COURSE STRUCTURE AND SYLLABUS

B.Sc. (Hons) Agriculture

2025-26 Batch

Centurion UNIVERSITY

Shaping Lives...
Empowering Communities...

M.S. SWAMINATHAN SCHOOL OF AGRICULTURE , CENTURION UNIVERSITY OF TECHNOLOGY AND MANAGEMENT. ODISHA-761211, INDIA

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B.Sc. (Hons) Agriculture

Program Outcomes

PO1 : **Knowledge Enhancement** : Demonstrate knowledge and understanding of essential facts, concepts, principles and theories relating to Soil Science, Agronomy, Horticulture, Genetics and Plant Breeding, Plant Pathology, Entomology and other such areas of agriculture.

PO2 : **Professional Enhancement** : Understanding the value and processes of life-long learning and professional development.

PO3 : **Entrepreneurship Skills** : Understanding the processes of setting up and managing viable business ventures.

PO4 : **Communication & Extension Skills** : Developing appropriate communication skills for effective transfer of knowledge and technologies through extension programs.

PO5 : **Team Work** : Play effective roles in multidisciplinary teams.

PO6 : **Educational Leadership** : Recognize and meet emerging agriculture challenges of global society in the 21st century and developing leadership and strong linkages in the agro-industrial setup.

PO7 : **Data Handling** : Collect, analyze and interpret scientific data.

PO8 : **Ethics** : Apply ethical principles and commit to professional ethics and responsibilities and norms of the scientific practice.

PO9 : **Computational Skills** : Recognize, analyze problems and plan strategies for their solutions with the help of computer skills.

PO 10: **Modern tool usage**: Having an ability to use techniques, skills and modern engineering tools necessary for agricultural practices

PO 11: **Environment and sustainability**: Understand the impact of the professional agricultural solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development. Demonstrate an understanding of comprehensive systemic analysis across both physical and behavioral dimensions involving society, the environment, and the economy.

PO 12: **Project Management and finance**: Demonstrate knowledge and understanding of the agriculture and agri-business management principles and apply these to one's own work, as a member and leader in a team. Manage project in multidisciplinary environments.

PEOs of B.Sc. (Hons.) Agriculture

PEO1: Preparing students to understand the knowledge of agriculture science with respect to agronomy and horticulture crops and to develop skills to solve complex problems at farmers field level.

PEO2: To intensify student`s knowledge and skills with different methodologies of soil analysis, crop production, plant protection, processing and seed production (both varieties and hybrids) of various crops.

PEO3: To be well versed with various pests and diseases of crops both field and Horticultural and suggest management strategies.

1. Introduction

Present report is an outcome of the valuable suggestions and recommendations of Sixth Deans' Committee members after having multistage in-depth deliberations and discussions in virtual and physical meetings as well as personal communications with the Deans and faculty members of the Agriculture discipline of different SAUs and Central Agricultural Universities, stakeholders from related industries, Government Institutions, alumni and students of the existing course programme across the country.

Restructuring of Undergraduate programme of Agriculture has been carried out as per National Education Policy-2020 guidelines to build among students, a strong foundation of knowledge and increased practical exposure to instil competence and confidence for application of the professional knowledge coupled with hard and soft skills. New scientific advancements in the field of agriculture have been also given due emphasis with inclusion of courses with contents from such areas.

More emphasis has been given on Skill Enhancement Courses, industry attachments, flexibility in choice of courses via electives offered in fourth year and also through online courses along with provision of project work and internship. Provision of UG-Certificate in Agriculture, UG-Diploma in Agriculture and B.Sc. (Hons) Agriculture degree with internship with amalgamation of multiple exit and entry options as per NEP-2020 is important change in the course curriculum.

The detailed report on undergraduate courses of Agriculture viz. UG certificate in Agriculture, UG-diploma in Agriculture and B.Sc. (Hons) Agriculture has been prepared with due care and inputs of Deans, Heads and faculty members of various departments of agriculture nationwide.

2. Key highlights

- The B.Sc (Hons) Agriculture program will be of 177 credits, which will have 167 credits offered by the parent university and 10 credits of online courses taken by the student as per choice in consultation with university/HAEIs.
- After the admission in the college, the students will register for the Foundation programme of 2 weeks' duration in the 1st semester. A course entitled Deeksharambh

(0+2) (Non-gradial) will be offered at the start of first semester for two weeks' duration. This will create a platform

- for students to learn from each others life experiences, help for cultural Integration of students from different backgrounds, know about the operational framework of academic process in university, instilling life and social skills, social awareness, ethics and values, team work, leadership, creativity, etc. It will also help in identifying the traditional values and indigenous cultures along with diverse potentialities both in indigenous and developed scenario. There will be sessions by alumni, business leaders, outstanding achievers in related fields, people with inspiring life experiences as well as the university academic and research managers.
- The first year of the course program comprises skill development courses along with other fundamental courses of agricultural science. After satisfactory completion of 42 credits of courses in two semesters of 1st year and subsequent satisfactory completion of 10 credits (10 weeks) of industry/ institute training/ internship, the student will become eligible for the award of UG-Certificate in Agriculture on exit. The students continuing the study further, would not have to attend the internship after 1st year.
- The second year has been designed with the skill development courses, basic courses as well as fundamental courses in agriculture with adequate theory and practical components, enabling the student to get acquainted with the basic principles and applications of agricultural sciences. After satisfactory completion of the courses (84 credits) during first two years and subsequent satisfactory completion of 10 credits (10 weeks) of internship, the student will become eligible for the award of UG-Diploma in Agriculture on exit. The students continuing the study further,would not have to attend the internship after 2nd year.
- During the 5th semester, the students will have a study tour of 10-12 days duration, which will be counted as 2 credits (Non-gradial).
- The third- and fourth- year courses have been designed to impart specialized knowledge to the students in the major disciplines. During the 7th semester, the students will adequately select 20 credits from a basket of elective courses, each course being of 4 credits giving an opportunity to them to gain advanced knowledge in frontier areas of agricultural science. The Universities will have flexibility to include more courses as Electives depending on specific needs and situational variations. The objective is to enable the student to acquire deeper understanding in any particular field.

- In the 8th semester of the course the major focus has been on strengthening of the knowledge and skill for developing confidence of the students to take entrepreneurship as their future career. For this they will undergo an advanced skill enhancement through Student READY: RAWE/ Industrial Attachment /Experiential Learning / Hands-on Training/ Project Work /Internship. A student will select option/s on choice to complete the degree and pursue future career with 20 credits. Each student will be attached to a mentor either from the institution or from an organization/ industry. A university or a college will have the freedom to select the options as referred above.
- The core and elective courses can also be modified maximum up to 30% with approval from competent authority of the University.
- The students will take a minimum of 10 credits of online courses during four years as a partial requirement for the B.Sc. (Hons) Agriculture program. The indicative list of courses has been provided; however, online courses can be from any field such as Agriculture and allied sciences, Basic Sciences, Humanities, Psychology, Anthropology, Economics, Business Management, Languages including foreign language, Communication skills/ Music, etc. and can be taken from NPTEL, Mook IT, edX, Coursera, SWAYAM or any other such reputed portal. The objective is to allow the students to groom their passion or strengthen their knowledge and competency in any field beyond prescribed courses. These online courses will be non-gradial and separate certificates would be issued by institute/organization offering the courses. However, the university/ institute will keep a record of such courses registered and completed by each student and indicate the title of the (successfully completed) courses in final transcript issued to the student. A student must submit the list of online courses along with the content he intends to undertake to the Dean/Assoc. Dean/Principal of the college for a permission and records.
- At each stage of exit (UG-certificate/ UG-Diploma and B.Sc. (Hons) Agriculture, the students are expected to acquire competency and confidence to get jobs, to face the real challenges in varied jobs and research, as well as to start their own enterprise. The social skills acquired by the students will also make the students more empathetic towards the society and social issues.
- The credits (and contact hours) have been designed in such a way that along with class room teaching, the students will take up NSS/ NCC and Physical Education,

Yoga, etc. in the first year as the case may be. Further a balance has been made by inclusion of common courses, ore courses in basic and applied areas, skill development courses, elective courses in advanced areas, online courses of choice, options for entrepreneurship and skill development to pursue future career. This will increase their acquaintance with the social/ technical problems, improve their analytical ability of the issues/ challenges and enhance their social responsibility.

