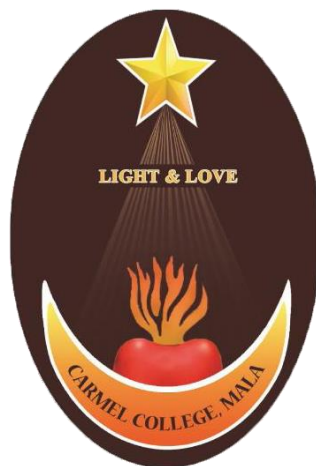




# **CARMEL COLLEGE (AUTONOMOUS) MALA**

**B.VOC DEGREE PROGRAMME  
IN  
AGRICULTURE**



**UNDER  
FACULTY OF AGRICULTURE  
2022**

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## **REGULATIONS**

### **FOR THE DEGREE OF B.Voc AGRICULTURE**

#### **1. TITLE OF THE PROGRAMME:**

This programme shall be called Bachelor of Vocational studies in Agriculture under Choice Based Credit and Semester System for Vocational Under Graduate Curriculam 2021(CBCSSVUG2021)

#### **2. PROGRAMME – AN OVERVIEW**

The University Grants Commission (UGC) had launched a scheme for skills development based higher education as part of college/university education, leading to Bachelor of Vocation (B.Voc.) degree with multiple entry and exit points. The B.Voc. programme is focused on universities and colleges providing undergraduate studies which would also incorporate specific job roles along with general education. This would enable the graduates completing B.Voc to make a meaningful participation in accelerating India's economy by gaining appropriate employment, becoming entrepreneurs and creating appropriate knowledge.

B. Voc is a three year undergraduate degree programme in agriculture. The above mentioned course deals with agriculture science. Agriculture science deals with applying scientific knowledge, technology and principles to boost agricultural productivity. It has a multidisciplinary scope. This course consists of elements such as chemistry, biology, animal husbandry, technology, management, and marketing. Agriculture is a broader concept within itself. It constitutes of many sub-disciplines and sub-branches such as, floriculture, horticulture, poultry farming, organic farming and many more.

The programme will make the student an agriculture professional who can deal with the various aspects of agriculture and farming.

### **Broad Objectives**

Upon successful completion of the programme, students will:

- To provide judicious mix of skills relating to a profession and appropriate content of General Education.
- To ensure that the students have adequate knowledge and skills, so that they are work ready at each exit point of the programme.
- To provide flexibility to the students by means of pre-defined entry and multiple exit points.
- To integrate NSQF within the undergraduate level of higher education in order to enhance employability of the graduates and meet industry requirements. Such graduates apart from meeting the needs of local and national industry are also expected to be equipped to become part of the global work force.
- To provide vertical mobility to students coming out of 10+2 with vocational subjects
- Accommodate insightful information of Agriculture principles necessary for the applications of Agriculture.
- Graduates of the program will acquire knowledge of recent trends in technology and solve problem in industry and farmers.

### **Programme Outcome (PO)**

PO-1 To impart first hand knowledge on agriculture and allied sciences

PO-2 Understand the impact of the professional agricultural solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO-3 To demonstrate research based knowledge of the legal and ethical environment impacting agriculture organizations and exhibit an understanding and appreciation of the ethical implications of decisions.

PO-4 To demonstrate an understanding of and appreciation for the importance of the impact of globalization and diversity in modern agriculture organizations. Understanding of globalization, and NGO working.

PO-5 To understand and analyze the current events and issues that are occurring in agriculture and how they affect futuristic agriculture.

PO-6 To understand and analyze the current events and issues that are occurring in agriculture and how they affect futuristic agriculture.

PO-7 Able to recognize and examine the relationships between inputs and outputs in their agricultural field to make effective and profitable decisions. To understand mechanics of a agriprenurship

### **Programme Specific Outcome (PSO)**

PSO-1 To acquire knowledge on importance of agriculture and various types of farming.

PSO-2 To acquaint with importance, division and classification of horticultural crops and to understand the basic principles and types of plant propagation.

PSO-3 To familiarize with fundamentals of water management and to acquaint with various soil conservation methods.

PSO-4 To understand the fundamentals of Plant breeding, Basics of Seed technology and cultivation aspects of Plantation crops, spices and fruit crops.

PSO-5 To build theoretical foundation in plant tissue culture and biotechnology and to develop knowledge on the theoretical basis of integrated pest management and also to familiarize with protected cultivation structures and cultivation practices.

PSO-6 To understand the general characters of weeds and their management and to acquaint with cultivation of rice, fibre crops, fodder crops, etc

PSO -7 To develop practical skill in propagation and cultivation aspects of horticultural crops, Plantation crops, spices and fruit crops

PSO-8 To develop skill in various aspects of seed production and to do the micropropagation of plants.

### **3. ELIGIBILITY CRITERIA FOR ADMISSION**

- The admission to this programme will be as per the rules and regulations of the University for UG admissions.
- Basic eligibility for B. Voc is 10+2 and above in any stream (No age limit).
- A weightage of 25 marks will be given to VHSE students from the concerned area of specialization
- The eligibility criteria for admission shall be as announced by the University from time to time.
- Separate rank lists shall be drawn up for reserved seats as per the existing rules.
- The candidates admitted for B.Voc. Degree (without multiple exit) shall subsequently undergo the prescribed courses of study in a college affiliated to the University for six semesters within a period of not less than three years; clear all the examinations prescribed and fulfil all such conditions as prescribed by the University from time to time.
- The college shall make available to all students admitted a prospectus listing all the courses offered in various departments during a particular semester. The information so provided shall contain title of the courses, the semester in which it is offered and credits for the courses. Detailed syllabi shall be made available in the University/college websites.
- There shall be a uniform calendar prepared by the University for the registration, conduct/schedule of the courses, examinations and publication of results. The University shall ensure that the calendar is strictly followed.
- Grace Marks may be awarded to a student for meritorious achievements in co-curricular activities such as Sports/Arts/ NSS/NCC/ Student Entrepreneurship.
- Preferred subjects & index mark calculations will be decided by the respective Board of Studies

#### **4. DURATION OF THE PROGRAMME**

- Duration of an undergraduate programme is six semesters distributed over a period of 3 academic years.
- An academic week is a unit of five working days in which distribution of work is organized from Monday to Friday with six contact periods of one hour duration on each day.
- A sequence of 18 such weeks (16 instructional weeks and 2 weeks for

examination) constitutes a semester.

## 5. COURSESTRUCTURE

- **Programme** means the entire course of study and examinations for the award of a degree.
- **Courses:** Course means a segment of subject matter to be covered in a semester. This undergraduate programme includes 3 types of courses, viz.,
  - i. **General Education Components (GEC):** Common course means a course that comes under the category of courses, including compulsory English and additional language courses and a set of General courses applicable for Language Reduced Pattern (LRP) programmes, the selection of which is compulsory for all students undergoing UG programmes.
  - ii. **Skill Development Components (SDC):**
    - a) This component should match the skill gap identified.
    - b) At least 50% of Skill Development Component should be allotted to practical and can grow up to 60% based on the nature of the course. The practical component can be carried out in the college and/or the industry partner premises
  - iii. **Audit courses** are courses which are mandatory for a programme but not conducted for the calculation of SGPA or CGPA. There shall be one audit course each in the first 4 semesters. Audit courses are not meant for class room study. The students can attain only pass(Grade P) for these courses. At the end of each semester there shall be examination conducted by the college from a pool of questions (Question Bank).
  - iv. **Electives:** Students are permitted to take elective subjects provided along with the syllabus of the programme.

## 6. CREDIT

- o Each course shall have certain credits. **Credit** is a unit of academic input measured in terms of weekly contact hours/course contents assigned to a course.
- o A student is required to acquire a minimum of 180 credits for the completion of the UG programme which shall only be counted for SGPA and CGPA.
- o The maximum credit for a course shall not exceed 5 and the minimum credit for a course is 2.

- o Each subject shall have a certain number of credits assigned to it depending upon the academic load and the nature and importance of the subject.
- o Audit course shall have 4 credits as per course and a total of 16 credits in the entire programme. The credit of audit course or extra credits are not counted for SGPA or CGPA.
- o **Extra credits** are mandatory for the programme. Extra credits will be awarded to students who participate in activities like NCC, NSS and Swatch Bharath. Those students who could not join in any of the above activities have to undergo Calicut University Social Service Programme (CUSSP). Extra credits are not counted for SGPA or CGPA. The maximum credits acquired under extra credits shall be 4. If more Extra credit activities are done by a student that may be mentioned in the Grade card.

## 7. SCHEME OF EVALUATION

The evaluation scheme for each courses hall contain two parts 1)internal evaluation 2)external evaluation. 20% weight shall be given to the internal evaluation. The remaining 80% weight shall be for the external evaluation. The marks secured for internal evaluation only need to be sent to University by the colleges concerned. The internal evaluation shall be based on a predetermined transparent system involving written tests, classroom participation based on attendance in respect of theory courses and lab involvement/records attendance in respect of practical courses. Internal evaluation of the project will be based on its content, method of presentation, final conclusion and orientation to research aptitude. Components with percentage of marks of internal evaluation of theory Courses are-Test paper 40%, Assignment 20%, Seminar 20% and Class room participation based on attendance20%.

For practical courses - Record 60% and lab involvement 40% as far as internal is concerned. (If a fraction appears in internal marks, nearest whole number is to be taken) For the test paper marks, at least one test paper should be conducted. If more test papers are conducted, the mark of the best one should be taken. To ensure transparency of the evaluation process, the internal assessment marks awarded to the students in each course in a semester shall be notified on the notice board at least one week before the commencement of external examination. There shall not be any chance for improvement for internal marks.



The course teacher(s) shall maintain the academic record of each student registered for the course, which shall be forwarded to the University by the college Principal after obtaining the signature of both course teacher and Head of the Department. The split up of marks for Test paper and Classroom Participation (CRP) for internal evaluation are as follows.

### **Split Up of Marks for Test paper**

Range of Marks in Test paper	Out of 8 (Maximum marks is 20)	Out of 6 (Maximum marks is 15)
Less than 35%	1	1
35% - 45%	2	2
45% - 55%	3	3
55% - 65%	4	4
65% - 85%	6	5
85% - 100%	8	6

### **Split Up of Marks for Classroom Participation**

Range of CRP	Out of 4 (Maximum marks is 20)	Out of 3 (Maximum marks is 15)
$50\% \leq \text{CRP} < 75\%$	1	1
$75\% \leq \text{CRP} < 85\%$	2	2
85 % and above	4	3

### **External Evaluation**

External evaluation carries 80% of marks. All question papers shall be set by the

University. The external question papers may be of uniform pattern with 80/60 marks. The courses with 2/3 credits will have an external examination of 2 hours duration with 60 marks and courses with 4/5 credits will have an external examination of 2.5 hours duration with 80 marks. The external examination in theory courses is to be conducted by the University with question papers set by external experts. The evaluation of the answer scripts shall be done by examiners based on a well-defined scheme of valuation and answer keys shall be provided by the University. The external examination in practical courses shall be conducted by two examiners – one internal and an external, the latter appointed by the University. The project evaluation with viva also shall be conducted by two examiners – one internal and an external, the latter appointed by the University.

**The model of question** papers may be prepared by the concerned Board of Studies. Each question should aim at – (1) assessment of the knowledge acquired (2) standard application of knowledge (3) application of knowledge in new situations. Different **types of questions** shall possess different marks to quantify their range. A general scheme for the question paper is given below.

### **Question paper type 1**

#### **Scheme of Examinations:**

The external QP with 80 marks and internal examination is of 20 marks. Duration of each external examination is 2.5 Hrs. The pattern of External Examination is as given below. The students can answer all the questions in Sections A&B. But there shall be Ceiling in each section.

#### **Section A**

Short answer type carries 2 marks each- 15 questions	Ceiling 25
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#### **Section B**

Paragraph /Problem type carries 5 marks each- 8 questions	Ceiling 35
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#### **Section C**

Essay type carries 10 marks (2 out of 4)	2 X 10- 20
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Total	80
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### **Question paper type 2**

**Scheme of Examinations:**

The external QP with 60 marks and internal examination is of 15 marks. Duration of each external examination is 2 Hrs. The pattern of External Examination is as given below. The students can answer all the questions in Sections A&B. But there shall be Ceiling in each section.

**Section A**

Short answer type carries 2 marks each-12 questions Ceiling -20

**Section B**

Paragraph/Problem type carries 5 marks each-7 questions Ceiling -30

**Section C**

Essay Typer Carries 10 Marks(1 out 2) 1X10= 10

	Total	60
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## B.Voc PROGRAMME STRUCTURE

<b>SEMESTER I</b>									
C.No	CourseCode	CourseName	Credit	Marks			Hrs/wk		
				Int	Ext	Tot	T	P	Tot
1.1	A01	English	3	15	60	75	3		3
1.2	A02	English	3	15	60	75	3		3
1.3	A07(3)	Mal/Hindi/Arabic	4	20	80	100	4		4
1.4	SDC1AG01	Fundamentals of Agronomy	4	20	80	100	4		4
1.5	SDC1AG02	Fundamentals of Horticulture	4	20	80	100	4		4
1.6	SDC1AG03	Fundamentals of Soil Science	4	20	80	100		4	4
1.7	SDC1AG04(P)	Fundamentals of Agronomy and Horticulture– Practicals	4	20	80	100	1	3	4
1.8	SDC1AG05(P)	Fundamentals of Soil Science– Practicals	4	20	80	100	1	3	4
1.9	AuditCourse1	Environmental Studies	4						
<b>Semester Total</b>			<b>30</b>			<b>750</b>	<b>20</b>	<b>10</b>	<b>30</b>
<b>SEMESTER II</b>									
C.No	CourseCode	CourseName	Credit	Marks			Hrs/wk		
				Int	Ex	To	T	P	Tot

			dit		t	t			
2.1	A03	English	4	20	80	100	4		4
2.2	A04	English	4	20	80	100	4		4
2.3	A08(3)	Mal/Hindi/Arabic	4	20	80	100	4		4
2.4	SDC2AG06	Plantation Crops, Spices and Fruits	4	20	80	100	4		4
2.5	SDC2AG07	Fundamentals of Seed technology	4	20	80	100	4		4
2.6	SDC2AG08(P)	Plantation Crops, Spices and Fruits -Practicals	3	15	60	75		3	3
2.7	SDC2AG09(P)	Fundamentals of Seed technology-Practicals	3	15	60	75		3	3
2.8	SDC2AG10(Pr)	Internship/Project (Cultivation of Crops)		20	80	100		4	4
2.9	AuditCourseII	Disaster management	4						
<b>SemesterII Total</b>			<b>30</b>			<b>750</b>	<b>20</b>	<b>10</b>	<b>30</b>

### SEMESTER III

C.No	CourseCode	CourseName	Credit	Marks			Hrs/wk		
				Int	Ext	Tot	T	P	Tot
3.1	A11	Biodiversity- scope and relevance	4	20	80	100	4		4
3.2	A12	Research Methodology	4	20	80	100	4		4
3.3	SDC3AG11	Plant Tissue Culture & Biotechnology	4	20	80	100	4		4
3.4	SDC3AG12	Integrated Pest Management in Crops	4	20	80	100	4		4
3.5	SDC3AG13	Fundamentals of Agricultural Engineering	4	20	80	100	4		4

3.6	SDC3AG14(P)	Agricultural Engineering –Practicals	4	20	80	100	4/4	4	
3.7	SDC3AG15(P)	Micropropagation of Plants- Practicals	3	15	60	75	3	3	
3.8	SDC3AG16(P)	Integrated Pest Management-Practicals	3	15	60	75	3	3	
	<b>Audit course AUD3E03</b>	<b>Human Rights</b>	<b>4</b>						
<b>Semester III Total</b>			<b>30</b>			<b>750</b>	<b>20</b>	<b>10</b>	
<b>SEMESTER IV</b>									
C.No	CourseCode	CourseName	Credit	Marks			Hrs/wk		
				Int	Ext	Tot	T	P	Tot
4.1	<b>A13</b>	<b>Natural Resource Management</b>	<b>4</b>	20	80	100	4	4	
4.2	<b>A14</b>	<b>Intellectual Property Rights</b>	<b>4</b>	20	80	100	4	4	
4.3	SDC4AG17	Protected Cultivation of HorticulturalCrops	3	15	60	75	3	3	
4.4	SDC4AG18	Weed Management and Fodder Crop Production	4	20	80	100	4	4	
4.5	SDC4AG19	Livestock Farming	4	20	80	100	4	4	
4.6	SDC4AG20(P)	Protected Cultivation of Horticultural Crops- Practical	4	20	80	100	4	4	
4.7	SDC4AG21(P)	Weed Management and Fodder Crop Production and Livestock Farming- Practical	3	15	60	75	3	3	
4.8	SDC4AG22(Pr)	Internship/Project (Cultivation of Rice)	4	20	80	100	4	4	
	<b>AuditCourseIV (AUD4E04)</b>	<b>GENDER STUDIES</b>	<b>4</b>						

<b>SemesterIVTotal</b>					<b>30</b>			<b>750</b>	<b>19</b>	<b>11</b>	<b>30</b>
<b>SEMESTER V</b>											
C.No	CourseCode	CourseName	Credit	Marks			Hrs/wk				
				Int	Ext	Tot	T	P	Tot		
5.1	SDC5AG23E1/E2	E1-Environmental Microbiology and Biotechnology/  E2-Government Policies and Programmes Related to Agriculture	4	20	80	100	4		4		
5.2	SDC5AG24E3/E4	E3-Food and Dairy Microbiology/  E4-Landscaping and Gardening	4	20	80	100	4		4		
5.3	SDC5AG25	Commercial Vegetable Production	4	20	80	100	4		4		
5.4	SDC5AG26	Agricultural Enterprises	3	15	60	75	3		3		
5.5	SDC5AG27	Fundamentals of organic Farming	4	20	80	100	4		4		
5.6	SDC5AG28(P)	Agricultural Enterprises-Practicals	3	15	60	75		3	3		
5.7	SDC5AG29(P)	Commercial Vegetable Production- Practical	4	20	80	100	1	3	4		
5.8	SDC5AG30(P)	Fundamentals of organic Farming- Practical	4	20	80	100		4	4		
<b>SemesterVTotal</b>					<b>30</b>			<b>750</b>	<b>20</b>	<b>10</b>	<b>30</b>
<b>SEMESTER VI</b>											
C.No	CourseCode	CourseName	Credit	Marks			Hrs				
				Int	Ext	Tot	T	P	Tot		

					t			
6.1	SDC6AG31(Tp)	Term paper	30	50	--	50		
6.2	SDC6AG32(Pr)	Internship & Project (900 hrs.)					900	900
		Internship		40	160	200		
		Project		40	160	200		
<b>Semester VITotal</b>			<b>30</b>	<b>130</b>	<b>320</b>	<b>450</b>		<b>900</b>
<b>GrandTotal</b>			<b>180</b>			<b>4200</b>		



## B. Voc Programme in Agriculture

### Detailed Syllabus

#### SEMESTER I

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CourseNo: 1.4	Credits:4
CourseCode: SDC1AG01	Hours Per Week:4
CourseName: Fundamentals of Agronomy	Totalhours: 60
<b>CourseObjectives</b>	
<ol style="list-style-type: none"><li>1. To enable the students to acquire knowledge on importance of agriculture and various types of farming.</li><li>2. To study the fundamentals of agronomy and classification of field crops</li></ol>	
<b>CourseOutcomes</b>	
CO1: Describe the importance of agriculture in India and Kerala	
CO2: To understand the agricultural classification of crops	
CO3: Explain the Soil productivity and fertility	
CO4: Describe the crop nutrition and nutrient cycling through manures and fertilizers.	
CO5: Explain the Integrated Nutrient Management.	
CO6: Explain the irrigation and irrigation methods.	

