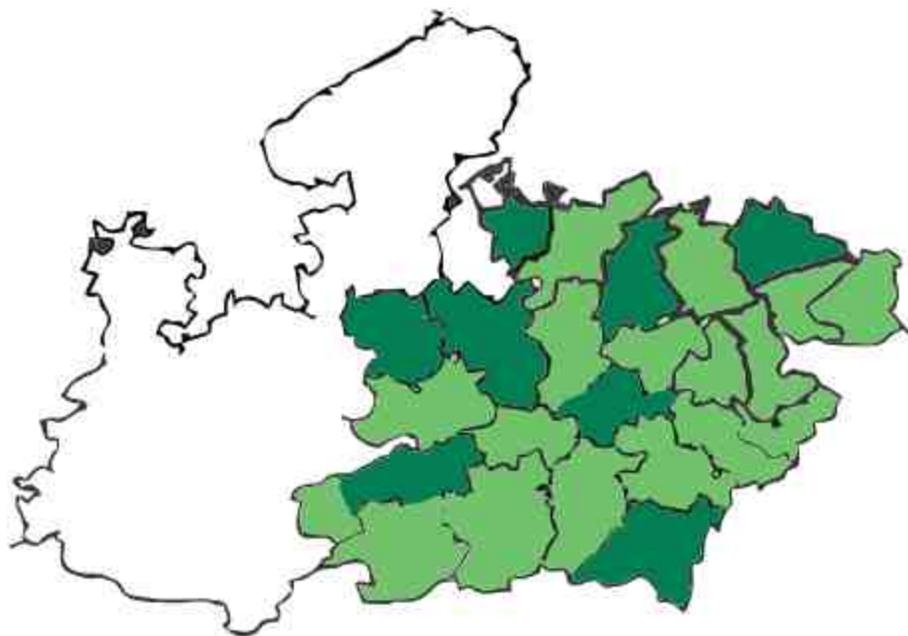


JNKRW

**Course Curriculum and Syllabus**  
*for*  
**Bachelor Degree Program**  
*In*  
**Agriculture**

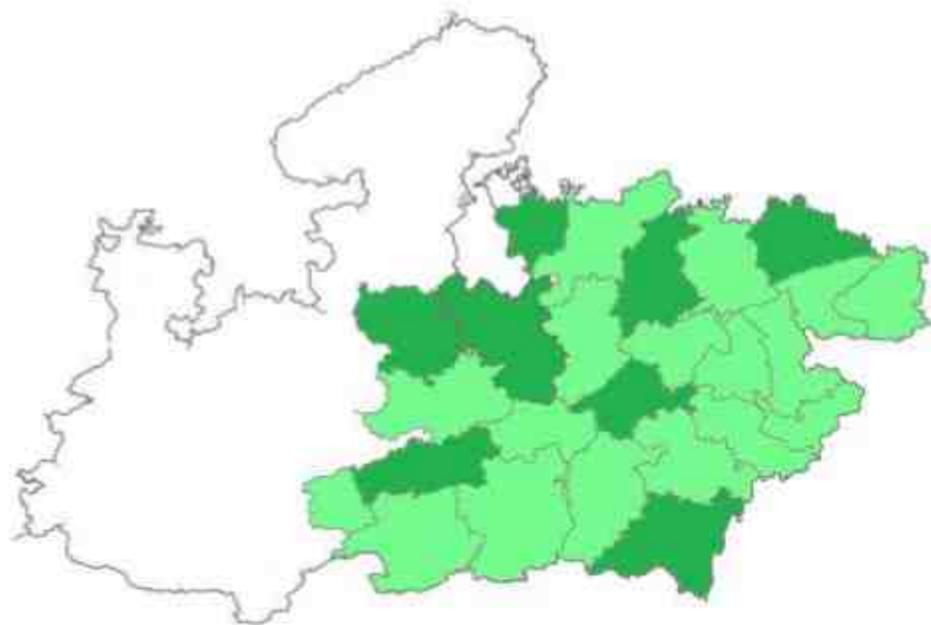
*(After the Implementation of the  
VI Deans' Committee Report)*



**Faculty of Agriculture**  
**Jawaharlal Nehru Krishi Vishwa Vidyalaya**  
**Jabalpur 482 004 MP**  
**2025**

**Course Curriculum and Syllabus**  
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**Jabalpur 482 004 MP**  
**2025**

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## *Prologue*

Jawaharlal Nehru Krishi Vishwa Vidyalaya, Jabalpur stands as a beacon of agrotechnology and human resource development in Central India. With a steadfast commitment to advancing agricultural education and allied sciences, the university cultivates a skilled workforce ready to meet the challenges of the future. The Faculty of Agriculture, proudly offers the B.Sc. (Hons) Agriculture degree program across eight constituent colleges.

In alignment with progressive academic reforms, the University has adopted the recommendations of the VI Deans' Committee Report of ICAR, as per notification number Acs/II/Q-1(IV)/2024/20269, effective from the academic session 2024–2025. The curriculum restructuring followed a rigorous evaluation process, beginning at the Bachelor Degree Class Level Committee on Teaching, progressing through the College Level Committee on Teaching, and subsequently reviewed by the Department Level Committee on Teaching. These proposed modifications were scrutinized at the 30th Meeting of the Board of Studies on November 12, 2024, before being presented to the 281st meeting of the Academic Council for final deliberation. After extensive discussion, the Council approved all additions while rejecting deletions, culminating in the official Notification Acd/II/Q-1(IV)/2025/845, issued on June 3, 2025.

This meticulously curated course curriculum serves as a guiding framework for educators and students, ensuring a seamless and proficient learning experience within the prescribed timeframe. The unwavering dedication of Deans of the constituent Colleges and Professor and Heads of the Departments in shaping these academic enhancements is deeply commendable. Their collaborative efforts have been instrumental in crafting a syllabus that reflects excellence and innovation.

The committee extends its sincere gratitude to the Vice-Chancellor, Directors, Deans and all stakeholders for their invaluable support in accomplishing this endeavor. Special recognition is due to the Professor and Head of Departments, alongside the members of the Board of Studies and Academic Council, whose expertise and commitment have been pivotal in this achievement.

With this document, we aspire to establish a uniformly high academic standard in the Bachelor Degree program, reinforcing the university's legacy of distinction in agricultural education.



Dhirendra Khare

Date: June 9, 2025

Place: Jabalpur



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## 1 Semester Wise Distribution of Courses

Sr	Course Title	Credit Hrs				Total
		T	Th	P	G/NG	
<b>I Semester</b>						
1.	Communication Skills	2	1	1	G	<b>23</b>
2.	Farming based Livelihood Systems	3	2	1	G	
3.	Fundamentals of Extension Education	3	2	1	G	
4.	Fundamentals of Agronomy	4	3	1	G	
5.	Fundamentals of Soil Science	3	2	1	G	
6.	Fundamentals of Horticulture	3	2	1	G	
7.	National Service Scheme(NSS-I)/ National Cadet Corps (NCC-I)	1	0	1	G	
8.	Skill Enhancement Course-I	2	0	2	G	
9.	Skill Enhancement Course-II	2	0	2	G	
	<b>Total</b>	<b>23</b>	<b>12</b>	<b>11</b>	<b>G</b>	
10.	Induction cum Foundation course ( <i>Deekshaarambh</i> )	2	0	2	NG	
11.	Introductory Mathematics (need based)	1	1	0	NG	
<b>II Semester</b>						
12.	Personality Development	2	1	1	G	<b>21</b>
13.	Environmental Studies and Disaster Management	3	2	1	G	
14.	Soil Fertility Management	3	2	1	G	
15.	Fundamentals of Entomology	3	2	1	G	
16.	Livestock and Poultry Management	2	1	1	G	
17.	Fundamentals of Plant Pathology	3	2	1	G	
18.	NCC-II/NSS-II	1	0	1	G	
19.	Skill Enhancement Course-III	2	0	2	G	
20.	Skill Enhancement Course-IV	2	0	2	G	
	<b>Total</b>	<b>21</b>	<b>10</b>	<b>11</b>		
<b>III Semester</b>						
21.	Principles of Agricultural Economics and Farm Management	2	2	0	G	<b>21</b>
22.	Physical Education, First Aid and Yoga Practices	2	0	2	G	
23.	Principles of Genetics	3	2	1	G	
24.	Crop Production Technology-I ( <i>Kharif</i> crops)	3	2	1	G	
25.	Production Technology of Vegetables and Spices	3	2	1	G	
26.	Rural Sociology and Educational Psychology	2	2	0	G	
27.	Fundamentals of Nematology	2	1	1	G	
28.	Principles and Practices of Natural Farming	2	1	1	G	
29.	Skill Enhancement Course-V	2	0	2	G	
	<b>Total</b>	<b>21</b>	<b>12</b>	<b>9</b>		
<b>IV Semester</b>						
30.	Entrepreneurship Development and Business Communication	3	2	1	G	<b>21</b>
31.	Production Technology of Fruit and Plantation Crops	2	1	1	G	
32.	Diseases of Field & Horticultural Crops of Rabi and their Management	2	1	1	G	
33.	Crop Production Technology-II (Rabi Crops)	3	2	1	G	
34.	Farm Machinery and Power	2	1	1	G	
35.	Water Management	2	1	1	G	
36.	Problematic Soils and their Management	2	1	1	G	
37.	Basics of Plant Breeding	3	2	1	G	
38.	Skill Enhancement Course-VI	2	0	2	G	

<b>Total</b>		<b>21</b>	<b>11</b>	<b>10</b>	<b>G</b>	
<b>V Semester</b>						
39.	Agricultural Marketing and Trade	3	2	1	G	
40.	Introduction to Agro-meteorology	2	1	1	G	
41.	Fundamentals of Crop Physiology	3	2	1	G	
42.	Pest Management of Kharif Crops and Stored Grains	2	1	1	G	
43.	Diseases of Field & Horticultural Crops of Kharif & their Management	2	1	1	G	
44.	Crop Improvement - I	2	1	1	G	
45.	Weed Management	2	1	1	G	
46.	Ornamental Crops, MAPs and Landscaping	2	1	1	G	
47.	Introductory Agro forestry	2	1	1	G	
48.	Agricultural Informatics and Artificial Intelligence	3	2	1	G	
	<b>Total</b>	<b>23</b>	<b>13</b>	<b>10</b>		
<b>VI Semester</b>						
49.	Fundamentals of Agri Biotechnology	3	2	1	G	
50.	Basic and Applied Agril. Statistics	3	2	1	G	
51.	Crop Improvement - II	2	1	1	G	
52.	Pest Management in <i>Rabi</i> Crops and Stored Grains	2	1	1	G	
53.	Renewable Energy in Agriculture and Allied Sector	2	1	1	G	
54.	Dryland Agriculture/ Rainfed Agriculture & Watershed Management	2	1	1	G	
55.	Essentials of Plant Biochemistry	3	2	1	G	
56.	Agricultural Microbiology and Phyto -remediation	2	1	1	G	
57.	Agricultural Finance and Cooperation	2	1	1	G	
58.	Fundamentals of Seed Science and Technology	2	1	1	G	
	<b>Total</b>	<b>23</b>	<b>13</b>	<b>10</b>		<b>23</b>
<b>VII Semester</b>						
<i>Opt any five proposed Elective Course</i>						
	<b>Proposed course</b>	<b>Department</b>				
59.	Agri-Business Management	Agricultural Economics and FM	4	3	1	G
60.	Post harvest management of field and horticultural crops and Value addition	Agricultural Engineering	4	3	1	G
61.	Principles and Practices of Organic Farming and Conservation Agriculture	Agronomy	4	3	1	G
62.	Micro propagation technologies	Biotechnology	4	3	1	G
63.	Plant Protection Equipment, Pesticides and their Application Technique	Entomology	4	3	1	G
64.	Agricultural Journalism	Extension Education	4	3	1	G
65.	Food Safety and Standards	Food Science and Technology	4	3	1	G
66.	Principles of Food Science and Technology	Food Science and Technology				G
67.	Commercial Landscape	Horticulture	4	3	1	G
68.	Commercial Seed Production	Genetics and Plant Breeding				G
69.	Bio-pesticides and Bio-fertilizers	Plant Pathology	4	3	1	G
70.	Fundamentals of Botany	Plant Physiology	4	3	1	G
71.	Management of Natural Resources	Soil Science and AC	4	3	1	G
	<b>Total</b>		<b>20</b>	<b>15</b>	<b>5</b>	<b>20</b>

VIII Semester						
72.	Student	READY				
73.	RAWE		10	0	10	G
74.	Industrial Attachment / Experiential Learning		10	0	10	G
	<b>Total</b>		<b>20</b>	<b>0</b>	<b>20</b>	
75.	<b>Online courses</b> <i>In any semester preferably in 3 and 4 Year</i>		<b>10</b>	<b>0</b>	<b>10</b>	NG
	<b>Total</b>		<b>10</b>	<b>0</b>	<b>10</b>	
<b>Summary</b>						
			Core		120	
			Elective		20	
			SEC		12	
			Student READY		20	
			<b>Total</b>		<b>172</b>	
			Deekshambh		02	
			Remedial		01	
			Online		10	
			<b>Total</b>		<b>13</b>	
			<b>Grand Total</b>		<b>185</b>	

## 2 Department/section wise breakup of courses

Sr	Course title	Credit Hs	Total
<b>A</b>	<b>Gradiual Courses</b>		
<b>Agricultural Economics</b>			
1.	Principles of Agricultural Economics and Farm Management	2 (2+0)	9(6+3)
2.	Entrepreneurship Development and Business Communication	3 (2+1)	
3.	Agricultural Marketing and Trade	2 (1+1)	
4.	Agricultural Finance and Cooperation	2 (1+1)	
<b>Agricultural Engineering</b>			
1.	Farm Machinery and Power	2(1+1)	6(3+3)
2.	Renewable energy in Agriculture and Allied Sector	2(1+1)	
3.	Water Management	2 (1+1)	
<b>Agronomy</b>			
1	Fundamentals of Agronomy	4 (3+1)	21(13+8)
2	Farming based Livelihood Systems	3 (2+1)	
3	Crop Production Technology-I (Kharif Crops)	3 (2+1)	
4	Crop Production Technology-II (Rabi Crops)	3(2+1)	
5	Weed Management	2(1+1)	
6	Dryland Agriculture/ Rainfed Agriculture and Watershed Management	2(1+1)	
7	Principles and Practices of Natural Farming	2(1+1)	
8	Introduction to Agro-meteorology	2(1+1)	
<b>Bio-technology</b>			
1.	Fundamentals of Agri Biotechnology	3(2+1)	3(2+1)
<b>Entomology</b>			
1.	Fundamentals of Entomology	3(2+1)	7(4+3)
2.	Pest Management in Kharif Crops and Stored Grains	2(1+1)	
3.	Pest Management in Rabi Crops and Stored Grains	2(1+1)	
<b>Extension Education</b>			
1.	Rural Sociology and Educational Psychology	2(2+0)	8(5+3)
2.	Fundamentals of Extension Education	3(2+1)	
3.	Communication Skills	2(1+1)	
4.	Personality Development	2(1+1)	
<b>Food Science and Technology</b>			
1.	Essentials of Plant Biochemistry	3(2+1)	3(2+1)
<b>Forestry</b>			
1	Introductory Agro-forestry	2 (1+1)	2(1+1)
<b>Genetics and Plant Breeding</b>			
1.	Principles of Genetics	3(2+1)	12(7+5)
2.	Basics of Plant Breeding	3(2+1)	
3.	Crop Improvement - I	2(1+1)	
4.	Crop Improvement - II	2(1+1)	
5.	Fundamentals of Seed Science and Technology	2(1+1)	
<b>Horticulture</b>			
1.	Fundamentals of Horticulture	3(2+1)	10(6+4)
2.	Production Technology of Fruit and Plantation Crops	2(1+1)	
3.	Production Technology of Vegetables and Spices	3(2+1)	
4.	Ornamental Crops, MAPs and Landscaping	2(1+1)	

Sr	Course title	Credit Hs	Total
<b>Mathematics and Statistics</b>			
1.	Agricultural Informatics and Artificial Intelligence	3(2+1)	<b>6(4+2)</b>
2.	Basic and Applied Agricultural Statistics	3(2+1)	
3.	Introductory Mathematics (NG)	1(1+0)	
<b>Plant Pathology</b>			
1.	Fundamentals of Plant Pathology	3(2+1)	<b>11(6+5)</b>
2.	Diseases of Field and Horticultural Crops of Kharif and their Management	2(1+1)	
3.	Diseases of Field and Horticultural Crops of Rabi and their Management	2(1+1)	
4.	Fundamentals of Nematology	2(1+1)	
5.	Agricultural Microbiology and Phyto-remediation	2(1+1)	
<b>Plant Physiology</b>			
1.	Fundamentals of Crop Physiology	3(2+1)	<b>6 (4+2)</b>
2.	Environmental Studies and Disaster Management	3(2+1)	
<b>Soil Science</b>			
1	Fundamentals of Soil Science	3(2+1)	<b>8(5+3)</b>
2	Soil Fertility Management	3(2+1)	
3	Problematic Soils and their Management	2(1+1)	
<b>Veterinary Science and Animal Husbandry</b>			
1.	Livestock and Poultry Management	2(1+1)	<b>2(1+1)</b>
<b>Other</b>			
1.	NCC/NSS	1(0+1)	<b>4(0+4)</b>
2.	NCC/NSS	1(0+1)	
3.	Physical Education, First Aid and Yoga Practices	2(0+2)	
<b>STUDENT READY</b>			
1	RAWE	10(0+10)	<b>20(0+20)</b>
2	Industrial Attachment / Experiential Learning	10(0+10)	
<b>SEC and Elective</b>			
1	Skill Enhancement Courses	12(0+12)	<b>12(0+12)</b>
2	Elective	20(15+4)	<b>20 (15+5)</b>

<b>B</b>	<b>Non Gradual Courses</b>		
1	Online	10(0+10)	<b>10(0+10)</b>
2	Introductory Mathematics (Included in the Department of Mathematics and Statistics)	1(1+0)	<b>1(1+0)</b>
3	Deekshaarambh	2(0+2)	<b>2(0+2)</b>

### **3 First Year Semester I**

<b>S.No.</b>	<b>Course</b>	<b>Credit hours</b>
1.	Induction-cum-Foundation Course ( <i>Deeksha Arambh</i> )	2 weeks (NG)
2.	Communication Skills	2(1+1)
3.	Farming Based Livelihood Systems	3 (2+1)
4.	Fundamental of Extension Education	3 (2+1)
5.	Fundamentals of Agronomy	4(3+1)
6.	Fundamentals of Soil Science	3(2+1)
7.	Fundamentals of Horticulture	3(2+1)
8.	NCC/ NSS	1(0+1)
9.	Introductory Mathematics (need based)	1(1+0) non-grdaial
10.	Skill Enhancement Course-I	2(0+2)
11.	Skill Enhancement Course-II	2(0+2)
<b>Total</b>		<b>23(12+11)+3 NG</b>

**First year I Semester  
Induction cum Foundation Course  
(Deeksharambh)  
Non gradial Credit Hours: 2(0+2)**

**Objectives:**

- Help for cultural Integration of students from different backgrounds,
- Know about the operational framework of academic process in the University/College/Institute Instilling life and social skills,
- Social Awareness, Ethics and Values, Team Work, Leadership, Creativity, etc.
- Identify the traditional values and indigenous cultures along with diverse potentialities both in indigenous and developed scenario.
- Identify strength and weakness of the students in different core areas of the discipline.

The details of activities will be decided by the parent universities. The structure shall include, but not restricted to

- Discussions on operational framework of academic process in the University, as well as interactions with academic & research managers of the University
- Interaction with alumni, business leaders, perspective employers, outstanding achievers in related fields, and people with inspiring life experiences
- Group activities to identify the strength and weakness of students (with expert advice for their improvement) as well as to create a platform for students to learn from each other's life experiences
- Activities to enhance cultural Integration of students from different backgrounds.
- Field visits to related fields/ establishments
- Sessions on personality development (instilling life and social skills, social awareness, ethics and values, team work, leadership, etc.) and communication skills.

*No examination will be organized for this course*

## Department of Extension

### First year I Semester Communication Skills Credit hrs 2 (1+1)

#### Objectives:

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

#### Theory

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

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

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

#### Practical

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

#### Suggested readings

- Allport, GW, 1937, *Personality: A Psychological Interpretation*. Holt, New York
- Brown Michele and Gyles Brandreth, 1994, *How to Interview and be Interviewed*. Sheldon Press, London
- Carnegie Dale, 1997, *The Quick and Easy Way to Effective Speaking*. Pocket Books, New York
- Dhama OP and Bhatnagar OP. 2019. *Education and Communication for development*. (Second Edition) Oxford and IBH Publicity Co., New Delhi. 734p ISBN-9788120400306
- Francis Peter S J, 2012, *Soft Skills and Professional Communication*. Tata McGraw Hill, New Delhi
- Kapoor S. 2011. *Personality Development and Communication Skills*. New Delhi:Vikas Pvt. Ltd.
- Kumar S and Pushpa Lata, 2011, *Communication Skills*. Oxford University Press
- Neuliep James W, 2003, *Intercultural Communication A Contextual Approach*. Houghton Mifflin Co Boston



**Department of Agronomy**

**First Year I Semester  
Farming based Livelihood Systems  
Credit hrs 3 (2+1)**

**Objectives**

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

**Theory**

Status of agriculture in India and different states, Income of farmers and rural people in India, Livelihood-Definition, concept and livelihood pattern in urban & rural areas, Different indicators to study livelihood systems. Agricultural livelihood systems (ALS) : Meaning, approach, approaches and framework , Definition of farming systems and farming based livelihood systems Prevalent Farming systems in India contributing to livelihood. Types of traditional & modern farming systems. *Efficient cropping system and their evaluation*, Components of farming system/ farming based livelihood systems- Crops and cropping systems, Livestock, (Dairy, Piggery, Goatry, Poultry, Duckry etc.), Horticultural crops, Agro-forestry systems, Aqua culture Duck/Poultry cum Fish, Dairy cum Fish, Piggery cum Fish etc., Small, medium and large enterprises including value chains and secondary enterprises as livelihood components for farmers, Factors affecting integration of various enterprises of farming for livelihood. Feasibility of different farming systems for different agro-climatic zones, Commercial farming based livelihood models by NABARD, ICAR and other organizations across the country, Case studies on different livelihood enterprises associated with the farming. Risk & success factors in farming based livelihood systems, Schemes & programmes by Central & State Government, Public & Private organizations involved in promotion of farming based livelihood opportunities. Role of farming based livelihood enterprises in 21<sup>st</sup> Century in view of circular economy, green economy, climate change, digitalization & changing life style.

**Practical**

Survey of farming systems and agricultural based livelihood enterprises, Study of components of important farming based livelihood models/ systems in different agro-climatic zones, Study of production and profitability of crop based, livestock based, processing based and integrated farming based livelihood models, Field visit of innovative farming system models. Visit of Agri-based enterprises & their functional aspects for integration of production, processing & distribution sectors and Study of agri-enterprises involved in industry and service sectors (Value Chain Models), Learning about concept of project formulation on farming based livelihood systems along with cost & profit analysis, Case study of Start-Ups in agri-sectors.

**Suggested Readings**

- Agarwal A and Narain S (1989) Towards Green Villages: A strategy for Environmentally, Sound and Participatory Rural Development; Environment and Urbanization 4(1): 53- 64, publ., Center for Science and Environment, New Delhi, India; ISBN- 0956-2478
- Ashley C and Carney D (1999) Sustainable Livelihoods: Lessons from Early Experience 55p; publ., Department for International Development: London, UK; ISBN-9780850034196
- Carloni A (2001) Global Farming Systems Study: Challenges and Priorities to 2030 Regional Analysis:

- Sub-Saharan Africa, Consultation Document, 38p, publ., FAO, Rome, Italy
- Dixon J and Gulliver with D Gibbon (2001) Farming Systems and Poverty: Improving Farmers' Livelihoods in a Changing World 412p. publ., FAO & World Bank, Rome, Italy, Washington, DC, USA; ISBN-9789251046272
- Evenson RE (2000) Agricultural Productivity and Production of Food and Agriculture, publ., FAO, Rome, Italy
- Panda S.C. (2022). Cropping and Farming System 472p, Publ., Agrobios, ISBN No. 9788177542059
- Panwar AS, N Ravisankar, AK Prusty, M Shamim, Raghuveer Singh, S Bhaskar, SK Malik, RK Tomar, A Arunachalam and K Alagusundaram. (2019). Integrated farming system for agricultural diversification, enhanced income and employment, Indian Council of Agricultural Research, New Delhi
- Reddy SR (2016) Farming System and Sustainable Agriculture 225p, publ., Kalyani Publishers, New Delhi.; ISBN-10 9327274466
- Singh, J.P., Ravisankar, N., Prusty, A.K., Sikka, A.K. and Gangwar, B (2016). Region Specific Synthesized Integrated Farming System Models for Improved Production, Profitability and Nutrition (Series 1). IIFSR Bulletin No. 2016-1, AICRP on Integrated Farming Systems, ICAR-Indian Institute of Farming Systems Research, Modipuram, Meerut, pp. 1-88.
- Walia SS and US Walia (2020) Farming System and Sustainable Agriculture 280p, publ., Scientific Publishers, Jodhpur, Rajasthan.; ISBN-9789388812900

**Department of Extension Education**

**First year I Semester  
Fundamentals of Extension Education  
Credit Hours: 3 (2+1)**

**Objectives**

State the importance of extension education in agriculture.  
Familiarize with the different types of agriculture and rural development programs launched by Government of India.  
Classify the types of extension teaching methods.  
Elaborate the importance and different models of communication.

**Theory**

Education: Meaning, definition & Types; Extension Education- meaning, definition, scope and process; objectives and principles of Extension Education; Extension Program planning- Meaning, Process, Principles and Steps in Program Development. Extension systems in India: extension efforts in pre- independence era (Sriniketan, Marthandam, Firka Development Scheme, Gurgaon Experiment, etc.) and post-independence era (Etawah Pilot Project, Nilokheri Experiment, etc.); Reorganised Extension System (T&V system) various extension/ agriculture development programmes launched by ICAR/ Govt. of India (IADP, IAAP, HYVP, KVK, IVLP, ORP, ND, NATP, NAIP, etc.). Social Justice and poverty alleviation program- ITDA, IRDP/SGSY/NRLM. Women Development Program-RMK, MSY etc. New trends in agriculture extension: privatization extension, cyber extension/ e-extension, market-led extension, farmer-led extension, expert systems, etc.

Rural Development: concept, meaning, definition; various rural development programs launched by Govt. of India. Community Dev.-meaning, definition, concept & principles, Philosophy of C.D. Rural Leadership: concept and definition, types of leaders in rural context; Method of identification of Rural Leader. Extension administration: meaning and concept, principles and functions. Monitoring and evaluation: concept and definition, monitoring and evaluation of extension programs; transfer of technology: concept and models, capacity building of extension personnel; extension teaching methods: meaning, classification, individual, group and mass contact methods, ICT Applications in TOT (New and Social Media), media mix strategies; communication: meaning and definition; Principles and Functions of Communication, models and barriers to communication. Agriculture journalism; diffusion and adoption of innovation: concept and meaning, process and stages of adoption, adopter categories.

**Practical**

To get acquainted with university extension system. Group discussion--exercise; Identification of rural leaders in village situation; preparation and use of AV aids, preparation of extension literature (leaflet, booklet, folder, pamphlet news stories and success stories); Presentation skills exercise; micro teaching exercise; A visit to village to understand the problems being encountered by the villagers/ farmers; to study organization and functioning of DRDA/PRI and other development departments at district level; visit to NGO/FO/FPO and learning from their experience in rural development; understanding PRA techniques and their application in village development planning; exposure to mass media: visit to community radio and television studio for understanding the process of programme production; script

writing, writing for print and electronic media, developing script for radio and television.

