b>Introductory Crop Physiology</b> |

## **SYLLABUS**

### **Objectives:**

- i) To study different physiological plant aspects such as water uptake and movement in plants, nutrient absorption, assimilation,
- ii) To study factors affecting photosynthesis and its importance in plants.

### **THEORY**

Water Relations in Plants: Role of water in plant metabolism, Osmosis inhibition, Diffusion, Water potential and its components, Measurement of water potential in plants, Absorption of water, Mechanism of absorption and Ascent of sap. Stomata: Structure, distribution, classification, mechanism of opening and closing of stomata. Osmotic pressure, Guttation, Stem bleeding; Transpiration methods and Mechanism and factors affecting transpiration. Drought: Different types of stresses; Water, Heat and Cold tolerance; Mechanism of tolerance. Plant Nutrition: Essentiality, Mechanism of absorption and its role in plant metabolism. Biological Nitrogen Fixation. Photosynthesis, Structure and Function of chloroplast, Dark and Light reactions, Cyclic and non-cyclic Electron Transfer, CO<sub>2</sub> fixation – C<sub>3</sub>, C<sub>4</sub> and CA metabolism, Advantages of C<sub>4</sub> pathway. Photorespiration and its implications, Factors affecting photosynthesis. Mode of herbicide action, Secondary metabolites and Plant defense.

### **PRACTICAL**

Measurement of water potential, osmosis, root pressure, Structure of the stomata, distribution, opening and closing of the stomata, Measurement, Transpiration and calculation of transpiration pull demonstration. Importance of light and chlorophyll in photosynthesis, Pigment identification in horticultural crops, measurement of Relative Water Content (RWC), Studying plant movements.

## TEACHING SCHEDULE

### THEORY [PP-351]

| Lecture No. | Topic                                      | Sub-topics / Key Points                                                                                                                                                                                                 | Weightage (%) |
|-------------|--------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|
| 1           | Water Relations in Plants                  | Role of water in plant metabolism, Enzymatic activity, Transport, Growth, Turgor                                                                                                                                        | 5             |
| 2           | Osmosis and Diffusion                      | Definitions & Principles: Osmosis, Inhibition, Diffusion and Biological significance                                                                                                                                    | 5             |
| 3           | Water Potential                            | Definition, Concept of Water Potential; Components: Solute, Pressure, Matric potential                                                                                                                                  | 5             |
| 4           | Measurement of Water Potential             | Pressure chamber, Psychrometer, Other techniques                                                                                                                                                                        | 5             |
| 5           | Absorption of Water                        | Active vs. Passive absorption mechanisms                                                                                                                                                                                | 5             |
| 6           | Ascent of Sap                              | Cohesion-tension theory, Capillarity                                                                                                                                                                                    | 5             |
| 7           | Stomata Structure                          | Structure, Distribution, Classification                                                                                                                                                                                 | 5             |
| 8           | Stomatal Physiology                        | Mechanism of opening and closing of stomata                                                                                                                                                                             | 5             |
| 9           | Plant Exudations                           | Osmotic pressure, Guttation, Stem bleeding                                                                                                                                                                              | 5             |
| 10          | Transpiration                              | Definition, Methods, Mechanisms, Factors affecting transpiration                                                                                                                                                        | 10            |
| 11 - 12     | Stress Tolerance Mechanisms                | Drought- Def <sup>m</sup> .; Classification of Plant Stresses, Stress tolerance mechanism; Osmo-protectants, ABA signaling, Heat-shock proteins                                                                         | 10            |
| 13          | Plant Nutrition                            | Essentiality of nutrients, Absorption mechanism, Role in plant metabolism                                                                                                                                               | 5             |
| 14          | Biological Nitrogen Fixation               | Symbiotic and Non-symbiotic pathways, Nodulation, Nitrogenase enzyme                                                                                                                                                    | 5             |
| 15          | Photosynthesis - I                         | Chloroplast structure & function, Light and Dark reactions, Cyclic and Non-cyclic electron transfer                                                                                                                     | 10            |
| 16          | Photosynthesis - II and Applied Physiology | CO <sub>2</sub> fixation (C <sub>3</sub> , C <sub>4</sub> , CAM), Advantages of C <sub>4</sub> , Photorespiration, Factors affecting photosynthesis, Mode of Herbicide action, Secondary metabolites and Plant defense. | 15            |
| Total =     |                                            |                                                                                                                                                                                                                         | 100           |