3. Entry and Exit Options

The entry and exit options for the UG programme in Agriculture are shown in the Figure 1 below.

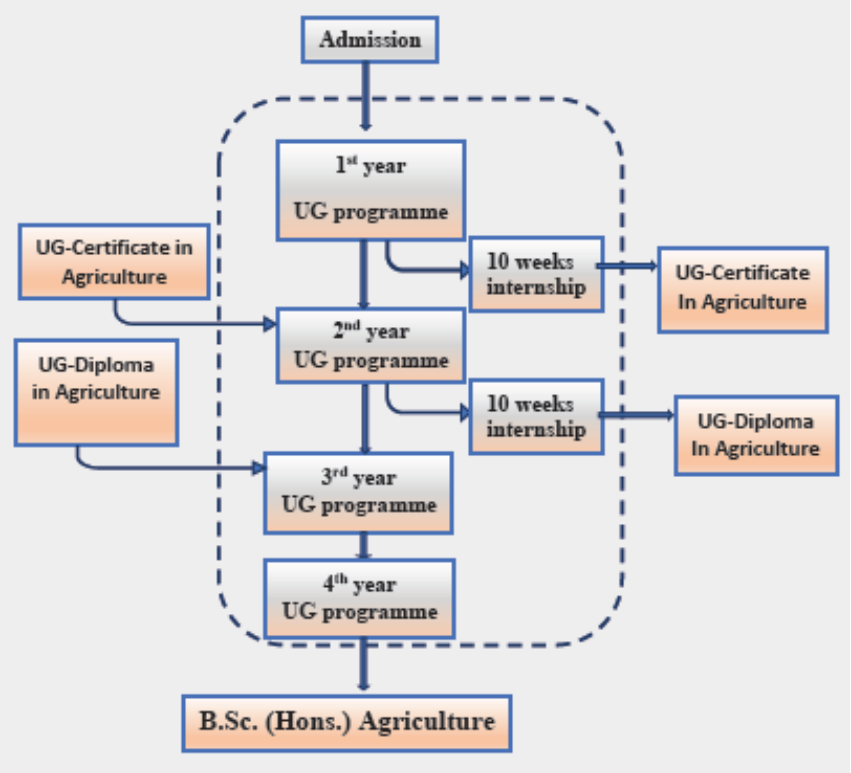

Figure 1: Entry and Exit options for the UG programme in Agriculture

Exit options

1. UG-Certificate in Agriculture (exit after first year and completion of 10 weeks' internship)

2. UG-Diploma in Agriculture (exit after second year and completion of 10 weeks' internship)

3. B.Sc. (Hons) Agriculture (on successful completion of four-year degree requirements)

Eligibility for Entry into 1st year UG programme: +2 Science with biology as one subject

Provision for multiple exit and entry into the UG programme in agriculture has been made in the light of NEP-2020. A student may exit after completion of 1st year and 2nd year requirements followed by 10 weeks of internship after 1st year and 2nd year, respectively, to get UG-Certificate in Agriculture and UG-Diploma in Agriculture.

The Universities may consider allowing lateral entry for the candidates having Diploma in Agriculture (as such courses are available in many states and lateral entry is practiced in some Universities). In such cases, the candidates having Diploma in Agriculture (with minimum 3 years course programme after 10th or equivalent) may be allowed admission into the 2nd year of the UG programme, as per the provisions and norms to be notified by the respective AU from time to time.

4. Academic Programme

Semester wise course and credits Allocation

I Semester		**T-P-P**	**Course code**
1	Deeksharambh (Induction cum Foundation course)	2(0+2+0)*	ASDA 1101
2	Skill Enhancement course-I	2(0+2+0)	CUTM
3	Skill Enhancement course-II	2(0+2+0)	CUTM
4	Communication Skills	2(1+1+0)	ASEE 1103
5	Farming based livelihood systems	3(2+1+0)	ASAG 1102
6	Rural Sociology and Educational Psychology	2 (2+0+0)	ASEE 1101
7	Fundamentals of Agronomy	3(2+1+0)	ASAG 1101
8	Fundamentals of Soil Science	3(2+1+0)	ASSS 1101
9	Fundamentals of Horticulture	3(2+1+0)	ASHO 1101
10	National Service Scheme (NSS-1)/ National Cadet C	1(0+1+0)	ASPE 1101
11	Introductory mathematics (need based)	1(1+0+0)*	ASAS 1103
Total ***NC= Non-gradial courses**		21 (11+10+0)	
II Semester		**T-P-P**	**Course code**
1	Skill Enhancement course-III	2(0+2+0)	CUTM
2	Skill Enhancement course-IV	2(0+2+0)	CUTM
3	Personality Development	2(1+1+0)	ASEE 1204
4	Environmental Studies and Disaster Management	3(2+1+0)	ASAM 1201
5	Soil Fertility Management	3(2+1+0)	ASSS 1202
6	Fundamentals of Entomology	3(2+1+0)	ASEN 1201
7	Livestock and Poultry Management	2(1+1+0)	ASAH 1201
8	Fundamentals of Plant Pathology	3(2+1+0)	ASPP 1201
9	NCC-II/NSS-II	1(0+1+0)	ASPE 1202
Total		21(10+11+0)	
III Semester		**T-P-P**	**Course code**
1	Skill Enhancement course-V*	2(0+2+0)	CUTM

2	Entrepreneurship Development and Business Communication	3 (2+1+0)	ASEC 1202
3	Physical Education, First Aid, Yoga Practices and Meditatio	2(0+2+0)	ASSW 2103
4	Principles of Genetics	3(2+1+0)	ASPG 2101
5	Crop Production Technology-I (Kharif crops)	3(1+2+0)	ASAG 2103
6	Production Technology of Fruit and Plantation Crops	2 (1+1+0)	ASHO 2102
7	Fundamentals of Extension Education	2(1+1+0)	ASEE 2102
8	Fundamentals of Nematology	2(1+1+0)	ASNE 2101
9	Principles and Practices of Natural Farming	2(1+1+0)	ASAG 2104
Total		21(09+12+0)	
IV Semester		**T-P-P**	**Course code**
1	Skill Enhancement course-VI*	2(0+2+0)	CUTM
2	Agricultural Informatics and Artificial Intelligence	3(2+1+0)	ASAS 2201
3	Production Technology of Vegetables and Spices	2(1+1+0)	ASHO 2209
4	Principles of Agricultural Economics and Farm Management	2(2+0+0)	ASEC 2201
5	Crop Production Technology-II (Rabi Crops)	3(1+2+0)	ASAG 2204
6	Farm Machinery and Power	2 (1+1+0)	ASAE 2201
7	Water Management	2 (1+1+0)	ASAG 2205
8	Problematic Soils and their management	2 (1+1+0)	ASSS 2203
9	Basics of Plant Breeding	3(2+1+0)	ASPG 2202
Total		21(11+10+0)	

SEMESTER I

1.1 Deeksharambh (Induction cum Foundation course) 2(0+2+0)* ASDA 1101

Objectives

- To give a broad view and application areas of the subject of study
- Helping students from different backgrounds for cultural Integration
- Knowing about the operational framework of academic process in university
- Instilling life and social skills, leadership qualities, team working spirit
- Developing social awareness, ethics and values, creativity
- Helping students to identify the traditional values and indigenous cultures along with diverse potentialities both in indigenous and developed scenario.