**Suggested readings:**

- Dhama OP and Bhatnagar OP. 2019. Education and Communication for development. (Second Edition) Oxford and IBH Publicity Co., New Delhi. 734p ISBN-9788120400306
- Mondal S and Ray, GL. 2012. Text Book on Rural Development, Entrepreneurship and Communication Skills, Kalyani Publications, New Delhi. 275p. ISBN-10: 9327220692 ISBN-13: 978-9327220698
- Mondal S. 2015. Agricultural Extension. Kalyani Publishers, New Delhi. 336p ISBN-978-93-272-5048-0
- Mondal S. 2019. Fundamentals of Agricultural Extension Education. Kalyani Publishers, New Delhi. 400p ISBN: 978-93-272-8203-0
- Ray GL 2008. Extension Communication and Management. (Seventh revised edition). Kalyani publishers. 407p. ISBN 9788127245160.
- Singh D and Singh BK. 2012. Agricultural Extension and Rural Development. Narendra Publishing House, Delhi. 278p ISBN 10: 93980428375 ISBN 13: 9789380428376
- Singh R. 2015. Extension Education. Kalyani Publishers, New Delhi. 392p ISBN-978-93-272-5747-2
- Singh, AK, Lakhan Singh, R and Roy Burman. 2021. Dimensions of Agricultural Extension. Rama Publishing House. 388p ISBN-9789384479671
- Supe SV. 2019. An Introduction to Extension Education. (Second **Edition**) Oxford & IBC Published Co., New Delhi. 166p ISBN-13:9788120411784

**Department of Agronomy**

**First Year I Semester  
Fundamentals of Agronomy  
Credit hrs 4 (3 +1)**

**Objectives:**

To impart the basic and fundamental knowledge of Agronomy

**Theory:**

Agronomy and its scope: Definition, Meaning and scope of Agronomy; Art, science and business of crop production, relation of Agronomy with other disciplines of Agricultural Science, Fields crops and classification, importance, ecology and ecosystem, Seeds and sowing: Definitions of crops, variety and seed. Factors affecting crop stands establishment: good quality seed, proper tillage, time of sowing seed rate, depth and method of sowing: broadcasting, drilling, dibbling, transplanting etc.

Tillage and tillth: Definition, objectives, types, advantages and disadvantages of tillage including conservation tillage. Crop density and geometry: plant geometry and planting geometry, its effect on growth, yield

Crop nutrition: Definition of essential nutrients, criteria of essentiality, functional elements, classification of essential nutrients, role of macro and micro nutrients. Nutrient absorption, active and passive absorption of nutrients, forms of plant nutrients absorbed by plants, Combined /un-combined forms

Manures and fertilizers, nutrient use efficiency: Sources of nutrients: Inorganic (fertilizers), organic (manures) and bio-fertilizers; their classification and characteristics, method of preparation and role of organic manures in crop production

Integrated Nutrient Management: Meaning, different approaches and advantages of INM

Green manure- role in crop production: Definition, objectives types of green manuring, desirable characteristics, advantages and limitations of green manuring

Water management: Water resources of the world, India and the state; Soil Moisture Constants gravitational water, capillary water, hygroscopic water, Soil moisture constants, Concept of water availability to plants, soil- plant-water relationship, crop water requirement, water use efficiency, Methods of irrigation : Scheduling of irrigation, different approaches of scheduling irrigation

Weeds: Definition, Importance and basics of classification of weeds and their control Cropping systems: Factors affecting cropping systems, major cropping patterns and systems in the country. Sustainable crop production: Definition, importance and practices, natural resources and conservation pollution and pollutants, Allelopathy: Meaning and importance in crop production ,Growth and development of crops: Definition, Meaning and factors affecting growth and development

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

Practice on time and method of application of manures and fertilizers, Measurement of soil moisture by gravimetric and volumetric method and bulk density, Determination of field capacity, Determination of gross and net irrigation requirement, Determination of infiltration rate

**Suggested readings:**

- Rao VS (2000) Principles of Weed Science 620 p, publ., Oxford and IBH Publishing Co. Ltd. New Delhi, ISBN-978-1578080694.
- Reddy SR (2014) Principle of Crop Production 495p, publ., Kalyani Publisher, Ludhiana, ISBN-978-9327218589
- Reddy Yellamanda T and Shankar Reddy GH (2023) Principles of Agronomy 650 p, publ., Kalyani Publishers Ludhiana, ISBN-9789327269154
- William L Donn (1975) Meteorology 518p, publ., McGraw-Hill Book Co. New York, ISBN No. 978-0070175990
- Yawalkar KS, Bokde S and Agarwal JP (2016) Manures and Fertilizers 366p, publ., Agricultural Horticultural Publishing House, Nagpur, ISBN-8190039229

**Department of Soil Science and Agricultural Chemistry**

**First Year I Semester  
Fundamentals of Soil Science  
Credit hrs 3(2+1)**

**Objective:**

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

**Theory :**

Soil: Pedological and edaphological concepts. Rocks and minerals, weathering, Silicate clays: constitution and properties, sources of charge, ion exchange, cation and anion exchange capacity and base saturation (after buffering capacity), Soil formation, Soil organic matter, Pedogenic processes, Soil colloids; inorganic and organic, Properties of soil colloids and Ion exchange in soils, Soil profile, soil texture, soil structure, soil porosity, soil colour, soil organism . Bulk density and particle density, soil consistency, soil temperature, soil air, soil water. Soil reaction and buffering capacity. Soil taxonomy, keys to soil orders. Soils of India.

**Practical :**

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

**Suggested readings:**

- Buckman, Harry O. and Brady, Nyle C. (1960) The nature and properties of soils. *Soil Science* 90(3): 212p © Williams & Wilkins 1960
- Das Dilip Kumar (2022) Introductory Soil Science, Kalyani Publishers 879p ISBN-10 9789327257540
- John L. Havlin, Samuel L. Tisdale, Werner L. Nelson, James D. Beaton (2013) Soil Fertility and Fertilizers, Publ., Pearson Education, 528p ISBN:9780133055696, 0133055698
- Singh S. S. (2004) Soil Fertility and Nutrient Management, Kalyani Publishers 250p ISBN-10 8127269980

**Department of Horticulture**

**First Year I Semester  
Fundamentals of Horticulture  
Credit hrs 3 (2+1)**

**Objectives:**

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

**Theory:**

Horticulture-its different branches, importance & scope, Horticulture & botanical classification, soil and climate for horticultural crops, plant propagation- methods and propagation structures- *Phytotron*, seed dormancy and seed germination, principles of orchard establishment, principles and methods of training and pruning of fruit crops, Juvenility and flower bud differentiation, unfruitfulness in horticultural crops, pollination, pollinizers and pollinators, fertilization and parthenocarpy, medicinal and aromatic plants, importance of bio-regulators in horticultural crops, irrigation and its methods, Fertilizer application in horticultural crops

**Practical:**

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

**Suggested readings:**

- Adams CR, Bamford KM and Early MP. 2021. Principles of Horticulture ebook. 6<sup>th</sup> Edition. Publ. Taylor & Francis. 396p, ISBN 9781136074530.
- Chadha KL. 2019. Handbook of Horticulture II Volume Edition 2<sup>nd</sup> Revised Publ., ICAR, New Delhi, 1218p, ISBN: 9788171641871.
- Hartmann HT and Kester DE. 2002. Plant Propagation: Principles and Practices Edition VII, Publ. Prentice – Hall of India Private Limited, New Delhi, 880p, ISBN 9780136792352.
- Kirad KS, Barche S and Gupta NK. 2018. Fundamentals of Horticulture. Publ., Brillion Publishing, New Delhi, 202p, ISBN : 9789387445062.
- Kumar N. 2021. Introduction to Horticulture 9<sup>th</sup> Edition. Publ. MedTech Science Press, 430p, ISBN 978-8195237296.
- Misra KK and Rajesh K. 2014. Fundamentals of Horticulture, Publ. Biotech Books, 232p, ISBN 978-8176223249.
- Muruganantham M, Ravivarman J, Vijai Ananth A, and Kannan M. 2019 Fundamentals of Horticulture. Publ. Jaya Publishing House. 156p, ISBN:9789388668279
- Peter KV. 2017. Basic Horticulture 3<sup>rd</sup> Revised and Enlarged Edition. Publ. New India Publishing Agency, 800p, ISBN 978-9386546524.
- Prasad S and Kumar U. 2012. Principles of Horticulture 2<sup>nd</sup> Revised Edition. Publ. Agrobios, 672p ISBN: 978817754190.

Ray PK. 2020. Essentials of Plant Nursery Management. E book 2<sup>nd</sup> Edition. Publ. Scientific Publishers. 419p, ISBN 9789389832747.

Singh B, Nair R, Singh KP and Sharma A. 2023. Textbook on Fundamentals of Horticulture. Biotech Books, New Delhi. ISBN 9788176225816. Pp 336

Singh J. 2020. Fundamentals of Horticulture 2<sup>nd</sup> Edition. Reprint 2023. Publ. Kalyani Publications, New Delhi, 300p, ISBN : 9789390104079.

**First Year I Semester  
National Cadet Corps (NCC)  
Credit hours 1(0+1)**

**National Cadet Corps**

As government guidelines, for getting B and C certificate in NCC, minimum years of requirement is 2 & 3 years along with 1-2 annual camps

Aims, objectives, organization of NCC and NCC song. DG's cardinals of discipline.

Drill- aim, general words of command, attention, stands at ease, stand easy and turning.

Sizing, numbering, forming in three ranks, open and close order march, and dressing.

Saluting at the halt, getting on parade, dismissing, and falling out.

Marching, length of pace, and time of marching in quick/slow time and halt. Side pace, pace forward and to the rear. Turning on the march and wheeling. Saluting on the march.

Marking time, forward march, and halt. Changing step, formation of squad and squad drill.

Command and control, organization, badges of rank, honors, and awards

Nation Building- cultural heritage, religions, traditions, and customs of India. National integration. Values and ethics, perception, communication, motivation, decision making, discipline and duties of good citizens. Leadership traits, types of leadership. Character/personality development. Civil defense organization, types of emergencies, firefighting, protection. Maintenance of essential services, disaster management, aid during development projects.

Basics of social service, weaker sections of society and their NGO's and their contribution of youth towards social welfare and family planning.

Structure and function of human body, diet and exercise, hygiene and sanitation. Preventable diseases including AIDS, safe blood donation, first aid, physical and mental health. Adventure activities. Basic principles of ecology, environmental conservation, pollution and its control.

*Traffic rule, Digital security awareness, social evil, maintain social justice, POCSO Act. Sexual harassment at workplace and CPR*

**Suggested reading**

Anonymous (2013) National Cadet Corps - Specialized subject SD/SW, 225p, Publ., Directorate General of NCC Ministry of Defense RK Puram, New Delhi

Gupta R (2022) A Concise Handbook of NCC Cadets for 'A', 'B' & 'C' Certificate Examinations, 416p, Publ., Ramesh Publishing House, ASIN : B0B254TWZG

Gupta RK (2020) Handbook of NCC Cadets for 'A', 'B' and 'C' Certificate Examinations, 458p, Publ., Ramesh Publishing House, ISBN:9789387918573, 9387918572

Mishra R.C. Major (2013) A Handbook of NCC, Kaanti Prakashan, ISBN-13978-8190263979

Puran RK Cadet Hand book (Army Wing)

Sharma R.C. Major Cadet's Hand book (Army Wing) – available online

## **National Service Scheme (NSS)**

Evoking social consciousness among students through various activities viz., working together, constructive, and creative social work, to be skilful in executing democratic leadership, developing skill in programme, to be able to seek self-employment, reducing gap between educated and uneducated, increasing awareness and desire to help sections of society.

Community Service, Identify method of mobilization Conflict management, Gender equality and its types and description, roll of NSS volunteers in human trafficking, child trafficking and child protection

All the activities related to the National Service Scheme are distributed under four different courses viz., National Service Scheme I, National Service Scheme II, National Service Scheme III and National Service Scheme IV each having one credit load.

The entire four courses should be offered continuously for two years.

A student enrolled in NSS course should put in at least 60 hours of social work in different activities in a semester other than five regular one day camp in a year and one special camp for duration of 7 days at any semester break period in the two years. Different activities will include orientation lectures and practical works. Activities directed by the Central and State Government have to be performed by all the volunteers of NSS as per direction.

## **Introduction and Basic Components of NSS**

- Moto and Goal of NSS
- Orientation: history, objectives, principles, symbol, badge; regular programs under NSS
- Organizational structure of NSS, Code of conduct for NSS volunteers, points to be considered by NSS volunteers' awareness about health.
- NSS program activities. Concept of regular activities, special camping, day camps, basis of adoption of village/slums, conducting survey, analyzing guiding financial patterns of scheme, youth program/ schemes of GOI, coordination with different agencies and maintenance of diary. Understanding youth. Definition, profile, categories, issues and challenges of youth; and opportunities for youth who is agent of the social change.
- Community mobilization. Mapping of community stakeholders, designing the message as per problems and their culture; identifying methods of mobilization involving youth-adult partnership. Social harmony and national integration and community service
- Indian history and culture, role of youth in nation building, conflict resolution, management and peace- building. Volunteerism and shramdaan. Indian tradition of volunteerism, its need, importance, motivation, and constraints; shaman as part of volunteerism
- Citizenship, constitution, and human rights. Basic features of constitution of India, fundamental rights and duties, human rights, consumer awareness and rights and rights to information. Family and society. Concept of family, community (PRIs and other community-based organizations) and society, Gender equality and its types and description, Roll of NSS volunteers in human trafficking and child protection, Education through community services

**Suggested reading**

- Anonymous (2006) National Service Scheme Manual (Revised) 171p, Publ., Ministry of Youth Affairs & Sports, Government of India, New Delhi
- Anonymous (2012) Margdarshika, Empanelled Training Institute, BU NSS, Bhopal
- Chouhan J (2016) Communication and Extension Management Publ., Kushal Publication and Distributor Varanasi ISBN-13: 978-8192999050
- Mondal Sagar and GL Ray (2012) Text Book of Entrepreneurship and Rural Development 275p Publ., Kalyani Publishers, New Delhi ISBN-10 9327220692 and ISBN-13 978-9327220698
- Swami Vivekananda (2011) Awaking India 203p, Publ., Ramkrishan Mission, New Delhi SKU BK 0001385

**Department of Mathematics and Statistics**

**First Year I Semester  
Introductory Mathematics  
(Non-gradual) 1 (1+0)**

- Theory: Algebra: Progressions- Arithmetic, Geometric and Harmonic Progressions (definition and example).
- Matrices: Definition of Matrices, Addition, Subtraction, Multiplication, Transpose and Inverse up to 3rd order by adjoint method, Properties of determinants up to 3rd order and their evaluation. Function limit and continuity simple numerical example
- Differential Calculus: Definition - Differentiation of function using first principle (Sin x, Cos x,  $e^x$  and third-degree polynomial equation), Derivatives of sum, difference, product and quotient of two functions, Methods, Increasing and Decreasing Functions.
- Application of Differentiation - Growth rate, Average cost, and Marginal cost, Marginal cost, Marginal revenue. Partial differentiation: Homogeneous function, Euler's theorem, Maxima and Minima of the functions of the form  $y = f(x)$  and  $y = f(x_1, x_2)$ .
- Integral Calculus: Integration - Definite and Indefinite Integrals-Methods-Integration by substitution, Integration by parts. Area under simple well-known curves.
- Mathematical Models: Agricultural systems - Mathematical models - classification of mathematical models- Fitting of Linear, quadratic and exponential models to experimental data.

**Suggested reading**

- Gilbert Strang (1991) Calculus, Wellesley-Cambridge Press, 1<sup>st</sup> edition, ISBN- 978-09-61408-82-4
- Gupta, B. N., Pushkar Nath and Shyamles Kumar (2020) Business Mathematics, SBPD Publications, ISBN- 978-93-88117-31-9
- Narayan, Shanti and Mittal, P.K. (2007). A Text Book of Matrices, S. Chand and company Ltd, 11<sup>th</sup> edition ISBN 81-219-2596-7
- Rajeev K. Sharma (2016) Mathematics in Agriculture, Medtech publication, 1<sup>st</sup> edition, ISBN- 978-93-85998-38-6
- Singh, R. and Singh S.P. (2019). Elementary Mathematics, Rama Publishing House, Meerut, New edition, ISBN- 978- 93- 87018-79-2

**First Year I Semester  
Skill Enhancement Course -I  
2 (0+2)**

**Student has to select from the Skill Enhancement Courses offer by the College**

**First Year I Semester  
Skill Enhancement Course -II  
2 (0+2)**

**Student has to select from the Skill Enhancement Courses offer by the College**

#### **4 First year II Semester**

<b>S. No</b>	<b>Course title</b>	<b>Credits</b>
1.	Personality Development	2(1+1)
2.	Environmental Studies and Disaster Management	3(2+1)
3.	Soil Fertility Management	3(2+1)
4.	Fundamentals of Entomology	3(2+1)
5.	Livestock and Poultry Management	2(1+1)
6.	Fundamentals of Plant Pathology	3(2+1)
7.	NSS-II/NCC-II	1(0+1)
8.	Skill Enhancement Course-III	2(0+2)
9.	Skill Enhancement Course -IV	2(0+2)
<b>Total</b>		<b>21(10+11)</b>

**Department of Extension**

**First Year II Semester  
Personality Development  
Credits Hours : 2 (1+1)**

**Objectives:**

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

**Theory:**

Personality Definition, Nature of personality, theories of personality and its types .  
The humanistic approach  
- Maslow's self-actualization theory, shaping of personality, determinants of personality, Myers-Briggs Typology Indicator, Locus of control and performance, Type A and Type B Behaviours, personality and Organizational Behaviour.  
Foundations of individual behavior and factors influencing individual behavior, Models of individual behavior, Perception and attributes and factors affecting perception, Attribution theory and case studies on Perception and Attribution.  
Learning: Meaning and definition, theories and principles of learning, Learning and organizational behavior, Learning and training, learning feedback. Attitude and values, Intelligence- types of Intelligence, theories of intelligence, measurements of intelligence, factors influencing intelligence, intelligence and Organizational behavior, emotional intelligence. Motivation- theories and principles, Teamwork and group dynamics.

**Practical**

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

**Suggested reading**

- Andrews S 1988. How to Succeed at Interviews. McGraw-Hill Education (India) Pvt Limited. 89 p. ISBN 9780074515235
- Heller R 1999. Effective Leadership DK Essential Manager Series. Penguin UK 72 p. ISBN 13978-0751307672
- Hindle T 2009. Reducing Stress DK Essential Manager Series. Dorling Kindersley Ltd. 72 p. ISBN 9781405352093
- Kumar P 2005. All about Self- Motivation. Goodwill Publishing House 148p. ISBN 988172453756
- Lucas S. 2001. Art of Public Speaking. Tata - Mc-Graw Hill. 135p ISBN 9780072387766
- Mile DJ 2016. Power of Positive Thinking. Rohan Book Company. 301p ISBN 978-0091906382
- Shaffer DR 2008. Social and Personality Development (6th Edition). Cengage Learning Publishers. 608p. ISBN 9780495600381

**Department of Plant Physiology**

**First Year II Semester  
Environmental Studies and Disaster Management  
Credits Hours 3 (2+1)**

**Objective:**

To expose and acquire knowledge on the environment and to gain the state-of-the-art skill and expertise on management of disasters

**Theory**

Introduction to Environment - Environmental studies - Definition, scope and importance Multidisciplinary nature of environmental studies - Segments of Environment-Spheres of Earth Lithosphere Hydrosphere - Atmosphere Different layers of atmosphere. Natural Resources: Classification Forest resources. Water resources. Mineral resources Food resources. Energy resources. Land resources. Soil resources. Ecosystems- Concept of an ecosystem - Structure and function of an ecosystem - Energy flow in the ecosystem. Types of ecosystem. Biodiversity and its conservation: Introduction, definition, types. Bio-geographical classification of India. Importance and Value of biodiversity. Biodiversity hot spots. Threats and Conservation of biodiversity Environmental Pollution: Definition, cause, effects and control measures of: a. Air pollution. b. Water pollution. c. Soil pollution. d. Marine pollution. e. Noise pollution. f. Thermal pollution h. light pollution. Solid Waste Management: Classification of solid wastes and management methods, Composting. Incineration, Pyrolysis, Biogas production, Causes, effects and control measures of urban and industrial wastes. Social Issues and the Environment: Urban problems related to energy. Water conservation, rain water harvesting, watershed management. Environmental ethics: Issues and possible solutions, climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Environment Protection Act. Air (Prevention and Control of Pollution) Act. Water (Prevention and control of Pollution) Act. Wildlife Protection Act. Forest Conservation Act. Human Population and the Environment: Environment and human health: Human Rights, Value Education. Women and Child Welfare. Role of Information Technology in Environment and human health.

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

**Practical**

Visit to a local area to document environmental assets river/ forest /grassland /hill/ mountain. Energy: Biogas production from organic wastes. Visit to wind mill/hydro power/solar power generation units. Biodiversity assessment in farming system. Floral and faunal diversity assessment in polluted and unpolluted system. Visit to local polluted site Urban/Rural/Industrial/Agricultural to study of common plants, insects and birds. Environmental sampling and preservation. Water quality analysis:

pH, EC and TDS. Estimation of acidity and alkalinity. Estimation of water hardness. Estimation of DO and BOD in water samples. Estimation of COD in water samples. Enumeration of *E. coli* in water sample. Assessment of Suspended Particulate Matter (SPM). Study of simple ecosystem - Visit to pond/river/hills. Visit to areas affected by natural disaster.

### **Suggested Readings**

- De AK 2010. Environmental chemistry. Published by New Age International Publishers, New Delhi. ISBN:13-978 81 224 2617 5.384 pp
- Dhar Chakrabarti. PG 2011. Disaster management - India's risk management policy frameworks and key challenges. Published by Centre for Social Markets (India). Bangalore. 36 p
- Erach Bharucha, Text book for Environmental studies. University Grants Commission, New Delhi
- Parthiban, KT Vennila, S. Prasanthrajan, M. Umesh Kanna, S. Forest, Environment, Biodiversity and Sustainable development. Narendra Publishing House, New Delhi, India 2023. (In Press)
- Prasanthrajan Mand PP Mahendran, 2008. A text book on Ecology and Environmental Science. ISBN 81-8321-104-6 Agrotech Publishing Academy, Udaipur-313002. First Edition: 2008
- Prasanthrajan M 2018. Objective environmental studies and disaster management. ISBN 9789387893825 Scientific publishers, Jodhpur, India. Pp. 146.
- Sharma, PD 2009, Ecology and Environment, Rastogi Publications, Meerut, India
- Tyler Miller and Scot Spoolman 2009. Living in the Environment (Concepts, Connections, and Solutions). Brooks/cole, Cengage learning publication, Belmont, USA

**Department of Soil Science and Agricultural Chemistry**

**First Year II Semester  
Soil Fertility Management  
Credits Hours 3 (2+1)**

**Objective:**

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

**Theory:**

History of soil fertility and plant nutrition. Criteria of essentiality. Role, deficiency and toxicity symptoms of essential plant nutrients. Mechanisms of nutrient transport to plants, factors affecting nutrient availability to plants. Chemistry of macro and micronutrients. Soil fertility evaluation, Soil testing. Critical levels of different nutrients in soil. Forms of nutrients in soil, plant analysis, rapid plant tissue tests. Indicator plants. Introduction and importance of manures and fertilizers. Fertilizer recommendation approaches.

Integrated nutrient management. Chemical fertilizers: classification, composition and properties of major fertilizers, secondary and micronutrient fertilizers, Complex fertilizers, Customized fertilizers, water soluble fertilizers, nano fertilizers Soil amendments, Fertilizer Storage, Fertilizer Control Order. Methods of fertilizer recommendations to crops. Factor influencing nutrient use efficiency (NUE), methods of application under rainfed and irrigated conditions. STCR/RTNM/ IPNS, Carbon sequestration and Carbon Trading, Preparation and properties of major manures (FYM, Compost, Vermicompost, Green manuring, Oilcakes).

**Practical:**

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

**Suggested readings:**

Buckman Harry O. and Nyle C The Nature and Properties of Soils

Das Dilip Kumar Introductory Soil Science, Kalyani Publishers

Samual L. Tisdale, Werner L. Nelson and James Beaton D., Soil Fertility and Fertilizers Macmillan Publishing Company, New York

Singh SS. Soil Fertility and Nutrient Management , Kalyani Publishers

**Department of Entomology**

**First Year II Semester  
Fundamentals of Entomology  
Credits Hours 3 (2+1)**

**Objectives:**

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

**Theory**

History of Entomology in India. Major points related to dominance of Insecta in Animal kingdom.

Classification of phylum Arthropoda upto classes. Relationship of class Insecta with other classes of Arthropoda. Morphology: Structure and functions of insect cuticle and molting. Body segmentation. Structure of head, thorax and abdomen. Structure and modifications of insect antennae, mouth parts, legs, Wing venation, modifications and wing coupling apparatus. Structure of male and female genital organ. Metamorphosis and diapause in insects. Types of larvae and pupae. Structure and functions of digestive, circulatory, excretory, respiratory, nervous, secretory (Endocrine) and reproductive system, in insects. Types of reproduction in insects. Major sensory organs. Insect Ecology: Introduction, Environment and its components. Effect of abiotic factors and biotic factors. Categories of pests. Concept of IPM, Practices, scope and limitations of IPM. Classification of insecticides, toxicity of insecticides and formulations of insecticides. Systematics: Taxonomy importance, history and development and binomial nomenclature. Definitions of Biotype, Sub-species, Species, Genus, Family and Order. Classification of class Insecta upto Orders, basic groups of present day insects with special emphasis to orders and families of Agricultural importance like Orthoptera: Acrididae, Tettigonidae, Gryllidae, Gryllotalpidae; Dictyoptera: Mantidae, Blattidae; Odonata; Isoptera: Termitidae; Thysanoptera: Thripidae; Hemiptera: Pentatomidae, Coreidae, Cimicidae, Pyrrhocoridae, Lygaeidae, Cicadellidae, Delphacidae, Aphididae, Coccidae, Lophophidae, Aleurodidae, Pseudococcidae; Neuroptera: Chrysopidae; Lepidoptera: Pieridae, Papilionidae, Noctuidae, Sphingidae, Pyralidae, Gelechiidae, Arctiidae, Saturniidae, Bombycidae; Coleoptera: Coccinellidae, Chrysomelidae, Cerambycidae, Curculionidae, Bruchidae, Scarabaeidae; Hymenoptera: Tenthredinidae, Apidae, Trichogrammatidae, Ichneumonidae, Braconidae, Chalcididae; Diptera: Cecidomyiidae, Tachinidae, Agromyziidae, Culicidae, Muscidae, Tephritidae.

**Practical**

Methods of collection and preservation of insects including immature stages; External features of Grasshopper/Blister beetle; Types of insect antennae, mouthparts and legs; Wing venation, types of wings and wing coupling apparatus. Types of insect larvae and pupae; Dissection of digestive system in insects (Grasshopper); Study of characters of orders Orthoptera, Dictyoptera, Odonata, Isoptera, Thysanoptera, Hemiptera, Lepidoptera, Neuroptera, Coleoptera,

Hymenoptera, Diptera and their families of agricultural importance. Insecticides and their formulations. Pesticide appliances and their maintenance. Sampling techniques for estimation of insect population and damage.