#### MODULE1

12 Hrs

Importance of agriculture in India and Kerala, Agronomy, Sustainable agriculture, Subsistence agriculture, commercial agriculture, Extensive and intensive agriculture, Peasant farming, Urban agriculture, Agribusiness, Agricultural seasons in India and Kerala.

#### MODULE2

12Hrs

Agricultural classification of crops, Agronomic classification of crops, Botanical classification of crops, Major farming systems in Kerala and Cropping Intensity, Methods of sowing/planting - planting geometry and its effect on growth and yield.

### **MODULE3**

**12Hrs**

Soil and climatic requirements, varieties, cultural practices including water management, special systems of cultivation, harvesting and processing of major cereals and millets, pulses, tuber crops, rice, maize, finger millet, cowpea, tapioca, sweetpotato, amorphophallus, yams, coleus, arrowroot etc

### **MODULE4**

**12Hrs**

Soil productivity and fertility. - Crop nutrition - nutrients -classification. Nutrient recycling through manures and fertilizers. Fertilizers and fertilizer use- management of fertilizers. Integrated Nutrient Management.

### **MODULE5**

**12Hrs**

Irrigation: definition and objectives. Role of water in soil and plants- Irrigated agriculture vs. Rainfed agriculture, dry farming and dryland farming- definition. Water resources in India and Kerala. Irrigation methods - drip and sprinkle irrigation systems.

#### **Text Books:**

1. Balasubramanian, P and Palaniappan, S.P. 2001. Principles and Practices of Agronomy  
AgroBios(India )Ltd., Jodhpur.
2. Cox, G.W and Atkins, M.D. 1979. Agricultural Ecology : An Analysis of World Food Production Systems. W.H. Freeman and Company, San Francisco
3. De, G.C. 1989. Fundamentals of Agronomy. Oxford & IBH Publishing Co., New Delhi.
4. Grigg, D.B. 1974. The Agricultural Systems of the World: An Evolutionary Approach. Cambridge University Press, Cambridge.
5. Harlan, J.R. 1992. Crops and Man. American Society of Agronomy & Crop Science Society of America, Madison, WI.
6. Havlin, J. L., Beaton, J. D., Tisdale, S.L., and Nelson, W.L. 2006. Soil Fertility and Fertilizers: An Introduction to Nutrient Management (7 ed.). Pearson Education, Delhi.

7. ICAR.2006. Hand book of Agriculture, ICAR, NewDelhi.
8. Janick, J., Schery, R.W., Woods, F.W., and Ruttan, V.W. 1974. Plant Science:An Introduction to World Crops. W.H. Freeman and Company, SanFrancisco.
9. Noor Mohammed.1992. Origin, diffusion and development of agriculture. In: Noor Mohammed (ed.), New Dimensions in agricultural geography: Vol.1.Historical Dimensions of agriculture. Concept publishing Co., NewDelhi.pp29-75.
10. Reddy.T.Y and Reddy, G.H.S.1995.Principles of Agronomy, KalyaniPublishers, Ludhiana.
11. Chatterjee, B.N. and Maiti, S.1985.Principles and Practices of Rice Growing. Oxford & IBH Publishing Co., NewDelhi.

CourseNo: 1.5	Credits:4
CourseCode: SDC1AG02	Hours Per Week:4
CourseName:Fundamentals of Horticulture	Total hours: 60
<b>CourseObjectives</b>	
<ol style="list-style-type: none"> <li>1. To acquaint with importance, division and classification of horticultural crops.</li> <li>2. To understand the basic principles and types of plant propagation.</li> </ol>	
<b>CourseOutcomes</b>	
<p><b>CO1:</b> Describe the definition, importance, division and classification of horticultural crops.</p> <p><b>CO2:</b> Explain the layout, planting systems and management practices in an orchard.</p> <p><b>CO3:</b> Describe the training and pruning in horticultural crops</p> <p><b>CO4:</b> Describe the fruit drop and seedlessness in horticultural crops..</p> <p><b>CO5:</b> Describe the different types of plant propagation methods</p> <p><b>CO6:</b> Describe the components of nursery and its various aspects.</p>	

## MODULE1

12 Hrs

Horticulture - definition, importance, division and classification of horticultural crops. Importance of horticulture in India and Kerala. Orchard planning, layout, planting systems - management practices. Training and pruning in horticultural crops - principles and methods, techniques of training and pruning, fruit thinning.

## **MODULE2**

Phases of growth and development - vegetative/ reproductive balance; Flowering in plants - bearing habit and its classification- factors associated with flowering and fruit set. Fruit set and development. Fruit drop - factors affecting and control measures - unfruitfulness - internal and external factors. Seedlessness in horticultural crops; significance and induction.

## **MODULE3**

**12 Hrs**

Plant propagation - definition and basic concepts, sexual and asexual types - advantages and disadvantages. Media, containers, potting, re potting and pre planting treatments. Asexual propagation -propagation by cuttings, types of cuttings, factors affecting rooting of cuttings. Propagation by layering - types of layering.

## **MODULE4**

**12 Hrs**

Propagation by grafting - methods of grafting - development of graft unions, separation and after care. Stock-scion relationship - Graft incompatibility - factors affecting incompatibility. Propagation by budding, methods of budding - A comparative study between grafting and budding.

## **MODULE5**

**12 Hrs**

Nursery - site selection, layout - components of a nursery - production unit, sales unit, display area, management and maintenance, propagation unit - close planted progeny orchards.

### **Text books:**

1. Bose, TK., Mitra, SK. and Sadhu, K. 1986.*Propagation of tropical and subtropical horticultural crops*.NayaProkash,Calcutta.
2. Denixon, RI. 1979. *Principles of Horticulture*. Mac Millan,NewYork.
3. Edmond, JB., Sen, TD, Andrews, TS and Halfacre, RG. 1977. *Fundamentals of Horticulture*. Tata McGraw Hill, NewDelhi.
4. Hartmann, HT. and Kester, DE.1986.*Plant propagation - Principles and practices*.Prentice-Hall, New Delhi.
5. Leopold, A.C. and Kriedeman, P.E. 1975.*Plant Growth and Development*.Tata McGrawHill Publishing Co. Ltd., NewDelhi.
6. Chadha, K. L. 2003. Handbook of Horticulture, ICAR, New Delhi.Choudhury,B.1983. Vegetables. National Book Trust, NewDelhi.

7. Das, P. C.1993. Vegetable crops in India.KalyaniPublishers
8. Gopalakrishnan, T. R. 2007. Vegetable Crops.New India PublishingAgency, NewDelhi.
9. Hazra, P. and Som, M. G. 1999. Technology for vegetable Production And Improvement.NayaProkash,Calcutta

CourseNo: 1.6	Credits:4
CourseCode: SDC1AG03	Hours Per Week:4
CourseName:Fundamentals of Soil Science	Totalhours: 60
<b>CourseObjectives</b>	
<ol style="list-style-type: none"> <li>1. To provide the student with a formalized way to build their fundamental knowledge and skills within the different areas of soil science to enhance their professional skills</li> <li>2. To provide a better appreciation of the distribution and variability of soils and their properties across the landscape.</li> <li>3. To impart knowledge to the students on the Fundamentals of Soil Science and impart skills in collecting and analyzing soils for basic physical, physico-chemical and chemical properties for using it as a medium for plant growth.</li> </ol>	
<b>CourseOutcomes</b>	
<p><b>CO1:</b>Understand the fundamentals and principles of Soil Science</p> <p><b>CO2:</b>Explain how different soils are formed and how does soils act as a medium for plant growth.</p> <p><b>CO3:</b>Explain soils of India and Land use capability, soil pollution and its effect on crop and mitigation of soil pollution</p> <p><b>CO4:</b> Analyze the soils for basic physical, physico-chemical &amp; chemical properties.</p>	

### **Module 1**

Soil –formation and classification and need for classification. Soil forming minerals – primary, secondary, accessory minerals – classification. Weathering of rocks and minerals types of weathering, factors affecting weathering.

### **Module 2**

Soil physical properties – soil texture, importance of soil texture, textural classification of Soils.

Soil structure – definition, classification. Aggregation of soil particles – factors controlling them. Soil consistency - Soil crusting. Soil compaction -Soil air – importance – composition – comparison with atmospheric air.

### **Module 3**

Soil classification, need for classification, comparison of different systems of classification. Soil taxonomy and its characteristics. Soil survey-importance, objectives- different types -Land capability classification. Soils of India – soils of Kerala – characterization.

### **Module 4**

Soil organic matter – composition - properties - decomposability, influence on soil properties. Humus fractions of soil Organic matter – carbon cycle - Transformation of organic matter – C:N ratio. Soil biology - soil organisms- their beneficial and harmful roles. Role of organic matter in maintaining the physical and chemical properties of soils- importance in plant nutrition.

#### **Suggested Readings**

1. Biswas, T.D. and Mukherjee, S.K. 1987. Text Book of Soil Science. Tata McGraw Hill Publishing Co., New Delhi
2. Black, C.A. 1982. Methods of Soil Analysis, Part I ASA, Madison, USA.
3. Brady, N.C. 1990 Nature and Properties of Soils. 10th Edn, Macmillan Publishing Co. Inc., New York
4. Das, D.K. 1997. Introductory Soil Science. Kalyani Publishers New Delhi
5. Fundamentals of Soil Science. Published by Indian Society of Soil Science, IARI New Delhi, 2002
6. Gupta, P.K. 2007. Soil, Plant, Water and Fertilizer Analysis. Published by AGROBIOS (India), Jodpur
7. Jackson, M.L. 1973 Soil Chemical Analysis. Prentice hall of India, New Delhi
8. Jaiswal, P.C. 2006. Soil, Plant and Water Analysis. 2nd Edn. Kalyani Publishers, Ludhiana
9. Page, A.L. 1982. Methods of Soil Analysis, Part II, ASA Madison, USA
10. Sehgal, J.2005. Pedology – Concepts and Applications. Kalyani Publishers New Delhi
11. Tisdale,S.L., Nelson,W.L.,Beaton, J.D. and Havlin, J.L. 1995. Soil fertility and Fertilizers. 5th Edn. Macmillan publishing company, USA

<b>Course No: 1.7</b>	<b>Credits:4</b>
<b>Course Code: SDC1AG04 (P)</b>	<b>Hours Per Week:4</b>
<b>Course Name: Fundamentals of Agronomy and Horticulture- Practicals</b>	<b>Total hours: 60</b>

<b>Course Objectives</b>
1. To develop skill in propagation and cultivation aspects of horticultural crops. 2. To familiarize with cultivation aspects of cereals and millets, pulses and tuber crops.
<b>Course Outcomes</b>
CO1- Identification of cereals and millets, pulses, and tuber crops. CO2. Explain the different methods of sowing; direct seeding: broadcasting, dibbling and drilling- transplantation. CO3. Describe the seed treatment - Rhizobium inoculation of leguminous crops. CO4. Identification of manures and fertilizers and their preparation CO5- Explain the fertilizer recommendation and calculation for major cereals and pulses. CO6. Fertilizer recommendation and calculation for major cereals and pulses CO7-Familiarization with green manure crops and cover crops, Different planting systems and layout and the propagation methods

### **Contents**

1. Identification of cereals and millets, pulses, and tuber crops.
2. Different methods of sowing; direct seeding: broadcasting, dibbling and drilling transplantation.
3. Seed treatment - Rhizobium inoculation of leguminous crops.
4. Identification of manures -organic manures: bulky and concentrated manures  
Fertilizers: Straight, complex and mixed fertilizers - identification and preparation.
5. Fertilizer recommendation and calculation for major cereals and pulses.
6. Familiarization with green manure crops and cover crops.
7. Familiarization to Different planting systems and layout
8. Propagation methods - sexual propagation -seed viability tests, dormancy breaking methods.
9. Propagation structures - mist chamber, green house, hot beds etc.
10. Propagation by cuttings.
11. Propagation by layering - types of layering.
12. Propagation by grafting - methods of grafting

Course No: 1.8 Course Code: SDC1AG05 (P) Course Name: Fundamentals of Soil Science- Practicals	Credits:4 Hours Per Week:4 Total hours: 60
<b>Course Objectives</b>	
1. To familiarize with soil properties related to crop production 2. To familiarize with soil sampling and estimation of different soil nutrients	
<b>Course Outcomes</b>	
CO1- Identification of soil properties for crop production CO2- How to collect and prepare soil samples CO3. Describing the methods of determination of different nutrient contents in soil	

### **Contents**

1. Identification of different types of soils
2. Determination of Soil moisture constants - Field capacity, PWP
3. Measurement of soil temperature variations
4. Collection and preparation of soil samples
5. Determination of Organic C
6. Determination of soil pH, and electrical conductivity of soil
7. Total elemental analysis -Determination of total N
8. Determination of total P, K
9. Visit to soil science laboratory

### **Audit Course 1 (AEC /AC): (Environment Studies)**

#### **Module 1**

Introduction – Environment in the Indian context: Concept of an ecosystem, Multidisciplinary nature of environmental studies. Components of environment- Atmosphere, hydrosphere, lithosphere and biosphere. Definition, scope and importance. Concept of sustainability and sustainable development.

#### **Module 2**

Natural Resources : Renewable and non-renewable resources : Natural resources and associated



problems.

(a) Forest resources : Use and over-exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forest and tribal people.

(b) Water resources : Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems.

(c) Mineral resources : Use and exploitation, environmental effects of extracting and using mineral resources, case studies.

(d) Food resources : World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies.

(e) Energy resources : Growing energy needs, renewable and non renewable energy sources, use of alternate energy sources. Case studies.

(f) Land resources : Land as a resource, land degradation, man induced landslides, soil erosion and desertification. Role of an individual in conservation of natural resources. Carbon footprint Water conservation, rain water harvesting, watershed management

### **Module 3**

Structure and function of an ecosystem, Producers, consumers and decomposers, Energy flow in the ecosystem, Ecological Succession, Food chains, food webs and ecological pyramids. Introduction, types, characteristic features, structure and function of the following ecosystem : (a) Forest ecosystem

(b) Grassland ecosystem

(c) Desert ecosystem

(d) Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)

### **Module 4**

Biodiversity and its conservation, Introduction – Definition : genetic, species and ecosystem diversity, Biogeographical classification of India, Value of biodiversity : consumptive use, productive use, social, ethical, aesthetic and option values, Biodiversity at global, National and local levels., Hot-spots of biodiversity, Threats to biodiversity : habitat loss, poaching of wildlife, man-wildlife conflicts, Endangered and endemic species of India, Conservation of biodiversity

### **Module 5**

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) Nuclear hazards , Solid waste Management : Causes, effects and control measures of urban and

industrial wastes.Role of an individual in prevention of pollution.

### **Module 6**

Environmental Policies and practices: Climate change, Climate change, Global warming, acid rain, ozone layer depletion, nuclear accidents

## SEMESTER II

Course No: 2.4	Credits:4
Course Code: SDC2AG06	Hours Per Week:4
Course Name: Plantation Crops, Spices and Fruits	Total hours: 60
<b>Course Objectives</b>	
<ol style="list-style-type: none"><li>1. To acquaint with the cultivation aspects of Plantation crops, spices and fruit crops.</li><li>2. To provide technical and scientific cultivation practices of different fruit and plantation crops.</li><li>3. To provide field knowledge and acquaint the students with practical field</li></ol>	
<b>Course Outcomes</b>	
<p><b>CO1-</b> Explain the importance - area, production ,origin, distribution of plantation crops.</p> <p><b>CO2:</b>Students will get knowledge on technical cultivation techniques of different fruits and plantation crops.</p> <p><b>CO3:</b>Students will able to identify different practical issues related to fruits and plantation crops</p> <p><b>CO4:</b> Analyze the propagation, planting, irrigation ,and manuring of Coconut and Rubber.</p>	

### Module1

15 Hrs

Plantation crops, Introduction - importance - area, production - origin, distribution - botany, varieties - climate, soil, site selection - propagation, production of quality planting materials and hybrids - nursery management - layout, planting, aftercare - irrigation, manuring - stage of harvest, harvesting, yield and uses of :-coconut and Rubber.

### Module2

12Hrs

Plantation crops, Importance - area, production - origin, distribution - botany, varieties - climate, soil, site selection - propagation, production of quality planting materials and hybrids. Nursery management - layout, planting, aftercare - irrigation, manuring - stage of harvest, harvesting,

yield and uses of cashew, tea and coffee.

### **Module3**

**12 Hrs**

Spices, Definition - classification - importance to the state. Origin - distribution - area, production .varieties - climate, soil - propagation, nursery management - site selection, layout, planting - crop management including manuring, irrigation, shade regulation, harvesting, yield of the following crops: Pepper, cardamom, ginger, and nutmeg.

### **Module4**

**15 Hrs**

Fruits, Importance and scope of commercial fruit production - Global scenario of fruit production and export - Present status of fruit production in the state and in the country - problems and prospects. Crop management practices - selection and preparation of planting materials, field preparation and planting, manuring, irrigation, weed management, use of bio-regulators, other cultural operations. Cultural practices for quality improvement. Maturity indices, harvesting, grading, packing, storage and ripening techniques. Industrial and export potential- of Crops- Banana, mango,and pineapple.

### **Module5**

**6 Hrs**

Fruits, Management practices of crops gaining importance in the state recently (mangosteen, rambutan, durian).