Activities

- The details of activities/ schedules will be decided by the university. The structure hall includes:
- Discussions on operational framework of academic process in university, as well as interactions with academic and research managers of the University
- Creating awareness on the subject of study, and the traditional values and indigenous cultures along with diverse potentialities both in indigenous and developed scenario
- 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
- 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

1.2 Skill Enhancement course-I 2(0+2+0) CUTM

The student can choose any skill course offered by the university

[Refer https://course.cutm.ac.in/skill-courses/]

1.3 Skill Enhancement course-II **2(0+2+0)** **CUTM**

The student can choose any skill course offered by the university

[Refer https://course.cutm.ac.in/skill-courses/]

1.4 Communication Skills **2(1+1+0)** **ASEE 1103**

Objectives

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

Course Outcomes:

After completing of this course, students will be able to:

CO1: Gain knowledge on communication skills, structural and functional grammar.
CO2: Acquire skills on technical communication and writing.
CO3: Enhance knowledge on oral presentation skills and comprehension of general and technical articles.
CO4: Distinguish individual and group presentations, impromptu presentation, public speaking, group discussion.
CO5: Foster ability in organizing seminars and conferences

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✔	✔		✔								
CO2		✔		✔					✔	✔		
CO3							✔		✔	✔		
CO4			✔		✔							✔
CO5		✔		✔					✔			✔

Theory

Communication Process: The magic of effective communication; Building self-esteem and overcoming fears; Concept, nature and significance of communication process; Meaning, types and models of communication; Verbal and non-verbal communication; Linguistic and non-linguistic barriers to communication and reasons behind communication gap/miscommunication. Basic Communication Skills: Listening, Speaking, Reading and Writing Skills; Precis writing/Abstracting/ Summarizing; Style of technical communication Curriculum vitae/resume writing; Innovative methods to enhance vocabulary,

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

Practical

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

Suggested readings

1. Allport, G. W.1937. Personality: A Psychological Interpretation. Holt, New York.
2. Brown Michele and Gyles Brandreth. 1994. How to Interview and be Interviewed. Sheldon Press, London.
3. Carnegie Dale. 1997. The Quick and Easy Way to Effective Speaking. Pocket Books, New York.
4. Francis Peter S J. 2012. Soft Skills and Professional Communication. Tata McGraw Hill, New Delhi.
5. Kumar S and Pushpa Lata. 2011. Communication Skills. Oxford University Press.
6. Neuliep James W. 2003. Intercultural Communication A Contextual Approach. Houghton Mifflin Co Boston.
7. Pease, Allan. 1998. Body Language. Sudha Publications, Delhi.
8. Raman M and Singh P. 2000. Business Communication. Oxford University Press.
9. Seely J. 2013. Oxford Guide to Effective Writing and Speaking. Oxford University Press.
10. Thomson A J and Martinet A V. 1977. A Practical English Grammar. Oxford University

1.5 Farming based livelihood systems 3(2+1+0) ASAG 1102

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
- To explore institutional models, value chains, and government schemes that support farming-based livelihood enterprises and rural development.

Course outcomes

- **CO1:** Understand the status of agriculture and farming systems in India, including regional livelihood patterns and their socio-economic implications.
- **CO2:** Analyze the components and integration of various farming-based livelihood systems across different agro-climatic zones.
- **CO3:** Evaluate the feasibility, productivity, and profitability of crop-based, livestock-based, and integrated livelihood models.
- **CO4:** Assess the role of institutions, government schemes, and value chains in promoting sustainable farming-based livelihoods.
- **CO5:** Develop practical skills in surveying, project formulation, and analyzing start-ups and enterprises in agriculture for enhanced livelihood opportunities.

CO-PO mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✔										✔	
CO2		✔		✔							✔	
CO3					✔	✔			✔			
CO4		✔	✔	✔			✔					
CO5						✔		✔				✔

Theory

Status of agriculture in India and different states, Income of farmers and rural people in India, Livelihood-Definition, concept and livelihood pattern in urban and rural areas, Different indicators to study livelihood systems. Agricultural livelihood systems (ALS): Meaning, approach, approaches and framework, Definition of farming systems and farming based livelihood systems Prevalent Farming systems in India contributing to livelihood. Types of traditional and modern farming systems. Components of farming system/ farming-based livelihood systems- Crops and cropping systems, Livestock (Dairy, Piggery, Goatry, Poultry, Duckry etc.), Horticultural crops, 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 and success factors in farming-based livelihood systems, Schemes and programs by Central and State Government, Public and Private organizations involved in promotion of farming-based livelihood opportunities. Role of farming-based livelihood enterprises in 21st Century in view of circular economy, green economy, climate change, digitalization and changing life style.

Practical

Survey of farming systems and 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 and their functional aspects for integration of production, processing and distribution sectors and Study of agri-enterprises involved in industry and service sectors (Value Chain Models), Learning about concept of project formulation on farming-based livelihood systems along with cost and profit analysis, Case study of Start-Ups in agri-sectors.

Suggested Readings

1. Ashley, C. and Carney, D. 1999. Sustainable Livelihoods: Lessons from Early Experience; Department for International Development: London, UK; Volume 7. [Google Scholar]

2. Agarwal, A. and Narain, S. 1989. Towards Green Villages: A strategy for Environmentally, Sound and Participatory Rural Development, Center for Science and Environment, New Delhi, India

3. Carloni, A. 2001. Global Farming Systems Study: Challenges and Priorities to 2030 – Regional Analysis: Sub-Saharan Africa, Consultation Document, FAO, Rome, Italy

4. Dixon, J. and A. Gulliver with D. Gibbon. 2001. Farming Systems and Poverty: Improving Farmers Livelihoods in a Changing World. FAO & World Bank, Rome, Italy & Washington, DC, USA

5. Evenson, R.E. 2000. Agricultural Productivity and Production in Developing Countries'. In FAO, The State of Food and Agriculture, FAO, Rome, Italy

6. Livelihood Improvement of Underprivileged Farming Community: Some Experiences from Vaishali, Samastipur, Darbhanga and Munger Districts of Bihar by B. P. Bhatt, Abhay Kumar, P.K. Thakur, AmitavaDeyUjjwal Kumar, Sanjeev Kumar, B.K. Jha, Lokendra Kumar, K. N. Pathak, A. Hassan, S. K. Singh, K. K. Singh and K. M. Singh ICAR Research Complex for Eastern Region ICAR Parisar, P.O. Bihar Veterinary College, Patna - 800 014, Bihar

7. Panwar et al. 2020. Integrated Farming System models for Agricultural Diversification,

Enhanced Income and employment, Indian Council of Agricultural Research, New Delhi.

8. Reddy, S.R. 2016. Farming System and Sustainable Agriculture, Kalyani Publishers, New Delhi.

9. Singh, J.P., et al. 2015. Region Specific Integrated Farming System Models, ICAR-Indian Institute of Farming Systems Research, Modipuram.

1.6 Rural Sociology and Educational Psychology 2 (2+0+0) ASEE 1101

Objectives

- To provide knowledge on concept and importance of sociology
- To provide knowledge on concept and importance of rural sociology
- To provide relationship with Extension Education

Course Outcomes:

After completing of this course, students will be able to:

CO 1: Understand the concept of rural sociology and its importance in agricultural extension.

CO 2: Gain knowledge of rural society's characteristics, village institutions and social organisations.

CO 3: Understand social groups, social stratification, culture, social values, social control and attitudes, leadership and training.

CO 4: Understand the concepts of educational psychology, intelligence, personality, perceptions, emotions, frustration, and motivation.