**Suggested readings:**

Borror DJ and De Long Indian's General Text of Entomology

Reichards OW and RG Davies Introduction to the study of Insects

Eugene P Odum and Gray W. Barrett Fundamentals of Ecology

Dhaliwal GS and Ramesh Arora Integrated pest Management Concept and Approaches

**Section of Veterinary Sciences and Animal Husbandry**

**First Year II Semester  
Livestock and Poultry Management  
Credits Hours 2(1+1)**

**Objectives:**

Provide basic knowledge to the students about scientific livestock and poultry rearing practices

Entrepreneurship development through Livestock/poultry and Agriculture Integrated farming System

**Theory:**

Role of livestock in the national economy. *Common Animal husbandry term.* Reproduction in farm animals and poultry. Housing principles, space requirements for different species of livestock and poultry. Management of calves, growing heifers and milch animals. Management of sheep, goat and swine. *Milk and its composition in cows, buffalo and goat. Importance of colostrums.* Incubation, hatching and brooding. Management of growers and layers. Important Indian and exotic breeds of cattle, buffalo, sheep, goat, swine and poultry. Improvement of farm animals and poultry. Digestion in livestock and poultry. Classification of feedstuffs. Proximate principles of feed. Nutrients and their functions. Feed ingredients for ration for livestock and poultry. Feed supplements and feed additives. Feeding of livestock and poultry. Introduction of livestock and poultry diseases. Prevention (including vaccination schedule) and control of important diseases of livestock and poultry. *Effect of climate on production of animals. General management practices, exercising, grooming, dehorning and debeaking. Production of broiler*

**Practical:**

External body parts of cattle, buffalo, sheep, goat, swine and poultry. Handling and restraining of livestock. Identification methods of farm animals and poultry. Visit to IDF and IPF to study breeds of livestock and poultry and daily routine farm operations and farm records. Judging of cattle, buffalo and poultry. Culling of livestock and poultry. Planning and layout of housing for different types of livestock. Computation of rations for livestock. Formulation of concentrate mixtures. Clean milk production, milking methods. Hatchery operations, incubation and hatching equipments. Management of chicks, growers and layers. Debeaking, dusting and vaccination. Economics of cattle, buffalo, sheep, goat, swine and poultry production

**Suggested readings:**

- |             |  |
|-------------|--|
| Banerjee GC | A Textbook of Animal Husbandry                           |
| Verma D N   | A text Book of Livestock Production management in Tropic |

**Department of Plant Pathology**

**First Year II Semester  
Fundamentals of Plant Pathology  
Credits Hours : 3(2+1)**

**Objectives:**

- To get acquainted with the role of different microorganisms in the development of plant disease.
- To get general concepts and classification of plant diseases
- To get knowledge of general characteristics of fungi, bacteria, virus, and other microorganisms causing plant diseases.
- To acquaint the students with reproduction in fungi, and bacteria, causing plant diseases.
- To get acquainted with various plant disease management principles and practices.

**Theory:**

Introduction to Plant Pathology: Concept of disease in plants; Different terms used in Plant Pathology, History of Plant Pathology with special references to India, Causes of plant disease: Inanimate and animate causes; Classification of plant disease; Parasitism and pathogenesis, Development of disease in plants: Disease Triangle, Disease cycle, Fungi and their morphology, reproduction and classification of fungi, Bacteria: Morphology, reproduction classification of phytopathogenic bacteria, Other plant pathogens: Mollicutes; Flagellant protozoa; FVB; Green algae and parasitic higher plants; Viruses and viroids, virus transmission, Principles of Plant disease management: Disease management with chemicals, Host resistance, cultural and biological method of Integrated Disease Management (IDM).

**Practical:**

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

**Suggested readings:**

- Agrios, GN. 2010. Plant Pathology. Acad. Press.
- Alexopoulos, Mims and Blackwel. Introductory Mycology
- Dhingra OD and Sinclair JB. 1986. Basic Plant Pathology Methods. CRC Press, London, Tokyo.
- Gibbs A and Harrison B. 1976. Plant Virology - The Principles. Edward Arnold, London
- Goto M. 1990. Fundamentals of Plant Bacteriology. Academic Press, New York.
- Hull R. 2002. Mathew.s Plant Virology. 4th Ed. Academic Press, New York.
- Kamat, M. N. Introductory Plant Pathology. Prakash Pub, Jaipur
- Mehrotra RS and Aggarwal A. 2007. Plant Pathology. 7 th Ed. Tata Mc Grew Hill Publ. Co. Ltd.
- Nene YL and Thapliyal PN. 1993. Fungicides in Plant Disease Control. 3rd Ed. Oxford and IBH, NewDelhi.
- Pathak, V. N. Essentials of Plant Pathology. Prakash Pub., Jaipur

- Rajeev K and Mukherjee RC. 1996. Role of Plant Quarantine in IPM. Aditya Books.
- Rhower GG. 1991. Regulatory Plant Pest Management. In: Handbook of Pest Management in Agriculture. 2nd Ed. Vol. II. (Ed. David Pimental). CRC Press.
- Singh RS. 2008. Plant Diseases. 8 th Ed. Oxford and IBH. Pub. Co.
- Singh RS. 2013. Introduction to Principles of Plant Pathology. Oxford and IBH Pub. Co.
- Verma JP. 1998. The Bacteria. Malhotra Publ. House, New Delhi.
- Vyas SC. 1993. Handbook of Systemic Fungicides. Vols. I-III. Tata McGraw Hill, New Delhi.

**First Year II Semester  
National Cadet Corps (NCC)  
or  
National Service Scheme (NSS)  
Credit hours: 1(0+1)**

**National Cadet Corps (NCC)**

Arms Drill- Attention, stand at ease, stand easy. Getting on parade. Dismissing and falling out. Ground/take up arms, examine arms. Shoulder from the order and vice-versa, present from the order and vice-versa. Saluting at the shoulder at the halt and on the march. Short/long trail from the order and vice-versa. Guard mounting, guard of honor, Platoon/Coy Drill.

Characteristics of rifle (.22/.303/SLR), ammunition, fire power, stripping, assembling, care, cleaning, and sight setting. Loading, cocking, and unloading. The lying position and holding.

Trigger control and firing a shot. Range Procedure and safety precautions. Aiming and alteration of sight. Theory of groups and snap shooting. Firing at moving targets. Miniature range firing. Characteristics of Carbine and LMG.

Introduction to map, scales, and conventional signs. Topographical forms and technical terms.

The grid system. Relief, contours, and gradients. Cardinal points and finding north. Types of bearings and use of service protractor. Prismatic compass and its use. Setting a map, finding north and own position. Map to ground and ground to map. Knots and lashings, Camouflage and concealment, Explosives and IEDs.

Field defenses obstacles, mines and mine lying. Bridging, waterman ship. Field water supplies, tracks and their construction. Judging distance. Description of ground and indication of landmarks. Recognition and description of target. Observation and concealment. Field signals. Section formations. Fire control orders. Fire and movement. Movement with/without arms. Section battle drill. Types of communication, media, latest trends and developments.

*Indian Military History and modern warfare arms*

**Suggested reading**

- Anonymous (2013) National Cadet Corps - Specialized subject SD/SW, 225p, Publ., Directorate General of NCC Ministry of Defense RK Puram, New Delhi
- Gupta R (2022) A Concise Handbook of NCC Cadets for 'A', 'B' & 'C' Certificate Examinations, 416p, Publ., Ramesh Publishing House, ASIN : B0B254TWZG
- Gupta RK (2020) Handbook of NCC Cadets for 'A', 'B' and 'C' Certificate Examinations, 458p, Publ., Ramesh Publishing House, ISBN:9789387918573, 9387918572
- Mishra R.C. Major (2013) A Handbook of NCC, Kaanti Prakashan, ISBN-13978-8190263979
- Puran RK Cadet Hand book (Army Wing)
- Sharma R.C. Major Cadet's Hand book (Army Wing) – available online

### **National Service Scheme (NSS):**

Importance and role of youth leadership

Meaning, types and traits of leadership, qualities of good leaders; importance and roles of youth leadership, Life competencies

Definition and importance of life competencies, problem-solving and decision-making, interpersonal communication. Youth development programs

Development of youth programs and policy at the national level, state level and voluntary sector; youth-focused and youth-led organizations

Health, hygiene and sanitation. Definition needs and scope of health education; role of food, nutrition, safe drinking water, water borne diseases and sanitation (Swachh Bharat Abhiyan) for health; national health programs and reproductive health. Youth health, lifestyle, HIV AIDS and first aid. Healthy lifestyles, HIV AIDS, drugs and substance abuse, home nursing and first aid. Youth and yoga. History, philosophy, concept, myths, and misconceptions about yoga; yoga traditions and its impacts, yoga as a tool for healthy lifestyle, preventive and curative method

Education through community services

### **Suggested reading**

Anonymous (2006) National Service Scheme Manual (Revised) 171p, Publ., Ministry of Youth Affairs & Sports, Government of India, New Delhi

Chouhan J (2016) Communication and Extension Management Publ., Kushal Publication and Distributor Varanasi ISBN-13: 978-8192999050

Mondal Sagar and GL Ray (2012) Text Book of Entrepreneurship and Rural Development 275p Publ., Kalyani Publishers, New Delhi ISBN-10 9327220692 and ISBN-13 978-9327220698

Swami Vivekananda (2011) Awakening India 203p, Publ., Ramkrishan Mission, New Delhi SKU BK 0001385

Anonymous (2012) Margdarshika, Empanelled Training Institute, BU NSS, Bhopal

**Note**

As per the guidelines of Ministry of Youth Affairs and Sports, GOI, minimum duration for a NSS volunteer to be eligible for Certificate-A is 2 years; for Certificate-B is 3 years and for Certificate-C is 4 years.

Hence, additional contents for Semester III and Semester IV contents (optional) may be included by the College for securing those advanced certificates if interested students are there.

**Semester III (optional)**

Vocational Skill development

To enhance the employment potential and to set up small business enterprises skills of volunteers, a list of 12 to 15 vocational skills will be drawn up based on the local conditions and opportunities. Each volunteer will have the option to select two skill-areas out of this list of issues related environment.

Environmental conservation, enrichment and sustainability, climatic change, natural resource management (rainwater harvesting, energy conservation, forestation, waste land development and soil conservations) and waste management. Disaster management. Introduction and classification of disaster, rehabilitation, and management after disaster; role of NSS volunteers in disaster management. Entrepreneurship development. Definition, meaning and quality of entrepreneur; steps in opening of an enterprise and role of financial and support service institution.

Formulation of production-oriented project. Planning, implementation, management, and impact assessment of project. Documentation and data reporting. Collection and analysis of data, documentation, and dissemination of project reports

**Semester IV (optional)**

Youth and Crime

Sociological and psychological factors influencing youth crime, cybercrime, peer mentoring in preventing crime and awareness for juvenile justice.

Civil/self-defense. Civil defense services, aims and objectives of civil defense; needs and training of self-defense. Resource mobilization. Writing a project proposal of self-fund units (SFUs) and its establishment

Additional life skills. Positive thinking, self-confidence, and esteem, setting life goals and working to achieve them, management of stress including time management.

**First Year II Semester  
Skill Enhancement Course -III  
2 (0+2)**

**Student has to select from the Skill Enhancement Courses offer by the College**

**First Year II Semester  
Skill Enhancement Course -IV  
2 (0+2)**

**Student has to select from the Skill Enhancement Courses offer by the College**

## **5 II Year I Semester**

<b>S. No</b>	<b>Course</b>	<b>Credits</b>
1.	Principles of Agricultural Economics and Farm Management	2(2+0)
2.	Physical Education, First Aid and Yoga Practices	2(0+2)
3.	Principles of Genetics	3(2+1)
4.	Crop Production Technology-I (Kharif crops)	3(2+1)
5.	Production Technology of Vegetables and Spices	3 (1+1)
6.	Rural Sociology and Education Psychology	2(2+0)
7.	Fundamentals of Nematology	2(1+1)
8.	Principles and Practices of Natural Farming	2(1+1)
9.	Skill Enhancement- V	2(0+2)
<b>Total</b>		<b>21(12+9)</b>

**II Year Semester I**  
**Principles of Agricultural Economics and Farm Management**  
**Credits Hours 2(2+0)**

**Objectives:**

To aware the students about broad areas covered under agricultural Economics and farmmanagement  
To impart knowledge on judicious use of resources for optimum production

**Theory:**

Economics: Meaning, scope and subject matter, definitions, activities, approaches to economic analysis; micro and macro economics, positive and normative analysis. Nature of economic theory; rationality assumption, concept of equilibrium, economic laws as generalization of human behavior. Basic concepts: Goods and services, desire, want, demand, utility, cost and price, wealth, capital, income and welfare. Agricultural economics: meaning, definition, characteristics of agriculture, importance and its role in economic development. Agricultural planning and development in the country. Demand: meaning, law of demand, demand schedule

Marginal utility principle. Consumers equilibrium and derivation of demand curve, concept of consumer and demand curve, determinants, utility theory; law of diminishing marginal utility, equi-cerplus. Elasticity of demand: concept and measurement of price elasticity, income elasticity and cross elasticity. Production: process, creation of utility, factors of production, input output relationship. Laws of returns: Law of variable proportions and law of returns to scale. Cost: *CACP cost concepts*, short run and long run cost curves. Supply: Stock v/s supply, law of supply, supply schedule, supply curve, determinants of supply, elasticity of supply. Distribution theory: meaning, factor market and pricing of factors of production. Concepts of rent, wage, interest and profit. National income: Meaning and importance, circular flow, concepts of national income accounting and approaches to measurement, difficulties in measurement. Population: Importance, Malthusian and Optimum population theories, natural and socio-economic determinants, current policies and programs on population control. Money: Barter system of exchange and its problems, evolution, meaning and functions of money, classification of money, money supply, general price index, inflation and deflation. Economic systems: Concepts of economy and its functions, important features of capitalistic, socialistic and mixed economies, elements of economic planning. Forms of business organizations, international trade and balance of payments. GST and its implication on Indian economy. *Definition and Concept of farm and farm management, types of farms and systems of farming.*

**Suggested readings:**

- Johi, S.S and T.R Kapur. 2009. Fundamentals of Farm Business Management. 421p., Publ., Kalyani Publishers ISBN 9788127252236
- Subha Reddy S., P. Raghu Ram, T.V. Neelakanta and I. Bhvani Devi 2004. Publ., Agricultural Economics.646p., Publ., Oxford & IBH Publishing Co. Pvt. Ltd

## Section of Sports

### II Year Semester I Physical Education, First Aid and Yoga Practices Credit hours: 2 (0+2)

#### Objectives

To make the students aware about **Physical Education, First Aid and Yoga Practices**

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

#### Practical

Physical education; Training and Coaching - Meaning & Concept; Methods of Training; aerobic and anaerobic exercises; Calisthenics, weight training, circuit training, interval training, Fartlek training; Effects of Exercise on Muscular, Respiratory, Circulatory & Digestive systems; Balanced Diet and Nutrition; Effects of Diet on Performance; Physiological changes due to ageing and role of regular exercise on ageing process; Personality, its dimensions and types; Role of sports in personality development; Motivation and Achievements in Sports; Learning and Theories of learning; Adolescent Problems & its Management; Posture; Postural Deformities; Exercises for good posture.

Yoga; History of Yog, Types of Yog, Introduction to Yog, Asanas (Definition and Importance) Padmasan, Gaumukhasan, Bhadrasan, Vajrasan, Shashankasan, Pashchimotasan, Ushtrasan, Tadasan, Padhas tasan, Ardhchandrasan, Bhujangasan, Utanpadasan, Sarvangasan, Parvatasan, Patangasan, Shishupalanasan left leg-right leg, Pavanmuktasan, Halasan, Sarpasan, Ardhhdhanurasan, SawasanSuryanamskarPranayama (Definition and Importance) Omkar, Suryabhedan, Chandrabhedan, AnulomVilom, Shitali, Shitkari, Bhastrika, Bhramari Meditation(Definition and Importance), Yogic Kriyas (Kapalbhati, Tratak, Jalneti and Tribandh Mudras (Definition and Importance) Gyanmudra, Dhyamudra, Vayumudra, Akashmudra, Pruthvimudra, Shunyamudra, Suryamudra, Varunmudra, Pranmudra, Apanmudra, Vyanmudra, Uddanmudra  
Role of yoga in sports

Teaching of Asanas demonstration, practice, correction and practice.

History of sports and ancient games, Governance of sports in India; Important national sporting events; Awards in Sports; History, latest rules, measurements of playfield, specifications of equipment, skill, technique, style and coaching of major games (Cricket, football, table Tennis, Badminton, Volleyball, Basketball, Kabaddi and Kho-Kho) and Athletics

Need and requirement of first aid. First Aid equipment and upkeep. First Aid Techniques, First aid related with respiratory system. First aid related with Heart, Blood and Circulation. First aid related with Wounds and Injuries. First aid related with Bones, Joints Muscle related injuries. First aid related with Nervous system and Unconsciousness. First aid related with Gastrointestinal Tract. First aid related with Skin, Burns. First aid related with Poisoning. First aid related with Bites and Stings. First aid related with Sense organs, Handling and transport of injured traumatized persons. Sports injuries and their treatments.

*Gymnasium protocol, physical fitness and health related physical fitness, details about advance specific nutrition and supplement*

**Suggested reading**

- Haff Gregory and Tripathi N 2015. Essentials of strength training and conditioning 4<sup>th</sup> Edition Publ., Human Kinetic Australia
- Kamlesh ML 2011. Principles and History of Physical Education Publ., Friends Publication
- Kamlesh ML 2014. Rules of Games and Sports Publ., Sports Publication
- Kamlesh ML 2016. Management Concept in Physical Education and Sports Publ., Khel Sahitya Kendra New Delhi
- Park K 2015. Essentials of Community Health, Nursing, Nursing Science Publ., Banarsidas Bhanot, Jabalpur
- Saraswati Satyanand 2012. Assna Pranayama Mudra Bandha Publ., Yoga Publication Trust
- Singh Ajmer 2022. Essential of Physical Education Publ., Kalyani Publications
- Singh H 2013. Science of Sports Training Publ., Friends Publication New Delhi

**Department of Genetics and Plant Breeding**

**II Year Semester I  
Principles of Genetics  
Credits Hours : 3 (2+1)**

**Objective:**

To make the students acquainted with both principles and practices in the areas of classical genetics, modern genetics, quantitative genetics and cytogenetics.

**Theory**

Pre and post Mendelian concepts of heredity, Mendelian principles of heredity, Architecture of chromosomes, chromonemata, chromosome matrix, chromomeres, centromere, secondary constriction and telomere, special types of chromosomes, Chromosomal theory of inheritance- cell cycle and cell division-mitosis and meiosis. Probabilit and Chi-square. Dominance relationships, Epistatic interactions with example.

Multiple alleles, pleiotropism and pseudoalleles, Sex determination and sex linkage, sex limited and sex influenced traits, Blood group genetics, Linkage and its estimation, crossing over mechanism, chromosome mapping, Structural and numerical variations in chromosomes and their implications, Use of haploids, dihaploids and double haploids in Genetics, Mutation, classification, Methods of inducing mutations and CIB technique, mutagenic agents and induction of mutation. Qualitative and quantitative traits, Polygenes and continuous variations, multiple factor hypothesis, Cytoplasmic inheritance, Genetic disorders, Nature, structure and replication of genetic material, Protein synthesis, Transcription and translational mechanism of genetic material, Gene concept: Gene structure, function and regulation, Lac and Trp operons.

**Practical**

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

**Suggested readings:**

Singh B. D. Fundamentals of Genetics  
Gardner, Simmons and Snustad Principles of Genetics  
Strickberger M. W. Genetics  
Sinnott, Dunn and Dobzhansky Principles of Genetics

**Department of Agronomy**

**II Year Semester I  
Crop Production Technology-I (Kharif crops)  
Credits Hours 3(2+1)**

**Objectives:**

To impart basic and fundamental knowledge on principles and practices of kharif crop production.

To impart knowledge and skill on scientific crop production and management. .

**Theory:**

Origin, geographical distribution, economic importance, soil and climatic requirements, varieties, cultural practices and yield of Kharif crops. Cereals- rice, maize, sorghum, pearl millet and finger millet, pulses- pigeonpea, mungbean and urdbean; oilseeds- groundnut, soybean, *sesame and Niger*; fiber crops- cotton & jute; forage crops- sorghum, cowpea, cluster bean and napier.

**Practical:**

Rice nursery preparation, transplanting of rice, sowing of soybean, pigeonpea and mungbean, maize, groundnut and cotton, effect of seed size on germination and seedling vigour of Kharif season crops, effect of sowing depth on germination of Kharif crops, identification of weeds in Kharif season crops, top dressing and foliar feeding of nutrients, study of yield contributing characters and yield calculation of Kharif season crops, study of crop varieties and important agronomic experiments at experiential farm. Study of forage experiments, morphological description of Kharif season crops, visit to research centres of related crops.

**Suggested readings:**

- Bose Subhash Chandra, M. and Balakrishnan, V. 2001. Forage Production SouthAsian Publishers, New Delhi.
- Gururajan B, R.Balasubramanian and V.Swaminathan. Recent Strategies on Crop Production. Ka Publishers, New Delhi.
- Prasad Rajendra. Textbook of Field Crops Production - Commercial Crops. Volume II ICAR Publication.
- Reddy S.R.. 2009. Agronomy of Field Crops. Kalyani Publishers, New Delhi.
- Singh Chidda.1997. Modern techniques of raising field crops. Oxford and IBH Publishing Co. Pvt. New Delhi.
- Singh S.S.. 2005. Crop Management. Kalyani Publishers, New Delhi.
- UAS, Bangalore. 2011. Package of Practice. UAS, Bangalore.

**Department of Horticulture**

**II Year I Semester  
Production Technology of Vegetables and Spices  
Credits Hours :3 (2+1)**

**Objectives:**

To educate about the different forms of classification of vegetables  
To educate about the origin, area, climate, soil, improved varieties and cultivation practices of vegetables and spices.  
To educate about the physiological disorders of vegetables and spices

**Theory**

Importance of vegetables & spices in human nutrition and national economy, kitchen gardening, brief about origin, area, climate, soil, improved varieties and cultivation practices such as time of sowing, transplanting techniques, planting distance, fertilizer requirements, irrigation, weed management, harvesting and yield, physiological disorders, of important vegetable and spices (Tomato, Brinjal, Chili, Capsicum, Cucumber, Melons, Gourds, Pumpkin, *ridge and sponge gourd*; French bean, Peas, *cowpea*; Cole crops such as Cabbage, Cauliflower, Knol-Khol; Bulb crops such as Onion, Garlic; Root crops such as Carrot, Radish, Beetroot; Tuber crops such as Potato; Leafy vegetables such as Amaranth, Palak; Perennial vegetables *asparagus, spine gourd*; Herbal spices *Dill and thyme*; *Types of vegetable gardens*

**Practical**

Identification of vegetables & spice crops and their seeds. Nursery raising. Direct seed sowing and transplanting. Study of morphological characters of different vegetables & spices. Fertilizers applications. Harvesting & preparation for market. Economics of vegetables and spices cultivation. *Visit to vegetable and spice garden*

**Suggested readings:**

- Fagaria M.S., B.R. Choudhury, and R.S. Dhaka Vegetable Crops Production Technology, (Vol II) 375p., Publ., Kalyani ISBN: 9789327268713, 9327268717
- Kabir J., T.K. Bose and M.G. Som (1993) Vegetable crops 959p., Publ., Naya Prakash ISBN, 818542120X, 9788185421209.
- Singh K.P., Anant Bahadur Olericulture, Fundamentals of Vegetable Production (Vol.1) Publ., Kalyani Publ., ISBN: 9784577013212, 9784577013212

**Department of Extension**

**II Year Semester I  
Rural Sociology and Educational Psychology  
Credit Hrs 2(2+0)**

**Objective:**

Provide knowledge on concept and importance of sociology and rural sociology as well as the relationship with Extension Education

**Theory**

Extension Education and Agricultural Extension Meaning, Definition, Scope, and Importance. Sociology and rural sociology, Meaning, Definition, Scope, Importance of Rural Sociology in Agricultural Extension, and Interrelationship between Rural Sociology & Agricultural Extension. Indian Rural Society, Important characteristics, Differences and Relationship between Rural and Urban societies. Social Groups- Meaning, Definition, Classification, Factors considered information and organization of groups, Motivation in group formation and Role of social groups in Agricultural Extension. Social Stratification- Meaning, Definition, Functions, Basis for stratification, Forms of Social stratification- Characteristics and- Differences between Class & Caste System. Cultural concepts- Culture, Customs, Folkways, Mores, Taboos, Rituals and Traditions- Meaning, Definition and their Role in Agricultural Extension. Social Values and Attitudes Meaning, Definition, Types and Role of Social Values and Attitudes in agricultural Extension. Social Institutions- Meaning, Definition, Major institutions in Rural Society, Functions, and their Role in agricultural Extension. Social Organizations- Meaning, Definition, Types of organizations and role of social organizations in agricultural Extension. Social Control- Meaning, Definition, need of social control and Means of Social Control. Social change- Meaning, Definition, Nature of Social Change, Dimensions of social change and factors of social change. Leadership- Meaning, Definition, Classification, Roles of leader, Different methods of Selection of Professional and Lay leaders. Training of Leaders Meaning, Definition, Methods of training, Advantages and Limitations in use of local leaders in Agricultural Extension, Psychology and Educational Psychology- Meaning, Definition, Scope, and Importance of Educational Psychology in Agricultural Extension. Intelligence- Meaning, Definition, Types, Factors affecting intelligence and Importance of intelligence in Agricultural Extension. Personality- Meaning, definition, Types, Factors influencing the Personality and Role of personality in agricultural Extension. Teaching- Learning process- Meaning and Definition of Teaching, Learning, learning experience and Learning situation, Elements of learning situation and its characteristics. Principles of learning and their implication of teaching.

**Suggested readings**

- Chitambar JB. 2018. Introductory Rural Sociology. (Third Edition) New Age International (P) Limited Publishers. 257. ISBN-97881224366877
- Desai AR. 2019. Rural Sociology in India. Sage Publications Pvt. Ltd. 900p. ISBN 13: 9789353280000.
- Dhama OP and Bhatnagar OP. 2019. Education and Communication for Development. (Second edition). Oxford and IBH Publishing Co. New Delhi. 734p ISBN-8120400305
- Mondal S. 2017. Text book of Rural Sociology & Educational Psychology (Second revised edition). Kalayani Publishers New Delhi. 279p. ISBN-9789327281392.
- Ray GL. 2008. Extension Communication and Management. (Seventh revised edition). Kalyani publishers. 407p. ISBN 9788127245160.
- Velusamy R. 2020. Textbook on Rural Sociology and Educational Psychology. Daya Publishing House. 158p. ISBN-13: 978-9351249412.

सरजू नारायण एवं मण्डल सागर, 2017. ग्रामीण शास्त्र एवं शैक्षिक मनोविज्ञान. Kalayani Publishers. 322p.  
ISBN-9789327283105.

**Department of Plant Pathology**

**II Year Semester I  
Fundamentals of Nematology  
Credits Hours: 2(1+1)**

**Objectives:**

To impart knowledge on history, economic importance of plant parasitic nematodes, morphology, biology, host parasitic relationship of nematodes.  
To impart knowledge on nematode pests of different crops of national and local importance and their management

**Theory:**

Introduction- History of phytonematology, habitat and diversity, economic importance of nematodes. General characteristics of plant parasitic nematodes. Nematode - definition, general morphology and biology. Classification of nematodes upto family level with emphasis on groups containing economically important genera. Classification of nematodes on the basis of feeding/parasitic habit. Symptomatology, role of nematodes in disease development, Interaction between plant parasitic nematodes and disease causing fungi, bacteria and viruses. Nematode pests of crops: Rice, wheat, vegetables, pulses, oilseed and fiber crops, citrus and banana, tea, coffee and coconut. Different methods of nematode management: Cultural methods, physical; methods, Biological methods, Chemical methods, Plant Quarantine, Plant resistance and INM.