### **Text books:**

1. Chadha, K.L.2001. Hand Book of Horticulture,ICAR, NewDelhi.
2. Kumar.N, Abdul Khader.J.B.M.Rangaswami.P. and Irulappan., 1993. Introduction to spices
3. Menon.K.P.V. and Pandalai.K.M. 1960. The coconut Palm - a monograph. IndianCentral Coconut Committee,Ernakulam.
4. Purseglove. J.W., Brown, E.G.Green, C.L. and Robbins, S.R.G.1981.SpicesVol-I &II.
5. Pruthi.J.S. 1993.Major Spices of India, Crop Management - Post HarvestTechnology, ICAR, NewDelhi.
6. Pruthi, J.S.2001 Minor Spices and Condiments-Crop Management and Post HarvestTechnology, ICAR, New Delhi,India.
7. Amar Singh, 1986. Fruit Physiology and Production.Kalyani Publishers, NewDelhi.
8. Bose, T.K, Mitra,S.K. and Sanyal, D. 2002. Fruits: Tropical and Subtropical. Vol. I &II, Nayaprakash publications,Calcutta.
9. Hayes,W.B. 1957. Fruit Growing in India.Kitabitan,Allahabad.

10. Kumar, N. 1997 (6<sup>th</sup> Edition).Introduction to Horticulture.Rajhalakshmi Publications, Nagercoil
11. Mitra,S.K, Bose,T.K and Rathore, D.S. 1991. Temperate Fruits. Horticulture and Allied Publishers ,Calcutta.
12. Naik,K.C. 1949. South Indian Fruits and Their Culture.Varadachari Co.,Madras.

CourseNo: 2.5	Credits:4
Course Code: SDC2AG07	Hours Per Week:4
CourseName: Fundamentals of Seed technology	Totalhours: 60
<b>CourseObjectives</b>	
<ul style="list-style-type: none"> <li>● To familiarize with the fundamentals of plant breeding.</li> <li>● To familiarize with the basics of seed technology.</li> <li>● . To strengthen undergraduate student in the field of seed science &amp; technology.</li> <li>● To impart training for entrepreneurship programme .</li> <li>● To initiate basic research related to genetic purity, seed health and seed storage.</li> </ul>	
<b>CourseOutcomes</b>	
<p><b>CO1:</b>Core competency in the subject &amp; comparative evidence on development of seed.</p> <p><b>CO2:</b>High analytical ability in understanding the application of scientific principles and students will acquire skills &amp; handling operations of different equipments in seed science laboratory.</p> <p><b>CO3:</b>Develop an understanding of seed development, germination,vigour,deterioration and the relationship between laboratory tests and field performance</p> <p><b>CO4:</b>Understand seed increase systems, seed testing and the laws and regulations related to marketing high quality seed.</p>	

General features of important families - morphology of roots, stem, leaves, flowers, fruits and seeds. Introduction to field crops - Classification of field crops. Botany and economic importance of crops like Rice, Ragi, cowpea, Bitter Gourd, Cucumber, Brinjal, Chilli, Tomato, Soyabean, coconut, Groundnut, Gingelly, Tapioca, Cotton, Sweet potato, Rubber, Mango, Cashew, Pepper, Papaya and Banana.

**Module 2: Principles of Seed Technology**

**20 Hrs**

Introduction to Seed Production, Importance of Seed Production, The concept of a seed- definition- structure a seed- seed development process, Definition, Characters of good quality seed, Factors affecting seed quality - ecological influences, packing practices, harvest and post harvest handling, Genetic and agronomic principles of seed production, Seed testing procedures for quality assessment- Physical, Purity, germination and viability test, Principles of establishing a seed testing laboratory, Post harvest seed management techniques seed extraction- seed processing- drying- cleaning- upgrading- seed blending, Dormancy of seed, role of growth regulators in restoring seed viability, physical agents for increased seed germination, seed vigour etc. Seed treatment, Importance of seed treatment, types of seed treatment, equipment used for seed treatment, Seed packing and seed storage, factors affecting seed longevity during storage and conditions required for good storage, General principles of seed storage, measures for pest and disease control, temperature control, Seed production of major crops - field crops, plantation crops, fruit plants, spices, ornamental plants, medicinal plants, Different classes of seeds- Production of nucleus, breeder's seed, foundation and certified seed production, Seed certification, procedure for seed certification, field inspection and field counts etc.,

### Module 3: Legislation of Seed Technology

20 Hrs

Seed Legislation - Seed Act and Seed Act enforcement, Central Seed Committee, Central Seed Certification Board, State Seed Certification Agency, Central and State Seed Testing Laboratories; Organizations involved in seed production i.e., public, quasi, co operative, private etc. Planning seed production programme- seed farm organization- procurement and pricing policy-economics of seed production of different crops; government policy in seed production and study of export potential of seeds.

#### Text books:

1. Albert F-Hill and O.P. Sharma, 1996. Economic Botany. Tata McGraw - Hill Publishing Company Ltd., NewDelhi
2. Chalam, G.V., J. Venkateswarlu. 1966. Agricultural Botany in India-Vol. 1. Asia publishing house, Bombay, NewDelhi
3. Daniel Sundararaj, D and G. Thulasidas, 1993. Botany of field crops. Macmillan India Ltd., NewDelhi
4. Allard, R.W. 1960. Principles of Plant Breeding. John Wiley & Sons INC. USA. Toppan Co. Ltd. Japan
5. Choudhari, T.C. 1982. Introduction to Plant Breeding. Oxford A& IBH Publishing Co., NewDelhi
6. Elliot. 1958. Plant Breeding And Cytogenetics. Mc Grow Hill. New York
7. Sharma, J.R. 1989. Principles and Practice of Plant Breeding. Tata McGraw -Hill Publishing Company Limited, NewDelhi.
8. Singh, B.D. 2001. Fundamentals of Genetics. Kalyani Publishers. New Delhi. Ludhiana
9. Singh, B.D. 2003. Plant Breeding Principles and Methods. Kalyani Publishers. New Delhi/ Ludhiana.
10. Agrawal, R.L. 1995. *Seed Technology*. Oxford, IBH Publishing Co., NewDelhi.
11. Bose, T. K. and Som, M. G. 1990. Vegetable crops in India. Naya Prokash, Calcutta.
12. Das, P. C. 1993. Vegetable crops in India. Kalyani Publishers
13. Dahiya, B.S and Rai, K.N., 1997. *Seed Technology*, Kalyani Publishers.

CourseNo: 2.6 CourseCode: SDC2AG08(P) CourseName: Plantation Crops, Spices and Fruits -Practicals	Credits:3 Hours Per Week:3 Totalhours: 45
<b>CourseObjectives</b>	
<ul style="list-style-type: none"> <li>● To acquire skill on cultivation aspects of Plantation crops, spices and fruit crops</li> <li>● To familiarize with the botanical aspects of field crops.</li> <li>● To develop skill in various aspects of seed production</li> </ul>	
<b>CourseOutcomes</b>	
<p><b>CO1:</b> Demonstrate preparation and application of plant growth regulators to the crops, etc. Investigate the various problems with the production technology of fruit and plantation crops such as disorder, diseases and pests, etc.</p> <p><b>CO2:</b> Distinguish different fruits and plantation crops, symptoms of disorders diseases, insects and pests, etc.</p> <p><b>CO3:</b> Discuss various concepts of high density planting, new techniques of high density planting, plant propagation, seed propagation, etc.</p> <p><b>CO4:</b> Acquaint the knowledge on the method of field preparation for crop production and arrange the resources required in the field.</p> <p><b>CO5:</b> Apply the production techniques of crops in the practical crop production field.</p> <p><b>CO6:</b> Examine the production of sown crops in the practical crop production field</p>	

### **Plantation Crops**

Coconut: Nursery techniques, Seedling selection, Production of quality planting materials and hybrids and mother palm selection,



Familiarization with varieties, Moisture conservation methods in coconut plantations.

Layout and planting, care and management of plantations.

Tapping systems in rubber.

Training and pruning in tea, coffee.

### **Spices**

1. Morphology, nursery techniques, planting in main field, cultural operations and harvesting of pepper, cardamom, ginger, nutmeg

### **Fruits (Banana, Pineapple and Mango.)**

1. Familiarization with important varieties. Practice in propagation, selection of good planting materials, field preparation and planting, manuring and use of growth regulators. Familiarization with weedicides, and plant protection chemicals. Studies on major pests, diseases and nutritional disorders. Studies on maturity indices and storage.

<b>CourseNo: 2.7</b>	<b>Credits:3</b>
<b>CourseCode: SDC2AG09(P)</b>	<b>Hours Per Week:3</b>
<b>CourseName:Fundamentals of Seed technology-Practicals</b>	<b>Totalhours: 45</b>
<b>CourseObjectives</b>	
<ul style="list-style-type: none"><li>● Ensured by adhering to quality checks during production, post production and distribution</li><li>● Enhance the knowledge of seed biology, seed quality, seed production, seed storage and seed certification</li><li>● Possess sufficient knowledge on seed quality, its production strategy, processing methodology, distribution links and even legal issues.</li><li>● Provide students with the methodology of conducting and applying the industrial tests for monitoring seed quality.</li><li>● To provide students with steps required for controlling seed quality during seed production in the field.</li></ul>	

<b>CourseOutcomes</b>
<p><b>CO1:</b> Acquaint with scope and importance of seed technology in agriculture and the role of officials and legislation, seed act and seed order in quality seed production</p> <p><b>CO2:</b> Able to learn the main steps in seed production and certification</p> <p><b>CO3:</b> To learn about the important chemical components of seeds and their importance as source of human food and germinating embryo after planting</p> <p><b>CO4:</b> Develop an understanding of various seed production techniques for different field crops, the importance of maintenance of purity of crop varieties, and factors causing deterioration of variety.</p> <p><b>CO5:</b> Execution of various phases of seed certification, field inspection, and seed purity testing</p> <p><b>CO6:</b> Analyze the factors related to genetic and physical purity of seed and its health status of seeds of a variety during seed processing.</p>

### **Seed technology**

1. Introduction to field crops and agricultural classification of field crops.
2. Seed production in Cereals and Pulses
3. Microscopy
4. Preparation and use of fixatives and stains for light microscopy
5. Preparation of microslides
6. Identification of seeds of summer vegetables and cool season vegetables
7. Seed sampling principles and procedures
8. Physical purity analysis of seeds
9. Seed Testing: Germination analysis and viability analysis of seeds
10. Seed dormancy and breaking methods
11. Techniques of hybrid seed production in tropical vegetables
12. Seed extraction techniques

### 13. Seed treatment against systemic diseases

<b>CourseNo: 2.8</b> <b>CourseCode: SDC2AG10(Pr)</b> <b>CourseName: Internship/Project (Cultivation of Crops)</b>	<b>Credits:4</b> <b>Hours Per Week:4</b> <b>Totalhours: 60</b>
<b>CourseObjectives</b>	
<ul style="list-style-type: none"><li>● To develop skill and to get experience in the cultivation practices of various crops</li><li>● Provides opportunities for the students to attach with the agri related industries and make them know about the functioning them.</li><li>● Students will be oriented with the principles of crop planning and selection of crop</li><li>● Students will be given practical experience on raising of crops in their field with special emphasis on the agronomic management of the crop</li><li>● Familiarized with the calculation of economics of crop cultivation</li></ul>	
<b>CourseOutcomes</b>	
<p><b>CO1:</b> Acquaint with the knowledge of principles of crop planning and selection of crop</p> <p><b>CO2:</b>Developed the field experience on raising of crops in their field with special emphasis on the agronomic management of the crop</p> <p><b>CO3:</b>familiarized with the calculation of economics of crop cultivation</p> <p><b>CO4:</b>Demonstrate the ability to apply the scientific method to problems in crop</p>	

#### **Work planned:**

Familiarisation with seedling/sucker selection, land preparation, pit making and planting, Nutrient management, irrigation and other intercultural operations, pest and disease management aspects by allotting each student with different crops.

## **AUDIT COURSE – 2<sup>nd</sup> Semester**

### **DISASTER**

#### **MANAGEMENT(AUD2E02)**

#### **MODULE 1**

Introduction – Hazard and Disaster. Concepts of Hazard, Vulnerability, Risks. Different Types of Disaster : **A) Natural Disaster:** such as Flood, Cyclone, Earthquakes, Landslides etc **B) Manmade Disaster:** such as Fire, Industrial Pollution, Nuclear Disaster, Biological Disasters, Accidents (Air, Sea, Rail & Road), Structural failures(Building and Bridge), War & Terrorism etc. Slow Disasters (famine, draught, epidemics) and Rapid Onset Disasters(Air Crash, tidal waves, Tsunami) Causes, effects and practical examples for all disasters. Water and Climate Disaster: flood, hail storms, cloudburst, cyclones, heat and snow avalanches, cold waves, droughts, sea erosion, thunder and lightning. Geological Disaster: landslides, earthquakes, Tsunami, mine fires, dam failures and general fires. Biological Disaster: epidemics, pest attacks, cattle epidemic and food poisoning. Nuclear and Industrial Disaster: chemical and industrial disasters, nuclear accidents. Accidental Disaster: urban and forest fires, oil spill, mine flooding incidents, collapse of huge building structures.

#### **MODULE 2**

Natural disasters- Earthquakes, Tsunami, Floods, Drought, Landslides, Cyclones and Volcanic eruptions. Their case studies. Coastal disasters. Coastal regulation Zone. Risk and Vulnerability Analysis **1.**Risk : Its concept and analysis **2.** Risk Reduction **3.** Vulnerability : Its concept and analysis **4.** Strategic Development for Vulnerability Reduction . Disaster Prevention and Mitigation. Refugee operations during disasters, Human Resettlement and Rehabilitation issues during and after disasters, Inter-sectoral coordination during disasters, Models in Disasters.

#### **MODULE 3**

Disaster Preparedness and Response Concept and Nature Disaster Preparedness Plan Prediction, Early Warnings and Safety Measures of Disaster. Role of Information, Education, Communication, and Training, Disaster Management : Role of Government, International and NGO Bodies. Role of

IT in Disaster Preparedness Role of Engineers on Disaster Management. Response Disaster Response : Introduction Disaster Response Plan Communication, Participation, and Activation of Emergency Preparedness Plan Search, Rescue, Evacuation and Logistic Management Role of Government, International and NGO Bodies Psychological Response and Management (Trauma, Stress, Rumor and Panic) Relief and Recovery Medical Health Response to Different Disasters.

#### **MODULE 4**

Rehabilitation, Reconstruction and Recovery Reconstruction and Rehabilitation as a Means of Development. Damage Assessment Post Disaster effects and Remedial Measures. Creation of Long-term Job Opportunities and Livelihood Options, Disaster Resistant House Construction Sanitation and Hygiene Education and Awareness, Dealing with Victims' Psychology, Longterm Counter Disaster Planning Role of Educational Institute.

#### **MODULE 5**

The vulnerability atlas of India. Disaster Prevention and Mitigation. Agencies involved in Disaster Management. Warning and Prediction

#### **ESSENTIAL READING:**

1. Pandey, M., 2014. Disaster Management, Wiley India Pvt. Ltd., 240p.
2. Tushar Bhattacharya, Disaster Science and Management, McGraw Hill Education (India) Pvt. Ltd
3. Jagbir Singh, Disaster, Management: Future Challenges and Opportunities, K W Publishers Pvt. Ltd. 4. J.P. Singhal, Disaster Management, Laxmi Publications
5. C. K. Rajan, NavalePandharinath, Earth and Atmospheric Disaster Management : Nature and Manmade, B S Publication
6. Shailesh Shukla, ShamnaHussain, Biodiversity, Environment and Disaster Management, Unique Publications

## SEMESTER III

<b>Course No. 3.1</b>	<b>Credits: 4</b>
<b>Course Code: A11</b>	<b>Total Contact Hrs: 72 Hrs</b>
<b>Course Title: Biodiversity- scope and relevance</b>	

### **Unit 1 Defining Biodiversity (Hours: 12)**

The concept of biodiversity. Biodiversity crisis. Importance of biodiversity in daily life.

Biodiversity and climate change. India as mega biodiversity nation. Hot spots of biodiversity in India.

### **Unit 2 Components of Biodiversity. (Hours: 12)**

Genetic diversity, species diversity and ecosystem diversity. Brief outlines of the magnitude of bacterial, fungal, protist, animal and plant diversity.

### **Unit 3 Loss of Biodiversity (Hours: 12)**

Factors causing loss of genetic-, species- and ecosystem diversity. Processes responsible for species extinction. Threatened species and IUCN Red List categories. Loss of agrobiodiversity. Significance of wild relatives of cultivated plants and domesticated animals.

### **Unit 4 Values and uses of biodiversity (Hours: 12)**

Ethical and aesthetic values of biodiversity. Direct and indirect economic benefits of biodiversity. Bio-prospecting – micro-organisms and plants as a source of novel enzymes, antibiotics, antiviral agents, Immunosuppressive agents and other therapeutic agents.

### **Unit 5 Inventorying and Monitoring of Biodiversity (Hours: 12)**

The need for inventorying and monitoring of biodiversity. Methods of inventorying and monitoring of biodiversity and their limitations.

### **Unit 6 Conservation of biodiversity (Hours: 12)**

Conservation of genetic-, species- and ecosystem diversity. In situ and ex situ conservations: biosphere reserves, national parks, wild-life sanctuaries, gene banks, seed banks, botanical gardens, microbial culture collections.

### **SUGGESTED READING**

1. Patent, D. H., Munnoz W. 1996. Biodiversity. Clarion Books.
2. Maiti, P. K., Maiti, P. 2011. Biodiversity: Perception, Peril and Preservation. Prentice Hall India.

3. Maclaurin, J. 2008. What is biodiversity? University of Chicago Press.
4. Krishnamurthy, K. V. 2003. Textbook of Biodiversity. Science Publishers Inc.
5. Wilson E. O. 2010. The Diversity of Life. Harvard University Press.
6. Hosetti B.B., Ramkrishna, S. 2016. Biodiversity: Concepts and Conservation. Aavishkar Publishers.
7. Kumar A. 2011. Understanding Biodiversity. Discovery Publishing House.
8. Hendon, J. 2017. Textbook of Biodiversity. Syrawood Publishing House.
9. Adom, D. Umachandran, K., Ziarati, P., Sawicka, B., Sekyere, P. 2019. The Concept of Biodiversity and its Relevance to Mankind: A Short Review. Journal of Agriculture and Sustainability 12(2): 219-231.
10. Ehrlich, P.R., Ehrlich, A.H. 1992. The Value of Biodiversity. Stanford University Press.