CO 5: Acquire knowledge in theories of learning and teaching learning situation.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✔										✔	

CO2		✔		✔							✔	
CO3					✔	✔			✔			
CO4		✔	✔	✔			✔					
CO5						✔		✔				✔

Theory

Extension Education and Agricultural Extension: Meaning, definition, scope, and importance. Sociology and rural sociology: Meaning, definition, scope, importance of rural sociology in Agricultural Extension, and interrelationship between rural sociology and Agricultural Extension. Indian Rural Society: important characteristics, differences and relationship between rural and urban societies. Social Groups: Meaning, definition, classification, factors considered information and organization of groups, motivation in group formation and role of social groups in Agricultural Extension.

Social Stratification: Meaning, definition, functions, basis for stratification, forms of social stratification- characteristics and- differences between class and caste system. Cultural concepts: culture, customs, folkways, mores, taboos, rituals. Traditions: Meaning, definition and their role in Agricultural Extension. Social Values and Attitudes: Meaning, definition, types and role of social values and attitudes in agricultural Extension. Social Institutions: Meaning, definition, major institutions in rural society, functions, and their role in agricultural Extension. Social Organizations: Meaning, definition, types of organizations and role of social organizations in agricultural Extension. Social Control: Meaning, definition, need of social control and means of social control. Social change: Meaning, definition, nature of social change, dimensions of social change and factors of social change. Leadership: Meaning, definition, classification, roles of leader, different methods of selection of professional and lay leaders. Training of Leaders: Meaning, definition, methods of training, Advantages and limitations in use of local leaders in Agricultural Extension, Psychology and educational psychology: Meaning, definition, scope, and importance of educational psychology in Agricultural Extension. Intelligence: Meaning, definition, types, factors affecting intelligence and importance of intelligence in Agricultural Extension. Personality: Meaning, definition, types, factors influencing the personality and role of personality in agricultural Extension. Teaching: Learning process: Meaning and definition of teaching,

learning, learning experience and learning situation, elements of learning situation and its characteristics. Principles of learning and their implication of teaching.

Suggested readings

1. A. R. Desai -Rural Sociology in India
2. Dahama O. P. and Bhatnagar, O. P. - Education and Communication for Development
3. J.B. Chitambar -Introductory Rural Sociology
4. M.B. Ghorpade- Essential of psychology
5. Prepared You Tube videos
6. R Velusamy Textbook on Rural Sociology and Educational Psychology
7. Ray, G. L. -Extension Communication and Management
8. Sandhu A. S. -Textbook on Agricultural Communication
9. Web Materials

1.7 Fundamentals of Agronomy 3(2+1+0) ASAG 1101

Objectives

- To impart the basic and fundamental knowledge of Agronomy
- To understand various agronomic terms
- To have hands on experience of the basic agronomic practices

Course outcomes

After completing of this course, students will be able to:
CO1: Understand the scope of agronomy
CO2: Able to identify various fertilizers, manures and other agrochemicals
CO3: Gain knowledge on agronomic practices for crop production.
CO4: Understand the aspects of soil fertility, water management and weed management
CO5: Gain knowledge on various numerical exercises like fertilizer requirement, plant population, herbicide requirement, water requirement and yield estimation
CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12
CO1	✔	✔									✔	
CO2	✔	✔										
CO3	✔	✔	✔							✔	✔	
CO4	✔	✔	✔							✔	✔	
CO5	✔	✔	✔				✔		✔		✔	

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 tilth: 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 /uncombined 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 (INM): 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.

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

Practical

A visit to Instructional Crop farm and study 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.

Suggested readings

1. Rao V S. 1992. Principles of Weed Science. Oxford and IBH Publishing Co. Ltd. New Delhi.

2. Reddy Yellamanda T and Shankar Reddy G H. 1995. Principles of Agronomy. Kalyani Publishers, Ludhiana.

3. Reddy, S. R. 2008. Principle of Crop Production, Kalyani Publisher, Ludhiana.

4. William L Donn. 1965. Meteorology. McGraw-Hill Book Co. New York.

5. Yawalkar K S and Agarwal J P. 1977. Manures and Fertilizers. Agricultural Horticultural Publishing House, Nagpur.

1.8 Fundamentals of Soil Science 3(2+1+0) ASSS 1101

Objectives

- To impart knowledge on soil genesis, basic soil properties with respect to plant growth
- To study the various physical, and chemical properties of soil.
- To understand the different types of soils and its importance in crop production.

At the end of the course the students will be able to achieve the following outcomes:

Course Outcomes:

After completing of this course, students will be able to:

CO1: Understand the fundamental principles of Soil Science and its role in crop production.
CO2: Gain knowledge about different soil forming processes and factors affecting these processes.
CO3: Understand the different physical, chemical and biological properties of soil.
CO4: Get acquainted with different aspects of soil classification, land use capability and soil pollution.
CO5: Know about the different types of soils in India and their characteristics.

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓											
CO2	✓	✓										

CO3	✓											
CO4	✓	✓										
CO5	✓	✓										

Theory

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

Practical

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

Suggested readings

1. Introductory Soil Science – By Dilip Kumar Das, Kalyani Publishers

2. Soil Fertility and Nutrient Management – By S. S. Singh, Kalyani Publishers

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

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

1.9 Fundamentals of Horticulture 3(2+1+0) ASHO 1101

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

Course outcome:

After completing of this course, students will be able to:
CO1: Develop the ability to identify a wide range of horticultural crops.
CO2: Identify and describe the various parts of plants, their functions, and how they contribute to plant growth and development.
CO3: Explore various methods of plant propagation, including sexual and asexual methods and understand how to apply these techniques to produce new plants.
CO4: Understand the role of soil in plant growth, soil properties, soil fertility and the application of fertilizers and nutrients to promote healthy plant growth.
CO5: Study the cultivation practices of various horticultural crops

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓	✓	✓		✓						✓	
CO2	✓	✓	✓									
CO3	✓		✓	✓		✓						
CO4		✓	✓			✓				✓	✓	
CO5		✓	✓	✓							✓	

Theory

Horticulture: Its different branches, importance and scope, Horticulture and botanical classification, soil and climate for horticultural crops. Plant propagation: methods and propagation structures, seed dormancy and seed germination, Merits and demerits of sexual and asexual propagation Stock-scion relationship.

Principles of orchard establishment, principles and methods of training and pruning of fruit crops, Juvenility and flower bud differentiation, unfruitfulness in horticultural crops, pollination, pollinizers and pollinators, fertilization and parthenocarpy, 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 fruit crops, Understanding of plant propagation

structures, Propagation through seeds and plant parts, Propagation techniques for horticultural crops, Container, potting mixture, potting and repotting, Training and pruning methods on fruit crops, Preparation of fertilizer mixture and application, Preparation and application of PGR, Layout of different irrigation systems, Maturity studies, harvesting, grading, packaging and storage.

Suggested readings

1. Basics of Horticulture by Jitendra Singh
2. Introduction to Horticulture by N. Kumar
3. Handbook of Horticulture by ICAR

1.10 National Service Scheme (NSS-1)/ National Cadet Corps (NCC-1) 1(0+1+0) ASPE 1101

1.10.1 National Cadet Corps (NCC-1)

- 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 needs, NGOs and their contribution, contribution of youth towards social welfare and family planning.
- Structure and function of human body, diet and exercise, hygiene and sanitation. Preventable diseases including AIDS, safe blood donation, first aid, physical and

mental health. Adventure activities. Basic principles of ecology, environmental conservation, pollution and its control.

1.10.2 National Service Scheme

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.

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

- 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

1.11 Introductory mathematics (need based) 1(1+0+0)* ASAS 1103

Objectives

- To understand the concept of straight lines.
- To learn the principle of circles, differential and integral calculations.
- To understand the principles of matrices & determinants.