**Practical:**

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

**Suggested readings:**

Walia R.K. and H.K. Bajaj Text book on Introductory Plant Nematology  
Zukerman, Mai, Rohde Plant Parasitic Nematodes (Vol-1)  
Swarup Gopal, D. R. Dasgupta, P.K. Koshy. Plant Parasitic Nematodes of India: Problems and Progress  
Webster J.M. Economic Nematology

**Department of Agronomy**

**II Year Semester I  
Principles and Practices of Natural Farming  
Credits Hours 2 (1+1)**

**Objectives:**

To provide comprehensive understanding and knowledge to students about natural farming

To teach students the concept, need and principles of native ecology-based production under natural farming

To impart practical knowledge of natural farming and related agricultural practices in Indian and global environmental and economic perspectives

**Theory:**

Indian Heritage of Ancient Agriculture, History of Natural Farming, Importance of natural farming in view of climate change, soil health, water use carbon sequestration, biodiversity conservation, food security and nutritional security, and sustainable development goals (SDGs), Concept of natural farming; Definition of natural farming; Objective of natural farming, Essential characteristics and Principles of natural farming; Scope and importance of natural farming. Main Pillars of natural farming; Methods/ types/schools of natural farming. Characteristics and design of a natural farm, Concept of ecological balance, ecological engineering and community responsibility in natural versus other farming systems, Introduction to concept of ecological, water, carbon and nitrogen foot prints, Concept and evaluation of ecosystem services,

Integration of crops, trees and animals, cropping system approaches, Biodiversity, indigenous seed production, farm waste recycling, water conservation and renewable energy use approaches on a natural farm, Rearing practices for animals under natural farming, Nutrient management in natural farming and their sources, Insect, pest, disease and weed management under natural farming; Mechanization in natural farming, Processing, labelling, economic considerations and viability, certification and standards in natural farming, marketing and export potential of natural farming produce and products. Initiatives taken by Government (central/state), NGOs and other organizations for promotion of natural farming and chemical free agriculture, Case studies and success stories in natural farming and chemical free traditional farming, Entrepreneurship opportunities in natural farming.

**Practical:**

Visit of natural farm and chemical free traditional farms to study the various components and operations of natural farming principles at the farm; Indigenous technical knowledge (ITK) for seed, tillage, water, nutrient, insect-pest, disease and weed management; On-farm inputs preparation methods and protocols, Studies in green manuring in-situ and green leaf manuring, Studies on different types of botanicals and animal urine and dung based non-aerated and aerated inputs for plant growth, nutrient, insect and pest and disease management; Weed management practices in natural

Farming; Techniques of Indigenous seed production- storage and marketing, Partial and complete nutrient and financial budgeting in natural farming; farming; Evaluation of ecosystem services in natural farming (Crop, Field and System)..



**Second Year I Semester  
Skill Enhancement Course -V  
2 (0+2)**

**Student has to select from the Skill Enhancement Courses offer by the College**

## **6 II Year II Semester**

<b>Sr</b>	<b>Course title</b>	<b>Credit</b>
1.	Entrepreneurship Development and Business Communication	3 (2+1)
2.	Production Technology of Fruit and Plantation Crops	2 (1+1)
3.	Disease of Field and Horticultural Crops of Rabi and Their Management	2 (1+1)
4.	Crop Production Technology-II (Rabi Crops)	3 (2+1)
5.	Farm Machinery and Power	2 (1+1)
6.	Water Management	2 (1+1)
7.	Problematic Soils and Their Management	2 (1+1)
8.	Basics of Plant Breeding	3 (2+1)
9.	Skill Enhancement Course VI	2 (0+2)
<b>Total</b>		<b>21(11+10)</b>

**Department of Agricultural Economics and Farm Management**  
**II Year II Semester**  
**Entrepreneurship Development and Business Communication**  
**Credits Hours 3(2+1)**

**Objective:**

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

**Theory:**

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

**Practical:**

Visit to small scale industries/agro-industries, Interaction with successful entrepreneurs/ agric-entrepreneurs. Visit to financial institutions, support agencies, *smart city centre, Atal incubation centre and other agri-incubators*. Preparation of project proposal for funding by different agencies.

**Suggested Readings:**

- Charantimath P.M., 2009. Entrepreneurship Development and Small Business Enterprises. Pearson Publ., New Delhi.
- Desai V., 2015, Entrepreneurship: Development and Management, Himalaya Publishing House. Gupta CB. 2001. Management Theory and Practice. Sultan Chand & Sons.
- Indu Grover. 2008. Handbook on Empowerment and Entrepreneurship. Agrotech Public Academy. Khanka SS. 1999. Entrepreneurial Development. S. Chand & Co.
- Mehra P., 2016, Business Communication for Managers. Pearson India, New Delhi.
- Pandey M. and Tewari D., 2010, The Agribusiness Book. IBDC Publishers, Lucknow.

- Singh D. 1995. Effective Managerial Leadership. Deep & Deep Publ.
- Singhal R.K., 2013, Entrepreneurship Development & Management, Katson Books.
- Tripathi PC & Reddy PN. 1991. Principles of Management. Tata McGraw Hill.
- Vasant Desai, 1997. Small Scale Industries and Entrepreneurship. Himalaya Publ. House

Department of Horticulture

Second Year II Semester  
Production Technology for Fruits and Plantation Crops  
Credit Hours 2 (1+1)

	Theory	Date
1.	Importance and scope of fruit and plantation crop industry in India Area, production, productivity and export potential of fruit and plantation crops. <b>Production Technology of Fruit crops</b> <i>General Information- Common name, botanical name, family</i> <i>Climate and soil requirements, Improved varieties, Propagation methods &amp; rootstocks, Planting techniques, cropping system, after care-training and pruning, Manures &amp; fertilizer application, Irrigation, Intercultural operation including special practices as per crop, Insect-pest and disease management, harvesting and yield. Important disorders.</i>	
2.	Mango	
3.	Banana- Genomic classification	
4.	Papaya -Sex expression, Papain extraction	
5.	Guava- Bahar treatment and HDP	
6.	Citrus	
7.	Grape Training and Pruning	
8.	Litchi	
9.	Pineapple- Flowering regulation	
10.	Pomegranate	
11.	Jackfruit and <i>Custard apple</i>	
12.	Date palm -pollination	
<b>MID TERM</b>		
13.	Ber - Top working	
14.	Aonla and Sapota	
15.	Apple - Chilling Requirement	
16.	Pear and Peach	
17.	Strawberry	
18.	<i>Walnut and Almond</i> <b>Production Technology of Palm and Plantation crops</b> <i>General Information- Common name, botanical name, family</i> <i>Climate and soil requirements, Improved varieties, propagation, nursery management, planting and planting systems, cropping systems, after care, training and pruning for plantation crops, water, nutrient and weed management, intercropping, multi-tier cropping system, mulching, special horticultural practices, maturity indices, harvest and yield, pests and diseases, processing- value addition</i>	
19.	Coconut and Areca nut	
20.	Tea	
21.	Coffee	
22.	Rubber and Cocoa	
23.	Cashew nut	
24.	Oil Palm and Palmyrah palm	

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**Practical**

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1. Identification and description of fruits varieties
  2. Identification and description of Plantation crops varieties
  3. To study about seed propagation
  4. To study about scarification and stratification of seed
  5. To study about grafting technique of propagation
  6. To study about budding technique of propagation
  7. To study about cutting & layering technique of propagation
  8. Preparation of plant growth regulators- percent and ppm solution
  9. To study about method of use – Solution, powder and paste of PGR
  10. To study the Micro-propagation Protocol for Mass Multiplication and Hardening of Fruit Crops
  11. To study about Mother Palm and Seed Nut Selection in coconut
  12. Nursery raising Practices in Coconut and Arecanut
  13. To study about the nutritional disorders of fruit and Plantation crops
  14. To study about insect-pest of fruits and plantation crops
  15. To study about diseases and disorder of fruits and plantation crops
  16. Visit of commercial orchard and plantation industries
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**Suggested reading**

- Bal JS. 2019 Fruit Growing 3rd Edition. Publ. Kalyani Publishers. 454p, ISBN-13 978-9327239805.
- Bose TK, Kabir J, Das P and Joy PP. 2000. Tropical Horticulture Vol II, Publ. Naya Prakash, Kolkata. 770p, ISBN 9788185421339
- Bose TK, Mitra SK and Sanyal D. 2002. Fruits: Tropical and Sub-Tropical Vol-I 3rd Revised Edition. Publ. Naya Udyog, Kolkata. 721p, ISBN 978-8185971810
- Chadha TR. 2001. Textbook of Temperate Fruits. Publ. Directorate of Information and Publications of Agriculture, Indian Council of Agricultural Research. 217p, ISBN 978-8171642168
- Chattopadhyay TK. 1996 A Text Book on Pomology- Vol. 4. Temperate Fruits. Publ. Kalyani Publishers, 334p, ISBN : 9788127249090
- Chattopadhyay TK. 1996. A Text Book on Pomology- Vol 3 Subtropical Fruits. Publ. Kalyani Publishers. 238p, ISBN 9788127232290
- Dhillon WS. 2013. Fruit Production in India. Publ. Narendra Publishing House, New Delhi. 300p, ISBN: 9789382471066
- Ghosh SN, Kumar A, Rehman MU and Sharma RR. 2018. Temperate Fruit Crops: Theory to Practical, Part 1 & 2, Publ. NIPA, New Delhi. 1084p, ISBN 978-9387973152
- Ghosh SN, Singh A and Thakur A. 2017. Underutilized fruit crops-Importance and Cultivation (Part II). Publ., Jaya Publishing House. New Delhi. 1441p, ISBN 9386110091, 9789386110091
- Kavino M, Jegadeeswari V, Vijayakumar RM and Balakrishnan S. 2023. Production Technology of Fruits and Plantation Crops. Publ., Jaya Publishing House. 443p, ASIN B0CLJN8C7J
- Peter KV. 2011. Plantation crops. Publ. National Book Trust. 332p, ISBN 978-8123739618
- Prasad S and Kumar U. 2010. A Handbook of Fruit Production. Publ. Agrobios (India). 956p, ISBN 9788177543933
- Singh SP and Choudhary MR. 2012. Production Technology of Fruit Crops in Wasteland. Publ., Scientific Publishers India. 349p, ISBN 978-8172337377
- Yadav PK. 2020. Production Technology of Tropical and Subtropical Fruits. Publ. New India Publishing Agency, New Delhi. 384p, ISBN 9789390175987

## Department of Plant Pathology

### II Year II Semester

### Diseases of Field & Horticultural Crops of *Rabi* Season and their Management

Credits Hours 2 (1+1)

#### Theory

Symptoms, etiology, disease cycle, epidemiology and management of major diseases of the following field and horticultural crops:

#### Field crops

**Wheat:** rusts, loose smut, karnal bunt, and ear cockle; **Sugarcane:** red rot, smut, grassy shoot, ratoon stunting and Pokkah Boeng; **Cotton:** anthracnose, vascular wilt, and black arm; **Sunflower:** Sclerotinia stem rot and *Alternaria* blight; **Mustard:** *Alternaria* blight, white rust, downy mildew and Sclerotinia stem rot; **Gram:** wilt, grey mould and *Ascochyta* blight; **Pea:** downy mildew, powdery mildew and rust.

#### Horticultural crops

**Mango:** anthracnose, malformation, bacterial blight and powdery mildew; **Citrus:** canker and gummosis; **Grape vine:** downy mildew, Powdery mildew and anthracnose; **Apple:** scab, powdery mildew, fire blight and crown gall; **Peach:** leaf curl; **Strawberry:** leaf spot; **Potato:** early and late blight, black scurf, leaf roll, and mosaic; **Brinjal:** phomopsis blight and fruit rot, sclerotinia blight; **Cucurbits:** downy mildew, powdery mildew, wilt; **Onion and garlic:** purple blotch and *Stemphylium* blight; **Chillies:** anthracnose and fruit rot, wilt and leaf curl; **Turmeric:** leaf spot; **Coriander:** stem gall; **Marigold:** *Botrytis* blight and leaf spots; **Rose:** dieback, powdery mildew and black leaf spot.

#### Practical

To study the symptoms of different diseases of field and horticultural crops: Loose smut of wheat, Red rot of sugarcane, *Alternaria* blight and downy mildew of mustard, Powdery mildew and rust of pea, Early blight and late blight of potato, Phomopsis blight of brinjal, Downy mildew and powdery of cucurbits, stem gall of coriander, anthracnose and fruit rot of chilli, *Taphrina* leaf spot of turmeric; Acquaintance with fungicides, antibiotics and biopesticides and their use in management of diseases of horticultural crops. Identification and histopathological studies of selected diseases of field and horticultural crops covered in theory. Field visit for the diagnosis of field problems; Collection and preservation of plant diseased specimens for herbarium.

#### Suggested readings

- Chaube HS and Pundhir VS (2022) Crop Diseases and their Management. PHI Learning Pvt. Ltd. 724p ISBN:9788120326743
- Choudappa P (2016) Diseases of Field and Horticultural Crops. Daya Publishing House, Delhi. 556p ISBN: 978-9351309567
- Fry EW (1982). Principles of Plant Disease Management. Elsevier Science. 378p. ISBN: 9780122691805
- Kalita MK (2018) Diseases of Field and Horticultural Crops and their Management-I. Kalyani Publisher. 152p ISBN:978-9327296457
- Kalita MK (2020) Diseases of Field and Horticultural Crops and their Management-II. Kalyani Publisher. 274p ISBN:978-9389477887
- Rangaswamy G and Mahadevan A (1998) Diseases of Crop Plants in India. Prentice Hall India Learning Pvt. Ltd. 548p ISBN: 978-8120312470
- Singh RS (2017) Plant Diseases (10<sup>th</sup> Edition). MedTech- A division of Scientific International. 821p. ISBN:9789386479495
- [www.plantdisease.com](http://www.plantdisease.com)  
[www.cropprotection.html](http://www.cropprotection.html)  
[www.principlesofplantdiseasemanagement.html](http://www.principlesofplantdiseasemanagement.html)

**Department of Agronomy**

**II Year II Semester  
Crop Production Technology-II (Rabi Crops)  
Credits Hours 3(2+1)**

**Objectives:**

- To impart basic and fundamental knowledge on principles and practices of rabi crop production.
- To impart knowledge and skill on scientific crop production and management

**Theory:**

Origin, geographical distribution, economic importance, soil and climatic requirements, varieties, cultural practices and yield of Rabi crops; cereals- wheat and barley, pulses- chickpea, lentil, peas; oilseed- rapeseed, mustard, sunflower, *safflower and linseed*; sugar crops-sugarcane; medicinal and aromatic crops- mentha, lemon grass and citronella, Forage crops berseem, Lucerne and oat.

**Practical:**

Sowing methods of wheat and sugarcane, identification of weeds in rabi season crops, study of morphological characteristics of rabi crops, study of yield contributing characters of rabi season crops, yield and juice quality analysis of sugarcane, study of important agronomic experiments of rabi crops at experimental farms. Study of rabi forage experiments, oil extraction of medicinal crops, visit to research stations of related crops.

**Suggested readings:**

- Bose Subhash Chandra, M. and Balakrishnan, V. 2001. Forage Production SouthAsian Publishers, New Delhi
- Gururajan B., R. Balasubramanian and V. Swaminathan. Recent Strategies on Crop Production. Kalyani Publi New Delhi
- Prasad Rajendra 2002. Text Book of Field crops Production, ICAR, New Delhi
- Prasad Rajendra. Textbook of Field Crops Production – Food Grain Crops. Volume I ICAR Publication
- Prasad Rajendra. Textbook of Field Crops Production - Commercial Crops. Volume II ICAR Publication
- Reddy, S.R. 2004. Agronomy of Field Crops, Kalyani Publishers, Ludhiana
- Reddy S.R. 2009. Agronomy of Field Crops. Kalyani Publishers, New Delhi
- Singh. Chidda 1997. Modern techniques of raising field crops. Oxford and IBH Publishing Co. Pvt. Ltd., Delhi
- Singh S.S. 2005. Crop Management. Kalyani Publishers, New Delhi
- UAS, Bangalore. 2011. Package of Practice. UAS, Bangalore

## **Agricultural Engineering**

### **II Year II Semester Farm Machinery and Power Credits Hours 2(1+1)**

#### **Objectives:**

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

#### **Theory:**

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

#### **Practical:**

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

#### **Suggested readings:**

- Jain SC and Rai CR (2021) Farm Tractor and Maintenance and Repair 462p, Publ., Standard Publishers, Naisarak, Delhi, ISBN- 978-8180142055
- Kumar Sanjay, Vishal Kumar and Sahu R.K. (2015) Fundamental of Agricultural Engineering 567p, Publ., Kalyani Publishers, New Delhi, ISBN: 9789327221688
- Ojha TP and Michael AM (1996). Principles of Agricultural Engineering 91p, Publ., Jain brothers, New Delhi, ISBN: 9786609412239
- Sahay Jagdiswar (2020) Elements of Agricultural Engineering 461p, Publ., Standard Publishers Distributers, New Delhi, ISBN: 9788180140440
- Singh Surendra (2020) Farm Machinery Principles and Applications 700p, Publ., ICAR, New Delhi, ISBN: 9780190640675
- Singhal OP (1997) Element of Agricultural Engineering 341p, Publ., Aman PublishingHouse, Meerut.ISBN- 9789384479726.
- Singhal OP (1997) Numerical Problems in Agricultural Engineering, Publ., Aman Publishing House, Meerut ISBN- 9789384479725.

**Agricultural Engineering**

**II Year II Semester  
Water Management  
Credits Hours : 2(1+1)**

**Objectives:**

To study the important properties of soil affecting water availability to crops and water requirement for optimum growth and development  
To study different methods of irrigation and water management practices of both field and horticultural crops and drainage.  
To study the soil moisture conservation practices including management of rain water, watershed and command areas

**Theory:**

Irrigation: definition and objectives, Importance function of water for plant growth, water resources and irrigation development for different crops in India; Soil plant water relationships; Available and unavailable soil moisture distribution of soil moisture water budgeting rooting characteristics moisture extraction pattern, effect of moisture stress on crop growth.. Methods of soil moisture estimation, evapotranspiration and crop water requirement; effective rainfall, different approaches of scheduling of irrigation; Methods of irrigation: surface and sub-surface, pressurized methods viz., sprinkler and drip irrigation, their suitability, merits and limitations, fertigation, economic use of irrigation water; Layout of different irrigation systems, Irrigation efficiency and water use efficiency, conjunctive use of water, irrigation water quality and its management. Water management of different crops (rice, wheat, maize, groundnut, sugarcane, mango, banana and tomato); Agricultural drainage. Water management problem, soils quality of irrigation water, irrigation management practices for different soils and crops., drip, sprinkler. Layout of underground pipeline system.

**Practical:**

Determination of bulk density by field method; Determination of soil moisture content by gravimetric method, tensiometer, electrical resistance block and neutron moisture meter; Determination of field capacity by field method; Determination of permanent wilting point; Measurement of irrigation water by using water measuring devices viz., flumes and weirs; Calculation of irrigation water requirement (Problems); Determination of infiltration rate; Demonstration of furrow method of irrigation; Demonstration of check basin and basin method of irrigation; Visit to farmers field and cost estimation of drip irrigation system; Demonstration of filter cleaning, fertigation, injection and flushing of laterals; layout for different methods of irrigation, Erection and operation of sprinkler irrigation system; Measurement of emitter discharge rate, wetted diameter and calculation of emitter discharge variability; Determination of EC, pH, carbonates, bio-carbonates, Ca<sup>++</sup> and Mg<sup>++</sup> in irrigation water (quality parameters).

**Suggested readings:**

- Carr MKV and Elias Fereres (2014) *Advances in Irrigation Agronomy* 366p, Publ., Cambridge University Press ISBN- 9781139584012.
- Mal BC and Pandey A (2019) *Introductory Soil and Water Conservation Engineering* 193p, Publ., Kalyani Publishers, New Delhi ISBN- 9789327287936
- Michael AM (2002) *Irrigation Theory and practice* 772p, Publ., Vikas publishing house Pvt, Ltd ISBN – 978-8125918677
- Mujumdar Dilip Kumar (2014) *Irrigation water management: Principles and Practices* 843p, Publ., Prentice Hall of India Pvt. ISBN – 978-8120348264
- Pandey A and Mal BC (2023) *Irrigation Engineering* 265p, Publ., Kalyani Publishers, New Delhi. ISBN- 9789355404817.
- Patil SV and Rajakumar GR (2016) *Water Management in Agriculture and Horticultural Crops* 110p, Publ., Satish publishing House, Delhi. ISBN- 978-9385055560.
- Rajput, TBS and Neelam Patel (2012) *Drip Irrigation* 488p, Publ., Water Technology Centre IARI, New Delhi ISBN- 978-8171641109.
- Rao YP and Bhaskar SR (2008) *Irrigation technology: Theory and practice* 472p, Publ., Agrotech publishing Acad Udaipur ISBN- 978-8183211161

**Department of Soil Science and Agricultural Chemistry**

**II Year II Semester  
Problematic Soils and Their Management  
Credits Hours 2 (1+1)**

To acquaint the students about various problem soils like degraded soils, acid soils, saline soils, alkali soils, eroded soils, submerged soils, polluted soils. Also to impart knowledge about remote sensing, GIS, Multipurpose tree and Land capability classification

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

**Theory**

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

**Practical :**

Determination of pHs and EC of saturation extract of problematic soil. Determination of redox potential in soil, Estimation of water soluble and exchangeable cations in soil and computation of SAR and ESP and characterization of problematic soil. Determination of Gypsum requirement of alkali / sodic soil. Determination of lime requirement of acidic soil. Determination of Quality of irrigation water (pH, EC, Ca, Mg, Na, CO<sub>3</sub>, HCO<sub>3</sub>, Cl, SAR and RSC), Determination of nitrate (NO<sub>3</sub><sup>-</sup>) from irrigation water, Determination of dissolved oxygen and free carbon dioxide levels in water samples,

**Suggested readings:**

- Agarwal, R.R., Yadav, J.S.P. and Gupta, R.N. (1982). Saline Alkali soils of India, ICAR, New Delhi
- Brady Nyle C and Ray R Well, 2014. Nature and properties of soils. Pearson Education Inc., New Delhi.
- Cirsan J. Paul, 1985, Principles of Remote Sensing. Longman, New York
- Indian Society of Soil Science, 2002. Fundamentals of Soil Science. IARI, New Delhi.
- Osman, Khan Towhid, 2018, Management of Soil Problems. Springer publication
- Srivastava, V. C., 2002. Management of Problem Soils - Principles and Practices. AGROBIOS (India).

**Department of Genetics and Plant Breeding**

**II Year II Semester  
Basics of Plant Breeding  
Credits Hours 3(2+1)**

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

**Theory:**

Historical development, concept, nature and role of plant breeding, major achievements and future prospects; Genetics in relation to plant breeding, modes of reproduction and apomixes, self-incompatibility and male-sterility-genetic consequences, cultivar options, Domestication, Acclimatization and Introduction; Centres of origin/diversity, Components of Genetic variation; Heritability and genetic advance; Genetic basis and breeding methods in self pollinated crops-mass and pure line selection, hybridization techniques and handling of segregating population; Multiline concept, Concepts of population genetics and Hardy-Weinberg Law, Genetic basis and methods of breeding cross-pollinated crops, modes of selection; Population movement schemes- Ear to Row method, Modified Ear to Row, recurrent selection schemes; Heterosis and inbreeding depression, development of inbred lines and hybrids, composite and synthetic varieties; Breeding methods in asexually propagated crops, clonal selection and hybridization; Maintenance of breeding records and data collection; Wide hybridization and pre-breeding; Polyploidy in relation to plant breeding, mutation breeding- methods and uses; Breeding for important biotic and abiotic stresses; Biotechnological tools-DNA markers and marker assisted selection. Participatory plant breeding; Intellectual Property Rights, Patenting, Plant Breeders & Farmer's Rights.

**Practical:**

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

**Suggested readings:**

- Allard RW (1999) Principles of Plant Breeding, II Edition , 264p John Wiley & Sons, Ltd ISBN: 978-0-471-02309-
- Chahal GS and SS Gosal (2002) Principles and Procedures of Plant Breeding - Biotechnical and Conventional Approaches 624p, Publ., Alpha Science International Ltd ISBN 184265036X
- George Acquaah (2020) Principles of Plant Genetics and Breeding III Edition, 848p, Publ., John Wiley & Sons, Ltd ISBN: 1119626323
- Sharma JR, (1994) Principles and Practice of Plant Breeding 599p, Publ., Tata McGraw-Hill Pub. ISBN:9780074633670, 0074633678
- Singh B.D. (2022) Plant Breeding Principles and Methods 12th Edition, 968p, Publ., MedTech Science Press ISBN 9393168067

**Second Year II Semester  
Skill Enhancement Course -VI  
2 (0+2)**

**Student has to select from the Skill Enhancement Courses offer by the College**

## **7 III Year I Semester**

<b>S. No</b>	<b>Course</b>	<b>Credits</b>
1.	Agricultural Marketing and Trade	3 (2+1)
2.	Introduction to Agro-meteorology	2(1+1)
3.	Fundamentals of Crop Physiology	3 (2+1)
4.	Pest Management in <i>Kharif</i> Crops and Stored Grains	2(1+1)
5.	Diseases of Field & Horticultural <i>Kharif</i> Crops & Their Management	2 (1+1)
6.	Crop Improvement - I	2 (1+1)
7.	Weed Management	2 (1+1)
8.	Ornamental Crops, MAPs and Landscaping	2 (1+1)
9.	Introductory Agro forestry	2 (1+1)
10.	Agri-informatics and Artificial Intelligence	3(2+1)
<b>Total</b>		<b>23(13+10)</b>

**Department of Agricultural Economics and Farm Management**

**III Year I Semester  
Agricultural Marketing and Trade  
Credits Hours 3(2+1)**

**Objectives:**

- To understand the fundamentals of agricultural marketing and trade
- To analyze the factors influencing supply and demand in agricultural markets
- To explore different marketing channels and strategies in agriculture
- To examine the role of government policies and regulations in agricultural markets

**Theory:**

Agricultural Marketing: Concepts and definitions of market, marketing, agricultural marketing, market structure, marketing mix and market segmentation, classification and characteristics of agricultural markets; demand, supply and producer's surplus of agri-commodities: nature and determinants of demand and supply products, producers surplus- of farm meaning and its types, marketable and marketed surplus, factors affecting marketable surplus of agri-commodities; pricing and promotion strategies: pricing considerations and approaches cost based and competition based pricing; market promotion advertising, personal selling, sales promotion and publicity meaning, merits and demerits; marketing process and functions: Marketing process concentration, dispersion and equalization; exchange functions buying and selling; physical functions storage, transport and processing; facilitating functions packaging, branding, grading, quality control and labelling (Agmark); Market functionaries and marketing channels: Types and importance of agencies involved in agricultural marketing; meaning and definition of marketing channel; number of channel levels; marketing channels for different farm products; Integration, efficiency, costs and price spread: Meaning, definition and types of market integration; marketing efficiency; marketing costs, margins and price spread; factors affecting cost of marketing; reasons for higher marketing costs of farm commodities; ways of reducing marketing costs; Role of Govt. in agricultural marketing: Public sector institutions- CWC, SWC, FCI, CACP DMI, *APEDA, MPEDA & EXIM Bank* their objectives and functions; cooperative marketing in India; Risk in marketing: Types of risk in marketing; speculation & hedging; an overview of futures trading; Agricultural prices and policy: Meaning and functions of price; administered prices; need for innovations in agricultural price policy; Trade: Concept of International Trade and its need, theories of absolute and comparative advantage. Present status and prospects of international trade in agri-commodities; EXIM Policy and Agri Export Policy WTO; Agreement on Agriculture (AoA) and its implications on Indian agriculture; IPR. Role of government in agricultural marketing. Role of APMC and its relevance in the present day context.

**Practical:**

Plotting and study of demand and supply curves and calculation of elasticity; Study of relationship between market arrivals and prices of some selected commodities; Computation of marketable and marketed surplus of important commodities; Study of price behaviour over time for some selected commodities; Construction of index numbers; Visit to a local market to study various marketing functions performed by different agencies, identification of marketing channels for selected commodity, collection of data regarding marketing costs, margins and price spread and presentation of report in the class; Visit to market institutions NAFED, SWC, CWC, cooperative marketing society, etc. to study their organization and functioning. Application of principles of comparative advantage of international trade.