<b>Course No. 3.2</b>	<b>Credits: 4</b>
<b>Course Code: A12</b>	<b>Total Contact Hrs: 72</b>
<b>Course Title: Research Methodology</b>	<b>Hrs</b>

**Unit I (Hours: 13)**

Topic selection - Planning research – defining objectives - Preparation of work plans.  
 Identification of suitable methodology - Preparation of project proposal –Summer Schools –  
 Training in research institutes

**Unit II (Hours: 14)**

Collection of literature- News articles – Newsletters – Magazines – Books - Journals. Digital library and search of articles - Keywords and search - Internet – Google Scholar – PubMed – Infilibnet – Medline – Agricola – Science direct -Open access Journals - virtual sources – other sources. Short communications –review articles

**Unit III (Hours: 15)**

Collection of protocols and selection of suitable methods according to work plan. Observational and experimental research. Data analysis – Construction of tables – headings - footer - Tabulation – Presentation of results - Use of statistical software to analyze the results- SPSS.

**Unit IV (Hours: 15)**

Thesis structure –Components - Writing Introduction – review of literature – Materials & Methods – Presentation of results – Discussion of Results based on literature – Arriving at conclusions – Preparation of Summary/abstract – Arrangement of Bibliography and how to quote reference in thesis - Appendix.

### **Unit V (Hours: 15)**

Publishing of Articles in newspapers /newsletters - Selection of journals – ISSN Number – Peerreviewed

Journals – Science citation index – impact factor and importance. Manuscripts preparation for Journals – components – Plagiarism - Submission and Publication – reprints and pdf formats. Paper presentation in Conferences.

### **SUGGESTED READING**

1. Anderson, Durston & Polle 1970: Thesis and assignment, writing. Wiley Eastern Limited.
2. Booth W. C. et al. 2016. The Craft of Research. University of Chicago Press.
3. Rajendrakumar C. 2008. Research Methodology. APH publishing Corporation.
4. Kothari C. R. 2004. Research Methodology. New Age International Publishers.
5. Gurumani, N. 2006. Research Methodology for Biological Sciences. MJP. Publishers.
6. Marczyk, G., DeMatteo, D., Festinger, D. 2005. Essentials of research design and methodology. John Wiley.
7. Katz, M. J. 2009. From Research to Manuscript: A Guide to Scientific Writing. Springer.
8. Michael Alley. The Craft of Scientific Writing (3rd Edition) Publisher: Springer.

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9. Cargill, M., O'Connor, P. 2013. Writing Scientific Research Articles: Strategy and Steps. Wiley-Blackwell.
10. Blake, G. and Bly, R. W. 2000. The Elements of Technical Writing. Pearson.
11. Reep, D. C. 2014. Technical Writing: Principles, Strategies, and Readings. Longman.



<b>Course No. 3.3</b> <b>Course Code: SDC3AG11</b> <b>Course Title: Plant Tissue Culture and Biotechnology</b>	<b>Credits: 4</b> <b>Total Contact Hrs: 60</b> <b>Hrs</b>
<b>Objectives</b> <ul style="list-style-type: none"> <li>• To build theoretical foundation in plant tissue culture and biotechnology.</li> </ul>	
<b>Course Outcomes</b> CO1- Describe the principles and techniques of plant tissue culture CO2- Explain the Tissue culture medium CO3- Describe the preparation of explants and different methods of micropropagation CO4- Explain the different phases of micropropagation CO5- Explain the methods and applications of tissue culture CO6- Describe the recombinant DNA Technology CO7- Explain the cloning vectors and PCR CO8- Describe the different methods of gene transfer	

## **Plant tissue culture**

### **Module-1 (20 hours)**

1. Plant tissue culture – Principles and techniques; Cellular totipotency; *invitro* differentiation – de differentiation and re-differentiation.
3. Tissue culture medium – Basic components in tissue culture medium – Solid and liquid medium; Murashige and Skoog medium – composition and preparation.
4. Aseptic techniques in *in vitro* culture – sterilization – different methods –sterilization of instruments and glassware, medium, explants; working principle of laminar air flow and autoclave.
5. Preparation of explants – surface sterilization, inoculation, incubation, subculturing.
6. Micropropagation - Different methods – apical, axillary bud proliferation, direct and indirect organogenesis and somatic embryogenesis.
7. Different phases of micropropagation – multiple shoot induction, shoot elongation, *invitro* and *in vivo* rooting hardening, transplantation and field evaluation; Advantages and disadvantages of micropropagation. Somaclonal variation.

## **Module – II (15 hours)**

1. Methods and Applications of tissue culture:

1. Shoot tip and meristem culture
2. Somatic embryogenesis and synthetic seed production
3. Embryo culture
4. Protoplast isolation culture and regeneration – transformation and transgenics
5. Somatic cell hybridization, cybridization.
6. *In vitro* secondary metabolite production — cell immobilization, bioreactors
7. *In vitro* production of haploids – anther and pollen culture
8. *In vitro* preservation of Germplasm

## **Biotechnology**

### **Module –I (15 hours)**

1. Recombinant DNA Technology: Gene cloning strategies – recombinant DNA construction – cloning vectors – plasmids- Ti plasmids, pBR322, bacteriophage based vectors. Restriction endonucleases and ligases- transformation and selection of transformants – using antibiotic resistance markers. Blotting techniques; PCR.
2. Different methods of gene transfer – chemically stimulated DNA uptake by protoplast, electroporation, microinjection, biolistics. Agrobacterium mediate gene transfer- gene library, gene banks.

### **Module –II (10 hours)**

1. Application of Biotechnology in:

- a. Medicine - Production of human insulin, human growth hormones.
- b. Forensics - DNA finger printing.
- c. Agriculture - Genetically modified crops – Bt crops, Golden rice, Flavr Savr tomato, herbicide resistant crops, edible vaccines.
- d. Environment- Bioremediation- use of genetically engineered bacteria- super bugs.
- e. Industry- Horticulture and Floriculture Industry, production of vitamins, amino acids and alcohol.

## **Textbooks**

1. Bhojwani, S.S. and Razdan, S.K. 1993. *Plant tissue culture: Theory and Practice*. Elsevier

Science Publications, Netherlands.

2. Chawla, H.S.2012. *Introduction to plant biotechnology*. IBH publishing Co.

3. Christou, P. and Klee, H. (eds.). 2004. *Handbook of Plant Biotechnology*.Wiley, 768 p.

4. Smith, H.R. 2013. *Plant tissue culture –Techniques and Experiments* (third Ed). Elsevier. 188 p.

5. Singh, B. D. 2013. *Molecular biology, genetic engineering and applications of biotechnology*. Kalyani Publishers.

6. Slater, A., Scott, N. and Fowler, M. 2003. *Plant biotechnology: the genetic manipulation of plants*. Oxford University Press, 346 p.

<b>Course No. 3.4</b> <b>Course Code: SDC3AG12</b> <b>Course Title: Integrated Pest Management in Crops</b>	<b>Credits: 4</b> <b>Total Contact Hrs: 60</b> <b>Hrs</b>
<b>Objectives</b> <ul style="list-style-type: none"><li>• To develop knowledge on the theoretical basis of integrated pest management.</li></ul>	
<b>Course outcomes</b>	
CO1- Describe the concepts, principles and tools of IPM	
CO2- Explain the different types of IPM Methods	
CO3- Describe the important groups of micro organisms used in insect pest control.	
CO4- Explain the mass multiplication techniques of important biocontrol agents	

### **Module 1**

**12 Hrs**

IPM- introduction, importance, concepts, principles. Tools of IPM- Host plant resistance, definition, mechanisms of resistance, compatibility with other pest management practices - merits and demerits.

### **Module 2**

**12 Hrs**

IPM Methods- Cultural methods, Mechanical methods, Physical and Legislative methods, Biological methods- definition, methods, advantages, limitations. Natural enemies- parasites, predators and microorganisms used in pest control.

### **Module 3**

**12 Hrs**

Important groups of micro organisms-bacteria, viruses and fungi used in insect pest control.

Mass multiplication techniques of important biocontrol agents.

**Module 4**

**12 Hrs**

Chemical control - importance, hazards and limitations. Classification of insecticides based on chemical nature- insecticides of plant origin (botanical insecticides) and Synthetic insecticides. Preparation of neem oil garlic emulsion and tobacco decoction. Formulations of insecticides and calculation of quantity of formulations for field application. Synthetic insecticides - organophosphates, carbamates, synthetic pyrethroids. Plant protection equipments - Classification- and working principles- parts of sprayers, dusters and uses.

**Module 5**

**12 Hrs**

Distribution, host-range, symptoms of damage and management practices for major pests of the following crops-Rice, Coconut, Banana, Cashew, Pepper, cardamom, Brinjal, Bittergourd and cowpea.

**Text books:**

1. Mani, M. S. 1968. General Entomology. Oxford and IBH Publishing Company, New Delhi.
2. Nayar, K. K., Ananthakrishnan T. N. and David.B.V. 1976. General and Applied Entomology, Tata McGraw Hill Publishing Company Limited, New Delhi.
3. Pedigo, L. P. 1999. Entomology and Pest Management. Third Edition. Prentice Hall, New Jersey, USA.
4. Richards, O.W. and Davies, R. G. 1977.Imm's General Text Book of Entomology, Vol.1&2, Chapman and Hall Publication, London..
5. Srivastava, P. D. and Singh, R. P. 1997.An Introduction to Entomology, Concept Publishing Company, New Delhi.
6. Dhaliwal, G. S. and Ramesh Arora. 1998. Principles of Insect Pest Management.Kalyani Publishers, New Delhi.

<b>Course No. 3.5</b> <b>Course Code: SDC3AG13</b> <b>Course Title: Fundamentals of Agricultural Engineering</b>	<b>Credits: 4</b> <b>Total Contact Hrs: 60</b> <b>Hrs</b>
<b>Objectives</b>	

- 1.To familiarize with fundamentals of water management.
- 2.To acquaint with various soil conservation methods.

**Course outcomes**

- CO1- Describe the irrigation with definition and objectives
- CO2-Explain the methods of irrigation and their engineering aspects
- CO3- Describe the agronomic techniques to improve water use efficiency
- CO4-Describe the soil erosion and its relative aspects
- CO5-Describe the water harvesting techniques - in situ and ex situ methods
- CO6- Explain surveying: survey equipment, chain survey, cross staff survey, plotting procedure, calculations of area of regular and irregular fields.

**MODULE 1****12 Hrs**

Irrigation: definition and objectives. Role of water in soil and plants- Irrigated agriculture vs. Rainfed agriculture, dry farming and dryland farming-definition.

**MODULE 2****12 Hrs**

Methods of determining water requirement-effective rainfall. Methods of irrigation and their engineering aspects - surface irrigation, sprinkler, drip - Agronomic techniques to improve water use efficiency- factors affecting water use efficiency.

**MODULE 3****12 Hrs**

Soil erosion- nature and extent of erosion; types- soil erosion by water- different forms- Soil conservation vs. water conservation - agronomic measures- mechanical measures- Role of grasses and pastures in soil conservations; Wind breaks and shelter belts.

**MODULE 4****12 Hrs**

Water harvesting techniques - in situ and ex situ water harvesting methods - Farm ponds, percolation ponds or wells, check basin, minor irrigation tanks.

**MODULE 5****12 Hrs**

Surveying: survey equipment, chain survey, cross staff survey, plotting procedure, calculations of area of regular and irregular fields.

**Text books:**

1. Dhruvanarayana, V.V. 1993.*Soil and Water Conservation Research in India*. ICAR, New Delhi.
2. Gurmel Singh, C. Venkataraman, G., Sastry,B. and Joshi, P. 1990.*Manual of Soil and*

*Water Conservation Practices*. Oxford and IBH Publishing Co., New Delhi.

3. Hansen, V.Eh.,Israelsen, O.W., and Stringham, G.E. 1979. *Irrigation Principles and Practices* (4th Ed.). John Wiley and Sons, New York.

4. Lenka, D. 2001.*Irrigation and Drainage*. Kalyani Publishers, New-Delhi.

5. Mal, B. C.2002.*Introduction to Soil and Water Conservation Engineering*, KalyaniPublishers, New-Delhi.

6. Michael, A.M and Ojha, T.P. 2005.*Principles of Agricultural Engineering-Vol.II*.Jain Brothers, New Delhi.

7. Michael, A.M. 1988.*Irrigation Theory and Practice*.Vikas Publishing House Pvt. Ltd., New Delhi.

<b>Course No. 3.6</b>	<b>Credits: 4</b>
<b>Course Code: SDC3AG14 (P)</b>	<b>Total Contact Hrs: 60</b>
<b>Course Title: Agricultural Engineering- Practicals</b>	<b>Hrs</b>
<b>Objectives</b>	
1. To familiarize with fundamentals of water management	

### **Contents**

1. Study of soil loss by multi slot device
2. Estimation of runoff -problems
3. Study of water flow measuring devices
4. Study of water harvesting techniques
5. Study of ground water recharge techniques
6. Design of water harvesting ponds
7. Problems on drip irrigation systems
8. Problems on sprinkler irrigation systems
9. Study of fertigation equipments
10. Irrigation pump selection - problems
11. Field visit

<b>Course No. 3.7</b>	<b>Credits: 3</b>
<b>Course Code: SDC3AG15 (P)</b>	<b>Total Contact Hrs: 45</b>
<b>Course Title: Micropropagation of plants- Practicals</b>	<b>Hrs</b>

### **Course outcomes**

CO1-Explain the requirements for Plant Tissue Culture laboratory and media components and preparations.

CO2- Describe the preparation and sterilization of media and aseptic manipulation and inoculation of various explants

CO3- Explain the micro propagation of important crops

CO4- Describe the preparation of synthetic seeds

CO5- Explain the demonstration of anther culture and embryo culture.

1. Requirements for Plant Tissue Culture Laboratory.
2. Media components and preparations.
3. Preparation and sterilization of media.
4. Aseptic manipulation and inoculation of various explants.
5. Callus induction, subculturing and plant regeneration.
6. Micro propagation of important crops.
7. Preparation of synthetic seeds.
8. Demonstration of Anther culture.
9. Demonstration of embryo culture.
10. Hardening/ acclimatization of regenerated plants.

<b>Course No. 3.8</b>	<b>Credits: 3</b>
<b>Course Code: SDC3AG16 (P)</b>	<b>Total Contact Hrs: 60</b>
<b>Course Title: Integrated Pest Management- Practicals</b>	<b>Hrs</b>

**Objective-** Familiarization with methods of pest control

### **Contents**

1. Familiarization with Mechanical methods of pest control.
2. Identification of predators.
3. Identification of microbial agents.

4. Familiarization with different formulations of insecticides.
5. Preparation of neem oil garlic emulsion and tobacco decoction.
6. Familiarization with different insecticides.
7. Calculation of doses/concentrations of insecticides.
8. Preparation of spray fluid for field application.
9. Familiarization with Plant protection equipments.
10. Identification, symptoms of damage, collection and preservation of pests of:
  - a) Rice, Coconut.
  - b) Banana, Cashew.
  - c) Pepper, cardamom.
  - f) Brinjal, Bittergourd and cowpea

## **AUDIT COURSE – 3rd SEMESTER (AUD3E03)**

### **Human Rights**

#### **SYLLABUS**

##### **Module I - INTRODUCTION TO HUMAN RIGHTS**

Evolution, Nature, Philosophical and Historical foundation of Human Rights, National Human Rights Commission, State Human Rights Commission

##### **Module II – CONSTITUTION OF INDIA AND FUNDAMENTAL RIGHTS**

Right to Equality, Right to Freedom, Right against Exploitation, Right to Freedom of Religion, Cultural and educational rights, Rights to Constitutional Remedies.

##### **Module III - INTERNATIONAL HUMAN RIGHTS**

Evolution of human rights and duties on the international plane, The United Nations Charter and the development of human rights Provisions of the Charter, Universal Declaration of Human Rights 1948, International Covenant on Civil and Political Rights 1966 and other major UN instruments on human rights (Conventions on Women's Rights, Rights of the Child, Torture)

##### **Module IV - HUMAN RIGHTS COMMISSION FOR WOMEN AND CHILDREN**

Women Rights - National Commission for Women (NCW), Kerala Women Commission (KWC), Legal Aid for Women, Laws for protection of women

Child Rights - National Child Rights Protection Council, National Commission for Protection of Protection of Child Rights (NCPCR), Legal Aid, LokAdalats, Public Interest Litigation Laws for



the Protection and Care of Children

**Module V - HUMAN RIGHTS FOR MINORITIES, SC AND ST**

Special Laws and Policies: National Commission for Minorities Act (1992). Minority Rights in India, The Nation- Building Project and Minorities, Communal Mobilization and Minority's Rights. National Commission for Scheduled Tribes (NCST), National Commission for Scheduled Castes (NCSC)

## SEMESTER IV

<b>Course No. 4.1</b>	<b>Credits: 4</b>
<b>Course Code: A13</b>	<b>Total Contact Hrs: 72</b>
<b>Course Title: Natural Resource Management</b>	<b>Hrs</b>

### **Unit 1: Introduction to natural resources (Hours: 8)**

Definition of natural resources. Types of natural resources. Need for protecting natural resources

### **Unit 2: Sustainable utilization (Hours: 8)**

Concept of sustainable utilization. Economic, ecological and socio-cultural approaches.

### **Unit 3: Land (Hours: 8)**

Agricultural, pastoral, horticultural and silvicultural land utilization. Soil degradation and soil management.

### **Unit 4: Water (Hours: 8)**

Fresh water (rivers, lakes, groundwater); Marine; Estuarine; Wetlands; Threats and management strategies.

### **Unit 5: Biological Resources (Hours: 8)**

Biodiversity-definition and types; Significance; Threats; Management strategies. Bioprospecting. National Biodiversity Action Plan.

### **Unit 6: Forests (Hours: 8)**

Definition. Types of forests. Forest cover and its significance (with special reference to India); Major and minor forest products; Forest depletion. Forest Management.

### **Unit 7: Energy (Hours: 8)**

Renewable and non-renewable sources of energy.

### **Unit 8: Contemporary practices in natural resource management (Hours: 8)**

Environmental Impact Assessment, Remote Sensing, Geographic Information System, Participatory Resource Appraisal. Ecological footprint with emphasis on carbon footprint. Resource Accounting. Waste management.