Course outcome:

After completing of this course, students will be able to:
CO1: Learn the concept of straight lines.

CO2: Gain knowledge on equation of circles.

CO3: Learn differential calculus.

CO4: Learn integral calculus.

CO5: Understand matrices and determinants.

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✔											
CO2	✔											
CO3	✔	✔										
CO4	✔	✔										
CO5	✔	✔										

Theory

Algebra: Progressions- Arithmetic, Geometric and Harmonic Progressions. 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. Differential Calculus: Definition - Differentiation of function using first principle, 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 (x1, x2). 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.

SEMESTER II

2.1 Skill Enhancement course-III **2(0+2+0)** **CUTM**

The student can choose any skill course offered by the university

[Refer https://course.cutm.ac.in/skill-courses/]

2.2 Skill Enhancement course-IV **2(0+2+0)** **CUTM**

The student can choose any skill course offered by the university

[Refer https://course.cutm.ac.in/skill-courses/]

2.3 Personality Development **2(1+1+0)** **ASEE 1204**

Objectives

- To make students realize their potential strengths
- To cultivate their inter-personal skills and improve employability
- To equip students with practical tools to enhance personal effectiveness, teamwork, and decision-making within organizational settings.

Course Outcomes:

After completing of this course, students will be able to:

CO1: Understand and explain the key concepts of personality, including its nature, types, major theories (e.g., humanistic, trait-based, and Myers-Briggs Typology), and its role in shaping individual behavior within organizations.

CO2: Analyze the foundations of individual behavior, including perception, attribution, and various influencing factors, with the ability to apply models of individual behavior to real-world organizational scenarios.

CO3: Evaluate different learning theories and principles, and apply the knowledge to enhance employee training, development, and performance management in organizations.

CO4: Assess the roles of attitudes, values, intelligence (including emotional intelligence), and motivation in determining individual and group behavior in an organizational context.

CO5: Demonstrate an understanding of group dynamics, teamwork, and the interaction between personality, motivation, and behavior in teams to foster effective organizational outcomes.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12

CO1	✔									✔	
CO2		✔		✔						✔	
CO3					✔	✔			✔		
CO4		✔	✔	✔			✔				
CO5						✔		✔			✔

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, Firo-B, Interpersonal Communication, Teamwork and team building, Group Dynamics, Win-win game, Conflict Management, Leadership styles, Case studies on Personality and Organizational Behavior.

Suggested readings

1. Andrews, Sudhir. 1988. How to Succeed at Interviews. 21st (rep.) New Delhi. Tata McGraw-
Hill.
2. Heller, Robert. 2002. Effective Leadership. Essential Manager series. Dk Publishing.
3. Hindle, Tim. 2003. Reducing Stress. Essential Manager series. Dk Publishing.
4. Lucas, Stephen. 2001. Art of Public Speaking. New Delhi. Tata - Mc-Graw Hill.
5. Mile, D.J. 2004. Power of Positive Thinking. Delhi. Rohan Book Company.
6. Pravesh Kumar. 2005. All about Self- Motivation. New Delhi. Goodwill Publishing House.

7. Smith, B. 2004. Body Language. Delhi: Rohan Book Company.

8. Shaffer, D. R. 2009. Social and Personality Development (6th Edition). Belmont, CA: Wadswor.

2.4 Environmental Studies and Disaster Management 3(2+1+0) ASAM 1201

Objectives

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

Course outcomes

After completion of this course, students will be able to:

CO1: Gain knowledge on natural resources including renewable and non-renewable resources.
CO2: Understand the concepts, structure and functions of ecosystem.
CO3: Learn about biodiversity and its conservation.
CO4: Get familiarized with environmental pollution and the issues involved in it.
CO5: Get acquainted with environment and human health.

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓	✓		✓				✓	✓	✓	✓	✓
CO2	✓	✓			✓	✓		✓			✓	
CO3	✓	✓		✓		✓		✓			✓	
CO4	✓	✓	✓			✓	✓	✓			✓	
CO5	✓	✓	✓	✓			✓	✓		✓	✓	✓

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. iogeographical 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 un polluted system. Visit to local polluted site - Urban/Rural/Industrial/Agricultural to study of common plants, insects and birds. Environmental sampling and preservation. Water quality analysis: pH, EC and TDS. Estimation of Acidity, Alkalinity. Estimation of water hardness. Estimation of DO and BOD in water samples. Estimation of COD in water samples. Enumeration of *E. coli* in water sample. Assessment of Suspended Particulate Matter (SPM). Study of simple ecosystem – Visit to pond/river/hills. Visit to areas affected by natural disaster.

Suggested readings

1. De, A.K. 2010. Environmental chemistry. Published by New Age International Publishers, New Delhi. ISBN:13–978 81 224 2617 5. 384 pp

2. Dhar Chakrabarti, P.G. 2011. Disaster management - India's risk management policy frameworks and key challenges. Published by Centre for Social Markets (India), Bangalore. 36 pp.

3. Erach Bharucha, Text book for Environmental studies. University Grants Commission, New Delhi

4. Parthiban, K.T. Vennila, Prasanthrajan, S., Umesh, M. and Kanna, S. 2023. Forest, Environment, Biodiversity and Sustainable development. Narendra Publishing House, New Delhi, India. (In Press).

5. Prasanthrajan M. and Mahendran, P.P. 2008. A text book on Ecology and Environmental Science. ISBN 81-8321-104-6. Agrotech Publishing Academy, Udaipur - 313 002. First Edition: 2008

6. Prasanthrajan M. 2018. Objective environmental studies and disaster management. ISBN 9789387893825. Scientific publishers, Jodhpur, India. Pp. 146.

7. Sharma, P.D. 2009. Ecology and Environment, Rastogi Publications, Meerut, India

8. Tyler Miller and Scot Spoolman. 2009. Living in the Environment (Concepts, Connections, and Solutions). Brooks/cole, Cengage learning publication, Belmont, USA

2.5 Soil Fertility Management **3(2+1+0)** **ASSS 1202**

Objectives

- To provide a comprehensive knowledge of soil fertility, plant nutrition, fertilizers, and nutrient management
- To study the chemistry of various plant nutrients in soil and their role in crop production.
- To know about different soil fertility evaluation methods and soil fertility management practices

Course outcomes

CO1: Know the different types of manures and methods of preparation.
CO2: Get acquainted with different types of fertilizers, its nutrient contents and chemistry in soil.
CO3: Learn different aspects of soil fertility evaluation and soil fertility management. **CO4:** Gain knowledge of role and functions of various plant nutrients in crop production.
CO5: Explain different soil and plant testing techniques

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓	✓										
CO2	✓	✓										
CO3	✓						✓					
CO4	✓	✓										
CO5			✓						✓	✓		

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, Customised fertilisers, 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).

Introduction of analytical instruments and their principles, calibration and applications of Coloremetry 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

1. Introductory Soil Science by Dilip Kumar Das, Kalyani Publishers
2. Soil Fertility and Nutrient Management by S. S. Singh, Kalyani Publishers
3. Soil Fertility and Fertilizers by Samual L. Tisdale, Werner L. Nelson and James D. Beaton, Macmillan Publishing Company, New York
4. The nature and Properties of Soils by Harry O. Buckman and Nyle C.

2.6 Fundamentals of Entomology **3(2+1+0)** **ASEN 1201**

Objectives

- To know the history of entomology, classification of insects and their relationship with other arthropods
- To study the various morphological characters of class insect 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

Course Outcomes:

After completing of this course, students will be able to:

CO 1: Understand the basics of entomology, scope and its importance.
CO 2: Gain knowledge on the basics of insect identification and classifications
CO 3: Get familiarized with the collection and preservation of insects for future morphological and taxonomical studies
CO 4: Learn the various aspects of morphological features of insects
CO 5: Analyze the physiological system of insects

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓				✓			✓			✓	
CO2	✓				✓						✓	
CO3	✓	✓										
CO4	✓											
CO5	✓											✓

Theory

History of Entomology in India. Major points related to dominance of Insects in Animal kingdom. Classification of phylum Arthropoda up to classes. Relationship of class Insects 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.