## TEACHING SCHEDULE

### PRACTICAL [PP-351]

| Exercise No. | Exercise Title                                                    |
|--------------|-------------------------------------------------------------------|
| 1            | Determination of water potential in plant tissues.                |
| 2            | Experimental demonstration of osmosis.                            |
| 3            | Measurement of root pressure in plants.                           |
| 4            | Microscopic study of stomatal structure.                          |
| 5            | Comparative study of stomatal distribution on leaf surfaces.      |
| 6            | Observation of stomatal opening and closing mechanisms.           |
| 7            | Measurement of stomatal aperture using Micrometry.                |
| 8            | Demonstration of transpiration in plants.                         |
| 9            | Calculation of transpiration-pull using Photometer.               |
| 10           | Study of the importance of light in photosynthesis.               |
| 11           | Demonstration of the role of chlorophyll in photosynthesis.       |
| 12           | Identification of photosynthetic pigments in horticultural crops. |
| 13           | Measurement of Relative Water Content (RWC) in plant tissues.     |
| 14           | Experimental study of tropic movements in seedlings.              |
| 15           | Observation of nastic movements in plants.                        |
| 16           | Study of Diurnal leaf movements (Nyctinasty).                     |

### Suggested Readings [PP-351]:

1. **Bendre, A.M. and Pande, P.C.**, 2009, Introductory Botany. Rastogi publication, Meerut.
2. **Bhatia, K.N.**, 2015, Plant Physiology. Trueman Book Company, Jalandhar.
3. **Dutta, A.C.**, 2013, A Textbook of Botany. Oxford University Press, Oxford Lecture Schedule.
4. **Gardner, F.P., Pearce, R.B. and Mitchell, R.L.**, 2003, Physiology of Crop Plants. Scientific Publishers, Jodhpur.
5. **Jain, V.K.**, 2019, Fundamentals of Plant Physiology. S. Chand Publishers, New Delhi.

|                     |                                                    |                             |
|---------------------|----------------------------------------------------|-----------------------------|
| <b>Semester</b>     | <b>: V</b>                                         |                             |
| <b>Course No.</b>   | <b>: STAT-351</b>                                  | <b>Credit Hrs. : 3(2+1)</b> |
| <b>Course Title</b> | <b>: Basic Statistics and Experimental Designs</b> |                             |

### **SYLLABUS**

#### **Objectives:**

- i) To understand the analytical techniques for data analysis and interpretation,
- ii) To help students to compete for various competitive examinations.

### **THEORY**

Definition of Statistics, its Use and Limitations. Variable statistics, Types and Sources of data, Classification and Tabulation of data. Construction of frequency distribution tables – Graphic presentation of data, Simple, Multiple component and Percentage, Bar diagram, Pie diagram, Histogram, Frequency polygon and Frequency curve, Cumulative frequency curve. Measures of Central tendency: Mean, Median, Mode, Geometric mean, Harmonic mean, Percentiles and Quartiles for raw and grouped data, Measures of dispersion: Range, Quartile deviation, Mean deviation, Standard deviation for raw and grouped data, Coefficient of variation. Skewness and Kurtosis. Probability- Definition, Additive and Multiplicative law for two events, Normal distribution and its Properties. Introduction of sampling. Basic concepts, sampling vs. Complete enumeration parameter and Statistic. Sampling techniques (Simple random sampling: Lottery method and Random number table method). Tests of significance, Null hypothesis, Alternate hypothesis, Type I and II Error, One and Two tail tests, Level of significance and Confidence interval. Large sample tests for mean (Single sample and Two samples), Student's t-test for Single sample, Two samples and Paired t-test, F-test, Chi-square test for application of attributes (Contingency table) and Test for goodness to fit of Mendelian ratios, Yates' correction for continuity. Correlation - Scatter diagram and Karl Pearson coefficient of correlation for ungrouped data and its testing. Linear regression and its Properties. Inter-relation between 'r' and the Regression coefficient, Introduction to design of experiment- Basic principles of experimental design-Replication, Randomization and Local control, Analysis of Variance (ANOVA) and its Assumptions, Analysis of Completely Randomized Design (CRD), Randomized Block Design (RBD) and Latin Square Design (LSD), Comparisons based on means-critical difference.

## PRACTICAL

Construction of frequency distribution tables and frequency curves, Measures of Central tendency: Mean, Median, Mode, Geometric mean, Harmonic mean, Percentiles and Quartiles. Measures of dispersion: Range, Quartile deviation, Mean deviation, Standard deviation for raw and grouped data, Coefficient of variation. Skewness and Kurtosis. Probability. Large sample tests for mean, Student's t-test, F-test and Chi-square test, Correlation coefficient 'r' and its testing, Fitting of regression equations, Analysis of CRD, RBD and LSD.