### **Unit 9: National and international efforts in natural resource management and conservation (Hours: 8)**

#### **SUGGESTED READING**

1. Singh K. K. 2008. Natural Resources Conservation & Management. M D Publications Pvt. Ltd.

2. Singh, J. S., Singh, S.P. and Gupta, S. 2006. Ecology, Environment and Resource Conservation. Anamaya Publications.
3. Rogers, P.P., Jalal, K.F. and Boyd, J.A. 2008. An Introduction to Sustainable Development. Prentice Hall of India.
4. Pandey, B. W. 2005. Natural Resource Management. Mittal Publications.
5. Lynch D. R. 2011. Sustainable Natural Resource Management. Cambridge University Press.
6. Nuberg, I., George, B., Reid, R. 2009. Agroforestry For Natural Resource Management. CSIRO Publishing.
7. Camp, W. G., Heath-Camp, B. 2016. Managing Our Natural Resources. Cengage Learning Pte. Ltd
8. Chiras, D. D., Reganold, J. P. 2009. Natural Resource Conservation: Management for a Sustainable Future. Pearson.
9. Campbell, B. M., Sayer, J. A. 2003. Integrated Natural Resource Management: Linking Productivity, the Environment and Development. CABI Publishing.
10. Deal, K. H. 2011. Wildlife and Natural Resource Management. Delmar Cengage Learning.

<b>Course No. 4.2</b>	<b>Credits: 4</b>
<b>Course Code: A14</b>	<b>Total Contact Hrs: 72</b>
<b>Course Title: Intellectual Property Rights</b>	<b>Hrs</b>

**Module 1:** Overview of intellectual property (Hours: 4)

Introduction and the need for intellectual property right (IPR). IPR in India – Genesis and Development. Some important examples of IPR.

**Module 2:** Patents (Hours: 10)

Macro-economic impact of the patent system. Patent and kind of inventions protected by a patent. Patent document. How to protect your inventions? Granting of patent. Rights of a patent. How extensive is patent protection? Why protect inventions by patents? Searching a patent. Drafting of a patent. Filing of a patent

**Module 3:** Copyright (Hours: 10)

What is copyright? What is covered by copyright? How long does copyright last? Why protect copyright?

Related rights: What are related rights? Distinction between related rights and copyright.

Rights covered by copyright.

**Module 4: Trademarks (Hours: 14)**

Definition of trademark. Rights of trademark. Kinds of signs that can be used as trademarks. Types of trademark. Function that a trademark performs. How is a trademark protected? How is a trademark registered? How long is a registered trademark protected for? How extensive is trademark protection? What are well-known marks and how are they protected? Domain name and how does it relate to trademarks?

**Module 5: Geographical Indications (Hours: 4)**

What is a geographical indication? How is a geographical indication protected? Why protect geographical indications?

**Module 6: Industrial Designs (Hours: 10)**

What is an industrial design? How can industrial designs be protected? What kind of protection is provided by industrial designs? How long does the protection last? Why protect industrial designs?

**Module 7: Biotechnology and IPR (Hours: 20)**

Rationale for Intellectual Property Protection in biotechnology. Concept of Novelty in Biotechnological Inventions. Concept of Inventive Step in Biotechnological Inventions. Microorganisms as Biotechnological Inventions. Patenting biological inventions. Patenting microorganisms. Patenting other biological processes and products. Protection of new varieties of plants. Justification for Protection. Biotechnology and International Treaties such as Convention on Biological Diversity and TRIPs.

**SUGGESTED READING**

1. T. M Murray, M.J. Mehlman. 2000. Encyclopaedia of Ethical, Legal and Policy issues in Biotechnology, John Wiley & Sons.
2. P.N. Cheremisinoff, R.P. Ouellette and R.M. Bartholomew. 1985. Biotechnology Applications and Research, Technomic Publishing Co., Inc.
3. D. Balasubramaniam, C.F.A. Bryce, K. Dharmalingam, J. Green and K. Jayaraman, 2002. Concepts in Biotechnology, University Press (Orient Longman Ltd.).

4. Bourgagaize, Jewell and Buiser. 2000. Biotechnology: Demystifying the Concepts, Wesley Longman.
5. Ajit Parulekar, Sarita D' Souza. 2006. Indian Patents Law – Legal & Business Implications; Macmillan India,
6. B.L. Wadehra. 2000. Law Relating to Patents, Trade Marks, Copyright, Designs & Geographical Indications; Universal law Publishing Pvt. Ltd.
7. P. Narayanan. 2010. Law of Copyright and Industrial Designs; Eastern law House.
8. N.S. Gopalakrishnan, T.G. Agitha. 2009. Principles of Intellectual Property. Eastern Book Company.
9. T. Ramakrishan (Ed.).2003. Biotechnology and Intellectual Property Rights. CIPRA, NLSIU, Bangalore.
- 10 N.K. Acharya. 2012. Text Book on Intellectual Property Rights, 6th ed. Asia Law House.
- 11 M. M. S. Karki. 2009. Intellectual Property Rights: Basic Concepts. Atlantic Publishers.
- 12 N. S. Sreenivasalu. 2007. Intellectual Property Rights. Neha Publishers & Distributors.
- 13 Pal P. 2008. Intellectual Property Rights in India: General Issues and Implications.

Regal Publications

<b>Course No. 4.3</b>	<b>Credits: 3</b>
<b>Course Code: SDC4AG17</b>	<b>Total Contact Hrs: 45</b>
<b>Course Title: Protected Cultivation of Horticultural Crops</b>	<b>Hrs</b>
<b>Objectives</b>	
<ul style="list-style-type: none"> <li>• To familiarize with protected cultivation structures and cultivation practices</li> </ul>	
<b>Course outcomes</b>	
CO1- Describe the introduction, scope and important of problems and prospects of protected culture in India	
CO2- Explain the basic considerations in establishment and operation of greenhouses	
CO3- Explain the environmental control systems in green house.	
CO4- Describe the type of containers used in protected culture	
CO5- Explain the use of substrate and preparation of substrate for protected cultivation	
CO6- Describe the Crop regulation	
CO7- Explain the harvesting methods	

**Module1****12 Hrs**

Introduction - scope and importance - problems and prospects of protected culture in India - growing structures - green house - polyhouse –hot bed, cold frame, lath house, mist chamber, net house - basic considerations in establishment and operation of greenhouses - maintenance .

**Module 2****12 Hrs**

Advantages of growing plants in a greenhouse - functioning and maintenance. Manipulation of environmental factors - environmental control systems in green house. Maintenance of cooling and heating system in green houses.

**Module 3****12Hrs**

Type of containers used in protected culture. Substrate -Use of substrate and preparation of substrate for protected cultivation, soil decontamination. Water management- nutrient management (fertigation).

**Module 4****12 Hrs**

Crop regulation - special horticultural practices in protected cultivation for commercially important crops: vegetable crops, flowering plants, seedlings, etc

**Module 5****12Hrs**

Harvesting methods - postharvest handling - standards - grading - packing and marketing.

**Suggested Readings:**

1. Foja Singh., 1997. Advances in Floriculture. Media Today Pvt. Ltd., New Delhi-17.
2. Prasad, S. and U.Kumar. 1998. Commercial floriculture. Agro Botanica. Bikaner - 334 004.
3. Roy. A. Larson., 1992. Introduction of Floriculture. International Book Distributing Co., Lucknow.
4. Vishnu Swarup., 1997. Ornamental Horticulture. Macmillan India Ltd., New Delhi-2. Wltez, S., 1972. The world gladiolus, NAGG, USA.
5. Yadav, L.P. and Bose, T.K., 1986. Biology, conservation and culture of orchids. East- West Press Private Limited, New Delhi.E.
6. Yadav.I.S. and M.L. Choudhary., 1997. Progressive floriculture. The House of Sarpan, (Media), Bangalore.

<b>Course No. 4.4</b> <b>Course Code: SDC4AG18</b> <b>Course Title: Weed Management and Fodder Crop Production</b>	<b>Credits: 4</b> <b>Total Contact Hrs: 60 Hrs</b>
<b>Objectives</b> 1.To understand the general characters of weeds and their management 2.To acquaint with cultivation of rice, fibre crops, fodder crops, etc.	
<b>Course outcomes</b> CO1- Explain the classification, propagation and dissemination of weeds CO2- Describe the Integrated weed management CO3- Describe the herbicide classification, formulations, methods of application. CO4- Describe the soil and climatic requirement , varieties, cultural practices , harvesting and postharvest off major oil crops CO5- Explain the Crop Production in rice CO6- Describe the mechanised farming in rice CO7- Describe the cultivation and management of fodder crops	

### **MODULE 1**

**15 Hrs**

Weeds: Introduction, harmful and beneficial effects, classification, propagation and dissemination. Concepts of weed prevention, control and eradication; Methods of weed control: physical, cultural, chemical and biological methods. Integrated weed management (IWM); Herbicides: advantages and limitation of herbicide usage in India, Herbicide classification, formulations, methods of application. Compatibility of herbicides with other agro chemicals; Weed management in rice, banana, pineapple, coconut, rubber, vegetables. Aquatic and problematic weeds and their control.

### **MODULE 2**

**15 Hrs**

Origin, geographic distribution, economic importance, soil and climatic requirement, varieties, Cultural practices, harvesting and postharvest handling of major Oilseeds , Sugar cane, Fibre crop, Narcotics, Medicinal plants.

### **MODULE 3**

**10 Hrs**

Crop Production in rice in detail: Methods of sowing, Varieties and their duration, various systems of rice cultivation. Raising of nursery, sowing in the main field, Nutrient and water

**MODULE 4****10 Hrs**

Mechanised farming in Rice. Introduction to various machines employed in mechanised rice cultivation including field preparation, weeding and harvesting.

**MODULE 5****10 Hrs**

Fodder crops: their cultivation and management- value addition and nutrient enrichment in fodder crops

**Text books:**

1. Agarwal, P.C. 1990.Oilseeds in India. Oxford and IBH, New Delhi
2. Balasuramaniyan, P. and Palaniappan, SP. 2003.Principles and Practices of Agronomy.Agrobios(India)
3. Barnes, A.C. 1964.The Sugarcane.Interscience Publishers, New Delhi
4. ChiddaSnidngh, Prem Singh and Rajbir Singh.2003. Modern Techniques of Raising Field Crops (2 Ed.). Oxford &IBH, New Delhi.
5. ICAR [Indian Council of Agricultural Research].2006. Hand Book of Agriculture. ICAR, New Delhi
6. KAU [Kerala Agricultural University].2007.Package of Practices Recommendations - Crops. Directorate of Extension, Kerala Agricultural University, Thrissur
7. Lekshmikantan, M. 1983.Technology in Sugarcane Growing. Oxford & IBH Publishing Co., Pvt. Ltd., New Delhi
8. Prasad, R. (Ed.). 2001. Field Crop Production. ICAR, New Delhi
9. Purselove, J.W. 1975. Tropical Crops: Monocotyledons. The English Language Book Society and Longman, London
10. Thomas, J., Joy, P.P., Mathew, S., Skaria, B.P., Duethi, P.P. and Joseph, T.S. 2000.Agronomic Practices for Aromatic and Medicinal Plants.Directorate of Arecanut and Spices Development, Kozhikode.
11. Yadav, D.S. 1992. Pulse Crops. Kalyani Publishers., New Delhi.
12. Gurmel Singh, C. Venkataraman, G., Sastry,B. and Joshi, P. 1990.Manual of Soil and Water Conservation Practices. Oxford and IBH Publishing Co., New Delhi.
13. IARI [Indian Agricultural Research Institute]. 1977. Water Requirement and Irrigation
14. Management of Crops in India, IARI Monograph No.4, Water Technology Centre, IARI, New-Delhi.
15. Lenka, D. 2001.Irrigation and Drainage.Kalyani Publishers, New-Delhi.
16. Mal, B. C.2002. Introduction to Soil and Water Conservation Engineering,Kalyani
17. Michael, A.M. 1988.Irrigation Theory and Practice.Vikas Publishing House Pvt. Ltd., New



18. Mishra, R.D. and Ahamed, M. 1993. Manual of Irrigation Agronomy. Oxford and IBH Publishing Company Pvt. Ltd.
19. Prihar, S.S. and Sandhu, B.S. 1987. Irrigation of Field crops - Principles and Practices - ICAR, New-Delhi.
20. SankaraReddi, G.H. and Yellamanda Reddy, T. 2003 Efficient Use of Irrigation Water. Kalyani Publishing House, New Delhi.
21. Tideman, E.M. 1996. Watershed Management: Guidelines for Indian Conditions. Omega Scientific Publishers, New Delhi.
22. Aldrich, R.J. and Kramer, R.J. 1997. Principles in Weed Management. Panama Publications, New Delhi.
23. Anderson, P.W. 1983. Weed Science - Principles. West Publishing Co. New York
24. Ashton, P.M. and Crafts, A.S. 1981. Mode of Action of Herbicides (2 Ed.) Wiley- Inter Science, New York.

<p><b>Course No. 4.5</b></p> <p><b>Course Code: SDC4AG19</b></p> <p><b>Course Title: Livestock Farming</b></p>	<p><b>Credits: 4</b></p> <p><b>Total Contact Hrs: 60</b></p> <p><b>Hrs</b></p>
<p><b>Objectives</b></p> <p>1. To familiarize with fundamentals of livestock farming.</p> <p>2. To acquaint with the management of various farms.</p>	
<p><b>Course Outcomes</b></p> <p>CO1- Describe the role of Livestock in National economy</p>	
<p>CO2- Describe the general management Practices in Dairy farming</p>	
<p>CO3- Describe the cattle and buffalo management</p>	
<p>CO4- Explain the general management practices</p>	
<p>CO5- Explain the dairy development in India-</p>	
<p>CO6- Describe the composition of milk, Constituent of Milk, Factors affecting Quality and Quantity of milk, Nutritive value , and Physico-chemical properties of milk</p>	
<p>CO7- Describe the poultry management</p>	
<p>CO8- Detailed study of major animal diseases</p>	

**MODULE 1 12 Hrs**

Role of Livestock in National economy: Management- Principles of management, Functions of management, Tools of management. General Management Practices in Dairy farming-Grooming, Drying off, Control of bad habits, Castration, Dehorning, Trimming, Shoeing, Identification marks, removing extra teats.

#### **MODULE 2 12 Hrs**

Cattle and Buffalo management- Housing of Cattle, Calf raising, Heifer management, Management of pregnant and lactating cow and Buffaloes, Care and management of cross breed cow, Care and management of breeding bull, Sheep and Goat management- Housing of sheep and goat, General management practices.

#### **MODULE 3 12 Hrs**

Milk Industry: Dairy Development in India- Operation Flood Programme, Contribution of Military Dairy Farm, NDDB, NDRI, Milk grid to dairy development. Dairy Co-operatives structure and functions, Milk Chemistry and Milk constituents- Definition of Milk, Composition of Milk, Constituent of Milk, Factors affecting Quality and Quantity of milk, Nutritive value of milk, Physico-chemical properties of milk. Clean milk production: Source of contamination.

#### **MODULE 4 12 Hrs**

Poultry management: - Housing of Poultry, General Management practices, Pig Farming, Rabbit Farming, Duck Farming- Breeds of duck, General management practices. Quail management.

#### **MODULE 5 12 Hrs**

Classification of Animal Diseases: Study of major Diseases- Foot and mouth disease (FMD) Rinderpest, Anthrax, Black quarter (BQ), Haemorrhagic Septicaemia (HS). Study of Parasitic Diseases: Brucellosis, Babesiosis, Theileriosis. Diseases of lactating cow: Mastitis, Dystokia Milk fever, Prolaps, Ketosis. Diseases of Calves: Pneumonia, Calf score, Diarrhoea. Poultry Diseases- Ranikhet, Coccidiosis, Bird flu, Parasites of poultry. First aid measures. Disposal of carcasses.

#### **Text books:**

- 1) A Text Book of Animal Husbandry by G.C. Banarjee
- 2) A Text Book of Animal Science by Dr. A.U. Bhikane and Dr. S.B. Kawitkar
- 3) Advances in Dairy Animal Production by V.D. Mudgal, K.K. Singhal and D.D. Sharma
- 4) Handbook of animal Husbandry, The I.C.A.R. publication
- 5) Animal Husbandry & Dairy Science by Jagdish Prasad.
- 6) Dairy India Yearbook - 2007 by P.R. Gupta
- 7) Handbook of Veterinary Physician by V.A. Sapre
- 8) Farm Animal management and feeding practices in India by Thomas & Shashtri

9) Dairy Microbiology by K.C. Mahanta

<b>Course No. 4.6</b> <b>Course Code: SDC4AG20 (P)</b> Course Title: <b>Protected cultivation of Horticultural crops- Practicals</b>	<b>Credits: 4</b> <b>Total Contact Hrs: 60</b> <b>Hrs</b>
<b>Objectives</b> • To practice with protected cultivation practices of important crops	

**Contents**

**Protected cultivation in general:**

1. Study of structures utilized for protected culture.
2. Cost estimation of different growing structures
3. Design and orientation of poly/green houses.
4. Study of various inputs used for protected culture
5. Type of containers used in protected culture.
6. Use of substrate and preparation of substrate for protected cultivation
7. Fertigation system in green houses
8. Maintenance of cooling and heating system in green houses.
9. Special horticultural practices in protected cultivation

**Protected cultivation aspects of individual crops:**

1. Protected cultivation of cowpea,
2. Protected cultivation of capsicum
3. Protected cultivation of cucumber
4. Protected cultivation of tomato
5. Protected cultivation of orchids and anthurium.
6. Protected cultivation of rose.

<b>Course No. 4.7</b> <b>Course Code: SDC4AG21 (P)</b> Course Title: <b>Weed Management and Fodder crop Production and Livestock Farming- Practical</b>	<b>Credits: 3</b> <b>Total Contact Hrs: 45</b> <b>Hrs</b>
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## **Objectives**

- To familiarize with the general characters of weeds and their management.
- To familiarize with cultivation of rice, fibre crops, fodder crops etc.
- Familiarization with cultural methods of pest control.
- To familiarize with practices in livestock farming.
- To acquaint with the management of important farm animals and birds

## **Weed management**

1. Techniques of weed collection, identification and preparation of herbarium of weeds.
2. Herbicide formulation and identification- Herbicide label information.
3. Study of herbicide application equipments and calibration.
4. Computation of herbicide doses.
5. Field practice of spraying herbicides in the field.
6. Recording observations on the effect of herbicides on crops and weeds.
7. Hand weeding and hoeing using conoweeder in rice.
8. Hoeing and after cultivation in cassava plots.
9. Economics of weed control practices.
10. Visit to areas with problem weeds.
11. Familiarization and planting of various fodder crops and their preservation.
12. After cultivation operations of major crops.