Metamorphosis and diapause in insects. Types of larvae and pupae. Structure and functions of

digestive, circulatory, excretory, respiratory, nervous, secretary (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. Systematics: Taxonomy – importance, history and development and binomial nomenclature. Definitions of Biotype, Sub-species, Species, Genus, Family and Order. Classification of class Insecta up to Orders, basic groups of present day insects with special emphasis to orders and families of Agricultural importance like Orthoptera: Acrididae, Tettigoniidae, Gryllidae, Gryllotalpidae; Dictyoptera: Mantidae, Blattidae; Odonata; Isoptera: Termitidae; Thysanoptera: Thripidae; Hemiptera: Pentatomidae, Coreidae, Cimicidae, Pyrrhocoridae, Lygaeidae, Cicadellidae, Delphacidae, Aphididae, Coccidae, Lophophidae, Aleurodidae, Pseudococcidae; Neuroptera: Chrysopidae; Lepidoptera: Pieridae, Papiloinidae, Noctuidae, Sphingidae, Pyralidae, Gelechiidae, Arctiidae, Saturnidae, Bombycidae; Coleoptera: Coccinellidae, Chrysomelidae, Cerambycidae, Curculionidae, Bruchidae, Scarabaeidae; Hymenoptera: Tenthridinidae, Apidae. Trichogrammatidae, lchneumonidae, Braconidae, Chalcididae; Diptera: Cecidomyiidae, Tachinidae, Agromyziidae, Culicidae, Muscidae, Tephritidae.

Practical

Methods of collection and preservation of insects including immature stages; External features of Grasshopper/Blister beetle; Types of insect antennae, mouthparts and legs; Wing venation, types of wings and wing coupling apparatus. Types of insect larvae and pupae; Dissection of digestive system in insects (Grasshopper); Study of characters of orders Orthoptera, Dictyoptera, Odonata, Isoptera, Thysanoptera, Hemiptera, Lepidoptera, Neuroptera, Coleoptera, Hymenoptera, Diptera and their families of agricultural importance. Insecticides and their formulations. Pesticide appliances and their maintenance. Sampling techniques for estimation of insect population and damage.

Suggested readings

1. Fundamentals of Ecology - Eugene. P. Odum and Gray W. Barrett
2. Imm's General Text book of Entomology— O.W. Rechards and R.G. Davies
3. Introduction to the study of Insects –D. J. Borror and DeLongs

2.7 Livestock and Poultry Management 2(1+1+0) ASAH 1201

Objectives

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

- Entrepreneurship development through Livestock/poultry and Agriculture Integrated Farming
- To facilitate the understanding on feedstuffs of livestock & poultry.

Course Outcomes:

After completing of this course, students will be able to:

CO1: Gain knowledge on livestock, reproduction & principles of housing and management.

CO2: Understand the management of calves, heifers, milch animals sheep goat, swine& poultry.

CO3: Analyze the importance of Indian and exotic livestock, poultry and their diseases.

CO4: Learn the diseases of livestock and poultry.

CO5: Classify feedstuffs of livestock & poultry.

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✔	✔	✔	✔		✔					✔	
CO2	✔	✔	✔	✔		✔					✔	
CO3	✔	✔	✔	✔		✔					✔	
CO4	✔	✔	✔	✔	✔	✔					✔	
CO5	✔	✔	✔	✔		✔					✔	

Theory

Role of livestock in the national economy. 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. 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.

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 equipment. Management of chicks, growers and layers. Debeaking, dusting and vaccination. Economics of cattle, buffalo, sheep, goat, swine and poultry production.

Suggested readings

1. A Textbook of Animal Husbandry by G. C Banerjee
2. A text Book of Livestock Production management in Tropic by D. N. Verma

2.8 Fundamentals of Plant Pathology 3(2+1+0) ASPP 1201

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

Course Outcome:

After completing of this course, students will be able to:

CO1: Acquire knowledge about plant pathogens, diseases, and their management.

CO2: Gain skills in the isolation and identification of plant pathogens.

CO3: Understand the functioning of various lab equipment and their uses in Plant Pathology.

CO4: Acquire knowledge on recent plant disease management tools

CO5: Devise integrated management strategies against plant diseases

CO-PO Mapping

	PO 1	PO2	P O3	P O4	P O5	P O6	P O7	P O8	P O9	PO 10	PO 11	PO 12
CO 1	✔	✔				✔						
CO 2	✔	✔										
CO 3	✔	✔	✔									
CO 4	✔	✔	✔	✔						✔		
CO 5	✔	✔	✔									✔

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 equipment; 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

1. Agrios, G.N. 2010. Plant Pathology. Acad. Press.

2. Alexopoulos, Mims and Blackwel. Introductory Mycology.

3. Dhingra, O.D. and Sinclair, J.B. 1986. Basic Plant Pathology Methods. CRC Press, London, Tokyo.

4. Gibbs, A. and Harrison, B. 1976. Plant Virology - The Principles. Edward Arnold, London

5. Goto, M. 1990. Fundamentals of Plant Bacteriology. Academic Press, New York.

6. Hull R. 2002. Mathew's Plant Virology. 4th edn. Academic Press, New York.

7. Kamat, M. N. Introductory Plant Pathology. Prakash Pub, Jaipur.

8. Mehrotra, R.S. and Aggarwal, A. 2007. Plant Pathology. 7th edn. Tata Mc Graw Hill Publ. Co. Ltd.

9. Nene, Y.L. and Thapliyal, P.N. 1993. Fungicides in Plant Disease Control. 3rd Ed. Oxford & IBH, New Delhi.

10. Pathak, V. N. Essentials of Plant Pathology. Prakash Pub., Jaipur

11. Rajeev, K. and Mukherjee, R.C. 1996. Role of Plant Quarantine in IPM. Aditya Books.

12. Rhower, G.G. 1991. Regulatory Plant Pest Management. In: Handbook of Pest Management in Agriculture. 2nd edn. Vol. II. (Ed. David Pimental). CRC Press.

13. Singh R.S. 2008. Plant Diseases. 8 th Ed. Oxford & IBH. Pub. Co.

14. Singh R.S. 2013. Introduction to Principles of Plant Pathology. Oxford and IBH Pub. Co.

15. Verma, J.P. 1998. The Bacteria. Malhotra Publ. House, New Delhi.

16. Vyas SC. 1993. Handbook of Systemic Fungicides. Vols. I-III. Tata McGraw Hill, New Delhi.

2.9 NCC-II/NSS-II **1(0+1+0)** **ASPE 1202**

2.9.1 NCC-II

- 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.

2.9.2 NSS-II

- 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.

SEMESTER III

3.1 Skill Enhancement course-V **2(0+2+0)** **CUTM**

The student can choose any skill course offered by the university

[Refer https://course.cutm.ac.in/skill-courses/]

3.2 Entrepreneurship Development and Business Communication **3 (2+1+0)**

ASEC 1202

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

Course outcome

After completion of this course, students will be able to:

CO1: Understand key concepts and processes of entrepreneurship and business development.

CO2: Know the processes of differences between small and large firms and the economic environment.

CO3: Analyze the Govt. policies, programs and schemes for establishment of enterprises.

CO4: Gain knowledge on the establishment of Micro, Small & Medium Enterprises.

CO5: Improve their communication and managerial skills in managing enterprises.