**Suggested Readings:**

- Acharya, S.S. and Agarwal, N.L., 2006, Agricultural Marketing in India, Oxford and IBH Publishing Co.Pvt. Ltd., New Delhi.
- Chinna,S.S., 2005, Agricultural Economics and Indian Agriculture. Kalyani Pub, N Delhi.Dominic Salvatore, Micro Economic Theory
- Kohls Richard, L. and UhlJosheph, N., 2002, Marketing of Agricultural Products, Prentice-Hall of IndiaPrivate Ltd., New Delhi.
- Kotler and Armstrong, 2005, Principles of Marketing, Pearson Prentice-Hall.
- Lekhi, R. K. and Jogindr Singh, 2006, Agricultural Economics. Kalyani Publishers, Delhi.
- Memoria, C.B., Joshi, R.L. and Mulla, N.I., 2003, Principles and Practice of Marketing in India, KitabMahal, New Delhi.
- Pandey Mukesh and Tewari, Deepali, 2004, Rural and Agricultural Marketing, International BookDistributing Co. Ltd, New Delhi.
- Sharma, R., 2005, Export Management, LaxmiNarain Agarwal, Agra.

**Department of Agronomy**

**III Year I Semester  
Introduction to Agro-meteorology  
Credits Hours : 2(1+1)**

**Objectives:**

To introduce the students to the concept of weather and climate and the underlying physical processes occurring in relation to plant and atmosphere

To impart the theoretical and practical knowledge of instruments/equipments used for measurement of different weather variables in an agro-meteorological observatory

To study the meteorological aspects of climate change in agriculture and allied activities

**Theory**

Meaning and scope of agricultural meteorology; Earth atmosphere- its composition, extent and structure; Atmospheric weather variables; Atmospheric pressure, its variation with height; Wind, types of wind, daily and seasonal variation of wind speed, cyclone, anticyclone, land breeze and sea breeze; Nature and properties of solar radiation, solar constant, depletion of solar radiation, short wave, long wave and thermal radiation, net radiation, albedo; Atmospheric temperature, temperature inversion, lapse rate, daily and seasonal variations of temperature, vertical profile of temperature, Energy balance of earth; Atmospheric humidity, concept of saturation, vapor pressure, process of condensation, formation of dew, fog, mist, frost, cloud; Precipitation, process of precipitation, types of precipitation such as rain, snow, sleet, and hail, cloud formation and classification; Artificial rainmaking. Monsoon-mechanism and importance in Indian agriculture; Weather hazards - drought, floods, frost, tropical cyclones and extreme weather conditions such as heat-wave and cold-wave; Agriculture and weather relations; Modifications of crop microclimate, climatic normal for crop and livestock production. Weather forecasting- types of weather forecast and their uses. Climate change, climatic variability, global warming, causes of climate change and its impact on regional and national Agriculture.

**Practical**

Visit of Agro-meteorological Observatory, site selection of observatory, exposure of instruments and weather data recording, Measurement of total, shortwave and Plancks intensity law, Measurement of albedo and sunshine duration, computation of radiation intensity using long wave radiation, and its estimation using BSS; Measurement of maximum and minimum air temperatures, its tabulation, trend and variation analysis, Measurement of soil temperature and computation of soil heat flux, Determination of vapor pressure and relative humidity, Determination of dew point temperature, Measurement of atmospheric pressure and analysis of atmospheric conditions, Measurement of wind speed and wind direction, preparation of wind rose, Measurement, tabulation and analysis of rain, Measurement of open pan evaporation and evapo-transpiration, Computation of PET and AET.

**Suggested readings:**

Mahi G. S. & P. K. Kingra Fundamentals of Agro-meteorology and Climate Change

Mavi H. S. Introduction to Agro-meteorology

Patra Alok Kumar Introduction to Agro-meteorology & Climate Change

Prasado Rao G.S.L.H.V. Agricultural Meteorology

Varshneya MC and PB Pillai Text Book of Agricultural Meteorology

**Department of Plant Physiology**

**III Year I Semester  
Fundamentals of Crop Physiology  
Credits Hours 3(2+1)**

**Objectives:**

To explain about the basic physiological process of plant viz. plant cell and water relations, mineral nutrition, carbon metabolism, reproductive physiology and plant growth and development.

**Theory:**

Definitions of plant physiology and crop physiology, Importance of crop physiology, Relationship of crop physiology with other branches of crop science

Diffusion and osmosis, Physiological roles of water to crop plants, Definition of water potential and components of water potential, Water absorption by plants: Concept of active and passive absorption, Water loss by plants: Types of water loss: transpiration, stomatal physiology and guttation, Water use efficiency and factors affecting WUE.

Classification of mineral elements: Essential and beneficial elements, Passive and active transport of mineral element: Nernst equation, ion transport, ion pump and channels, Functions of essential elements and their deficiency and toxicity symptoms, Hydroponics and sand culture.

Brief outline of: Photosynthetic apparatus, pigment system, quantum requirement and quantum yield: Structure of chloroplast, Examples of different photosynthetic pigments (chlorophyll, carotenoids, phycobilins etc.), Difference between chlorophyll a and chlorophyll b, Structure of chlorophyll a and chlorophyll b, Short discussion on quantum requirement and quantum yield, Red drop and Emerson enhancement effect, Pigment system I & II.

Introduction to light reaction of photosynthesis, Light absorption by photosynthetic pigments and transfer of energy, Source of O<sub>2</sub> during photosynthesis: Hill reaction, Brief introduction to cyclic and non-cyclic photo-phosphorylation: production of assimilatory powers.

Introduction to C<sub>3</sub>, C<sub>4</sub> and CAM pathways: Calvin Cycle, Hatch & Slack Cycle, CAM Cycle, Significance of these pathways (concept of photorespiration, absence of photorespiration in C<sub>4</sub> plant: Productivity of C<sub>4</sub> plant, CAM: an adaptive mechanism), Factors affecting photosynthesis (light, temperature, CO<sub>2</sub>, O<sub>2</sub> etc).

Outline of the process of respiration: Definition and importance, Glycolysis, Krebs Cycle and ETC, Factors affecting respiration (O<sub>2</sub>, temperature, CO<sub>2</sub> etc.).

Terminologies / Definitions: Growth, Development and Differentiation. Measurement of plant growth (fresh weight, dry weight, linear dimension, area etc). Introduction to CGR, RGR, NAR etc. Short discussion on factors affecting growth and development.

Photoperiodism: Classical works of Garner and Allard. Photoperiodic Classification of plants: Short Day Plant, Long Day Plant, Day Neutral plant etc. Introduction to Photoperiodic induction Site of photo-inductive perception, Role of Phytochrome Introduction to Vernalization (What is vernalization, devernialization etc).

Meaning, classification (seasonal, sequential etc), relation with abscission. Physiological and biochemical changes during senescence, Abscission and its

significance, Concept of stay green, Hormonal regulation of senescence.

Terminologies / Definitions: Plant hormone, Plant growth regulators (PGR), Plant growth inhibitor. Recognized classes of PGR (Auxins, Gibberellins, Cytokinins, Ethylene and Absciscic acid) and their major-physiological roles, Agricultural uses of PGRs (IBA, NAA, 2, 4 D, GAs, Kinetin etc).

**Practical:**

Study on structure and distribution of stomata; Demonstration of imbibitions, osmosis, plasmolysis, estimation of water potential, relative water content; Tissue test for mineral nutrients, identification of nutrient deficiency and toxicity symptoms in plant; Estimation of photosynthetic pigments, rate of photosynthesis, respiration and transpiration; Plant growth analysis; Study on senescence and abscission, hormonal regulation of senescence; Demonstration of the effects of different PGRs on plants.

**Suggested readings:**

Devlin Robert M. and Francis H. Witham Plant Physiology

Devlin Robert, Francis H. Witham and David F. Blaydes Devlin's Exercises in Plant Physiology

Lincoln Taiz and Eduardo Zeiger Plant Physiology

Lincoln Taiz, Eduardo Zeiger, Ian Max Mølle and Angus Murphy  
Fundamentals of Plant Physiology

Salisbury Frank B. and Cleon W. Ross Plant physiology

Department of Entomology

III Year I Semester  
Pest Management in *Kharif* Crops and Stored Grains  
Credits Hours 2(1+1)

Sr.	Theory	Date
	General account on type of damage by different arthropods pests. <i>Scientific name, order, family, marks of identification, host range, distribution, biology and bionomics, nature of damage, damaging stage of insect pests and their management:</i>	
1.	<b>Rice:</b> WBPH, BPH, GLH, Gundhi bug, Army worm	
2.	<b>Rice (Contd.):</b> Gall midge, Leaf folder, Stem borer and Grasshopper	
3.	<b>Maize:</b> Sorghum; <b>Small millet &amp; Pearl millet:</b> Stem borer, Shoot fly, Stem fly, Gall midge and FAW	
4.	<b>Pigeonpea:</b> Gram pod borer, Maruca, Pod fly, Pod bug complex, Tur plume moth	
5.	<b>Urd bean &amp; Mung bean:</b> Whitefly, Bihar hairy caterpillar;	
6.	<b>Soybean:</b> Girdle beetle, Stem fly and Whitefly, Tobacco caterpillar and Green semilooper	
7.	<b>Sesame:</b> Til leaf roller and capsule borer, Leaf hopper, Gall fly and Bihar hairy caterpillar	
8.	<b>Groundnut:</b> White grub and Red hairy caterpillar; <b>Castor:</b> Semilooper	
9.	<b>Cotton:</b> Pink bollworm, Spotted bollworm and American bollworm, Jassid, Whitefly, Aphid, Mealy bug, Red cotton bug and Thrips	
10.	<b>Pineapple:</b> Pineapple thrips and Slug caterpillar; <b>Litchi:</b> Litchi bug and Mites; <b>Date palm:</b> Date palm scale, Rhinoceros beetle and Red palm weevil	
11.	<b>Pomegranate:</b> <i>Anar</i> butterfly, <i>Anar</i> fruit borer and Bark eating caterpillar; <b>Aonla:</b> Mealy bug and Gall caterpillar	
12.	<b>Citrus:</b> Lemon butterfly, Citrus Psylla, Citrus leaf miner, Whitefly, Fruit sucking moth, Bark eating caterpillar, Black fly, Cottony cushion scale, Mealy bug	
13.	<b>Grapevine:</b> Grapevine thrips, leaf roller, leaf hopper, girdler and beetle	
14.	<b>Water chestnut:</b> <i>Singhara</i> beetle, Red blood worm;	
15.	<b>Sweet potato:</b> Sweet potato weevil and Tortoise beetle;	
16.	<b>Areca nut:</b> Areca nut mealy bug; <b>Cashew nut:</b> Cashew tree borer, Cashew shoot borer, Inflorescence caterpillar; <b>Coconut:</b> Rhinoceros beetle, Red palm weevil, Black headed caterpillar, Coconut weevil, coconut white grub, coconut scale insect	
17.	<b>Coffee:</b> Coffee stem borer, Coffee shoot hole borer, Coffee berry borer, Helmet scale insect, Striped mealy bug; <b>Tea:</b> Tea mosquito bug, Bunch caterpillar, Humped slug caterpillar; <b>Cocoa:</b> Mealy bug; <b>Palm:</b> Rhinoceros beetle, bag worm moth, Braconid wasp	
18.	<b>Rose:</b> Rose aphid	
19.	<b>Cardamom:</b> Banana aphid, Castor capsule borer, Cardamom hairy caterpillar, Cardamom thrips, Rhizome weevil; <b>Large cardamom:</b> Banana aphid, Grapevine thrips	
20.	<b>Black pepper:</b> Pollu beetle; <b>Turmeric:</b> Castor capsule borer, Bihar hairy caterpillar; <b>Ginger:</b> Castor capsule borer; <b>Cinnamon:</b> Cinnamon butterfly <i>Scientific name, order, family, host range, distribution, biology and bionomics, nature of damage, damaging stage of important arthropod pests and their management:</i>	
21.	<b>Sweet potato:</b> Red vegetable mite / Two spotted spider mite; <b>Fruit crops:</b> <b>Mango:</b> Mango bud mite; <b>Papaya:</b> Red side mite; <b>Citrus:</b> Citrus mite; <b>Litchi:</b> Litchi gall mite and <b>Apple:</b> Mites	

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**22. Plantation crops:**

**Tea:** Red crevice tea mite, Yellow tea mite **Coconut:** Eriophyid mite;

**Ornamental crops: Jasmine:** Eriophyid mite; and **Spices and condiments**

**23.** Factors affecting losses of stored grain

**24.** Role of physical, biological, mechanical and chemical factors in deterioration of grain

**25.** Insect pests associated with stored grain and their management

**26.** Mites associated with stored grain and their management

**27.** Storage structure and methods of grain storage

**28.** Fundamental principles of grain store management

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**Practical**

**1.** Identification of different types of damage (specimen and herbarium)

**2.** Identification and study of life cycle and seasonal history of various insect pests attacking field crops and their produce (life cycle of two insects per student, one of complete and second of incomplete metamorphosis)

**3.** Identification and study of life cycle and seasonal history of various insect pests attacking vegetable crops and their produce

**4.** Identification and study of life cycle and seasonal history of various insect pests attacking fruit crops and their produce

**5.** Identification and study of life cycle and seasonal history of various insect pests attacking plantation (gardens, narcotics, spices & condiments) crops and their produce

**6.** Identification of insect pests and mites associated with stored grain  
Determination of insect infestation by different methods

**7.** Assessment of losses due to insects

**8.** Calculations of insecticide doses, calibration of appliances, application techniques and precautions

**9.** Fumigation of grain store / godowns

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**Suggested reading**

Atwal AS and Dhaliwal GS.2018. Agricultural Pests of South Asia and Their Management. Kalyani Publishers, Ludhiana, Edition-7<sup>th</sup>, 467p. ISBN No.978-9327250725.

Cotton RC. 2007. Insect Pests of Stored Grains and Grain Products. Biotech Books Delhi 110035, Edition-1<sup>st</sup>, 394 p. ISBN No.9781774636824.

Gupta HCL and Ameta OP. 2015. Management of Insect Pests of Horticultural Crops. Agritech Publishing Academy, Udaipur, Edition-1<sup>st</sup>, 224p. ISBN No.8185680949.

Khare BP. 2006. Stored Grain Pests and Their Management. Kalyani Publishers, Ludhiana, Edition-4<sup>th</sup>, 314 p. ISBN No.978-9387973671.

Kumar Ashok and Nigam Prem Mohan.2010. Economic and Applied Entomology. Emkay Publications, New Delhi, Edition-1<sup>st</sup>, 247 p. ISBN No.9788170359272.

Panwar VPS.2017. Agricultural Insect Pests of Crops and their Control. Kalyani Publishers, Ludhiana, Edition-3<sup>rd</sup>, 424 p. ISBN No.978-9327275438.

Pruthi HS.1969. Textbook of Entomology. ICAR, New Delhi, Edition-1<sup>st</sup>, 997 p. ISBN No.-0.00, Record No.-32637.

- Sathe TV. 2020. Cotton Pests and Bio- Control Agents. Daya Publishing House, Delhi, Edition-1<sup>st</sup>, 127 p. ISBN No. 9788170352341.
- Sharma S and Choudhary A. 2008. Storage Pest Management. Mahamaya Publishing House, Adampur, Jalandhar, Edition-1<sup>st</sup>, 148p. ISBN No.9788183250467.
- Shrivastava KP. 2013. A Text Book of Applied Entomology (Vol-II). Kalyani Publishers, Ludhiana, Edition-1<sup>st</sup>, 390p. ISBN No.978-8127267520.
- Sehgal PK and Bhardwaj DK. 2018. कृषि कीट विज्ञान. Kalyani Publishers, Ludhiana, Edition-1<sup>st</sup>, 276 p. ISBN No.978-8170354802.
- Upadhyay KD and Mathur YK.2021. फसल व संगृहित अनाज के कीट एवं उनका प्रबंधन Rama Publishing House, Meerut, Meerut, Edition-1<sup>st</sup>, 230 p. ISBN No. 9789387018624.

## Department of Plant Pathology

### III Year I Semester

### Diseases of Field & Horticultural Crops of *Kharif* Season and their Management Credits Hours 2 (1+1)

#### Theory

Symptoms, etiology, disease cycle, epidemiology and management of major diseases of the following field and horticultural crops:

#### Field crops-

**Rice:** blast, brown spot, bacterial blight, sheath blight, false smut, khaira and tungro disease; **Maize:** stalk rots, downy mildew, leaf spots; **Sorghum:** smuts, grain mold and anthracnose, **Bajra:** downy mildew and ergot; **Finger millet:** blast and leaf spot; **Soybean:** Rhizoctonia blight, bacterial leaf spot, seed and seedling rot and mosaic; **Pigeonpea:** Phytophthora blight, wilt and sterility mosaic; **Black & green gram:** cercospora leaf spot, anthracnose, web blight and yellow mosaic; **Groundnut:** early and late spots, rust and wilt.

#### Horticultural crops-

**Guava:** wilt and anthracnose; **Papaya:** foot rot, leaf curl and mosaic; **Banana:** Panama wit, bacterial wilt, sigatoka and bunchy top; **Pomegranate:** bacterial blight; **Cruciferous vegetables:** Alternaria leaf spot, cauliflower mosaic and black rot; **Tomato:** damping off, wilt, early and late blight, leaf curl and mosaic; **Okra:** Yellow Vein Mosaic; **Beans:** anthracnose and bacterial blight; **Ginger:** soft rot; **Tea:** blister blight; **Coffee:** rust, **Coconut:** Ganoderma wilt and bud rot.

#### Practical

1. To study the symptoms of different diseases of field and horticultural crops: Blast and brown spot of rice, sheath blight and bacterial leaf blight of rice, rhizoctonia and Cercospora leaf spot of green gram / black gram, early blight of late blight of tomato, Yellow Vein Mosaic of Okra
2. Acquaintance with fungicides, antibiotics and biopesticides and their use in management of diseases of horticultural crops.
3. Identification and histopathological studies of selected diseases of field and horticultural crops covered in theory.
4. Field visit for the diagnosis of field problems,
5. Collection and preservation of plant diseased specimens for herbarium.

#### Suggested readings

- Chaube HS and Pundhir VS (2022) Crop Diseases and their Management. PHI Learning Pvt. Ltd. 724p ISBN:9788120326743
- Choudappa P (2016) Diseases of Field and Horticultural Crops. Daya Publishing House, Delhi. 556p ISBN: 978-9351309567
- Fry EW (1982). Principles of Plant Disease Management. Elsevier Science. 378p. ISBN: 9780122691805
- Kalita MK (2018) Diseases of Field and Horticultural Crops and their Management-I. Kalyani Publisher. 152p ISBN:978-9327296457
- Kalita MK (2020) Diseases of Field and Horticultural Crops and their Management-II. Kalyani Publisher. 274p ISBN:978-9389477887



**Department of Genetics and Plant Breeding**

**III Year I Semester  
Crop Improvement - I  
Credits Hours : 2(1+1)**

**Objectives:**

- To provide knowledge about Self-pollinated and cross pollinated Kharif crops
- To learn about origin and distribution of Kharif crops
- To design breeding objectives of major kharif crops
- To impart information on different crop varieties for Kharif season

**Theory:**

Centres of origin, distribution of species, wild relatives in different cereals; pulses; oilseeds; fibres; fodders and cash crops; vegetable and other horticultural crops; Plant genetic resources, its utilization and conservation, study of genetics of qualitative and quantitative characters; Important concepts of breeding self-pollinated, cross-pollinated and vegetatively propagated crops. Major breeding objectives and procedures including conventional and modern innovative approaches for development of hybrids and varieties for yield, adaptability, stability, abiotic and biotic stress tolerance and quality ( physical, chemical, nutritional); Hybrid seed production technology in Maize, Rice, Sorghum, Pearl Millet and Pigeopea etc. Ideotype concept, climateresilient crop varieties for future.

**Practical:**

Floral biology, emasculation and hybridization techniques in different crop species viz. Rice, Jute, Maize, Sorghum, Pearl millet, Ragi, Pigeopea, Urdbean, Mungbean, Soybean, Groundnut, Sesame, Castor, Cotton, Cowpea, Tobacco, Brinjal, Okra and Cucurbitaceous crops. Maintenance breeding of different kharif crops. Handling of germplasm and segregating populations by different methods like pedigree, bulk and single seed decent methods; Study of field techniques for seed production and hybrid seed production in kharif crops; Estimation of heterosis, inbreeding depression and heritability; Layout of field experiments; Study of quality characters, donor parents for different characters; Visit to seed production plots; Visit to AICRP breeding plots of different crops.

**Suggested readings:**

- Chopra V.L. Breeding field crops-I
- Gupta S.K. Plant Breeding theory and practice
- Poehlman J.M. and D.N. Barthakur Breeding Asian field crops
- Rajendra Kumar Yadav Practical manuals on Crop Improvement I (Kharif crops)
- Ram Hari Har Vegetable breeding Principles and Practices
- Singh C.B. and D. Khare Genetic improvement of field crops Scientific Publ.,
- Singh D.P. Genetics and Breeding of Pulse crops
- Sleper D.A. and J.M. Poehlman Breeding field crops

**Department of Agronomy**

**III Year I Semester  
Weed Management  
Credits Hours 2 (1 + 1)**

**Objectives:**

To teach students about principles of weed science  
To impart practical knowledge of weed management in field and horticultural crops

**Theory:**

Introduction to weeds, characteristics of weeds,; their harmful and beneficial effects on ecosystem. Classification, reproduction and dissemination of weeds, crop-weed competition, factors of competition, losses on growth and yield of crops; factors affecting growth and development. Concepts of weed management: physical, cultural, chemical and biological; principles and methods, integrated weed management, Implements for weed control, robotic weed control, weed management in organic/ natural farming.

Herbicide classification and properties of important herbicides, concept of adjuvants, surfactants, herbicide formulation and their use. Mode of action of herbicides and selectivity phenomenon. Concept of herbicide mixture and utility in agriculture, Herbicide compatibility with agro-chemicals and their application, Herbicide resistance and its management. Weed management in different field and horticultural crops; aquatic weed management; *Parasitic weed management*

**Practical:**

Techniques of weed preservation, Weed identification and losses caused by weeds. Biology of important weeds. Study weeds in different situations, Study on shift in weed flora in long term trials, Study of herbicide formulations and mixture of herbicide. Study methods of herbicide application, Herbicide spraying equipments, their parts, use and maintenance. Weed control implements, Calculation of herbicide doses and requirement, weed control efficiency and weed index.

**Suggested readings:**

- Crafts, A.S. and Robbins, W.W. 1973. Weed Control. Tata McGraw-Hill Publishing Co. Ltd., New Delhi.
- Gupta, O.P. 1984. Scientific Weed Management. Today and Tomorrow Printers and Publishers, New Delhi.
- Gupta, O.P. 2015. Modern Weed Management. Agro Bios (India), Jodhpur.
- Naidu, V.S.G.R., Handbook of Weed Identification. Directorate of Weed Research, Jabalpur.
- Rajagopal, A., Aravindan, R. and Shanmugavelu, K.G., 2015. Weed management of Horticultural Crops. Agr (India), Jodhpur.
- Ramamoorthy, K. and Subbian, P., Predominant Weed flora in hill ecosystems. Agrobios (India), Jodhpur.
- Rao, V.S. 2000. Principles of Weed Science. Oxford & IBH Publishing Co., New Delhi.
- Subramanian, S., Mohammed Ali, A. and Jayakumar, R. 1991. All About Weed Control. Kalyani Publ. Ludhiana.
- Tadulingam, C. and Venkatnarayana, D. 1955. A Handbook of Some South Indian Weeds. Government Madras.
- Thakur, C. 1977. Weed Science. Metropolitan Book Co. Pvt. Ltd., New Delhi.

**Department of Horticulture**

**III Year I Semester  
Ornamental Crops, MAPs and Landscaping  
Credits Hours :3 (2+1)**

**Objectives:**

- To educate in detail about origin, area, climate, soil, improved varieties production technology of flowers and MAPs
- To educate about concept, designing principles and components of landscaping
- To educate about the physiological disorders of commercial flowers
- To educate about the post-harvest management and value addition in flower crops and MAP

**Theory:**

Production technology of ashwagandha, costus, isabgol, kalmegh and geranium; Production technology of mint, aloe and ocimum; Production technology of plants like lemongrass, citronella, vetiver and palmarosa. Importance and scope of ornamental crops; Importance and scope of medicinal and aromatic plants and landscaping; Principles of landscaping; Landscape uses of trees, shrubs and climbers, Production technology of important cut flowers like rose, gerbera and orchids; Production technology of gladiolus, tuberose and liliun; Production technology of chrysanthemum and carnation; Package of practices for loose flowers like marigold and jasmine under open conditions; Brief concept of Home landscaping, Carpet bedding, Topiary, Bonsai, Lawn, flower arrangement, Herbaceous Border, Hedge, Edge etc.; Processing and value addition important ornamental crops; Processing and value addition of MAPs produce.

**Practical:**

Identification MAPs and Ornamental plants (trees, Shrubs, Climbers, seasonal flower and house plants). Propagation of MAP, Bed preparation and planting of MAP. Nursery bed preparation and sowing of seasonal flower seeds; Propagation of ornamental plants by terminal/herbaceous cuttings; Propagation of Anthurium and orchids; Propagation of Bougainvillea; Planting of Gerbera suckers; Gladiolus corms; Establishment and maintenance of lawn; Preparation of flower preservatives and their use in extending the vase life of cut flowers; Training and pruning of ornamental plants and raising of hedge and edge; Planning and layout of garden. *Flower dehydration technology*

**Suggested readings:**

- Bose T.K. Commercial flowers (Vol 1 and 2)
- Kumar N., Abdul Khadder, P. Rangaswamy, I. Irulappam Introduction to spices, plantation crops, medicinal and aromatic plants
- Randhawa G.S and Mukopadhyay Floriculture in India
- Singh Anil K. and Anjana Sisodia Textbook of floriculture and landscaping

**Department of Forestry**

**III Year I Semester  
Introductory Agro-forestry  
Credits Hours : 2(1 + 1)**

**Objectives:**

- To study Agro forestry as an alternate system of land use
- To study different types of Agro forestry for soil and water conservation
- To study the characteristics of Agro forestry in terms its potential for soil moisture conservation practices

**Theory:**

Agro-forestry: Definition and scope of Agro-forestry system, Type of Agro-forestry system, potential of Agro-forestry in India, Prevailing agro-forestry system in NE India, MPTS- definition, role of MPTS in agro-forestry system, its selection for different agro-forestry system, MPTS of NE India, Ecological aspects of Agro-forestry system, tree -crop interaction competition, nutrient recycling, Traditional Agro-forestry as a viable choice to conserve Agro biodiversity in North-East India. Management of Agro-forestry system, Role of agro-forestry in soil and water conservation, windbreak, shelterbelt definition, objectives., Socio- economic aspects of Agro-forestry system, Design and Diagnostic study of agro-forestry system, Silviculture: Definition and scope of silvi-culture system, Propagation of tree species, Regeneration by seed, coppice, root suckers , Transplanting, stump, branch cutting, rhizomes, Nursery bed preparation and management, Cultural practices for bare root and seedling, field handling of nursery stock, Management of tree species, Silviculture of important tree species, choice of species- site factors, root, crown and bole characteristics, phenology, nutritional and water requirement, ground operation, tending, harvesting utility etc.

**Practical:**

Study of tree growth measurement, Study of environmental parameters affecting AF System .Plant propagation methods, Pre-sowing seed treatment, preparation of nursery bed exercise, practicing students experience in vegetation, afforestation method, practical training, pruning, coppicing, pollarding etc. natural and artificial regeneration. Design and diagnostic survey of agro-forestry system. Evaluation of agro-forestry system in different agro climatic zones. Exposure Visit to prevailing agro-forestry systems of the state and related important institutions.

**Suggested readings:**

Nair, P.K.R : 1993. An Introduction to Agro-forestry, Kluar Academic Publisher

**Department of Mathematics and Statistics**

**III Year I Semester  
Agricultural Informatics and Artificial Intelligence  
Credits Hours : 3 (2+1)**

**Objective**

To acquaint student with the basics of computer applications in agriculture, multimedia, database management, application of mobile app and decision- making processes, etc.

To provide basic knowledge of computer with applications in Agriculture.

To make the students familiar with Agricultural-Informatics, its components and applications in agriculture.