## **Pest management**

1. Familiarization with Mechanical methods of pest control.
2. Identification of predators.
3. Identification of microbial agents.
4. Familiarization with different formulations of insecticides.
5. Preparation of neem oil garlic emulsion and tobacco decoction.
6. Familiarization with different insecticides.
7. Calculation of doses/concentrations of insecticides.
8. Preparation of spray fluid for field application.
9. Familiarization with Plant protection equipments.
10. Identification, symptoms of damage, collection and preservation of pests of:
  - a) Rice, Coconut.

- b) Banana, Cashew.
- c) Pepper, cardamom.
- d) Brinjal, Bittergourd and cowpea.

**Live stock farming**

1. Morphology of cattle, buffalo and poultry
2. Classification of Cattle Breeds
3. Study of Cattle, Breeds
  - a. Milch : Gir, Sahiwal, Red Sindhi,
  - b. Draught: Khillar, Dangi, Red kandhari.
  - c. Dual: Deoni, Hariyana
  - d. Exotic: Jearsy, H.F.
  - e. Cross breed: Holdeo, Jerdeo.
4. Study of Buffalo Breeds: Murrah, Jaffrabadi, Nagpuri and Surti
5. Study of Sheep and Goat breeds: Osmanabadi, Jamnapuri, Saanem

<b>Course No. 4.8</b>	<b>Credits: 4</b>
<b>Course Code: SDC4AG22(Pr)</b>	<b>Total Contact Hrs: 60</b>
<b>Course Title: Internship/Project(Cultivation of Rice)</b>	<b>Hrs</b>

**Objectives**

- To understand the sustainable cultivation aspects of rice under low land condition.
- Rice-crop planning
- Nursery raising: Land preparation, seed treatment, sowing, water management, nutrient management, and plant protection
- Main field preparation, transplanting, nutrient management, water management, Identification of weeds and weed management
- Identification of insect pests and diseases and plant protection
- Harvesting, postharvest handling of produce, storage and marketing of produce. Harvest Index- Preparation of balance sheet including cost: benefit ratio (A minimum 5cents will be allotted to each student).

**NOTE:** In addition to regular practicals, the students will complete certain time bound operations after the regular class hours.

## **AUDIT COURSE 4th SEMESTER**

### **GENDER STUDIES (AUD4E04)**

#### **Objectives**

1. To provide basic understanding of the importance of Gender studies
2. To introduce basic concepts relating to gender and to provide logical understanding of gender roles.
3. To provide an analytical understanding of gender differences and major gender issues
4. To conscientise the students on cultural construction of masculinity and femininity
5. To provide an analytical understanding of women empowerment and gender equality
6. To provide a critical understanding of women developmental policies and programmes.

#### **MODULE I : Gender and Gender Studies**

- I.1. Origin and Development of Gender Studies, Gender Studies in National and International Settings, Objectives and Relevance of Gender Studies
- I.2. Social Construction of Gender: Sex and gender, Gender Difference, Gender Inequality, Gender Bias, Gender Discrimination
- I.3. Gender Socialization: Construction of Femininity and Masculinity, Equality and Difference, Gender Identity and Self Image, Gender Roles, Segregation and Ranking.

#### **MODULE II : Gender and Economy**

- II.1. Gender and Economy: Economic Inequality, Productive and Unproductive work, Visible and Invisible Work, Paid and Unpaid Work
- II.2. Sexual Division of Labor: Private-Public Dichotomy, organized and unorganized sector. Feminization of Work, New Economic Policy and its impact on Women.
- II.3. Women and Work: Production vs. Reproduction, Household Work, Women's Work and Technology

#### **MODULE III : Major Gender Issues**

III-1. Gender and Family: Gender Role Divisions, Domestic violence: physical, sexual, psychological and verbal, Denial of reproductive rights, Female Genital Mutilation (FGM), Dowry harassment and death, Child abuse.

III-2. Gender issues: Sexual exploitation, Rape, Prostitution, Sex Tourism, Sexual Harassment, Media violence

III.3. Women and Health: Early marriage and early motherhood. Ill-health, Mortality and Morbidity, Factors influencing health, Problems of destitute and aged women

#### **MODULE IV: Status of women and Challenges to Development**

V.1. Social and Economic Status of Women: Women in third world societies with special reference to India.

V.I Political and Religious Status of Women: Cultural and Religious prominence, Political participation and Power.

V2 Factors influencing the status of women: Illiteracy and low education, Denial of access to resources, Selective abortion and female infanticide.

#### **MODULE V: Women Empowerment and gender equality**

IV.1. Empowerment and need for empowerment: Quality of Life Perspective and Contribution of Women

IV2. Various facets for empowerment: social, economic, educational, legal, political empowerment

IV: 3. Empowerment Programmes: Government Empowerment Schemes and hindrances in the path of Women empowerment.

#### **MODULE VI : Women and Development policies and programmes**

VI-1. Gender and Politics: Political Role and Participation of Women in India, Women's Reservation Bill, and Laws related to women's property rights and inheritance, conditions of work and pay.

VI.2. National policies and programs: Feminist standpoint of development policy, Gender analysis of development policy, engendering development policies.

VI.3. Critical review of women development programs in India-Role of non-state actors, Role of NGOs – Development initiatives, Self Help Groups, Micro finance and micro enterprises,

VI.4. Women development: International initiatives, Copenhagen conference, Nairobi Conference, Beijing Conference, Mexico City conference

## SEMESTER V

<b>Course No. 5.1</b> <b>Course Code: SDC5AG23 E1</b> <b>Course Title: Environmental Microbiology and Biotechnology</b>	<b>Credits: 4</b> <b>Total Contact Hrs: 60</b> <b>Hrs</b>
<b>Objectives</b> <ul style="list-style-type: none"><li>• To understand various aspects of environmental microbiology and biotechnology</li></ul>	

### Module-I

Introduction to Microbiology-History-scope-Types –structure, biology and classification of bacteria, mycoplasma, fungi, algae and virus-identification (10 Hours)

### Module-II

Rules, regulations and tools in Microbiology- Basic principles of Autoclave, Hot air oven, laminar air flow. Microscopy-Bright field-phase contrast-dark field-fluorescent-con-focal electron microscopy (SEM,TEM) Centrifuge-spectrophotometer (10 Hours)

### ModuleIII

Sampling Techniques: Preparation of samples, types of media-sterilization techniques-cultivation and preservation of microorganism-methods of estimation and isolation of microorganism in soil, water and milk(10 Hours)

### Module-IV

Microbiology of soil-microbial flora of soil-interaction among soil microorganism-role of soil microorganisms-nitrogen, carbon, sulphur cycles-microbiology of aquatic micro organism- Air microbiology-distribution, techniques and role of air microorganisms.(10 Hours)

### Module-V

Microbial Genetics-concept of the gene mutations, transformation, conjugation, transduction, plasmids, microbial control of environmental pollution (10 Hours)

### Module-VI

Microbial growth process-major products of Industrial microbiology-alcoholic beverages, amino acids and antibiotics, genetic engineering,Recombinant DNA technique in Biotechnology-Gene



**Text Books:**

- Microbiology-Paul.A.Ketchum.1984.John wiley and Sons,Newyork.  
 Microbiology-L.M.Prescott,J.P.Harley,D.A.Klein,1993.2nd Ed.Wm.C.Brown Publishers  
 Microbiology-M.J.Pelczar,E.C.S.Chan,N.R.Kreig.1996. Mc Graw Hill Books Co.,Newyork  
 Microbiology-Fundamentals and Applications. Atlas,R.M.Macmillian Pub. Co.,New York

**References:**

- Bacterial Metabolism. Doelle,N.W.1975.2nd Ed.Academic Press  
 Microbial Genetics-D.Freigelder,1987.Jones BartkettPublishers,Inc,Boston  
 Introduction to Environmental Microbiology.Mitchell,R.1974.Prentice Hall Int.  
 Introduction to Soil Microbiology.M.Alexander.1977Ny. John Wiley and Sons  
 Aquatic Microbiology –G.Rheinheimer.1991.4th Ed. John Wiley and Sons  
 Microbial Biotechnology-A.N.Glazer,H.Nikadio.1995.W.H.Freeman &Co.,New York  
 Bacteriology- Salle  
 A text book of Microbiology. Ananthanarayanan,R and JayaramPanicker

<p><b>Course No. 5.1</b>  <b>Course Code: SDC5AG23 E2</b>  <b>Course Title: Government Policies and Programmes</b>  <b>Related to Agriculture</b></p>	<p><b>Credits: 4</b>  <b>Total Contact Hrs: 60 Hrs</b></p>
<p><b>Objectives</b></p> <ul style="list-style-type: none"> <li>• To acquaint with various Government Policies related to Agriculture in Kerala and India.</li> <li>• To familiarise with five year plans and Panchayathiraj system in India.</li> </ul>	

**MODULE 1 Introduction to agricultural policies 10 Hrs**

Introduction to agricultural policies of Kerala and of India - need and importance - National Agricultural Policy in brief.

**MODULE 2 Agricultural policies regarding land and labour 20 Hrs**

Agricultural policies regarding land - need and scope for land reforms - Abolition of

pattern of operational holdings, problem of sub-division and fragmentation of holdings.

Agricultural policies regarding labour - present position of agricultural labour - minimum wages- abolition of bonded labour - Recommendations of the National Commission on Rural Labour –NREGP.

**MODULE 3 Agricultural policies regarding seeds and fertilizers 20 Hrs**

Agricultural policies regarding seeds - National Seeds Policy -varietal development and plant variety protection - seed production - quality assurance - seed distribution and marketing – infrastructure facilities - transgenic plant varieties - import of seeds and planting material - export of seeds - Agricultural policies regarding fertilizers- Fertilizer pricing policy - payment of subsidy. Agricultural policies regarding plant protection chemicals - protection of consumers from adverse impacts of pesticides. Agricultural policies regarding irrigation, machinery, technology etc.

**MODULE 4 Agricultural policies regarding credit 15 Hrs**

Agricultural policies regarding credit - Co-operatives and rural credit - Commercial banks and rural credit - Regional Rural Banks - Lead Bank Scheme - NABARD. Agricultural policies of Kerala and of India- regarding agricultural products and their marketing, export and prices – food security.

**MODULE 5 Five Year plans and Panchayathiraj 15 Hrs**

Concept of planned growth- Five Year Plans-Government policies and programs in agriculture and rural development. IADP - IAAP- IWDP- Watershed development Programmes- IRDPNREGP-SGSY - Kudumbasree- etc. Peoples' Plan- Decentralised planning- current Plans -Agricultural development programmes and schemes of the dept. of Agriculture- liaison with Local Self Government. Panchayati raj system and institutions- gramasabha- Preparation of plan projects in agriculture.

**Text books:**

1. Government of India. Five year Plan Documents.
2. Government of India.Economic Survey. Published by Planning Commission (various issues)
3. Government of India.Economic Review. Published by State Planning Board (various issues)

<b>Course No. 5.2</b> <b>Course Code: SDC5AG24 E3</b> <b>Course Title: Food and Dairy Microbiology</b>	<b>Credits: 4</b> <b>Total Contact Hrs: 60 Hrs</b>
<b>Objectives</b> <ul style="list-style-type: none"><li>• To understand various aspects of food and dairy microbiology</li></ul>	

**Module 1****(10 hours)**

Food as a substrate for microorganisms. Types of microorganisms in food - Source of contamination - Factors influencing microbial growth in foods (extrinsic and intrinsic) Microbial examination of food- viable colony count, examination of fecal Streptococci.

**Module 2****(10 hours)**

Milk as a substrate for microorganisms. Types of microorganisms in Milk- bacteria, fungi and yeast. Sources of microbial contamination of milk. Microbiological analysis of milk. Rapid platform tests organoleptic, Clot on boiling (COB), turntable acidity alcohol test, DMC, sedimentation test and pH. Standard plate count, MBRT.

**Module 3****(10 hours)**

Food fermentations: Cheese, bread, yoghurt, idli, fermented pickles and fermented vegetables, Ice cream, - methods and organisms used. SCP, Probiotics and prebiotics.

**Module 4****(10 hours)**

General principles underlying spoilage, different kinds of foods, cereals and cereal products - sugar and sugar products - vegetable and fruits - meat and meat products - fish and other sea foods - eggs and poultry - dairy and fermentative products (ice cream/milk/bread/wine).

**Module 5****(10 hours)**

Food Poisoning : food borne infections (a) Bacterial: Staphylococcal, Brucella, Bacillus, Clostridium, Escherichia, Salmonella (b) Fungal : Mycotoxins including aflatoxins, ergotism (c) Viral: Hepatitis, (d) Protozoa - Amoebiasis.

**Module 6****(10 hours)**

Food preservation : Principles of food preservation - methods of preservation. a. Physical (irradiation, drying, heat processing, pasteurization, chilling and freezing, high pressure and modification of atmosphere) b. Chemical (Sodium benzoate Class I & II). Food Sanitation: Good manufacturing practices - HACCP, Personnel hygiene.

**Suggested Readings**

1. Food Microbiology by Adams, M R . and Moss, M.O.1995.The Royal Society of Chemistry, Cambridge.
2. Food Microbiology by Frazier, W.C. and Westhoff, D.C.1988.TATA McGraw Hill Publishing company ltd., New Delhi.
3. Modern Food Microbiology by Jay, J.M.1987.CBS Publishers and distributors, New Delhi.
4. Basic Food Microbiology by Banwart, G.J.1989.Chapman & Hall New York.
5. A Modern Introduction to Food Microbiology by Board, R.C.1983.Blackwell Scientific Publications,

Oxford.

6. Dairy Microbiology by Robinson, R.K.1990. Elsevier Applied Science, London.

7. Food Poisoning and Food Hygiene, Hobbs, B.C. and Roberts, D.1993. Edward Arnold.

8. MICROBIOLOGICAL EXAMINATION METHODS OF FOOD AND WATER by SILVA

9. Lund BM, Baird Parker AC, and Gould GW. (2000). *The Microbiological Safety and Quality of Foods*.

Vol. 1-2, ASPEN Publication, Gaithersberg, MD.

10. Gould GW. (1995). *New Methods of Food Preservation*. Blackie Academic and Professional, London.

<b>Course No. 5.2</b> <b>Course Code: SDC5AG24 E4</b> <b>Course Title: Landscaping and Gardening</b>	<b>Credits: 4</b> <b>Total Contact Hrs: 60 Hrs</b>
<b>Objectives</b> <ul style="list-style-type: none"><li>• To familiarize with landscaping, gardening and commercial floriculture</li></ul>	

### **Module 1**

Introduction to landscaping, gardening and commercial Floriculture. Components of landscapes and gardens, descriptions and functional uses – Living components – Non living components – Enrichment item. Garden enclosures, surfacing materials, roads and paths, enrichment items

### **Module 2**

Types of gardens – Styles in gardening – characteristics and components of gardens. Principles of landscaping. Designing and Preparation of landscape and garden plans. Functional uses of plants for different purposes.

### **Module 3**

Lawn Types of lawn grasses, methods of establishing, maintenance and rejuvenation of lawns. Annuals and herbaceous perennials Function and selection colour schemes, planting designs, Cultural practices

### **Module 4**

Specialized gardening techniques. Indoor gardening of plants Bonsai, vertical garden, tray garden, terrarium *etc.* Flower arrangement, flower shows and judging flower shows and arrangement, styles and designs

## Suggested Readings

1. Bose, T.K. and Mukherjee, D. 1972. *Gardening in India*. Oxford and IBH Publishing Company, Calcutta.
2. Bose, T.K., Maiti, R.G., Dhuna, R.S. and Das., P. (eds) 1909. *Floriculture and Landscaping*. Naya Prakash, Calcutta, India.
3. Bhattacharjee, S.K. (ed). 2006. *Advances in Ornamental Horticulture* Vol. I to VI. Pointer Publishers, Jaipur.
4. Chadha, K.L. and Choudhury, B. 1992. *Ornamental Horticulture in India.*, ICAR, New Delhi.
5. Gilbert, R. 1988. *200 House plants any one can grow*. Dorling Kindersley Ltd., London. 144p.
6. Jindal, S.L. 1987. *Flowering shrubs in India*. Publications Division, Govt. of India, New Delhi. 175p.
7. Joiner, J.N. 1981. *Foliage Plant Production*. Prentice Hall Inc., London.
8. KAU (Kerala Agricultural University) 2011. Package of Practices Recommendations: Crops (14th Ed). Kerala Agricultural University, Thrissur. 360p.
9. Pal, B.P. 1972. *The rose in India*. Indian Council of Agricultural Research, New Delhi. 73
10. Randhawa, M.S. 1983. *Flowering Trees*. National Book Trust, India, New Delhi. 208p.
11. Randhawa, G.S. and Mukhopadhyay, A. 1986. *Floriculture in India*. Allied Publishers, New Delhi. 656p.
12. Rajeevan, P.K., Singh, K.P. and Valsalakumari, P.K. 2003. ed. *Bulbous Flowers*. Indian Society of Ornamental Horticulture Division of Floriculture & Landscaping, IARI, New Delhi.
13. Sabina, G.T. 2009. *Ornamental plants*. New India Publishing Agency- 324p.
14. Santapau, H. and Heary, A.N. 1984. *A Dictionary of flowering plants in India*. CSIR, New Delhi. 198p.
15. Sheela, V.L. 2008. *Flowers for trade*. New India Publishing Agency, New Delhi. 379p.
16. Sidhu, S.S. 2016. *Ornamental Horticulture*. New India Publishing Agency, New Delhi. 485p.
17. Swarup, V. 1993. *Indoor Gardening*, ICAR, New Delhi.

<b>Course No. 5.3</b> <b>Course Code: SDC5AG25</b> <b>Course Title: Commercial Vegetable Production</b>	<b>Credits: 4</b> <b>Total Contact Hrs: 60 Hrs</b>
<b>Objectives</b> <ul style="list-style-type: none"> <li>• To understand various principles and practices of commercial vegetable production.</li> </ul>	

### **Module 1**

**12 Hrs**

Introduction - Importance and scope of vegetable crops of India with special emphasis to Kerala. Nutritional importance- nutrient value of vegetables, ANV. Classification of vegetables - types of classification and their bases - Botanical, cultural, thermo classification, classification based on parts used.

### **Module 2**

**12 Hrs**

Factors affecting vegetable production- soil, temperature, light, water, nutrients. Basic principles of vegetable production. Nursery, sowing and transplanting, Care and management.

### **Module 3**

**12 Hrs**

Types of vegetable farming - Kitchen garden and its site selection, principles of layout, cropping schedule; Market garden; Truck garden; vegetable forcing;Vegetable garden for seed production; Hydroponics, aeroponics, Riverbed system, Terrace Gardenetc. Growth regulators -role of growth regulators in vegetable production and methods of application.