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1		✔	✔	✔	✔	✔						✔
CO2									✔			✔
CO3							✔	✔				
CO4					✔				✔		✔	✔
CO5		✔			✔			✔		✔		

Theory

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

and short-term planning, book keeping, journal, ledger, subsidiary books, annual financial statement, taxation. Marketing management: market, types, marketing assistance, market strategies. Crisis management: raw material, production, leadership, market, finance, natural etc.

Practical

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

Suggested Readings

1. Charantimath, P.M. 2009, Entrepreneurship Development and Small Business Enterprises. Pearson Publications, New Delhi.

2. Desai, V. 2015, Entrepreneurship: Development and Management, Himalaya Publishing House.

3. Gupta, C.B. 2001. Management Theory and Practice. Sultan Chand & Sons.

4. Indu Grover. 2008. Handbook on Empowerment and Entrepreneurship. Agrotech Public Academy.

5. Khanka, S.S. 1999. Entrepreneurial Development. S. Chand & Co.

6. Mehra, P. 2016, Business Communication for Managers. Pearson India, New Delhi.

7. Pandey, M. and Tewari, D. 2010, The Agribusiness Book. IBDC Publishers, Lucknow.

8. Singh, D. 1995. Effective Managerial Leadership. Deep & Deep Publ.

9. Singhal, R.K. 2013, Entrepreneurship Development & Management, Katson Books.

10. Tripathi, P.C. and Reddy, P.N. 1991. Principles of Management. Tata McGraw Hill.

11. Vasant Desai, 1997. Small Scale Industries and Entrepreneurship. Himalaya Publ. House

3.3 Physical Education, First Aid, Yoga Practices and Meditation 2(0+2+0)

ASSW 2103

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

Course outcomes

CO1: Demonstrate understanding of physical training methods like calisthenics, weight training, circuit, interval, and Fartlek training.

CO2: Analyze the impact of exercise, diet, and ageing on various physiological systems and overall physical fitness.

CO3: Practice and explain different yoga asanas, pranayama techniques, meditation, and kriyas for physical and mental well-being.

CO4: Identify postural deformities and suggest corrective exercises for improving posture and body alignment.

CO5: Understand the role of physical education and yoga in personality development, stress management, and adolescent well-being.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1			✔				✔		✔			
CO2			✔				✔					
CO3			✔				✔					✔
CO4									✔			✔
CO5						✔			✔			

Practical

Physical education; Training and Coaching - Meaning and Concept; Methods of Training; aerobic and aerobic exercises; Calisthenics, weight training, circuit training, interval training, Fartlek training; Effects of Exercise on Muscular, Respiratory, Circulatory and 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 and its Management; Posture; Postural Deformities; Exercises for good posture.

- Yoga; History of Yog, Types of Yog, Introduction to Yog,
- Asanas (Definition and Importance) Padmasan,san, Vajrajasan, Shashankasan, Pashchimotasan, Ushtrasan, Tadasan, Padhastasan, Ardhchandrasan, Bhujangasan,

Utanpadasan, Sarvangasan, Parvatasan, Patangasan, Shishupalanasan – left leg-right leg, Pavanmuktasan, Halasan, Sarpasan, Ardhdhanurasan, Sawasan

- Suryanamskar Pranayama (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, Dhyanmudra, 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.

3.4 Principles of Genetics **3(2+1+0)** **ASPG 2101**

Objectives

- To impart knowledge on the ultrastructure of cell and cell organelles
- To understand basic concepts on both conventional and modern principles of genetics
- To learn the basic concepts of principles of genetics and its application in plant breeding

Course outcomes

After completing of this course, students will be able to:

CO1: Able to understand the basic concepts of the ultrastructure of cell, cell organelles, chromosomes and nucleic acids.

CO2: Gain knowledge on fundamentals of chromosomal inheritance.

CO3: Able to learn sex determination, mutations, chromosomal aberrations and gene concept.

CO4: Understand the basic concepts of gene structure, expression and its regulation

CO5: Able to learn the principles of inheritance and applications in plant breeding.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓					✓	✓	✓	✓	✓		
CO2	✓					✓	✓	✓	✓	✓		
CO3	✓	✓		✓	✓	✓	✓			✓	✓	
CO4	✓				✓	✓				✓		
CO5	✓	✓				✓	✓					✓

Theory

Pre and post Mendelian concepts of heredity, Mendelian principles of heredity, Study of model organisms (Drosophila, Arabidopsis, Garden pea, E. coli, and mice), Architecture of chromosomes, chromonemata, chromosome matrix, chromomeres, centromere, secondary constriction and telomere, special types of chromosomes, Chromosomal theory of inheritance- cell cycle and cell division-mitosis and meiosis. Probabilit and Chi-square. Types of DNA and RNA, Dominance relationships, Epistatic interactions with example, Introduction and definition of cytology, genetics and cytogenetics and their interrelation.

Multiple alleles, pleiotropism and pseudoalleles, Sex determination and sex linkage, sex limited and sex influenced traits, Blood group genetics, Linkage and its estimation, crossing over mechanism, chromosome mapping, Structural and numerical variations in chromosomes and their implications, Use of haploids, dihaploids and double haploids in Genetics, Mutation, classification, Methods of inducing mutations, mutagenic agents and induction of mutation. Qualitative and quantitative traits, Polygenes and continuous variations, multiple factor hypothesis, Cytoplasmic inheritance, Nature, structure and

replication of genetic material, Protein synthesis, Transcription and translational mechanism of genetic material, Gene concept: Gene structure, function and regulation.

Practical

Study of microscope, Study of cell structure, Mitosis and Meiosis cell 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 data), Study on sex linked inheritance in Drosophila. Study on models on DNA and RNA structures.

Suggested readings

1. Fundamentals of Genetics: B. D. Singh
2. Genetics: M. W. Strickberger.
3. Principles of Genetics: Gardner, Simmons and Snustad.
4. Principles of Genetics: Sinnott, Dunn and Dobzhansky

3.5 Crop Production Technology-I (Kharif crops) 3(1+2+0) ASAG 2103

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
- To educate students on package of practices of kharif crops

Course Outcomes:

After completing of this course, students will be able to:

CO 1: Gain knowledge on origin, geographical distribution, soil and climatic requirements of kharif crops

CO 2: Gain hands on training on raising of kharif field crops

CO 3: Analyze economic importance, soil and climatic requirements of kharif crops

CO 4: Understand the varieties, cultural and chemical weed management, fertilizer management and requirements of different kharif crops

CO 5: Learn the yield estimation of different kharif crops

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✔	✔										
CO2	✔	✔			✔		✔		✔	✔		
CO3	✔	✔	✔									
CO4	✔	✔					✔		✔	✔	✔	
CO5	✔	✔					✔		✔			

Theory

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

Practical

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

***Practical Crop Production- One (1) credit from practical of the course is allotted for Practical Crop Production of selected kharif crops covered under this course.**

Suggested Readings

1. B. Gurarajan, R. Balasubramanian and V. Swaminathan. Recent Strategies on Crop Production. Kalyani Publishers, New Delhi.

2. Chidda Singh.1997. Modern techniques of raising field crops. Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi.

3. Rajendra Prasad. Textbook of Field Crops Production - Commercial Crops. Volume II ICAR Publication.

4. S.R. Reddy. 2009. Agronomy of Field Crops. Kalyani Publishers, New Delhi.

5. S.S. Singh. 2005. Crop Management. Kalyani Publishers, New Delhi.

6. UAS, Bangalore. 2011. Package of Practice. UAS, Bangalore.

7. Subhash Chandra Bose, M. and Balakrishnan, V. 2001. Forage Production. South Asian Publishers, New Delhi.

3.6 Production Technology of Fruit and Plantation Crops 2 (1+1+0)

ASHO 2102

Objectives

- To educate about the different forms of classification of fruit crops
- To educate about the origin, area, climate, soil, improved varieties and cultivation practices of fruit and plantation crops
- To educate about the physiological disorders of fruit crops, palms and plantation crops

Course Outcomes

After completing of this course, students will be able to:

CO1: Understand the scope and importance of fruits and plantation crops.
CO2: Gain knowledge on origin, area, climate, soil, improved varieties, and cultivation practices of different fruits and plantation crops.
CO3: Get acquainted with insect pests, diseases, and physiological disorders of important fruits and plantation crops.
CO4: Gain hands-on experience related to propagation methods, planting, canopy management, and other cultural practices.
CO5: Learn high-density plantation and precision farming.