**Theory**

Introduction to Computers: Definition, Characteristics, Block Diagram, Generations, and types, Anatomy of Computers, Memory Concepts, Units of Memory, Operating System: Definition and types, Applications of MS-Office for creating, Editing and Formatting a document, Data presentation, Tabulation and graph creation, Statistical analysis, Mathematical expressions, Database, concepts and types, creating database, Uses of DBMS in Agriculture. Internet and World Wide Web (www): Concepts and components.

Computer programming: General concepts like flowchart and Algorithm, Introduction general programming language types like Low Level & High level, e-Agriculture, Concepts, design and development, Application of innovative ways to use information and communication technologies (IT) in Agriculture. Computer Models in Agriculture: Statistical, weather analysis and crop simulation models, limitation, advantages and application of models for understanding plant processes, sensitivity, verification, calibration and validation, Smartphone mobile apps in agriculture for farm advice: Market price, post-harvest management etc. Geospatial technology: Concepts, techniques, components and uses for generating valuable agri-information. Decision support systems: Concepts, components and applications in Agriculture. Agriculture Expert System, Soil Information Systems etc., for supporting farm decisions. Preparation of contingent crop planning and crop calendars using IT tools. Digital India and schemes to promote digitalization of agriculture in India.

Introduction to artificial intelligence, background and applications, Turing test., Breadth-first search, Depth-first search, Heuristics search techniques: Best-first search, A\* algorithm, IoT (Concept, Key Component, Ecosystem, Application and Challenges) and Big Data: (Concept, of 5V's, Architecture, Application and Challenges); Use of AI in Concepts of smart agriculture.

Study of computer components, accessories, practice of important DOS Commands, Introduction of different operating systems such as Windows, Unix/Linux, creating files and folders, File Management. Use of MS-Word and MS Power-point for creating, editing and presenting a scientific documents, MS-EXCEL-Creating a spreadsheet, Use of statistical tools, Writing expressions, Creating graphs, Use of smart phones and other devices in agro-advisory and dissemination of market information, Introduction of Geospatial technology, AR/ VR demonstration, Preparation of contingent crop planning, India Digital Ecosystem of Agriculture (IDEA).



## **8 III Year II Semester**

<b>Sr</b>	<b>Course</b>	<b>Credits</b>
1.	Fundamentals of Agri Biotechnology	3(2+1)
2.	Basic and Applied Agril. Statistics	3(2+1)
3.	Crop Improvement - II	2(1+1)
4.	Pest Management in <i>Rabi</i> Crops and Stored Grains	2(1+1)
5.	Renewable energy in Agriculture and Allied Sector	2(1+1)
6.	Dryland agriculture/ Rainfed agriculture and watershed management	2(1+1)
7.	Essentials of Plant Biochemistry	3 (2+1)
8.	Agricultural Microbiology and Phyto -remediation	2(1+1)
9.	Agricultural Finance & Cooperation	2(1+1)
10.	Fundamentals of Seed Science & Technology	2(1+1)
<b>Total</b>		<b>23(13+10)</b>

## **Biotechnology Centre**

### **III Year II Semester Fundamentals of Agricultural Biotechnology Credits Hours 3(2+1)**

#### **Objectives:**

To familiarize the students with the fundamental principles of biotechnology, various developments in biotechnology and its potential applications.

#### **Theory:**

Introduction to Plant Tissue Culture & Genetic Engineering: History; Cellular totipotency and cyto-differentiation; Callus culture, Single-cell/suspension culture and their applications, Organogenesis & somatic embryogenesis, Somaclonal variation and its use in crop improvement, Embryo rescue technique and its significance in hybrid development, In vitro fertilization, ovule culture and its significance in hybrid development, Protoplast isolation, culture and regeneration, Somatic hybridization (somatic hybrids & cybrids) and its application in crop improvement, Anther and pollen culture for haploid production; Development of disease-free (virus free) plants through apical meristem culture, Micro-propagation technique for the generation of quality planting material,

Introduction to Molecular Biology: DNA structure, structure & function; DNA replication, transcription and translation, RNA, types and function, Nucleic acid hybridization, PCR and its applications,

Introduction to recombinant DNA technology: DNA modifying enzymes & vectors, Plant genetic transformation physical (Gene gun method), chemical (PEG mediated) and Agrobacterium-mediated gene transfer methods, Transgenics and its importance in crop improvement with successful stories,

Introduction to various molecular markers: RFLP, RAPD, SSR, SNP etc., Marker-assisted breeding in crop improvement

#### **Practical:**

Introduction to Plant Tissue Culture Laboratory, Good Laboratory Practices; Media Preparation & sterilization, Glassware sterilization; Micropropagation, Callus induction and culture, Anther culture, Apical meristem culture, Preparation of synthetic seeds, Isolation of plasmid DNA, Quantification of DNA; Agarose Gel Electrophoresis & visualization of plasmid DNA; Restriction digestion of plasmid DNA and agarose gel electrophoresis; Isolation of Plant genomic DNA; PCR amplification of DNA, Gel electrophoresis of amplified DNA

#### **Suggested readings:**

Bhojwani SS (2012) Plant Tissue Culture: Applications and Limitations, ...., Publ., Elsevier 1<sup>st</sup> Edition, ISBN-10:9781-299544086

Bhojwani SS and Razdan MK (1996) Plant Tissue Culture: Theory and Practice, a Revised Edition 766p, Publ., Elsevier Science Ltd. Revised Edition, ISBN-13:978-0448166238

Chawla HS (2020) Introduction to Plant Biotechnology 631p, Publ., Science Publishers 3<sup>rd</sup> Edition, ISBN-13:978-81204117328

Christou P and Klee H (2004) Handbook of Plant Biotechnology. Publ., John Wiley & Sons, ISBN-0-471-85199X

Lewin B (2013) Gene XI. Peterson Publications/ Panima 968p, Publ., W.H. Freeman & Co.

Primrose SB (2001) Molecular Biotechnology 196p, Publ., Panima Publishing Corporation 2<sup>nd</sup> Edition, ISBN-9788186535219

Singh BD (2023) Biotechnology: Expanding Horizon 938p, Publ., Kalyani V<sup>th</sup> Edition, ISBN-10:9327-22065X

**Department of Statistics and Mathematics**

**III Year II Semester**

**Basic and Applied Agricultural Statistics**

**Credits Hours 3(2+1)**

**Objectives:**

To provide an idea on Statistical concepts of both descriptive and inference Statistics which will be useful to do statistical analysis.

**Theory**

Introduction to Statistics and its Applications in Agriculture. Types of Data. Scales of measurements of Data. Summarization of Data. Classification of Data. Frequency Distribution. Methods of Classification. Definition of Grouped and Ungrouped Data. Definition of Class Interval (formula for determining the no. of class interval), Width of CI, Class Limits (Boundaries), Mid Points. Types of Frequency Distribution. Diagrammatic Presentation of Data. Bar Diagrams Simple, Multiple, Sub-divided and Percentage Bar Diagrams. Pie-diagram. Graphical Presentation of Data Histogram, Frequency Polygon and Ogives.

Measures of Central Tendency. Requisites for an Ideal Measure of Central Tendency. Different Types of Measure. Arithmetic Mean Definition, Properties, Merits, Demerits and Uses. A.M. (examples) for Grouped and Ungrouped Data. Step-deviation Method. Weighted Mean. Definition of Geometric Mean and Harmonic Mean. Relationship between A.M., G.M. and H.M. Median- Definition, Merits, Demerits and Uses. Graphical Location of Median. Mode- Definition, Merits, Demerits and Uses. Graphical Location of Mode. Relationship between Mean, Median and Mode.

Measures of Dispersion. Characteristics for an Ideal Measure of Dispersion. Different Types of Measures of Dispersions. Definition of Range, Interquartile Range, Quartile Deviation and Mean Deviation. Standard Deviation- Definition, Properties. S.D. and Variance for Grouped and Ungrouped Data. Variance of Combined Series. Coefficient of Dispersions. Co-efficient of Variation.

Measures of Skewness and Kurtosis. Definition of Symmetrical Distribution. Definition of Skewness, Measures of Skewness. Definition of Kurtosis. Measure of Kurtosis. Relationship between Mean, Median and Mode for Symmetrical and Skewed Distribution.

Probability Theory and Normal Distribution. Introduction to Probability. Basic Terminologies. Classical Probability-Definition and Limitations. Empirical Probability-Definition and Limitations. Axiomatic Probability. Independent and dependent events, Addition and Multiplication Theorem (without proof). Conditional Probability. Simple Problems based on Probability. Definition of Random Variable. Discrete and Continuous Random Variable.

Normal Distribution- Definition, Prob. Distribution, Mean and Variance. Assumptions of Normal Distribution. Normal Probability Curve. Properties of normal distribution

Correlation and Regression Definition of correlation, Scatter Diagram, Karl Pearson's Coefficient of Correlation. Types of Correlation Coefficient. Properties of Correlation Coefficient. Definition of Linear Regression. Regression Equations. Regression Coefficients. Properties of Regression Coefficients.

Tests of Significance. Definition. Null and Alternative Hypothesis. Type I and Type II Error. Critical Region and Level of Significance. One Tailed and Two Tailed Tests. Test Statistic. One Sample, Two Sample and Paired t-test with Examples. F-test for Variance.

ANOVA and Experimental Designs. Definition of ANOVA. Assignable and Non-assignable Factors. Analysis of One-way Classified Data. Basic Examples of Experimental Designs. Terminologies. Completely Randomized Design (CRD).

Sampling Theory. Introduction. Definition of Population, Sample, Parameter and Statistic. Sampling Vs Complete Enumeration. Sampling Methods. Simple Random Sampling with Replacement and without Replacement. Use of Random Number Table.

**Practical:**

Diagrammatic and Graphical representation of data. Calculation of A.M., Median and Mode (Ungrouped and Grouped data). Calculation of S.D. and C.V. (Ungrouped and Grouped data). Correlation and Regression analysis. Application of t-test (one sample, two sample independent and dependent). Analysis of variance one way classification. CRD. Selection of random sample using simple random sampling.

**Suggested readings:**

- Agarwal, B.L. (2013), Basic Statistics, New Age International Publishers, 6th Edition, ISBN- 13, - 978-8122433807
- Elhance, D.N., Elhance, V. and Aggarwal, B.M. (2018). Fundamentals of Statistics, Kitab Mahal Publishers, New Revised edition, ISBN- 13, - 978-8122505139
- Gupta, S.C. and Kapoor, V. K. (2014) Fundamentals of Applied Statistics, Sultan Chand and Sons, 4th edition, ISBN- 13, - 978-8180547058
- Gupta, S.C. and Kapoor, V. K. (2020) Fundamentals of Mathematical Statistics, Sultan Chand and Sons, 12th edition, ISBN- 13, - 978-9351611738
- Sahu, P.K. (2010), Agriculture and Applied Statistics-I, Kalyani Publishers, 221th edition, ISBN- 13, -978-8127239923
- Sahu, P.K. and Das, A.K. (2009) Agriculture and Applied Statistics-II, Kalyani Publishers, 1<sup>st</sup> edition ISBN-13, 978-9327240351

**Department of Genetics and Plant Breeding**

**III Year II Semester  
Crop Improvement - II  
Credits Hours 2(1+1)**

**Objectives:**

To provide knowledge about Self-pollinated and cross pollinated Rabi crops  
To learn about origin and distribution of Rabi crops  
To design breeding objectives of major rabi crops  
To impart information on different crop varieties for Rabi season

**Theory:**

Centres of origin, distribution of species, wild relatives in different cereals; pulses; oilseeds; fibres; fodders and cash crops; vegetable and other horticultural crops; Plant genetic resources, its utilization and conservation, study of genetics of qualitative and quantitative characters; Important concepts of breeding self-pollinated, cross-pollinated and vegetatively propagated crops. Major breeding objectives and procedures including conventional and modern innovative approaches for development of hybrids and varieties for yield, adaptability, stability, abiotic and biotic stress tolerance and quality (physical, chemical, nutritional); Hybrid seed production technology in Wheat, Oat, Chickpea, Rapeseed & Mustard etc. Ideotype concept, climate resilient crop varieties for future.

**Practical:**

Floral biology, emasculation and hybridization techniques in different crop species viz. Wheat, Oat, Rapeseed & Mustard, Pulses, Potato, Sugarcane, Tomato, Chilli, Onion etc. Study of field techniques for seed production and hybrid seed production in rabi crops; Estimation of heterosis, inbreeding depression and heritability;; Study of quality characters, donor parents for different characters in tomato; Visit to seed production plots; Visit to AICRP breeding plots of different crops.

**Suggested readings:**

Chopra V.L. Breeding field crops-I  
Gupta S.K. Plant Breeding theory and practice  
Poehlman J.M. and D.N. Barthakur Breeding Asian field crops  
Rajendra Kumar Yadav Practical manuals on Crop Improvement I (Kharif crops)  
Ram Hari Har Vegetable breeding Principles and Practices  
Singh C.B. and D. Khare Genetic improvement of field crops , Scientific Publ.,  
Singh D.P. Genetics and Breeding of Pulse crops  
Sleper D.A. and J.M. Poehlman Breeding field crops

Department of Entomology

III Year II Semester  
Pest Management in Rabi Crops and Stored Grains  
Credits Hours 2(1+1)

Sr.	Theory
	<i>General account on type of damage by different arthropods pests. Scientific name, order, family, marks of identification, host range, distribution, biology and bionomics, nature of damage, damaging stage of insect pests and their management;</i>
1.	<b>Wheat:</b> Termite
2.	<b>Chickpea:</b> Gram pod borer, Cutworm
3.	<b>Lentil and grass pea:</b> Aphid; <b>Pea:</b> Stem fly, Pod borer, Leaf miner
4.	<b>Mustard:</b> Aphid, Painted bug, Flea beetle and Saw fly; <b>Sunflower:</b> Head capsule borer;
5.	<b>Linseed:</b> Bud fly and Cutworm; <b>Safflower:</b> Aphid and Capsule borer;
6.	<b>Sugarcane:</b> Pyrilla, Early shoot borer and Top shoot borer, Termite, Mealy bug and Scale insect. <b>Tobacco:</b> Tobacco caterpillar and Aphid
7.	<b>Mango:</b> Mango hopper, Mango stem borer, Mango shoot borer, Mango mealy bug, Mango hopper, Oriental fruit fly, Mango stone weevil and Bark eating caterpillar
8.	<b>Banana:</b> Banana scab moth and Banana weevil; <b>Papaya:</b> AK grasshopper, Mealy bug and Whitefly
9.	<b>Sapota:</b> Sapota leaf webber, fruit borer and <i>Anar</i> butterfly;
10.	<b>Guava:</b> Guava fruit fly, Bark eating caterpillar, Mealy bug and Helmet scale insect;
11.	<b>Ber:</b> Ber fruit fly, Ber beetle, Leaf webber, Tortoise beetle; <b>Melon:</b> Red pumpkin beetle, Melon fruit fly
12.	<b>Apple:</b> Apple root borer, Apple stem borer, Woolly aphid, San Jose scale, Tent caterpillar, Codling moth and Indian Gypsy moth
13.	<b>Potato:</b> Potato tuber moth, Cutworm and Aphid ( <i>Myzus persicae</i> )
14.	<b>Tomato:</b> Fruit borer, Aphid, Tomato leaf miner/ pinworm, Whitefly and Serpentine leaf miner
15.	<b>Brinjal:</b> Shoot & fruit borer, Aphid, Jassid, Whitefly, Lace bug, Hadda beetle
16.	<b>Chilli:</b> Aphid, Thrips, Mites, Mealy bug, Fruit borer, Whitefly and White grub
17.	<b>Okra:</b> Shoot & fruit borer, Jassid, Whitefly, Red spider mite and Mealy bug
18.	<b>Onion &amp; Garlic:</b> Thrips and Cutworm;
	<b>Cucurbits:</b> Red pumpkin beetle, Fruit fly, Epilachna beetle and Blister beetle
19.	<b>Cole crops:</b> DBM, and Tobacco caterpillar ( <i>Spodoptera litura</i> & <i>S. exigua</i> )
20.	<b>Bougainvillea:</b> Groundnut aphid; <b>Hollyhock:</b> Hollyhock tingid bug;
	<b>Chrysanthemum; Marigold:</b> Sunflower lacewing bug; <b>Gerbera:</b> White fly
21.	<b>Jasmine:</b> Jasmine thrips, Jasmine budworm, Eriophyid mite; <b>Gladiolus:</b>
	<b>Marigold:</b> Gram pod borer
22.	<b>China rose:</b> Cotton aphid, Dusky cotton bug, Milk weed bug, Red cotton bug, Whitefly, Castor hairy caterpillar, Cotton grey weevil, Banded blister beetle;
	<b>Coriander:</b> Aphid;
	<i>Scientific name, order, family, host range, distribution, biology and bionomics, nature of damage, damaging stage of important arthropod pests and their management;</i>
23.	Rodents associated with stored grain and their management.
24.	Birds associated with stored grain and their management

Sr	Practical
1.	Identification of different types of damage (specimen and herbarium)
2.	Identification and study of life cycle and seasonal history of various insect pests attacking field crops and their produce (life cycle of two insects per student, one of complete and second of incomplete metamorphosis)
3.	Identification and study of life cycle and seasonal history of various insect pests attacking vegetable crops and their produce
4.	Identification and study of life cycle and seasonal history of various insect pests attacking fruit crops and their produce
5.	Identification and study of life cycle and seasonal history of various insect pests attacking plantation (gardens, narcotics, spices & condiments) crops and their produce
6.	Determination of insect infestation by different methods
7.	Assessment of losses due to insects
8.	Identification of rodents and rodent control operations in godowns
9.	Identification of birds and bird control operations in godowns.
10.	Visit to storage management, FCI and Research institute and submission of visit report

### **Suggested reading**

- Atwal AS and Dhaliwal GS.2018. Agricultural Pests of South Asia and Their Management. Kalyani Publishers, Ludhiana, Edition-7<sup>th</sup>, 467p. ISBN No.978-9327250725.
- Cotton RC. 2007. Insect Pests of Stored Grains and Grain Products. Biotech Books Delhi 110035, Edition-1<sup>st</sup>, 394 p. ISBN No.9781774636824.
- Gupta HCL and Ameta OP. 2015. Management of Insect Pests of Horticultural Crops. Agritech Publishing Academy, Udaipur, Edition-1<sup>st</sup>, 224p. ISBN No.8185680949.
- Khare BP. 2006. Stored Grain Pests and Their Management. Kalyani Publishers, Ludhiana, Edition-4<sup>th</sup>, 314 p. ISBN No.978-9387973671.
- Kumar Ashok and Nigam Prem Mohan.2010. Economic and Applied Entomology. Emkay Publications, New Delhi, Edition-1<sup>st</sup>, 247 p. ISBN No.9788170359272.
- Panwar VPS.2017. Agricultural Insect Pests of Crops and their Control. Kalyani Publishers, Ludhiana, Edition-3<sup>rd</sup>, 424 p. ISBN No.978-9327275438.
- Pruthi HS.1969. Textbook of Entomology. ICAR, New Delhi, Edition-1<sup>st</sup>, 997 p. ISBN No.-0.00, Record No.-32637.
- Sathe TV. 2020. Cotton Pests and Bio- Control Agents. Daya Publishing House, Delhi, Edition-1<sup>st</sup>, 127 p. ISBN No. 9788170352341.
- Sharma S and Choudhary A. 2008. Storage Pest Management. Mahamaya Publishing House, Adampur, Jalandhar, Edition-1<sup>st</sup>, 148p. ISBN No.9788183250467.
- Shrivastava KP. 2013. A Text Book of Applied Entomology (Vol-II). Kalyani Publishers, Ludhiana, Edition-1<sup>st</sup>, 390p. ISBN No.978-8127267520.
- Sehgal PK and Bhardwaj DK. 2018. कृषि कीट विज्ञान. Kalyani Publishers, Ludhiana, Edition-1<sup>st</sup>, 276 p. ISBN No.978-8170354802.
- Upadhyay KD and Mathur YK.2021. फसल व संगृहित अनाज के कीट एवं उनका प्रबंधन Rama Publishing House, Meerut, Meerut, Edition-1<sup>st</sup>, 230 p. ISBN No. 9789387018624.

## **Agricultural Engineering**

### **III Year II Semester Renewable energy in Agriculture and Allied Sector Credits Hours 2(1+1)**

#### **Objectives**

To gain the knowledge on different types of materials used in Renewable Energy  
To understand the importance of Renewable Energy technology and its applications.  
To train the students on the applications of solar thermal technology.

#### **Theory:**

Classification of energy sources, contribution of these of sources in agricultural sector, Familiarization with biomass utilization for biofuel production and their application, Familiarization with types of biogas plants and gasifiers, biogas, bio-alcohol, biodiesel and bio-oil production and their utilization as bioenergy resource, introduction of solar energy, collection and their application, Familiarization with solar energy gadgets: solar cooker, solar water heater, application of solar energy: solar drying, solar pond, solar distillation, solar photovoltaic system and their application, introduction of wind energy and their application. Availability of bio mass and their application in different places

#### **Practical:**

Familiarization with renewable energy gadgets. To study biogas plants, To study gasifier, To study the production process of biodiesel, To study briquetting machine, To study the production process of bio-fuels. Familiarization with different solar energy gadgets. To study solar photovoltaic system: solar light, solar pumping, solar fencing. To study solar cooker, To–study solar drying system. To study solar distillation and solar pond. Solar Wind hybrid system. Field visit to Solar Wind farm.

#### **Suggested readings:**

- Chawla OP (1986) Advances in Biogas technology 144p, Publ., Thakur Dass Publisher, New Delhi  
FAO 1988, Bio-mass Combustion Technology  
Khandelwal KC and Mandi SS (1989) Bio-gas Technology 202p, Publ., Tata McGraw-Hill, Mandi ISBN-0074517236  
Kishore VVN (2008) Renewable Energy Engineering and Technology: principles and practice 912p, Publ., Routledge; 1st edition Teri, India ISBN- 978-1138866980  
Mathure AN and Rathore NS (2007) New and Renewable Energy Sources 310p, Publ., New India Publishing Agency, New Delhi ISBN- 978-8189422721  
Rai GD (1988) Non-Conventional Sources of Energy 696p, publ., Khanna Publisher ISBN- 978-8174090737  
SolankiCS (2011) Solar Photovoltaic Fundamentals, Technologies and Applications 844p, Publ., PHI Learning Pvt. Ltd.  
Sukhatme S and NayakJ (2008) Solar Energy: Principles of Thermal Collection and Storage, Publ., Tata McGraw-Hill, ISBN - 978-0070142961  
SukhatmeSP (2009) Solar Energy 568p, Publ., Tata McGraw-HillISBN-978-0070142961  
Twivell JN and Weir A (2015) Renewable Energy Sources 784, Publ., Routledge; 3rd edition, Taylor and Francis group ISBN- 978-0415584388

**Department of Agronomy**

**III Year II Semester  
Dryland Agriculture/ Rainfed Agriculture and Watershed Management  
Credits Hours 2 (1+1)**

**Objectives:**

To learn about characteristics and conditions of dryland/rainfed agriculture  
To gain knowledge about drought and its mitigation  
To impart knowledge on water harvesting and watershed management

**Theory:**

Dryland/Rainfed agriculture: Introduction, types and characteristics; History of dry land/rainfed agric in India; Problems and prospects of dry land/rainfed agriculture in India ; Soil and climatic conditions prevail dry land/rainfed areas; Soil and water conservation techniques, Drought: types, effect of water deficit on phmorphological characteristics of the plants, Crop adaptation and mitigation to drought; Water harvesting: import its techniques, Efficient utilization of water through soil and crop management practices, Crops and cropping system in dry land/rainfed areas; Management of crops in dry land/rainfed areas, Contingent crop planning for abnormal weather conditions, Concept, history, objective, principles and components of watershed management, factors affecting watershed management.

**Practical:**

Studies on climate classification, studies on rainfall pattern in rainfed areas of the country and pattern of onset and withdrawal of monsoons. Studies on cropping pattern of different rainfed areas in the country demarcation of rainfed area on map of India. Interpretation of meteorological data and scheduling of supplementary irrigation on the basis of evapo-transpiration demand of crops. Critical analysis of rainfall and possible drought prone area in the country. Effective rainfall and its calculation. Studies on cultural practices for mitigating moisture including mechanical and agronomic measure. Soil moisture determination under different land situations, Importance of seed priming to mitigate drought. Assessment of meteorological drought. Characterization and delineation of watershed. Field demonstration on soil & moisture conservation measures. Field demonstration on construction water harvesting structures. Visit to rainfed research station/watershed.

**Suggested readings:**

- Lenka D., 2006. Climate, Weather and Crops in India. Kalyani Publishers, New Delhi.  
Mavi H.S., 1994. Introduction to Agro-meteorology. Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi  
Mavi H.S. and Graeme J.Tupper, 2005. Agro-meteorology Principles and applications of climate stud agriculture. International Book Publishing Co., Lucknow.  
Nanjappa H.V. and B.K. Ramachandrappa, 2007. Manual on Practical Agricultural Meteorology. AgrIndia. Jodhpur.  
Rao G.S. L.H .V. Prasad, 2008. Agricultural Meteorology. Prentice Hall of India Pvt. Ltd., New Delhi.  
Reddy S.R., 1999. Principles of Agronomy. Kalyani Publishers, New Delhi.  
Reddy T. Yellamanda and G.H. Sankara Reddi, 2010. Principles Of Agronomy. Kalyani Publishers, New  
Srivastava A.K. and P.K. Tyagi, 2011. Practical Agricultural Meteorology. New Delhi Publishing Agency, Delhi.

**Department of Food Science and Technology**

**III Year II Semester  
Essentials of Plant Biochemistry  
Credits Hours: 3(2+1)**

**Objective**

To impart the fundamental knowledge on structure and function of cellular components, bio-molecules and the biological processes in plants

**Theory**

Biochemistry – Introduction and importance, *structure and properties of water*, pH and buffer, plant cell and its components.

Bio-molecules – Structure, classification, properties and function of carbohydrates, amino acids, *proteins including amino acids*, lipids and nucleic acids.

Vitamins and *minerals* – physiological and metabolic role.

Enzymes: General properties; Classification; Mechanism of action; Michaelis and Menten and Line Weaver Burk equation and plots; Introduction to allosteric enzymes, use of enzymes.

Metabolic energy and its generation – Metabolism – Basic concepts, *Glycolysis*, Citric acid Cycle, Pentose phosphate pathway, oxidative phosphorylation, Fatty acid oxidation.

Biosynthetic Pathways – Photosynthesis in *C3 and C4 plants*, *CN metabolism*, Gluconeogenesis, nitrogen fixation, fatty acid and starch formation. Regulation of metabolic pathways. *TCA and Electron Transport Chain*

Secondary metabolites, Terpenoids, Alkaloids and Phenolic; *their importance and applications in food and pharmaceutical industries. Plant defense pathway*

**Practical**

Preparation of standard solutions and reagents, Determination of pH, Qualitative tests of carbohydrates and amino acids, Quantitative estimation of soluble sugars and starch, Estimation of protein by Kjeldhal method and Lowry's method, Preparation of mineral solution from ash, Estimation of fat by Soxhlet method, Determination of acid value, saponification value and iodine number, Estimation of ascorbic acid, Qualitative/quantitative tests of secondary metabolites.

**Suggested reading**

- Conn, Stumpf, Bruening and Doi. 2006. Outlines of Biochemistry. Fifth Edition. Wiley
- Gajera, HP., Patel, SV and Golakiya, BA. 2008. Fundamentals of Biochemistry- A Textbook. First edition. International Book Distributing Company, Lucknow, India.
- Goodwin and Mercer. 2005. Introduction to Plant Biochemistry. 2nd edition. CBS.
- Heldt. 2005. Plant Biochemistry. Elsevier (Can be downloaded)
- Horton, Moran, Rawn, Scrimgeour, Perry. 2011. Principles of Biochemistry. Fifth Edition. Pearson/Prentice Hall (Can be downloaded)
- Jain, V.K. 2020. Fundamentals of Plant Physiology( Nineteenth Editions and Reprint) ISBN:978-93-525-3334-3

- Lincoln Taiz and Eduardo Zeiger 2002. Plant Physiology (Third Edition) ISBN0-87893-823-0.
- Nelson and Cox. 2008. Lehninger Principles of Biochemistry. Fourth/Fifth edition. Freeman (Can be downloaded)
- Verma, SK and Verma, Mohit (2007). A textbook of Plant Physiology, Biochemistry and Biotechnology. 6th edition. S. Chand and Company, New Delhi. India.