### **Module 4**

**12 Hrs**

Production technology of warm season vegetable- Importance, origin, varieties, cultivation, problems and prospects for Solanaceous crops- tomato, brinjal and chilli-Cucurbits-bitter gourd, snake gourd, cucumber, melons, pumpkins, watermelon and ivy gourd. Leguminous crops- vegetable cow pea and winged bean. Other vegetables-okra, amaranthus.

### **Module 5**

**12 Hrs**

Production Technology of cool season vegetables- Importance, origin, Varieties, cultivation, problems and prospects of potato, cole crops - cabbage &cauliflower.Rootcrops carrot, radish, beetroot.Bulb crops- onion, garlic and Leafy vegetables.

<b>Course No. 5.4</b> <b>Course Code: SDC5AG26</b> <b>Course Title: Agricultural Enterprises</b>	<b>Credits: 3</b> <b>Total Contact Hrs: 45 Hrs</b>
<b>Objectives</b> <ul style="list-style-type: none"> <li>• To understand various commercial enterprises in agricultural sector through observation, field visits and presentation.</li> </ul>	

### **MODULE 1**

**12Hrs**

Bee keeping -history and development. Honey bees- kinds of bees, biology-Hiving and domestication. Seasonal management of bees.Bee pasturage. Bee products- extraction, uses, composition and preservation. Diseases and enemies of honey bees and their control. Bee poisoning. Scope of apiculture in Kerala. Recent advances in apiculture research.

### **MODULE 2**

**10 Hrs**

Sericulture - history and development. Types of silkworms in India - morphology, biology, rearing of silkworms.Host plants and their cultivation.Diseases and enemies of silkworm and their control. Scope of sericulture in Kerala. Recent advances in sericulture research.

### **MODULE 3**

**23 Hrs**

Mushroom cultivation, Importance of mushroom cultivation - definition of mushroom - its importance - present scenario of mushroom cultivation - general morphological features, taxonomy and identification of different mushrooms- Pure culture of mushrooms and their nutritional requirements. Definition of spawn, substrate for spawn, types of spawn, methods of spawn production, characteristic of a good spawn, storage of spawn. Cultivation of Agaricus species - composting - its formulation, casing, preparation of casing mixture, sterilization, cultivation of pleurotus, Volvariella, Lentinus, Calocybe and Auricularia. Different types of substrates, substrate preparation and sterilization, Spawning, methods of spawning, spawn run phase, cropping. Identification and management of different pests and diseases of mushrooms. Methods of harvesting mushrooms, post harvest treatments and preservation of mushrooms. Packing and processing - Different methods of processing, canning and dehydration. Nutritive value of mushrooms and preparation of different recipes.

### **MODULE 4**

**15 Hrs**

Commercial floriculture, Status and prospects of commercial cultivation of flowers. Cultivation aspects of traditional and cut flowers - jasmine, crossandra, marigold, tuberose, gladiolous, heliconia etc. Protected cultivation of rose, gerbera, chrysanthemum etc. - general concepts and practices.

Commercial cultivation of **orchid's** and anthurium. Status and prospects of Kerala. Classification and varieties, planting material production, methods of planting, media components and management, shade regulation, irrigation, nutrition, plant protection, stage and method of harvest, postharvest handling and marketing. Economics of cultivation.

**Text books:**

1. David, B. V. and Kumarawami, T. 1978. *Elements of Economic Entomology* Popular Book Depot, Madras.
2. Ganga, G. and Sulochanachetty. 1999. *An Introduction to Sericulture* Second edition. IBM and Oxford Publishing Company, New Delhi.
3. Groul, R.A. 1963. *The Hive and the Honeybee*. Dadani and Sons. Inc. Illinois.
4. Krishnaswami, S., Narasimhanna, Suryanarayana and Kumararaj. 1991. *FAO Manuals on Mulberry Cultivation, silkworm rearing and silk reeling*. IBM and Oxford Publishing Company, New Delhi.
5. Mishra, R. C. 1998. *Perspectives in Indian Apiculture*. Agro botanica, Bikaner, Rajasthan
6. Sardar Singh. 1962. *Bee Keeping in India*. ICAR, New Delhi.
7. Chang, S. T. Miles, P. G. and Hays, W. A. 1978. *The Biology and Cultivation of Edible Mushrooms*. Academic Press, London.
8. Lulu Das. 2002. *Mushroom Recipes*. (Released in the VIII Biennial meeting of AICMIP).
9. Nair, M. C. 1995. *Beneficial Fungi and Their Utilization*. Scientific publishers, New Pali Road, Jodhpur.
10. Randhawa, G.S. and Mukhopadhyay, A. 1986. *Floriculture in India*. Allied publishers New Delhi.
11. Rogers, J. 1974. *Flower arranging*. Hamlyn, London

<p><b>Course No. 5.5</b>  <b>Course Code: SDC5AG27</b>  <b>Course Title: Fundamentals of Organic Farming</b></p>	<p><b>Credits: 4</b>  <b>Total Contact Hrs: 60 Hrs</b></p>
<p><b>Objectives</b></p> <ul style="list-style-type: none"> <li>• To familiarize with the concept of sustainability and sustainable development.</li> <li>• To acquaint with the fundamentals of organic farming.</li> <li>• To have the knowledge about the organic certification procedures.</li> </ul>	



**MODULE 1****12Hrs**

The concept of sustainability and sustainable development-emerging issues- Sustainable agriculture- concept themes- differences between conventional, sustainable, and alternate agriculture- Various alternate agricultural systems- Conventional, sustainable, and alternate agriculture- Alternate agricultural systems- biodynamic farming, natural farming, organic farming, permaculture, homa farming, and other forms/limitations- Modernization of agriculture and its relation to sustainability.

**MODULE 2****12Hrs**

Factors affecting ecological balance and ameliorative measures- Indian agriculture in terms of availability of natural resources and their carrying capacity- Strategies for realizing sustainable agriculture- low vs. high external input agriculture -Natural resource management as a part of sustainable resource management -crop production practices- animal production practices-Basic ecological principles of LEISA - promising LEISA techniques and practices –Good Agricultural Practices(GAP)- GAP certification -Improved manure handling - crop residue management - strategic use of chemical fertilizers and pesticides, traps, repellants and biological control, water conservation measures for sustainability- water harvesting - ITK and farmer centered techniques and practices.

**MODULE 3****12 Hrs**

Organic agriculture-history-concepts- philosophy- objectives, opportunities and priorities- Criticisms- Organic farming and food security-Principles of organic farming. Tools and practices of organic farming: Planned crop rotation, Green manures and cover crops, organic Manuring and composting, multiple cropping. Intercropping in relation to maintenance of soil productivity.

**MODULE 4****12 Hrs**

Biological pest control: Biological agents -Mass multiplication and familiarization with field application, Different traps and pheromones for pest control. Biocontrol of weeds, diseases and insect pests, Sanitation, Tillage and cultivation, Mulching, Supplemental fertilization, Biorational pesticides, Foliar fertilization.

**MODULE 5****12 Hrs**

Socio-economic impacts; Marketing and export potential - National Programme for Organic Production (NPOP) -Operational structure of NPOP-Accreditation agencies- Certification Agencies - National Standards for Organic Products ( NSOP)-inspection and certification procedures.

**Text books:**

1. Ananthakrishnan, T.N. (ed.) 1992. Emerging Trends in Biological Control of Phytophagous insects. Oxford & IBH, New Delhi.
2. Chhonkar, P.K. and Dwivedi, B.S. 2004. Organic farming and its implications on India's

food security. Fertil. News 49(11): 15-18, 21-28, 31 & 38.

3. Gaur, A.C. 1982. A Manual of Rural Composting. FAO/UNDP Regional Project Document, FAO, Rome.

4. Howard, A. 1940. An Agricultural Testament. Oxford University, London. Lampin, N. 1990. Organic Farming. Farming Press Books, Ipswich, U.K.

5. Palaniappan, S.P and Anandurai, K. 1999. Organic Farming- Theory and Practice, Scientific Pub., Jodhpur.

6. Reddy, M.V. (ed.) 1995. Soil organism and Litter decomposition in the Tropics. Oxford & IBH, New Delhi.

7. Singh, S.P. (ed.) 1994. Technology for Production of Natural Enemies, Project Directorate of Biological Control, Bangalore.

8. Trewavas, A. 2004. A critical assessment of organic farming and food assertions with

9. Trivedi, R.N. 1993. A Text Book of Environmental Sciences, Anmol Pub., New Delhi.

10. Veeresh, G.K., Shivashankar, K. and Singlachar, M.A. 1997. Organic Farming and Sustainable Agriculture, Association for Promotion of Organic Farming, Bangalore.

11. Woome, P.L. and Swift, M.J. 1994. The Biological Management of Tropical Soil Fertility, S.B.F. & Wiley.

<b>Course No. 5.6</b> <b>Course Code: SDC5AG28(P)</b> <b>Course Title: Agricultural Enterprises -Practicals</b>	<b>Credits: 3</b> <b>Total Contact Hrs:60</b>
<b>Objectives</b> <ul style="list-style-type: none"><li>● To develop awareness on bee keeping, sericulture and lac culture through observation, field visit and reporting</li><li>● To develop skill in cultivation of edible mushrooms and to develop skill in dry flower production and bouquet making</li><li>● To familiarize with the production and utilization of biofertilizers and biocontrol agents</li></ul>	

### **Commercial Enterprises**

1. Different types of bees and bee equipments.
2. Handling of bee colonies.
3. Extraction and processing of honey.
4. Visit to apiaries.
5. Identification of silkworms

6. Laboratory rearing of mulberry silkworms and visit to rearing units.
7. Identification of lac insects and their natural enemies.
8. Identification of common edible and poisonous mushrooms.
9. Preparation of substrates for mushroom cultivation.
10. Oyster mushroom cultivation.
11. Paddy straw mushroom cultivation.
12. Button mushroom cultivation.
13. Visit to a commercial mushroom production unit.
14. Methods of harvesting mushrooms.
15. Mushroom recipes – preparation.
16. Production techniques of dry flowers.
17. Value addition in cut flowers and loose flowers, hands on training in preparation of garlands, bouquet, flower arrangements etc.

<p><b>Course No. 5.7</b>  <b>Course Code: SDC5AG29 (P)</b>  <b>Course Title: Commercial Vegetable Production- Practicals</b></p>	<p><b>Credits: 4</b>  <b>Total Contact Hrs:60 hrs</b></p>
<p><b>Objectives</b></p> <ul style="list-style-type: none"> <li>• To develop skills in cultivation of vegetable crops</li> </ul>	

### **Commercial vegetable production**

1. Main field preparation and planting of transplanted tropical vegetable crops.
2. Main field preparation and planting of direct sown vegetable crops.
3. Preparation of nursery bed, sowing and aftercare of seeds of vegetable crops.
4. Preparation of growth regulator solutions and application.
5. Maturity indices and harvesting of vegetables for vegetable purpose and seed purpose.
6. Identification and familiarization of cool season vegetables.
7. Main field preparation and planting of cool season vegetables.
8. Visit to the farmer's fields in the vegetable growing areas to study the field problems faced by the farmer.

<b>Course No. 5.8</b> <b>Course Code: SDC5AG30(P)</b> <b>Course Title: Fundamentals of Organic Farming- Practicals</b>	<b>Credits: 4</b> <b>Total Contact Hrs:60 hrs</b>
<b>Objectives</b> <ul style="list-style-type: none"> <li>● To familiarize with organic production of various crops</li> <li>● To gain skill with different composting techniques</li> </ul>	

### **Organic farming**

1. Preparation of enriched farm yard manure.
2. Coir pith composting.
3. Preparation of Vermicompost.
4. Study and field application of biofertilizers.
5. Raising green manure crops and cover crops.
6. Plant protection through bio-agents and traps.
7. Plant protection using pheromones.
8. Visit to urban waste recycling unit.
9. Study of profitable utilization of agricultural wastes.
10. Visit to poultry and dairy units to study resource allocation, utilization and economics.
11. Visit to an organic farm to study various components and utilization.

## **SEMESTER VI**

<b>Course No. 6.1</b> <b>Course Code: SDC6AG32</b> <b>Course Title: Major Internship/Main Project/Dissertation</b> <b>Credits: 30</b>
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### **Details of Project Work**

Industrial training will be conducted at the industrial premises engaged in agriculture and allied activities. A group of students (5-6 number) will be allotted to each industry. The interest of the students will be one of the major criteria in selecting the category of industry. A project report of the industrial training shall be submitted at the end of sixth semester and a viva-voce will be conducted by a panel of three subject experts.

**Model Question papers- First semester Courses**

**SDC1AG01- FUNDAMENTALS OF AGRONOMY**

**Time-2.5Hrs**

**Maximum-80 Marks**

**Section A Each question carries 2 marks (Ceiling 25)**

1. Comment on Water use Efficiency.
2. What do you mean by Selective herbicides?
3. Write a short note on Tillage.
4. Give a note on Post harvest Technology.
5. Write about Allelopathy.
6. Differentiate Sustainable and Subsistence Agriculture.
7. What is the use of cover crops?
8. Comment on Drip Irrigation.
9. Mention about Rain fed Agriculture.
10. What do you mean by Integrated Nutrient Management?
11. Organic fertilizers
12. Dry farming
13. INM
14. Biofertilizers
15. Pesant farming

**Section B Each question carries 5 marks (Ceiling 35)**

16. Describe Biological Nitrogen Fixation.
17. Define Growth and Development. Describe the factors affecting Growth and Development.
18. Comment on Crop rotation and its Principles.
19. What do you mean by Manure and Fertilizer? Describe about the different types of manure and Fertilizer application?
20. Write a brief note on Soil Water Plant Relationship.
21. Enlist the major soil factors which affect the plant Growth.
22. Briefly explain the importance of agriculture in India.
23. Briefly describe about the different agricultural seasons in Kerala.

**Section C Answer any two. Each Question carries 10 marks .(2x10=20)**

24. Define Irrigation. Explain about the different types of Irrigation methods?
25. What do you mean by Crop? Explain about various types of crop classifications?
26. Elucidate the various methods employed in sowing /planting of crops?
27. Enumerate the special systems of cultivation and harvesting methods of major Cereals and Millets.

## SDC1AG02- FUNDAMENTALS OF HORTICULTURE

Time-2.5Hrs

Maximum-80 Marks

### Section A Each question carries 2 marks (Ceiling 25)

1. Briefly describe the scope of Horticulture in India?
2. Comment on kitchen garden and roof garden/
3. Give a brief note on Pruning.
4. Describe about Growth Regulators.
5. Explain about various preplanting treatments.
6. What are the major advantages of asexual propagation?
7. What do you mean by the term fruit thinning?
8. Give the major differences between Green House and Glass house?
9. Comment on Graft Incompatibility?
10. What are the major apical grafting methods?
11. Hot Beds
12. Greenhouses
13. Repotting
14. IAA
15. Ripening Hormone

### Section B Each question carries 5 marks (Ceiling 35)

16. Compare the differences between Grafting and Budding?
17. Explain different irrigation methods and add a note on their merits and demerits?
18. Discuss briefly the different types of planting orchards?
19. Give a brief account on divisions of horticulture and nutritive value of horticultural crops?
20. Discuss about different training techniques of fruit crops and their merits and demerits.
21. Give a brief note on various cropping systems.
22. Write a brief account on plant propagation by Layering?
23. Write a critical note on unfruitfulness and various factors affecting them?

### Section C Answer any two. Each Question carries 10 marks . (2x10=20)

24. Define Propagation .Discuss about the various techniques of propagation by cuttings?
25. Briefly explain about various plant propagating structures?
26. Illustrate the various grafting techniques employed in plant propagation?
27. Define Nursery? Write a brief note on three types of nursery beds with examples?

## SDC1AG05- Fundamentals of Soil Science

**Time-2.5Hrs**

**Maximum-80 Marks**

### **Section A Each question carries 2 marks (Ceiling 25)**

1. How soil is formed? What are major factors which affect soil formation?
2. Write a short note on soil profile showing different Horizons?
3. Comment on the physical, chemical and biological effects of organic matter in the soil.
4. How soils are classified on the basis of their texture?
5. Comment on the formation of rocks.
6. Which are the major factors which affect weathering of soil?
7. Mention the importance of soil texture in agriculture.
8. Write a short note on the aggregation of soil particles.
9. Give a comparative note on soil air and atmospheric air.
10. Define soil
11. Mineralization
12. Humus
13. Porosity of soil
14. Pedology
15. Cation Exchange capacity

### **Section B Each question carries 5 marks (Ceiling 35)**

16. Describe about the major physical properties of soil.
17. What do you mean by soil air? Which are the various factors which affect soil air?
18. Comment on soil survey and its importance?
19. Describe about the role of organic matter in plant nutrition.
20. Discuss the importance of humus in soil fertility?
21. Mention the importance of soil components in Agriculture.
22. Describe about Land Capability and its classification.
23. Types of soil

### **Section C Answer any two. Each Question carries 10 marks . (2x10=20)**

24. Briefly explain the different soil forming processes and the importance of soil in agriculture.
25. Describe about various micro biota present in the soil. Enlist the various beneficial and harmful roles of microorganisms present in the soil.
26. Describe about the various types of soils in Kerala.
27. What do you mean by Organic matter? Explain about the formation of organic matter in the soil with the help of Carbon Cycle?

**MODEL QUESTION PAPER- Second semester  
SDC2AG06 - Plantation Crops, Spices and Fruits**

**Time-2.5Hrs**

**Maximum-80 Marks**

**Section A Each question carries 2 marks (Ceiling 25)**

1. Motherpalm selection in coconut
2. Climate and soil in rubber cultivation.
3. Brown budding
4. Epicotyl grafting in cashew.
5. Top working in cashew.
6. Inflorescence of banana.
7. Major pests of mango
8. Major diseases of Banana
9. Floral biology of pepper.
10. Forking and mulching in cardamom.
11. Propagation of pineapple
12. Processed products in cashew
13. Varieties of pepper
14. Major pests of rubber
15. Major diseases of coconut

**Section B Each question carries 5 marks (Ceiling 35)**

16. Propagation methods in pepper.
17. Use of bioregulators in mango'
18. Pest, diseases and control measures in cardamom.
19. Mangosteen fruit cultivation aspects.
20. Industrial and export potential of pineapple.
21. Cultural practices for quality improvement in banana.
22. List out pest and diseases of major spices in Kerala. Suggest some control measures
- 23.. Write down the characteristics of tall and Dwarf varieties of coconut.