### Suggested Readings [STAT-351] :

1. **Bansal M.L., Singh Sukhminder, Singh Tejinderpal and Jindal Rakesh Kumar.** 2014. Statistical Methods for Research Workers. Kalyani Publishers, 4<sup>th</sup> Edn.
2. **Chandal S.R.S.** 2014. A Handbook of Agricultural Statistics. Achal Prakashan Mandir.
3. **Gupta S.P.** 2021. Statistical Methods. Sultan Chand and Sons.
4. **William G. Cochran and George W. Snedecor.** 2014. Statistical Methods. Wiley India Pvt. Ltd. 8<sup>th</sup> Edn.

## TEACHING SCHEDULE

### THEORY [STAT-351]

| Lecture No.    | Topic                        | Sub-topics/ Key Points                                                                                                                                                                          | Weightage (%) |
|----------------|------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|
| 1 - 2          | Statistics and Data          | Definition, Use and Limitations. Variable Statistics, Types and Sources of Data, Classification and Tabulation of data, Construction of frequency distribution tables.                          | 5             |
| 3 - 4          | Representation of Data       | Graphic presentation of data, Simple, Multiple component and Percentage, Bar diagram, Pie diagram, Histogram, Frequency polygon and Frequency curve, Cumulative frequency curve.                | 5             |
| 5 - 7          | Measures of Central Tendency | Mean, Median, Mode, Geometric mean, Harmonic mean, Percentiles and Quartiles for raw and grouped data                                                                                           | 5             |
| 8 - 10         | Measures of Dispersion       | Range, Quartile deviation, Mean deviation, Standard deviation for raw and grouped data, Coefficient of variation. Skewness and Kurtosis                                                         | 5             |
| 11 - 12        | Probability                  | Definition, Additive and Multiplicative Law for two events                                                                                                                                      | 5             |
| 13             | Normal Distribution          | Concept and its Properties                                                                                                                                                                      | 5             |
| 14 - 15        | Sampling                     | Basic Concepts;<br>Sampling vs. Complete enumeration;<br>Sampling techniques (Simple random sampling: Lottery method and Random number table method)                                            | 5             |
| 16 - 18        | Tests of Significance        | Null hypothesis, Alternate hypothesis, Type I and II errors, One and Two tail tests, Level of significance and Confidence interval. Large sample tests for mean (Single sample and Two samples) | 10            |
| 19 - 21        | Student's t-Test             | Single sample, Two samples and Paired t-test, F-test                                                                                                                                            | 10            |
| 22             | Chi-square Test              | Chi-square ( $\chi^2$ ) test for application of attributes (Contingency table) and Test for Goodness to fit of Mendelian ratios                                                                 | 10            |
| 23 - 24        | Correlation                  | Yates' correction for continuity, Correlation-scatter diagram and Karl Pearson coefficient of correlation for ungrouped data and its testing                                                    | 5             |
| 25             | Linear Regression            | Introduction and its properties. Inter-relation between 'r' and the Regression coefficient                                                                                                      | 5             |
| 26 - 28        | Design of Experiment         | Basic Principles of Experimental design - Replication, Randomization and Local control, Analysis of Variance (ANOVA) and its Assumptions                                                        | 10            |
| 29 - 30        | CRD and RBD                  | Analysis of Completely Randomized Design (CRD), Randomized Block Design (RBD)                                                                                                                   | 10            |
| 31 - 32        | LSD                          | Analysis of Latin Square Design (LSD), Comparisons based on means - Critical difference.                                                                                                        | 5             |
| <b>Total =</b> |                              |                                                                                                                                                                                                 | <b>100</b>    |

**PRACTICAL [STAT-351]**

| <b>Exercise No.</b> | <b>Exercise Title</b>                                                                    |
|---------------------|------------------------------------------------------------------------------------------|
| <b>1</b>            | Construction of frequency distribution tables and frequency curves.                      |
| <b>2</b>            | Computation of Measures of Mean, Median and Mode.                                        |
| <b>3</b>            | Calculation of geometric mean, harmonic mean, percentiles and quartiles.                 |
| <b>4</b>            | Measurement of range, quartile deviation, mean deviation.                                |
| <b>5 - 6</b>        | Calculation of standard deviation for raw and grouped data and coefficient of variation. |
| <b>7</b>            | Concept of Skewness and Kurtosis.                                                        |
| <b>8</b>            | Introduction to Probability concepts.                                                    |
| <b>9 - 10</b>       | Large sample tests for mean, Student's t-test and F-test.                                |
| <b>11</b>           | Introduction to Chi-square test.                                                         |
| <b>12</b>           | Computation of Correlation coefficient 'r' and its testing.                              |
| <b>13</b>           | Introduction to Fitting of regression equations.                                         |
| <b>14</b>           | Problems on analysis of Completely Randomized Design (CRD).                              |
| <b>15</b>           | Problems on analysis of Randomized Block Design (RBD).                                   |
| <b>16</b>           | Problems on analysis of Latin Square Design (LSD).                                       |