**Department of Plant Pathology**

**III Year II Semester  
Agricultural Microbiology and Phyto-remediation  
Credits Hours:2(1+1)**

**Objectives:**

To get an introduction to microbiology with specific focus on its significance in agriculturescience  
To get acquainted with the bacterial structure and the function of the different bacterial components  
To get highlights on different fields of microbiology  
To get highlights on the Bioremediation of polluted soils using microbial mediators and phyto-remediation  
To get a concept of biological control and the role of bio-pesticides in plant diseasemanagement

**Theory:**

Introduction to Microbiology: Definition, applied areas of Microbiology and Importance of Microbiology. History of Microbiology: Discovery of microorganisms, spontaneous generation theory, Germ theory of diseases, Immunization, fermentation, and origin of life  
Bacteria: cell structure, chemoautotrophy, photo autotrophy, growth. Bacterial genetics: Genetic recombination- transformation, conjugation and transduction  
Genetic Engineering: Plasmids, episomes, and genetically modified organisms  
Air Microbiology: Phyllosphere microflora, Phylloplane microflora, microflora of floral parts etc. Food Microbiology: Microbial spoilage and principles of food preservations, Food poisoning  
Water Microbiology: Types of water, water microorganisms, and microbial analysis of water e.g. coliform test, Purification of water.  
Industrial Microbiology: Microbial products, Biodegradation, Biogas production, Biodegradable plastics etc. Biological control: Microbial biopesticides for plant disease management  
Concepts of rhizosphere microbiology- Rhizodeposits -biochemical nature, release mechanism in rhizosphere, function, Carbon flow in rhizosphere, Rhizosphere microbiome-residents and their roles  
Potential of plant growth promoting rhizobacteria (PGPR) and endophytes on soil health and sustainability  
Bioremediation of polluted soils using microbial mediators  
Phytoremediation of polluted soils

**Practical:**

Study of the microscope, Acquaintance with laboratory material and equipments, Microscopic observation of different groups of microorganisms: moulds (Fungi), Direct staining of bacteria by crystal violet, Negative or indirect staining of bacteria by nigrosin, Gram staining of bacteria, Study of phyllosphere and rhizosphere microflora, Measurement of microorganisms, Preparation of culture media, Isolation and purification of rhizospheric microbes, Isolation and purification of N-fixers, Isolation and purification of Nutrient solubilizers, Isolation and purification of Endophytes.

**Suggested readings:**

Pelczar, M.J., Chan, E.C.S. and Kreig, N.R. (2002) Microbiology. 5th Edition, Tata McGraw-Hill, New Delhi.

- Rangaswami, G. & Bagyaraj, D. J. (2005) Agricultural Microbiology. Prentice-Hall of India Pvt. Ltd., New Delhi.
- Mukherjee, N. & Ghosh, T. (2004). Agricultural Microbiology. Kalyani Publishers, Calcutta
- Dubey, H.C. (2007). A Textbook of Fungi, Bacteria and Viruses. Vikas Publishing House Ltd., New Delhi
- Salyers, AA & Whitt DD (2001) Microbiology: diversity, disease, and the environment. Fitzgerald Science Press,
- Prescott, L. M. (2002). Microbiology 5th Edition, McGraw-Hill Inc., US

**Department of Agricultural Economics and Farm Management**

**III Year II Semester  
Agricultural Finance and Cooperation  
Credits Hours 2(1+1)**

**Objectives:**

To impart knowledge on issues related to lending to priority sector credit management and financial risk management.

**Theory:**

Agricultural Finance- meaning, scope and significance, credit needs and its role in Indian agriculture. Agricultural credit: meaning, definition, need, classification. Credit analysis: 4 R's, and 3C's of credits.

Sources of agricultural finance: institutional and non-institutional sources, commercial banks, social control and nationalization of commercial banks, Micro financing including KCC. Lead bank scheme, RRBs, Scale of finance and unit cost. An introduction to higher financing institutions RBI, NABARD, ADB, IMF, world bank, Insurance and Credit Guarantee Corporation of India. Cost of credit. Recent development in agricultural credit. Preparation and analysis of financial statements Balance Sheet and Income Statement. Basic guidelines for preparation of project reports Bank norms SWOT analysis. Agricultural Cooperation Meaning, brief history of cooperative development in India, objectives, principles of cooperation, significance of cooperatives in Indian agriculture. Agricultural Cooperation in India- credit, marketing, consumer and multi- purpose cooperatives, farmers' service cooperative societies, processing cooperatives, farming cooperatives, cooperative warehousing, role of ICA, NCUI, NCDC, NAFED. *4 R's, 5 C's and 7 P's of credit*. Crop insurance its scope, significance and limitations and the potential of the newly launched 'Pradhan Mantri Fasal Bima Yojana' (Prime Minister's Crop Insurance Scheme). Successful cooperative systems in Gujarat (AMUL), Tamil Nadu (Aavin), Karnataka (Nandini), Maharashtra and Punjab. *Recent Development in banking sector*.

**Practical:**

Optimum allocation of limited amount of capital among different enterprise. Analysis of progress and performance of cooperatives using published data. Analysis of progress and performance of commercial banks and RRBs using published data. Visit to a commercial bank, cooperative bank and cooperative society to acquire firsthand knowledge of their management, schemes and procedures. Estimation of credit requirement of farm business A case study. Preparation and analysis of balance sheet A case study. Preparation and analysis of income statement A case study. Appraisal of a loan proposal A case study. Techno-economic parameters for preparation of projects. Preparation of Bankable projects for various agricultural products and its value added products. Seminar on selected topics. Different types of repayment plans.

**Suggested readings:**

Gittinger JP 1982. Economic Analysis of Agricultural Projects. The Johns Hopkins Univ. Press.  
Reddy S. S and Ram P.R 1996. Agricultural Finance and Management. Oxford & IBH.

**Department of Genetics and Plant Breeding**

**III Year II Semester  
Fundamentals of Seed Science & Technology  
Credits Hours 2(1+ 1)**

**Objectives:**

- i) To impart basic and fundamental knowledge on principles and practices seed science and technology
- ii) To impart practical skills on scientific seed production and post harvest quality management. .

**Theory:**

Introduction to seed technology, definition and importance. Seed quality -definition, characters of good quality seed, Causes of deterioration of varietal purity and assessment of genetic purity, different classes of seed. Foundation and certified seed production of important cereals, pulses and oilseed, field inspection, importance and procedures, post harvest seed quality management, seed processing procedures, seed drying Seed treatment, its importance, method of application and seed packing ;seed storage - general principles, stages and factors affecting seed longevity during storage, Seed health management during storage. Seed Certification and legislation, Seed Act and Seed Act enforcement, duty and powers of seed inspector, offences and penalties. Seeds Control Order 1983, basics of seed quality testing

**Practical:**

Seed Structure, Seed sampling, Physical purity, Moisture determination, Germination test, Seed and seedling vigour test, Seed Viability, Genetic purity test: Grow out test , Field inspection, seed health testing using blotter and agar plate method. Visit to seed production farms, seed testing laboratories and seed processing plant.

**Suggested Readings**

- Agarwal, R.L. 1995. Seed Technology (2<sup>nd</sup> edition) Oxford & IBH Publishing Co. Pvt. Ltd. New Delhi, India
- Bhojwani SS and Bhatnagar SP. 1999. The Embryology of Angiosperm. Vikas Publ
- Khare, D. and Bhale M.S. 2019. Seed Technology, Scientific Publishers, ISBN: 978-81-72338-84-8,
- McDonald MB Jr & Copeland LO. 1997. Seed Production: Principles and Practices. Chapman & Hall.
- Tunwar NS and Singh SN. 1988. Indian Minimum Seed Certification Standards. CSCB, Ministry of Agriculture, New Delhi.
- Vanangamudi, K. (2014). Seed Technology (An illustrated book), New India Publishing Agency, New Delhi, India

## 9 IV Year I Semester

S. No	Course	Credits
1	5 Elective Courses each of 4(3+1) credits	20
<b>Total</b>		<b>20</b>

Following Department wise elective courses are to be offered at the University level. The student has to opt any five in the first Semester of the IV Year. Each elective course will be of 4(3+1) credit hrs.

Department	Proposed Elective Courses
1. Agricultural Economics and FM	Agri-Business Management
2. Agricultural Engineering	Post harvest management of field and horticultural crops and Value addition
3. Agronomy	Principles and Practices of Organic Farming and Conservation Agriculture
4. Biotechnology	Micro propagation technologies
5. Entomology	Plant Protection Equipment, Pesticides and their Application Technique
6. Extension Education	Agricultural Journalism
7. Food Science and Technology	Food safety and standards
8. Food Science and Technology	Principles of Food Science and Technology
9. Horticulture	Commercial Landscape
10. Genetics and Plant Breeding	Commercial Seed Production
11. Plant Pathology	Bio-pesticides and Bio-fertilizers
12. Plant Physiology	Fundamentals of Botany
13. Soil Science and AC	Management of Natural Resources

**Department of Agricultural Economics and Farm Management**

**IV Year I Semester  
Agri-Business Management  
Credits Hours :4(3+1)**

**Objectives:**

To impart knowledge on understanding the concepts processes, significance, and role of management and organizational behaviour.

**Theory**

Transformation of agriculture into agribusiness, various stakeholders and components of agribusiness systems. Importance of agribusiness in the Indian economy and New Agricultural Policy. Distinctive features of Agribusiness Management: Importance and needs of agro-based industries, Classification of industries and types of agro based industries. Institutional arrangement , procedures to set up agro based industries. Constraints in establishing agro-based industries, Agri-value chain: Understanding primary and support activities and their linkages. Business environment : PEST & SWOT analysis. Management functions: Roles & activities, Organization culture. Planning, meaning, definition, types of plans. Purpose or mission, goals or objectives, Strategies, policies procedures, rules, programs and budget. Components of a business plan, Steps in planning and implementation. Organization staffing, directing and motivation. Ordering, leading, supervision, communications, control. Capital management and Financial management of Agribusiness. Financial statements and their importance. Marketing Management: Segmentation, targeting & positioning. Marketing mix and marketing strategies. Consumer behavior analysis, Product Life Cycle(PLC). Sales & Distribution Management. Pricing policy, various pricing methods. Project Management definition, project cycle, identification, formulation, appraisal, implementation, monitoring and evaluation. Project Appraisal and evaluation techniques.

**Practical**

Study of agri input markets: Seed, fertilizers pesticides. Study of output markets: grains, fruits, vegetables, flowers. Study of product market, retails trade commodity trading , and value added products. Study of financing institutions- Cooperative, Commercial Bank, RRBs, Agribusiness Finance Limited, NABARD. Preparations of projects and Feasibility reports for agribusiness entrepreneur. Appraisal /evaluation techniques of identifying viable project- Non discounting techniques. Case study of agro- based industries. Trend and growth rate of price of agricultural commodities. Net present worth technique for selection of viable project. Internal rate of return.

**Suggested readings:**

Broadway, A.C. and Broadway Arif A 2002 A textbook of Agri-Business Management. Kalyani Publishers

Bairwa, S.L. 2016. Objective on fundamentals of Agri-business Management. Kalyani Publishers

Anjan Nishra, Debasish Biswas and Arunangshu Giri, 2019  
Agribusiness Management, Himalaya Publishing House, 220p.

Shoji Lal Bairwa, Chandra Sen, L.K.Meena and Meera Kumari, 2018. Agribusiness Management Theory And Practices;, Write And Print Publications

Virender Kamalvanshi , Agribusiness Management:, Random.

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## Agricultural Engineering

### IV Year I Semester Post Harvest Management of field and Horticultural crops and value addition Credit Hours 4 (3+1)

#### Classes:

<b>Theory</b>	
1-2	Important engineering properties such as physical, thermal and aero & hydrodynamic properties of cereals, pulses and oilseed, their application in PHT equipment design and operation
3-4	Drying and dehydration; moisture measurement, EMC, Drying theory, various drying method
5-6	Commercial grain dryer (deep bed dryer, flat bed dryer, tray dryer, fluidized bed dryer, recirculatory dryer and solar dryer)
7-8	Cleaning and grading of crop produces- cleaning and grading, aspiration, scalping; size separators
9-10	Screens sieve analysis, capacity and effectiveness of screens.
11	Various types of separators, specific gravity.
12-13	Magnetic, disc, spiral, pneumatic, inclined draper, velvet roll, color sorters, cyclone, shape grader.
14-15	Milling of crop grains- Milling of rice, conditioning and parboiling, advantages and disadvantages
16	Traditional methods, CFTRI and Jadavpur method, pressure parboiling method
17-19	Types of rice milling, modern rice milling, different unit operations and equipment
20	Milling of wheat: unit operations and equipment
21-22	Milling of pluses: traditional milling methods, commercial methods, pre-conditioning, dry milling and wet milling methods: CFTRI method,
23-24	Milling of oil seeds: Mechanical expression, screw press, hydraulic press, solvent extraction methods.
25	Material handling equipments;
26-27	Conveyer and elevator, their principle Working and selection.
28-30	Packing house operation: Collection, Pre-sorting, Washing/Cleaning, Sizing and Grading
31-33	Pre cooling of horticultural crop produce
34-35	Packing of horticultural crop produce
36-38	Storage of horticulture crop produce
39-40	Concept of value addition: Preservation through canning, drying/dehydration
41-43	Preparation of Jam, Jellies, marmalades, candies, ketchup
44-48	Preparation sauce, puree, juice, squashes and cordials
<b>Practical</b>	
1	Visit to various Post Harvest Laboratories
2	Determination of Moisture content of various grains by oven & infrared moisture methods
3	Determination of engineering properties (shapes and size, bulk density and porosity of biomaterials).
4	Determination of Moisture content of various rains by moisture meter
5	Field visit to seed processing plant.
6	Familiarization with different cleaning and grading equipments
7	Familiarization with different rice milling equipments
8	Familiarization with different wheat milling equipments
9	Familiarization with different pluses milling equipments

- 10 Familiarization with different oilseed milling equipments
  - 11 Study of Packing house operation: Collection, Pre-sorting, Washing/Cleaning, Sizing and Grading
  - 12 Study of Pre cooling of horticultural crop produce
  - 13 Study Packing of horticultural crop produce
  - 14 Field visit of Storage of horticulture crop produce
  - 15 Field visit of value addition: Preservation through canning, drying/dehydration unit
  - 16 Study of preparation of Jam, Jellies, marmalades, candies, ketchup
  - 17 Study of preparation sauce, puree, juice, squashes and cordials
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**Suggested readings:**

- Chakraverty A (1988) Post-Harvest Technology of Cereal, Pulses and Oilseeds 368p, Publ., Oxford & IBH Publishing House, Pvt. Ltd ISBN- 978-8120409699
- Jagdiswar Sahay (2020) Elements of Agricultural Engineering 461p, Publ., Standard Publishers Distributers, New Delhi, ISBN- 9788180140440
- Kumar Sanjay, Kumar Vishal and Sahu RK (2015) Fundamental of Agricultural Engineering 567p, Publ., Kalyani Publishers, New Delhi. ISBN- 9789327221688
- Michael AM (2002) Irrigation Theory and practice 772p, Publ., Vikas publishing house Pvt, Ltd ISBN - 978-8125918677
- Sahay K M and Singh KK (2004) Unit operations of Agricultural Processing 388p, Publ., Vikash Publishing House, Pvt. Ltd ISBN- 978-8125911425
- Singhal OP (1997) Numerical Problems in Agricultural Engineering, Publ., Aman Publishing House, Meerut ISBN- 9789384479725.

**Department of Agronomy**

**IV Year I Semester**  
**Principles and Practices of Organic Farming and Conservation Agriculture**  
**Credits Hours 4 (3+1)**

**Objectives:**

To teach students the principles of crop production under organic and conservation agriculturesituation

To impart practical knowledge of organic and conservation agriculture practices

**Theory:**

Concept of organic farming, principles and its scope in India; Choice of crops and varieties in organic farming; Nutrient management in organic farming and their sources, Fundamentals of insect, pest, disease and weed management under organic mode of production; Operational structure of NPOP; Certification process and crop standards of organic farming; Processing, labelling, economic considerations and viability, marketing and export potential of organic products. Initiatives taken by Government (central/state), NGOs and other organizations for promotion of organic agriculture. Conservation agriculture: definition, origin, principles, advantages, challenges, primary practices in conservation agriculture: minimum soil disturbance, crop residue retention, and crop diversification, complementary practices, conservation agriculture vis a vis Climate smart Agriculture.

**Practical:**

Visit of organic farms to study the various components and their utilization; Preparation of enrich compost, vermicompost and their quality analysis; Method of application of bio-fertilizers; Indigenous technology knowledge (ITK) for nutrient, insect-pest and disease management; Studies in green manuring in-situ and green leaf manuring, Studies on different type of botanicals for insect-pest management; Weed management in organic farming; Cost of organic production system; Practices of conservation agriculture

**Suggested readings:**

Acharya Sankar Kr, Sreemoyee Bera, Cornea Saha, Prabhat Kumar, Monirul Haque, Riti Chatterjee and Anwasha Mandal, 2022 Conservation Agriculture Approach and Application, Scholars World, 292p

Dahama A.K. Organic farming for sustainable agriculture. Agrobios (India), Jodhpur

Gaur A.C. Handbook of Organic farming and bio-fertilizers

Palaniappan S.P. and K. Annadurai. Organic farming Theory and Practice. Scientific Publishers

Purshit, S.S. Trends in Organic Farming in India. AgrosBios(INDIA), Jodhpur.

Sathe, T.V. Vermiculture and Organic Farming. Days Publishing House, New Delhi

Sharma Arun. K. Handbook of Organic farming. Agrobios (India), Jodhpur.

Singh Abhinandan Pankaj Kumar Ojha and Rahul Kumar, 2018. Conservation Agriculture Technologies, Biotech Books

Thampan, P.K. Organic Agriculture. Peckay tree Crops Development Foundation, Cochin, Kerala.

Thapa U. and P. Tripathy. Organic farming in India- Problems and Prospects. Agrotech Publishing Udaipur

Veeresh G.K.. Organic farming. Foundation Books. New Delhi

## **Biotechnology Centre**

### **IV Year I Semester Micro-propagation Technologies Credit Hrs 4 (3+1)**

#### **Objectives**

To educate the students in detail about the sterilization techniques for explants, preparation of stocks and working solution, culturing of explants, regeneration of whole plants from different explants and hardening procedures.

#### **Theory**

Introduction, History, Advantages and limitations. Types of cultures (seed, embryo, organ, callus, cell); Stages of micro propagation; Axillary bud proliferation (Shoot tip and meristem culture, bud culture); Organogenesis (callus and direct organ formation); Somatic embryogenesis; Cell suspension cultures; production of secondary metabolites; Somaclonal variation; Cryopreservation.

#### **Practical**

Identification and use of equipment in tissue culture Laboratory; Nutrition media composition; Sterilization techniques for media, containers and small instruments; Sterilization techniques for explants; Preparation of stocks and working solution; Preparation of working medium; Culturing of explants: Seeds, shoot tip and single node; Callus induction; Induction of somatic embryos regeneration of whole plants from different explants; Hardening procedures.

#### **Suggested readings**

- ICAR New Delhi. Handbook of Horticulture by ICAR. p299. ASIN: B07Z523VJC  
Jha TB and Ghosh B. 2016. Plant Tissue Culture: Basic and Applied. Platinum Publishers. p.439.  
ISBN-10: 8189874403  
Kumar N. 2020. Introduction to Horticulture. Oxford & IBH Publishing Company Private, Limited. p452.  
ISBN: 8120417542, 9788120417540  
Singh J. 2019. Basics of Horticulture. Kalyani Publishers. p495. ISBN: 9789327296259, 9327296257



2. **Contd.:** Pest control equipments, principles, operation, maintenance, selection, and application of pesticides
  3. Application of drones in plant protection
  4. Seed treating equipments, fogging machine *etc*
  5. To study and identify various formulations of insecticide available in market
  6. To understand the colour coding & symbols used for pesticides and comprehend the information given in the labels
  7. Calculation of doses of and prepare stock solutions of pesticides
  8. Use personal protective equipments during work
  9. Prepare Bordeaux mixture and paste
  10. Study of herbicide formulations and mixture of herbicide
  11. Study methods of herbicide application
  12. Herbicide spraying equipments, their parts, use and maintenance
  13. Calculation of herbicide doses and requirement
  14. Weed control efficiency and weed index
  15. Methodology for conducting in-house trials and on farmers field
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### **Suggested Readings**

- Alford DV. 1999. *A Textbook of Agricultural Entomology*. Blackwell Science, London.
- Atwal AS and Dhaliwal GS. 2009. *Agricultural Pests of South Asia and Their Management*. Kalyani Publishers, Ludhiana. Pp 616, ISBN: 978-81-272-4918-2
- Buchel KH (Ed.) 1992. *Chemistry of pesticides*. John Wiley & Sons
- Crampton JM and Eggleston P. 1992. *Insect Molecular Science*. Academic Press, London.
- Dent D. 2000. *Insect Pest Management*. CABI Publishing, CAB International, Wallingford, Oxon OX 10 8DE, Pp 410. ISBN: 0-85199-341-9
- Gupta HCL. *Insecticides: Toxicology and Uses*. Agrotech Publishing Academy, Udaipur, pp. 382
- Gupta OP. 2015. *Modern Weed Management*. Agro Bios (India), Jodhpur.
- Larramendy ML. 2017. *Toxicity and Hazard of Agrochemicals*, INTECH 170p.
- Manisegaran S and Soundararajan RP. 2012. *Pest management in field crops: Principles and Practices*. Agrobios (India), Jodhpur. Pp 297, ISBN: 978-81-7754-309-4
- Manisegaran S and Soundararajan RP. 2012. *Pest management in field crops: Principles and Practices*. Agrobios (India), Jodhpur. Pp 297, ISBN: 978-81-7754-309-4
- माधुर योगेश कुमार और उपाध्याय कृष्ण दत्त। 2008. पदप रक्षा कीट नियंत्रण। रामा पब्लिशिंग हाउस, अग्रवाल कॉलोनी, रामलीला मैदान के सामने, दिल्ली रोड, मेरठ (उत्तर प्रदेश)। पृष्ठ 224. ISBN 81-87254-39-4
- Panda H. 2022. *The Complete Technology Book on Pesticides, Insecticides, Fungicides and Herbicides (Agrochemicals) with Formulae, Manufacturing Process, Machinery & Equipment Details 2nd Revised Edition*. NPCS
- Prakash Alka. 2007. *Laboratory manual of entomology*. New Age International (P) Limited Publishers, New Delhi, Pp 138, ISBN 81-224-1292-0.
- Rajagopal A, Aravindan R and Shanmugavelu KG. 2015. *Weed management of Horticultural Crops*. Agr (India), Jodhpur.
- Rakshit A. 2015. *Manures, Fertilizers and Pesticides*. CBS Publishing pp. 266
- Saha LR and Dahliwal GS. 2006. *Handbook of Plant Protection*. Kalyani Publishers, Ludhiana.
- Singh A. 2022. *Basics of Agrochemical Formulations*. Brillion Publishing, 176p.
- Subramanian S, Mohammed Ali A and Jayakumar R. 1991. *All About Weed Control*. Kalyani Publishers, Ludhiana.

**Department of Extension Education**

**IV Year I Semester  
Agricultural Journalism  
Credit hours 4 (3+1)**

**Objectives:** To impart knowledge and skill in agricultural journalism

**Theory**

1. Journalism Meaning, nature, importance, and types of journalism.
2. Agricultural Journalism Meaning, definition, principle, objectives, types, and scope.
3. Similarities and difference between agricultural journalism and other types of journalism.
4. Role of agricultural journalist, Training of agricultural journalist.
5. Qualities of journalist
6. Role of journalist /journalism in agricultural development and development of newspaper and magazines readers.
7. Newspaper and magazines as communication media: Characteristics, kinds and functions of newspaper and magazines, Characteristics of newspaper and magazines readers.
8. Form, content, style and language of newspaper and magazines, Standard part of newspaper and magazines.
9. The agricultural story: Types of Agriculture stories, subject matter of the agricultural story, structure of the agricultural story.
10. Gathering farm information-Sources of farm information: abstracting from research and scientific materials, interviews, coverage of events,
11. Other sources: electronic media, field study.
12. Success stories-definition, nature, components, guidelines of writing a success story-
13. Writing a news story difference between news and feature story, the principle of writing a news story, Inverted pyramid structure.
14. Organizing the material, treatment of the story, writing the news lead and the body
15. Readability measure-readability ease score, automated readability index, gunning fog index
16. How to improve readability of articles and stories.
17. Use of photograph in agricultural journalism- Basic principles of photography composition, exposure, lens, light Use of artwork (Graphs, charts maps, etc)
18. Writing the captions
19. Editorial mechanism: Copy reading, headline and title writing
20. Proofreading: definition, signs and symbols of proofreading, level of proofreading, duties of a proof-reader
21. Layout meaning, principles of layout and design.

**Practical**

1. Practice in writing an agricultural news story.
2. Practice in writing an agricultural feature story.
3. Covering agricultural events for the information collection.
4. Practice in interviewing for the information collection.
5. Abstracting stories from research and scientific materials and wire services. Selecting pictures and artwork for the agricultural story.
6. Practice in editing, copy reading.
7. Practice in headline and title writing

8. Practicing proof reading.
9. Practice in lay outing of newspaper.
10. Testing copy with a readability formula.
11. Visit a publishing office

### **Suggested readings**

- Bhaskaran C; R Prakash and N Kishore Kumar (2013) Farm Journalism and Media Management. Agrotech Publ. 200p. ISBN 10: 8183211100, 9788183211109
- Carole Fleming; Hemmingway Emma; Moore Gillian; Welford Dav. (2005) Introduction To Journalism, Kindle Edition SAGE Publications, ISBN 978-0761941811
- Jana BL and- KP Mitra (2005) Farm Journalism, Agrotech Publ., Acad. 376p. ISBN:9788185680989, 8185680981
- Kamath MV (2018) Professional Journalism. S Chand Publ. 280p. ISBN 0706990285
- Parthasarathy R. (2000) Basic Journalism (Cruising Guides). Laxmi Publ. 144p. ISBN 0333904559
- Shrivastava KM (2015) News Reporting and Editing. Sterling Publishers Private Limited, 304p. Publ. ISBN: 9788120798144, 8120798147
- Singh AK (2014) Agricultural Extension and farm Journalism. Agrobios Publ. 248p. ISBN 8177545426

**Department of Food Science and Technology**

**IV Year I Semester  
Food Safety and Standards  
Credits Hours 4(3+1)**

**Objectives:**

- To develop the skills to convert raw materials into safe, attractive food products
- To manage the production of food products
- To use scientific knowledge to develop new products

**Theory**

Food safety Definition , Importance, Scope and Factors affecting Food Safety. Hazards and Risks, Type of Hazards - Biological, Chemical Physical hazards. Management of hazard Need. Control of Parameters. Temperature Control. Food Storage. Production Design. Hygiene and Sanitation in Food Service Establishments- Introduction. Sources of contamination and their control. Waste Disposal. Pest and Rodent Control .Personnel Hygiene .Food safety Measures. Food Safety Management Tool- Basic concepts. PRPs, GHPs, GMPs, SSOPs etc. HACCP.ISO series. TQM- concept and need for quality ,components of TQM, Kaizen. Risk Analysis. Accreditation and Auditing, Water Analysis, Surface Sanitation and Personal Hygiene. Food laws and Standards Indian Food Regulatory Regime, FSSAI. Global Scenario CAC. Other laws and standards related to food. Recent concerns-New and Emerging Pathogens. Packaging ,Product labeling and Nutritional labeling. Genetically modified food/transgenic. Organic foods. Newer approaches to food safety. Recent Outbreaks. Indian and International Standards for food products.