**Section C Answer any two. Each Question carries 10 marks . (2x10=20)**

24. Write elaborate note on propagation, production of quality plant materials, nursery management, planting and aftercare of coconut.
25. Propagation methods of Rubber
26. Write elaborately on mangosteen,. Rambutan and durian cultivation in Kerala.



**MODEL QUESTION PAPER**  
**SDC2AG07 – Fundamentals of Seed Technology**

**Time-2.5Hrs**

**Maximum-80 Marks**

**Section A Each question carries 2 marks (Ceiling 25)**

1. Define hybrid seed
2. Objectives of Seed act 1966
3. Write on different classes of seeds
4. Differentiate seed and grain
5. Characters of a good quality seed
6. Differentiate Breeder seed and Registered seed
7. Emasculation and dusting
8. Storage conditions for seed storage
9. Differentiate single cross hybrid and double cross hybrid
10. NSC
11. Off-Types
12. Certified seed
13. Tetrazolium test
14. Truthfully labeled seeds
15. Breeder seeds

**Section B Each question carries 5 marks (Ceiling 35)**

16. Explain the structure of a seed with a neat diagram
17. Write on the factors affecting seed quality
18. Dormancy of a seed and methods to break seed dormancy
19. Factors affecting seed longevity during storage
20. Seed Act
21. Public organizations involved in seed production
22. Government policy in seed production.
23. Seed certification

**Section C Answer any two. Each Question carries 10 marks . (2x10=20)**

21. Hybrid seed production in rice
22. Seed Certification and procedure of seed certification
23. Seed production in coconut
24. Write a brief essay on storage godowns and their maintenance

**Model Question Paper- Third Semester**  
**SDC3AG11- Plant Tissue Culture and Biotechnology**

**Time-2.5Hrs**

**Maximum-80 Marks**

**Section A Each question carries 2 marks (Ceiling 25)**

1. Plant tissue culture
2. MS Media
3. Autoclave
4. Cybridization
5. Ligases
6. pBR322
7. Somatic embryogenesis
8. Gene cloning
9. Agrobacterium mediate gene transfer
10. LAF
11. Expression vectors
12. Transformation
13. YAC
14. Gelling agents in tissue culture medium
15. Meristem culture

**Section B Each question carries 5 marks (Ceiling 35)**

16. Different sterilization methods in tissue culture
17. Different phases of micropropagation
18. Synthetic seed production
19. Differentiate between inoculation and incubation
20. Protoplast culture
21. Direct methods of gene transfer
22. Liquid and solid tissue culture media
23. Embryo culture

**Section C Answer any two. Each Question carries 10 marks . (2x10=20)**

21. Basic components in tissue culture medium
22. Application of Biotechnology
23. Recombinant DNA Technology
24. Briefly explain
  - a. Callus culture
  - b. Endosperm culture
  - c. Anther culture
  - d. Shoot tip culture

**SDC3AG12- Integrated Pest Management in Crops**

**Time-2.5Hrs**

**Maximum-80 Marks**

**Section A Each question carries 2 marks (Ceiling 25)**

1. Define pest. Write down the classification of pest
2. Principles of IPM
3. Define Host Plant Resistance
4. What is antixenosis?
5. Define physical method of pest control.
6. Define cultural method of pest control.
7. List out major pest of pepper.
8. Define plant quarantine.
9. What is phytosanitary certificate?
10. Define wettable powder.
11. List out major pest of brinjal.
12. Preparation of neem oil garlic emulsion.
13. *Bt* Cotton
14. IPM
15. Cultural method of pest control

**Section B Each question carries 5 marks (Ceiling 35)**

16. Describe Host Plant Resistance in IPM.
17. Describe mechanical method of control of pest.
18. Describe management practices of major pest of cardamom
19. Write elaborate note on Entomopathogenic bacteria.
20. Write note on Botanical insecticide.
21. Chemical control-importance, hazards and limitations
22. Write down the symptoms of damage and management practices of pests in banana
23. Write a note on Parasites and predators used in pest control.

**Section C      Answer any two. Each Question carries 10 marks . (2x10=20)**

24. Write elaborate note on Integrated Pest Management.
25. Write detailed note on distribution, host range, symptom of damage and management practices of major pest of rice.
26. Write elaborate note on insecticides, its classification, organic insecticides and botanical insecticides.
27. Write a detailed note on various Plant protection equipments, their classification and working principles.

**SDC3AG13- Fundamentals of Agricultural engineering**

**Time-2.5Hrs**

**Maximum-80 Marks**

**Section A Each question carries 2 marks (Ceiling 25)**

1. Define dryland farming
2. Sprinkler irrigation
3. Irrigated vs rainfed agriculture
4. Chain survey
5. Windbreaks
6. Dry farming
7. Methods of irrigation
8. *Ex situ* irrigation
9. List out the factors affecting water use efficiency
10. Role of water in soil
11. Gully Erosion
12. Rainwater harvesting
13. Surface irrigation
14. Rill erosion
15. Drip Irrigation

**Section B Each question carries 5 marks (Ceiling 35)**

16. What is soil erosion? What are the types of soil erosion?
17. How wind breaks and shelter belts help in soil conservation
18. Role of grasses and pastures in soil conservation
- 19.. Explain
  - a. Farm ponds
  - b. Check basin
  - c. Percolation ponds
- 20.. Cross staff survey
21. What is Surface irrigation? Give examples of crops irrigated through surface irrigation
22. Agronomic techniques to improve water use efficiency.
23. *In situ* water harvesting methods

**Section C      Answer any two. Each Question carries 10 marks . (2x10=20)**

24. Write on water harvesting methods
25. Explain the mechanical measures on soil conservation
- 26.. Write briefly on surveying, survey equipments and survey procedure.

**Model Question Paper- Fourth semester**

**SDC4AG17 - Protected cultivation of horticulture crops**

**Time-2.5Hrs**

**Maximum-80 Marks**

**Section A    Each question carries 2 marks (Ceiling 25)**

1. Greenhouse effect
2. Briefly explain packaging
3. Rules of watering in green houses
4. Advantages of Greenhouses
5. Even span type greenhouse
6. Shade nets
7. Benches in greenhouses
8. Advantages of containers in greenhouse production
9. Briefly explain different types of alternative containers
10. Green house ventilation
11. Write a short note on site selection for greenhouse construction
12. Briefly describe boom watering
13. Green house
14. Substrates for Protected cultivation
15. Fertigation

**Section B      Each question carries 5 marks (Ceiling 35)**

16. Greenhouse type based on covering materials
17. Types of containers

18. Fertigation in greenhouses
19. Substrates used for greenhouse cultivation
20. Grading
21. Explain different greenhouse types based on construction?
22. Special horticultural practices in green houses
23. Cooling systems in green houses

**Section C Answer any two. Each Question carries 10 marks . (2x10=20)**

24. Classification of greenhouses
25. Environmental control systems in greenhouses
26. Water and nutrient management in protected cultivation

**SDC4AG18- Weed management and fodder crop production**

**Time-2.5Hrs**

**Maximum-80 Marks**

**Section A Each question carries 2 marks (Ceiling 25)**

1. Conoweeder
2. Tillage
3. Hoeing
4. Mechanical Weeders
5. Crop rotation
6. Soil solarization
7. Explain Mulching
8. What is Stale seed bed
9. Merits of cultural methods
10. Write on Herbicidemixtures
11. Define weeds with examples
12. ABS
13. Major weeds of coconut plantation
14. Glyphosate
15. List out any four commonly used chemical herbicides used to control weeds

**Section B Each question carries 5 marks (Ceiling 35)**

16. Weeds affecting vegetable crops and their management
17. Advantages and disadvantages of use of herbicides
18. Biological methods of Weed control
19. Integrated weed management
20. Soil and Climatic requirements for sugarcane
21. Production technology of tobacco
22. Nursery management in rice

23. Mechanized farming in rice

**Section C** Answer any two. Each Question carries 10 marks . (2x10=20)

24. Production technology of Rice

25. Methods of weed control

26. Aquatic and problematic weeds and their control

**SDC4AG19- Livestock Farming**

**Time-2.5Hrs**

**Maximum-80 Marks**

**Section A** Each question carries 2 marks (Ceiling 25)

1. Write down the physio- chemical properties of milk
2. List out the systems of housing for cattle.
3. Holstein Friesian
4. Military Dairy farm
5. Anthrax
6. Principles of milking
7. Poultry Diseases
8. Average composition of cattle milk



9. Draw the diagram of Tail to Tail system of housing
10. List out the factors affecting selection of site for cattle shed.
11. Cross breeding
12. Give example for milch, Drought and Dual purpose cattle breeds
13. NDRI
14. List out viral diseases of Cattle
15. Define Milk

**Section B Each question carries 5 marks (Ceiling 35)**

16. Define operation flood programme
17. Write down the major diseases of lactating cow.
18. List out and write a note on breeds of duck
19. Write a note on clean milk production
20. Explain Foot and Mouth Disease (FMD)
21. Briefly explain housing of Goat.
22. Explain Dairy cooperatives structure and functions.
23. Write a note on adulterants in milk and sources of contamination.

**Section C Answer any two. Each Question carries 10 marks . (2x10=20)**

24. Write an elaborate note on care and management of new born calf and heifers
25. Write an essay on parasitic diseases of animals.
26. Write an essay on the role of livestock in national economy
27. Define Poultry farming - Breeds and general management practices.

**MODEL QUESTION PAPER**

**Fifth Semester**

**SDC5AG23 – E1- Environmental Microbiology and Biotechnology**

**Time-2.5Hrs**

**Maximum-80 Marks**

**Section A Each question carries 2 marks (Ceiling 25)**

1. Laminar air flow chamber
2. Autoclave
3. Spectrophotometer
4. SEM
5. Preservation of bacterial culture
6. Bacterial Conjugation
7. Growth curve
8. Wine
9. Viruses
10. Binary fission
11. Scope of Microbiology
12. Plasmids
13. Bacteriophage.
14. Vector
15. Restriction enzymes

**Section B Each question carries 5 marks (Ceiling 35)**

16. What is recombinant DNA technology?
17. What do you mean by gene mutation and what are the different types of gene mutation
18. What are antibiotics? Name any two antibiotics produced by microorganism?
19. Explain the role of microorganisms in carbon cycle
20. Bioremediation
21. Centrifugation
22. Need for preservation of bacterial cultures
23. Differentiate between Bright field microscopy and Dark field microscopy

**Section C Answer any two. Each Question carries 10 marks . (2x10=20)**

24. Write on
  - a. Structure of bacteria
  - b. Classifications of bacteria
  - c. Bacterial Recombination
25. Elaborate the role of microorganisms in the production of alcoholic beverages, aminoacids and antibiotics
26. Write an essay on Nitrogen fixation? Explain the role of microorganisms in nitrogen cycle

**SDC5AG23- E2- Government Policies and Programmes Related to Agriculture**

**Time-2.5Hrs**

**Maximum-80 Marks**

**Section A Each question carries 2 marks (Ceiling 25)**

1. Write down the objective of price policy
2. Food security
3. Types of watersheds
4. Non- institutional credit agencies
5. List out the functions of Zilla Paishad
6. Explain PPV and FR act
7. Describe the size pattern of operational holdings
8. Write a note on IAAP
9. What is Minimum wages act
10. Decentralized planning
11. NREGS
12. NABARD
13. TRYSEM
14. Agricultural Price commission
15. Lead bank Schemes

**Section B Each question carries 5 marks (Ceiling 35)**

16. Characteristic features of RRBs
17. Write a note on nationalisation of banks
18. Write a note on Fertilizer pricing policy

19. Agricultural policies regarding labour
20. Write down the need and scope for land reforms
21. Steps in preparation of project plan in agriculture
22. Write the different tiers of Panchayati Raj
23. Features of NABARD

**Section C      Answer any two. Each Question carries 10 marks . (2x10=20)**

24. Write an elaborate note on Five Year Plans in India
25. Write an essay on National Seeds Policy
26. Write an essay on the IADP, IAAP, IWDP
27. Give a detailed note on Kudumbasree, its features and functions

**SDC5AG24- E3- Food and Dairy Microbiology**

**Time-2.5Hrs**

**Maximum-80 Marks**

**Section A Each question carries 2 marks (Ceiling 25)**

1. Briefly explain the *E. coli* strains involved in foodborne illness
2. Differentiate between homofermenters and heterofermenters
3. Viable colony count in Microbial examination
4. Mucor and Rhizopus contamination in food
5. Explain Fecal *Streptococci* test
6. Food poisoning by bacteria
7. What is pasteurization
8. Food spoilage
9. What is Amoebiasis
10. Write on Probiotics and prebiotics
11. Kefir grains
12. Mastitis
13. SCP
14. HACCP
15. Fermented dairy

**Section B Each question carries 5 marks (Ceiling 35)**

16. Explain microbial examination of food
17. Factors influencing microbial growth in foods
18. Methods of preservation
19. Food borne infection
20. Dairy and Fermentative products
21. Write on Fermented pickles and Fermented Vegetables
22. Meat and Meat products
23. Microbiological analysis of milk

**Section C Answer any two. Each Question carries 10 marks . (2x10=20)**

24. Write on Food borne infections caused by bacteria, fungus, virus and protozoan
25. Write briefly on methods of preservation using physical and chemical methods
26. Microorganisms causing food contamination and the factors influencing microbial growth

## SDC5AG24- E4- Landscaping and Gardening

Time-2.5Hrs

Maximum-80 Marks

### Section A Each question carries 2 marks (Ceiling 25)

1. Describe Lawn
2. What is enrichment items?
3. Define terrariums and write the name of two suitable plants
4. What is commercial floriculture?
5. What is mowing?
6. What is shrubs and give two examples
7. What is flower arrangement?
8. Give two suitable examples for Hanging basket plants
9. What is turf plastering?
10. Define mobility?
11. What is carpet bedding?
12. List out any two type of Lawn grass along with its Botanical name.
13. Tray Garden
14. Pergolas
15. Mughal garden

### Section B Each question carries 5 marks (Ceiling 35)

16. Write a short notes about vertical gardening and its classification
17. Explain the following terms along with its examples
  - a) Hedge
  - b) Pergola
  - c) Topiary
  - d) Climbers
18. Enlist the different styles of garden and explain any two
19. Write the difference between Formal and Informal garden
20. Explain about various methods of Lawn establishment
21. Write about potting media preparation for indoor and aftercare.
22. Write the names of two suitable plants for the following terms
  - a) Terrariums
  - b) Indoor garden
  - c) Bonsai
  - d) Annuals

23. Write about the important point to be taken up during the land preparation for a garden

**Section C      Answer any two. Each Question carries 10 marks . (2x10=20)**

24. Explain about bonsai and different styles of bonsai with suitable diagrams

25. Describe the various principles of landscaping

26. Write an essay about scope and limitation of commercial floriculture in India

27. Enlist the various living and non living components of a garden and explain it

**SDC5AG25- Commercial Vegetable Production**

**Time-2.5Hrs**

**Maximum-80 Marks**

**Section A    Each question carries 2 marks (Ceiling 25)**

1. Briefly explain hydroponics.

2. Vegetable forcing

3. Classification of vegetables based on the parts used with examples

4. Name two PGR and their role

5. Riverbed cultivation

6. List the vegetables rich in vitamin A and Vitamin C

7. Write down a brief note on ivy gourd

8. Factors determining nursery location

9. List out Solanaceous crops and their varieties

10. Methods of sowing in nursery

11. Define thinning

12. Define mulching

13. Soilless culture

14. Botanical classification of ridge gourd

15. Long day plants

**Section B      Each question carries 5 marks (Ceiling 35)**

16. Draw the layout of kitchen garden

17. List and briefly describe the various protected structures used for vegetable cultivation

18. Describe botanical classification of vegetables

19. Explain the nutritive value of vegetables

20. Onion and Garlic - scientific name, family, seed rate, season, varieties and important cultural operations

21. Briefly explain types of vegetable farming

22. List out four cucurbitaceous crops with examples

23. List put two cool season crops, their scientific name, family, seed rate and varieties

**Section C      Answer any two. Each Question carries 10 marks . (2x10=20)**

24. Write an essay on the types of vegetable farming

25. Describe the Production Technology of Okra

26. Describe the Production Technology of Bitter gourd

27. Write an essay on the role of growth regulators in vegetable production and methods of application.



## SDC5AG26- Agriculture Enterprises

**Time- 2hrs**

**Marks-60**

**Section A      Each question carries 2 marks (Ceiling 20)**

1. Bee space
2. Brushing
3. Bee pasturage
4. Reeling
5. Sericulture
6. Pinching in chrysanthemum
7. Pulsing
8. Bending in roses
9. Apiary
10. Give two examples each for loose flower and cut flower
11. Worker bees
12. Mounting in sericulture

**Section B      Each question carries 5 marks (Ceiling 30)**

13. Methods of communication in honey bees
14. Explain production technology of Jasmine
15. Cultivation practices of mulberry
16. Seasonal management of honey bees
17. Processing of cocoons
18. Special cultural practices to improve the quality of roses
19. Explain different value added products of mushroom

**Section C      Answer any one questions out of two (1 x 10 = 10)**

20. Explain in detail about different bee keeping equipment
21. Write an essay on different enemies and diseases of silk worm

## SDC5AG27- Fundamentals of Organic Farming

Time-2.5Hrs

Maximum-80 Marks

### Section A Each question carries 2 marks (Ceiling 25)

1. Biological weed control
2. Mechanical weed control
3. Bacterial bio-pesticides
4. Crop residue burning
5. NPOP
6. Need for certification in organic farming
7. Sustainable agriculture and social sustainability
8. GAP certification
9. Briefly explain crop rotation
10. Describe composting and enlist its different types
11. Relay inter cropping and strip inter cropping
12. Briefly describe permaculture
13. Define composting
14. Sex pheromones
15. Fungal Biopesticide

### Section B Each question carries 5 marks (Ceiling 30)

- 16.. Need for Sustainable agriculture
- 17.. Briefly describe
  - a. Row intercropping
  - b. Mixed inter cropping
  - c. Relay intercropping
  - d. Strip intercropping
- 18.. Briefly explain
  - a. Sustainable utilization of land resources
  - b. Sustainable utilization of water resources
19. Briefly describe the soil health management in GAP
20. Discuss the challenges in marketing and export of organic products
21. Briefly describe the operational structure of NPOP
22. Briefly describe biological weed control
23. Briefly describe:
  - a. Allelopathy
  - b. Bio-rationals
  - c. Pheromones

### Section C Answer any two questions (2 x 10 =20)

24. Write an essay on Good Agricultural Practices
25. Write an essay on tools and practices of organic farming
26. Write an essay on marketing and export potential of organic products
27. Write an essay on organic weed management and organic disease and pest management