**Practical**

Water quality analysis physico-chemical and microbiological. Preparation of different types of media. Microbiological examination of different food samples. Assessment of surface sanitation by swab/rinse method. Assessment of personal hygiene. Biochemical tests for identification of bacteria. Scheme for the detection of food borne pathogens. Preparation of plants for Implementation of FSMS- HACCP,ISO:22000.

**Suggested readings:**

- Cletus Fernandes Safe Food Handling: HACCP booklet for food handlers, Notion Press
- Davis Bernard, Andrew Lockwood, Ioannis Pantelidis, Peter Alcott 2011 Food And Beverage Management, Rutledge
- Khatekar D.S.L. and N. Sarkate, 2023 Handbook of Food Safety., Step Up Academy, 576p.
- Pulkit Mathur, 2018 Food safety and Quality Control., The Orient Blackswan.332p.
- Sharma Avantina Text book of Food Science and Technology by

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**Department of Food Science and Technology**

**IV Year I Semester**  
**Principles of Food Sciences and Technology**  
**4 (3+1)**

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<b>Sr.</b>	<b>Theory</b>
1.	Introduction of Food Science and Technology, Definition, Scope and Objectives, Physical and Chemical properties of food.
2.	Concept of Primary, Secondary and Tertiary Processing techniques
3.	Cereals - Structure, composition and milling of cereals.
4.	Pulses - Structure, composition, milling of legumes
5.	Oil seeds - Structure, composition and milling of oilseeds
6.	Fruits – composition, and processing for product development
7.	Vegetables – composition and processing for product development
8.	Milk and milk products –Composition, types, products
9.	Basic principles of Food preservation
10.	Sensory evaluation of food
11.	Food Packaging- Flexible packaging, Paper packaging, glass containers, Tin containers, Plastic containers

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<b>Sr.</b>	<b>Practical</b>
1.	Determination Physical and Chemical composition of food stuff
2.	Determination Chemical composition of food stuff
3.	Milling of Cereals
4.	Milling of Pulses
5.	Milling of Oilseed
6.	Process operation for production of bread, biscuit and pasta
7.	Preparation of Jam
8.	Preparation of Jelly
9.	Preparation of Marmalade
10.	Preparation of Tomato products
11.	Preparation of Milk Products like Dahi, Yoghurt etc
12.	Sensory Evaluation of Food Products
13.	Collection, Identification and Evaluation of Packaging Material
14.	Field visit to Cereal, Pulse, Oilseed Milling unit
15.	Field visit to Fruits and vegetables processing plants

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**Suggested reading**

- Coles R, McDowell D and Kirwan MJ, 2003, Food Packaging Technology, CRC Press
- De Sukumar. 2007 Outlines of Dairy Technology, Oxford University Press
- Jenkins WA and Harrington JP, 1991, Packaging Foods with Plastics, Technomic Publishing Company Inc., USA
- Manay NS and Shadaksharaswamy M, Food-Facts and Principles, New Age International
- Potter NH, 1998 Food Science, CBS Publication, New Delhi
- Ramaswamy H and Marcottn M 2006, Food Processing Principles and Applications CRC Press,
- Ranganna S, 1986, Handbook of Analysis and Quality Control for Fruits and Vegetable Products, 2nded. TMH Education Pvt. Ltd
- Srilakshmi, B. 2002 Food science, New Age Publishers

**Department of Horticulture**

**IV Year I Semester  
Commercial Landscape  
Credits Hours:4(3+1)**

**Objectives:**

To educate the students on designing different styles and types of gardens  
To enable the students to identify different ornamental plants and their utilization in landscaping design.

**Theory**

Importance and scope of landscaping: Principles of landscaping, garden styles and types terrace enable students to design landscapes in software like AUTOCAD, ARCHCADE etc. gardening, vertical gardening, garden components, adornments, lawn making, rockery water garden, walk- paths, bridges, other constructed features etc. gardens for special purposes Trees: selection, propagation, planting schemes, canopy management, shrubs and herbaceous perennials: selection, propagation, planting schemes, architecture. Climber and creepers importance, selection, propagation, planting, Annuals: selection, propagation, planting scheme. Other garden plants: palms, ferns, grasses and cacti succulents. Pot plants: selection, arrangement, management. Bio-aesthetic planning: definition, need, planning; landscaping of urban and rural areas, Peri-urban landscaping, Landscaping of schools, public places like bus station, railway station, townships, river banks, hospitals, play grounds, airports, industries, institutions, Bonsai principles and management, lawn: establishment and maintenance.CAD application.

**Practical**

Identification of trees, shrubs, annuals, pot plants; Propagation of trees, shrubs and annuals, care and maintenance of plants, potting and repotting, identification of tools and implements used in landscape design, training and pruning of plants for special effects, lawn establishment and maintenance, layout of formal gardens, informal gardens, special type of gardens (sunken garden, terrace garden, rock garden) and designing of conservatory and lathe house. Use of computer software, visit to important gardens /parks /institutes.

**Suggested readings:**

Textbook of floriculture and landscaping by Anil K. Singh and Anjana Sisodia  
Principles Of Landscape Gardening: Y. Chandrasekhar and Hemla Naik B., 2020. ICAR,  
Introductory Ornamental Horticulture and Landscape Gardening: Rajaneesh Singh and Brijendra Kumar Singh, 2020, Bio-Green Books.  
Principles of Landscape Architecture: Pragnyashree Mishra and Bhimasen Naik, 2022, New India Publishing Agency.  
Landscape Gardening: Sudhir Pradhan, 2018, Scientific Publishers India.

**Department of Genetics and Plant Breeding**

**IV Year I Semester  
Commercial Seed Production  
Credits Hours : 4(3+1)**

**Objectives:**

To introduce the basic principles of planting material production at commercial scale and seed quality evaluation

**Theory**

**General Principles of Seed Production:** Raising the seed crop, Introduction, Procurement of a class of Improved seeds, Reporting to Monitoring or certification Agency, Principles and practices of selection of area and agronomic requirement of seed production of field crops, Importance of isolation distance and Rouging, Principles of hybrid seed production in field crops, Principles and practices of selection of area and agronomic requirement of seed production of horticultural crops, Concept of apomixis, male sterility and self incompatibility and its application in hybrid seed production of horticultural crops

**General Principles of Seed Processing:** Introduction, Objectives of Seed Processing, Seed Drying, Principles of Drying, Water vapour equilibrium, Methods of drying seeds, Cleaning and grading, Air and screen machines, Dimensional separators, Density separators, Surface texture separators, Colour separators, Spiral separators, Electric separators, Vibrator separators, Separation based on Affinity to liquids, Seed treatment, Temperature treatment, Chemical treatment, Bagging and Labeling. Seed storage, factors affecting storability and management of storage factors, seed packaging, storage structure and management of disease and insect pest during storage

**General Principles of Seed Testing:** Seed testing-Introduction, Procedure of Seed testing, components of seed quality testing genetic, physical, physiological and seed health testing and management, Seed sampling, Types of seed sampling, Requirements of sampling, Concept of seed viability and vigour ; dormancy, types and principles of seed dormancy, methods of release dormancy, Physiological quality of seed, Principles of seed Germination, types of germination, biochemical and genetic basis

**Seed Certification:** History, concept, objectives and procedure of seed certification; seed certification agency/organization and staff requirement Indian Minimum Seed Certification Standards (I.M.S.C.S.) - general and specific crop standards including GM varieties, field and seed standards

**Seed Industry and Seed Marketing :** Introduction, Evolution of the seed industry, Development of the vegetable and Flower seed industry, Seed marketing concept, definition and purpose, importance and promotion of quality seed, formal and informal seed supply systems, Seed marketing intelligence and product mix, sales promotion, distribution channels, marketing costs and margins; packaging and labeling, Seed Associations, Factors influencing seed marketing, Seed marketing programs, Seed industry organizations, Marketing of public versus private players, Demand and supply of seed; role of seed replacement rate (SRR), seed multiplication ratio (SMR), economics of seed production; determining seed needs, Seed pricing and price policy, seed processing and /packaging, demand forecasting

and factors affecting demand for seeds, effect of price and farm income on seed demand

Biotechnology in Seed Technology: History of plant tissue culture, Laboratory organization, Composition of nutrient medium, Micro-propagation, Axillary bud proliferation approach, Meristem and shoot tip culture, Bud culture, Advantages of Micro-propagation, Problems associated with micro-propagation, Synthetic seed production, Types of synthetic seeds, methods of development of synthetic seeds, Components of nutrient media for synthetic seed development, Storage of synthetic seeds, Advantages and limitations of synthetic seed production. Molecular techniques for testing genetic purity and seed health.

### **Practical**

Planning of Seed Production, requirements for different classes of seeds in field crops - unit area and rate Operation and handling of mechanical drying equipments; effect of drying temperature and duration on seed germination and storability seed processing equipments; seed treating equipments

Seed production in cross pollinated crops with special reference to land, isolation, Planting ratio of male and female lines, synchronization of parental lines and methods to achieve synchrony; supplementary pollination, pollen storage, hand emasculation and pollination in tomato, Hybrid seed production in Maize, detasseling in maize, identification of rogues and pollen shedders, Pollen collection, storage, viability and stigma receptivity; gametocide application and visits to seed production plots etc., Visit to seed processing plant and commercial controlled and uncontrolled Seed Stores, Seed industries and local entrepreneurs visit to nearby areas, Different methods of examination of seeds to assess seed-borne microorganisms and to quantify infection percentage, detection of seed borne fungi, bacteria and viruses, identification of storage fungi, control of seed borne diseases, seed treatment methods., Maintenance of aseptic conditions and sterilization techniques, Preparation of nutrient stocks for synthetic media, Selection of explants for callus induction, Preparation of MS medium for micro-propagation and Callus induction, Selection of explants for callus induction, Preparation of MS medium for micro-propagation and Callus induction, Inoculation of explants for micro-propagation, Inoculation of explants for callus induction and subsequently regeneration of plantlets from matured seeds of field and horticultural crops, Synthetic seed preparation

### **Suggested readings:**

- Agarwal RL. 1997. Seed Technology. 2nd Ed. Oxford & IBH.  
Chawla H.S. (2008) Introduction to Plant Biotechnology second edition, Oxford & IBH publishing Co.Ltd. 113-B Shahpur Jat, New Delhi-110049  
Dadlani M and Yadav DK (2023). Seed Science and Technology: Biology Production and Quality ISBN 978-981-5887-8  
Justice OL & Bass LN. 1978. Principles and Practices of Seed Storage. Castle House Publ. Ltd.  
Khare, D. and M.S. Bhale, (2019). Seed Technology (2<sup>nd</sup> revised & enlarged edn), Scientific Publishers, ISBN: 978-81-72338-84-8  
McDonald MB Jr and Copeland LO. (1997). Seed Production: Principles and Practices. Chapman & Hall  
Singhal NC. (2003). Hybrid Seed Production in Field Crops. Kalyani.  
Thompson JR. (1979). An Introduction to Seed Technology Leonard Hill.  
Tunwar NS & Singh SN. (1988). Indian Minimum Seed Certification Standards. CSCB, Ministry of Agriculture, New Delhi

**Department of Plant Pathology**

**IV Year I Semester  
Bio-pesticides and Bio-fertilizers  
Credits Hours :4(3+1)**

**Objectives:**

To provide knowledge on principles, methods, and mechanisms of bio-control agents and their use against plant diseases

To provide knowledge on principles, methods, and mechanism of biofertilizers and their use in agriculture

**Theory**

History and concept of bio pesticides. Importance, scope and potential of bio pesticides. Definitions, concepts and classification of bio pesticides viz. Pathogen, botanical pesticides, and bio rationales. Botanicals and their uses. Mass production technology of bio-pesticides. Virulence, pathogenicity and symptoms of entomopathogenic pathogens and nematodes, Methods of application of bio pesticides. Methods of quality control and Techniques of bio pesticides. Impediments and limitation in production and use of bio pesticides. Biofertilizers - Introduction, status and scope. Structure and characteristics features of bacterial biofertilizers *Azospirillum*, *Azotobacter*, *Bacillus*, *Pseudomonas*, *Rhizobium* and *Frankia*; Cyanobacterial bio fertilizers-*Anabaena*, *Nostoc*, *Hapalosiphon* and fungal biofertilizers AM mycorrhiza and ectomycorrhiza. Nitrogen fixation Free living and symbiotic nitrogen fixation. Mechanism of phosphate solubilisation and phosphate mobilization, K solubilisation. Production Technology: Strain selection, sterilization, growth and fermentation, mass production of carrier based and liquid biofertilizers. FCO specifications and quality control of biofertilizers . Application technology for seeds, seedlings, tubers, sets etc. Biofertilizers-Storage, shelf life, quality control and marketing. Factors influencing the efficiency of biofertilizers.

**Practical**

Isolation and purification of important biopesticides: trichoderma *Pseudomonas*, *Bacillus*, *Metarhizium* etc. and its production. Identification of important botanicals. Visit to biopesticide laboratory in nearby area. Field visit to explore naturally infected cadavers. Identification of entomopathogenic entities in field condition. Quality control of biopesticides.

Isolation and purification of *Azospirillum*, *Azotobacter*, *Rhizobium*, P-solubilizers and cyanobacteria. Mass multiplication and inoculum production of biofertilizers. Isolation of AM fungi- Wet sieving method and sucrose gradient method. Mass production of AM inoculants.

**Suggested readings:**

**Bio-pesticides**

Baker, E.F. and James, R.C. 1982. Biological Control of Plant Pathogens. American Phytopathological Society

Boland, G.J. and David, L. 1998. Plant microbe interactions and Biological Control. Kuykendall Marel Dekker, INC.

- Borkar, S.G. 2015. Beneficial Microbes as Biofertilizers and its Production Technology
- Ciancia, A. and Mukerji, K.J. 2007. General Concepts of Integrated Pest and Disease Management. Edited Published by Springer.
- Cinchoalkar, S.B. and Mukherji, K.G. 2007. Biological Control of Plant Diseases. Haworth Food and Agricultural Products.
- Gnanamanickam, S.S. 2002. Biological control of crop Disease. Kuykendall Marel Dekker, INC.
- Ramanujam, B. and Rabindra, R.J. 2006. Current Status of Biological Control of Plant Disease using Antagonistic Organisms in India. Precision Fototype Services Bangalore.
- Singh, S.P. and Hussanini, S.S. 1998. Biological Suppression of Plant Disease, Phyto-parasitic Nematodes and Weeds. Precision Fototype Services Bangalore.

### **Bio-fertilizers**

- Bhatnagar, R.K and, R.K. Palta Earthworm Vermi-culture and Vermi-composting, Kalyani Publishers
- Gehlot Dushyent Organic Farming; Standards, Accreditation, Certification and Inspection-, Agrobios(India)
- Nehra Sampat, Biofertilizers for Sustainable Agriculture- Aavishkar Publishers, Jaipur, India
- Singh A.K. Organic Farming-, New India Publishing Agency, New Delhi
- Singh AK. Handbook of Microbial Biofertilizers, Agrotech Press, Jaipur, India
- Trivedi PC Fungal Biopesticides and VAM applications-, Pointer publishers, Jaipur, India



**Department of Soil Science and Agricultural Chemistry**

**IV Year I Semester  
Management of Natural Resources  
Credits Hours 4(3+1)**

**Objectives:**

- To enlighten students about available natural resources and their relationship with crop production
- To impart the knowledge of principles and practices of natural resource management

**Theory:**

Introduction to Natural Resource Bases: Concept of resource, classification of natural resources. Factors influencing resource availability, distribution and uses. Interrelationships among different types of natural resources. Concern on Productivity issues. Ecological, social and economic dimension of resource management. Land resources: Land as a resource. Dry land, land use classification, land degradation, man induced landslides, soil erosion and desertification. Landscape impact analysis, wetland ecology & management. Water resources: Use and over-utilization of surface and ground water, floods, drought, conflict over water, dams-benefits and problems. Water ecology and management. Energy resources: Growing energy needs, renewable and non-renewable energy sources, use of alternate energy sources. Resource Management Paradigms: Resource management the evolution and history of resource management paradigms. Resource conflicts: Resource extraction, access and control system. Approaches in Resource Management: Ecological approach; economic approach; ethnological approach; implications of the approaches; integrated resource management strategies. Introduction to soil and water conservation and causes of soil erosion., Definition and agents of soil erosion, water erosion - Forms of water erosion, Gully classification and control measures. Soil loss estimation by universal soil loss equation - Soil loss measurement techniques. Principles of erosion control - Introduction to contouring, strip cropping. Contour bund - Graded bund and bench terracing. Wind erosion - Mechanics of wind erosion, types of soil movement - Principles of wind erosion control and its control measures, Water harvesting techniques - Lining of ponds, tanks and canal systems.

**Practical:**

Identifying natural resources and their utility Practicing survey - Principles and educating to use pacing technique for measurement. Area calculations through chain survey - GPS demo for tracking and area measurement. Estimation of soil loss and calculation of erosion index. Leveling concepts and practical utility in agriculture. Preparation of contour maps. Concept of vegetative water ways and design of grassed water ways. Wind erosion and estimation process. Different irrigation pumps and their constructional differences. Farm pond construction and its design aspects. Visit to nearby farm pond. Visit to an erosion site. Exposure to strip cropping/contour bunding.

**Suggested readings:**

- Blackswan 2016 Management of Resources for Sustainable Development:, The Orient, 284p.
- Goel Sushma and A Upadhyay Natural Resources: Their Conservation and Management:, Aspiration Academy,320p.

Lynch Danill R. Sustainable Natural Resource Management

Mishra HN 2014. Managing Natural Resources: Focus on Land and Water: PHI, 496p.

Pal Vasudeva Srishti 2023 Natural Resource Management for Growth Development and Sustainability, Publ., Today & Tomorrows Printers And Publishers, 336p.

Rathor VS and BS Rathor Management of Natural Resource for Sustainable Development, Daya Publ.,

## 10 IV Year II Semester

S. No	Course	Credits
1	Student READY- RAWE	10
2	Student READY- Experiential Learning / Industrial Attachment	10
<b>Total</b>		<b>20</b>

### Implementation of RAWE - 10 (0+10) Credit hrs

The Rural Agricultural Work Experience (RAWE) program is a crucial part of the B.Sc. Agriculture curriculum, providing students with hands-on experience in rural settings and agro-industrial environments. Here are some potential improvements that could enhance the RAWE program:

1. **Integration of Modern Technologies:** Incorporating advanced technologies such as drones, AI, and machine learning in agricultural practices can provide students with exposure to cutting-edge tools and techniques.
2. **Enhanced Industry Collaboration:** Strengthening partnerships with agro-industries can offer students more diverse and practical experiences. This could include internships, workshops, and guest lectures from industry experts.
3. **Focus on Sustainable Practices:** Emphasizing sustainable and eco-friendly agricultural practices can prepare students to address environmental challenges and promote sustainable farming.
4. **Soft Skills Development:** Including modules on communication, leadership, and entrepreneurship can help students develop essential soft skills that are valuable in the agricultural sector.
5. **Research Opportunities:** Providing opportunities for students to engage in research projects related to agriculture can enhance their analytical and problem-solving skills.
6. **Feedback Mechanism:** Implementing a robust feedback system where students can share their experiences and suggestions for improvement can help continuously refine the program.

**Weekly Activities and Duties of the Departments for Implementation of RAWE**

Duration	Department	Component-wise Activity	Days
<b>Week 1</b>	Extension Education	<b>RAWE Orientation</b>	<b>05</b>
<b>Week 2</b>	Extension Education	<b>Survey of Village interventions</b>	<b>06</b>
Monday		Village identification, selection of host farmers with the help of KVK and departments	
Tuesday		Visit to nearby KVK/ KCC	
Wednesday		Visit to village: Rapport building	
Thursday		Conduct of PRA activities, Baseline survey	
Friday		Socio-economic survey of the village	
Saturday		Socio-economic survey of the village	
<b>Week 3</b>	Extension Education	<b>Extension and Transfer of Technology Activities Interventions</b>	<b>06</b>
Monday		Village attachment (Visit to village): Rapport building, Conduct demographic survey, Socio-economic survey, agriculture survey and mapping of village layout	
Tuesday		Visit to nearby important centers of Agriculture	
Wednesday		Village attachment: Survey to study rural development program, extension agencies or organization	
Thursday		Visit to FTC/ RUDSETI/ MGPRI/ NGO/ SHG/ FPO etc.	
Friday		Organizing Method Demonstration, Studying Ongoing Extension Program in Village	
Saturday	Participation in village social activities		
<b>Week 4</b>	Agronomy	<b>Agronomical Interventions</b>	<b>06</b>
Monday		Village attachment	
Tuesday		Exposure visit/ Hands-on training etc.	
Wednesday		Village attachment	
Thursday		Exposure visit/ Hands-on training etc.	
Friday		Village attachment	
Saturday	Participation in village social activities		
<b>Week 5</b>	Soil Science & AC	<b>Soil Improvement Interventions (Soil Sampling and Testing)</b>	<b>06</b>
Monday		Village attachment	
Tuesday		Exposure visit/ Hands-on training etc.	
Wednesday		Village attachment	
Thursday		Exposure visit/ Hands-on training etc.	
Friday		Village attachment	
Saturday	Participation in village social activities		
<b>Week 6</b>	Entomology	<b>Plant Protection Interventions: Entomology</b>	<b>06</b>
Monday		Village attachment	
Tuesday		Exposure visit/ Hands-on training etc.	
Wednesday		Village attachment	
Thursday		Exposure visit/ Hands-on training etc.	
Friday		Village attachment	
Saturday	Participation in village social activities		
<b>Week 7</b>	Plant Pathology	<b>Plant Protection Interventions: Plant Pathology</b>	<b>06</b>
Monday		Village attachment	
Tuesday		Exposure visit/ Hands-on training etc.	
Wednesday		Village attachment	
Thursday		Exposure visit/ Hands-on training etc.	
Friday		Village attachment	
Saturday	Participation in village social activities		

Duration	Department	Component-wise Activity	Days
<b>Week 8</b>	Horticulture	<b>Fruit and Vegetables Productions Intervention</b>	06
Monday		Village attachment	
Tuesday		Exposure visit/ Hands-on training etc.	
Wednesday		Village attachment	
Thursday		Exposure visit/ Hands-on training etc.	
Friday		Village attachment	
Saturday		Participation in village social activities	
<b>Week 9</b>	Food Science	<b>Food Processing and Storage Interventions</b>	06
Monday		Village attachment	
Tuesday		Exposure visit/ Hands-on training etc.	
Wednesday		Village attachment	
Thursday		Exposure visit/ Hands-on training etc.	
Friday		Village attachment	
Saturday		Participation in village social activities	
<b>Week 10</b>	Livestock Production	<b>Animal production Interventions</b>	06
Monday		Village attachment	
Tuesday		Visit to dairy unit/ poultry unit of veterinary university	
Wednesday		Village attachment	
Thursday		Exposure visit/ Hands-on training etc.	
Friday		Village attachment	
Saturday		Participation in village social activities	
<b>Week 11</b>		<b>Report preparation and examination</b>	05
<b>Total working day</b>			<b>64</b>

Note - Saturday will be working day for RAWE

### Summary of RAWE

Duration	Activity	Village Attachment	Visit/hands on training	Total
			Day	
<b>Week 1</b>	RAWE Orientation	-	05	05
<b>Week 2</b>	Survey of Village Interventions	04	02	06
<b>Week 3</b>	Extension and Transfer of Technology Activities Interventions	04	02	06
<b>Week 4</b>	Agronomical Interventions	04	02	06
<b>Week 5</b>	Soil Improvement Interventions (Soil Sampling and Testing)	04	02	06
<b>Week 6</b>	Plant Protection Interventions: Entomology	04	02	06
<b>Week 7</b>	Plant Protection Interventions: Plant Pathology	04	02	06
<b>Week 8</b>	Fruit and Vegetables Productions Intervention	04	02	06
<b>Week 9</b>	Food Processing and Storage Interventions	04	02	06
<b>Week 10</b>	Animal Production Interventions	04	02	06
<b>Week 11</b>	Report Preparation and Examination	-	05	05
	<b>Total</b>	<b>36</b>	<b>28</b>	<b>64</b>

## 11 Skill Enhancement Courses (SECs)

Skill enhancement courses in Agriculture provide following advantages for students pursuing a Bachelor's degree in Agriculture:

**Increased Practical Knowledge:** These courses emphasize hands-on training, enabling students to apply theoretical concepts in real-world agricultural practices.

**Industry-Relevant Skills:** Students develop skills aligned with current trends in agriculture, making them better prepared for careers in modern farming, agribusiness, or research.

**Improved Employability:** Acquiring specialized skills makes graduates more attractive to employers in both the public and private sectors.

**Entrepreneurial Opportunities:** Courses like Agribusiness Management and Food Processing empower students to start their own ventures.

**Sustainable Practices:** Learning about eco-friendly and sustainable farming methods helps graduates contribute to environmental conservation.

**Adaptation to Technology:** Courses in Precision Agriculture and AI prepare students to use cutting-edge technologies in agriculture.

**Value Addition:** Skills like post-harvest technology and food preservation enable graduates to improve the quality and marketability of agricultural products.

**Global Perspective:** Understanding modern practices and technologies prepares students to compete and collaborate on an international level.

**Personal Development:** These courses enhance critical thinking, problem-solving, and project management abilities, contributing to overall professional and personal growth.

### *Operation*

- Choice-based Skill Enhancement Courses (SECs) are an essential component of the B.Sc. (Ag), UG-Diploma, and Certificate programs.
- Students are required to select any six courses from the basket of SECs offered by the College.
- Each course is structured as a 2 (0+2) credit-hour practical-oriented course.
- The SECs are distributed across the semesters as follows:
- **Semester I:** Two courses; **Semester II:** Two courses; **Semester III:** One course; **Semester IV:** One course

These courses serve as a bridge between academic knowledge and practical application, providing students with a competitive edge and preparing them to drive innovation in agriculture.

Following Skill Enhancement Courses are proposed by the University. The constituent College has the flexibility to offer additional SECs depending on its resources, while ensuring a minimum of six courses.

<b>Department</b>	<b>Proposed course</b>
Agronomy	Agriculture Waste Management
Agricultural Engineering	Custom Hiring Services
Biotechnology	Basic Biotechnology Laboratory Techniques
Entomology	Beneficial Insect Farming
Extension Education	E- Extension
Food Science and Technology	Manufacturing of Baking Product Jam, Jelly and Marmalade Preparation Technology
Horticulture	Nursery Management
Mathematics and Statistics	Data Analysis using R
Genetics and Plant Breeding	Maintenance Breeding
Plant Pathology	Mushroom Production Technology
Plant Physiology	Processing and Value Addition of Medicinal and Aromatic Plants
Plant Physiology	Hydroponics
Soil Science and AC	Soil Testing and Soil Health Card

*Colleges are free to propose courses on Skill Enhancement as per their strength*

## **12 Online courses**

- The student has to take a minimum of 10 credits of online courses, which will comprise of one or more courses totaling at least 16 weeks or 30 hrs duration as a partial requirement.
- It is offer to groom the passion or strengthen knowledge and competency of the student in any field beyond prescribed courses.
- The online courses can be from any field such as Basic Sciences, Humanities, Psychology, Anthropology, Economics, Engineering, Business Management, Languages including foreign language, Communication skills/ Music, etc.
- The Online courses can be taken from NPTEL, mooKIT, edX, Coursera, SWAYAM or any other portal.
- The courses will be non-gradual as separate certificates would be issued by institutes offering the courses.
- These can be taken any time during the duration of UG program, but preferably during the 3rd and 4th years.
- The student has to inform the consent teacher for the course and platform registered by him/her in the start of the semester in which s/he has joined the online course.
- The college has to keep a record of the online course registered and completed by each student and will indicate the title of the successfully completed online courses in the final transcript issued to the student.



**Faculty of Agriculture**  
**Jawaharlal Nehru Krishi Vishwa Vidyalaya**  
**Jabalpur 482 004 MP**  
**2025**