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1		✓	✓	✓	✓					✓	✓	
CO2	✓	✓	✓			✓	✓		✓	✓	✓	

CO3	✓	✓	✓	✓		✓	✓			✓	✓	
CO4	✓	✓	✓	✓	✓					✓	✓	
CO5	✓	✓	✓					✓		✓	✓	✓

Theory

Production status of fruit and plantation crops: Importance and scope of fruit and plantation crop industry in India; nutritional value of fruit crops; classification of fruit crops; area, production, productivity and export potential of fruit and plantation crops. Crop production techniques in tropical, sub-tropical and temperate fruit crops: Climate and soil requirements, varieties, propagation and use of rootstocks, planting density and systems of planting: High density and ultra-high density planting, cropping systems, after care – training and pruning; water, nutrient and weed management, fertigation, special horticultural techniques, plant growth regulation, important disorders, maturity indices and harvest, value addition.

Fruit crops: mango, banana, papaya, guava, sapota, citrus, grape, litchi, pineapple, pomegranate, apple, pear, peach, strawberry, nut crops Jackfruit and minor fruits- date, ber, apple, plantation crops-coconut, arecanut, cashew, tea, coffee and rubber.

Crop production techniques in palms and plantation crops: Climate and soil requirements, varieties, propagation, nursery management, planting and planting systems, cropping systems, after care, training and pruning for plantation crops, water, nutrient and weed management, intercropping, multi-tier cropping system, mulching, special horticultural practices, maturity indices, harvest and yield, pests and diseases, processing- value addition

Palms: Coconut, Arecanut, Oil palm and Palmyrah, Plantation crops: Tea, Coffee, Cocoa, Cashewnut, Rubber.

Practical

Propagation techniques, selection of planting material, varieties, important cultural practices for mango, banana, papaya, guava, sapota, grapes, Citrus (mandarin and acid lime), pomegranate, jackfruit, preparation and application of PGR’s for propagation, Micro propagation, protocol for mass multiplication and hardening of fruit crops, Identification and description of varieties, mother palm and seed nut selection, nursery practices, seedling

selection, fertilizers application, nutritional disorders, pests and diseases of Coconut, Arecanut and cocoa, Tea and coffee, Rubber and cashew, Visit to commercial orchard and plantation industries.

Suggested Readings

1. Banday, F.A. and Sharma, M.K.2010 Advances in temperate fruit production. Kalyani Publishers, Ludhiana

2. Bose, T.K., S.K. Mitra and D. Sanyal 2001. Fruits: Tropical and Subtropical (2 volumes) Naya Udyog, Calcutta.

3. Bose, T.K., S.K. Mitra, A.A. Farooqi and M.K. Sadhu (Eds). 1999. Tropical Horticulture Vol.1. Naya Prokash, Calcutta.

4. Chadha, K.L. 2001. Handbook of Horticulture. ICAR, Delhi

5. Chadha, T.R. 2001 Textbook of temperate fruits. ICAR, New Delhi

6. Chattopadhyay, T.K. 2001. A Text Book on Pomology (4 volumes). Kalyani Publishers, Ludhiana.

7. Chattopadhyay. 1998. A textbook on pomology (sub-tropical fruits) vol.III. Published by M/s. Kalyani publishers, Ludhiana, New Delhi, Noida. UP.

8. Chudawat, B. S.1990. Arid fruit culture Oxford &IBH, New Delhi

9. Das, B.C. and Das S.N. Cultivation of minor fruits. Kalyani Publishers, Ludhiana

10. David Jackson and N.E. Laone, 1999. Subtropical and temperate fruit production. CABI publications

11.H.P. Singh and M.M. Mustafa 2009. Banana-new innovations Westville publishing House, New Delhi

12. Kumar, N. 1997. Introduction to Horticulture. Rajalakshmi Publications, Nagercoil, Tamil Nadu.

13. Mitra, S.K., T.K. Bose and D.S. Rathore. 1991. Temperate fruits. Horticulture and allied Publishers, Calcutta.

14. Pal, J.S. 1997. Fruit Growing. Kalyani Publishers, New Delhi.

15. Radha, T. and Mathew, L.2007. Fruit crops. New India publishing Agency

16. Rajput, CBS and Srihari babu, R.1985. Citriculture, Kalyani Publishers, Ludhiana

17. Sadhu, M.K. and P.K. Chattopadhyay. 2001. Introductory Fruit Crops. Naya Prokash, Calcutta.

18. Singh, S.P. 2004. Commercial Fruits. Kalyani Publishers, Ludhiana

19. Symmonds. 1996. Banana, II Edn.Longman, London

20. Veeraragavathatham, D., Jawaharlal, M., Jeeva, S., Rabindran, R and Umapathy, G. 2004 (2nd edition). Scientific fruit culture. Published by M/s. Suri associates, 1362/4, Velraj Vihar Complex, Thadagam Road, Coimbatore- 2

21. W.S. Dhillon. 2013. Fruit production in India. Narendra publishing House, New Delhi

22. Kavino, M, V. Jegadeeswari, R. M. Vijayakumar and S. Balkrishnan. 2018. Production Technology of Fruits and Plantation Crops by Narendra Publishing House.

23. Kumar, N.J. B.M. Md. Abdul Khaddar, Ranga Swamy, P. and Irulappan, I. 1997. Introduction to spices, Plantation crops and Aromatic plants. Oxford & IBH, New Delhi.

24. Nair. 1979. Cashew, CPCRI, Kerela

25. Sharma, A., Kumar, P., Tripathi, V.K. 2024. Production Technology of Fruits and Plantation Crops. Elite Publishing House

26. Thampan, P.K.1981. Handbook of coconut palm. Oxford &IBH, New Delhi.

27. Thompson, P.K.1980. Coconut. Oxford &IBH, New Delhi

28. V. Ponnuswami, M. Kumar; S. Ramesh Kumar and C. Krishnamoorthy 2015. Fruit and Plantation Crops Narendra Publishing House.

3.7 Fundamentals of Extension Education 2(1+1+0) ASEE 2102

Objectives:

- To acquaint with the concept and history of India & agricultural extension and agricultural extension systems.
- To get familiarized with development programs and technology transfer.
- To impart knowledge on communication, adoption and diffusion of innovation

concepts in agriculture.

Course Outcomes:

After completing of this course, students will be able to:

CO1: Understand the concept of agriculture extension, principles and philosophy of Extension.

CO2: Learn extension systems in India: Extension efforts in pre- and post- independence eras.

CO3: Analyze new trends in agriculture extension.

CO4: Gain knowledge on monitoring, evaluation and Transfer of Technology in agriculture.

CO5: Describe the communication, adoption and diffusion of innovation concepts in agricultural extension.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✔			✔				✔			✔	
CO2		✔	✔						✔		✔	
CO3				✔								✔
CO4	✔					✔						✔
CO5				✔	✔		✔			✔		

Theory

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

Rural Development: concept, meaning, definition; various rural development programs launched by Govt. of India. Community Development: meaning, definition, concept and principles, Philosophy of C.D. Rural Leadership: concept and definition, types of leaders in rural context; 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

1. Adivi Reddy, A. 2001. Extension Education, Sree Lakshmi press, Bapatla.

2. Dahama, O. P. and Bhatnagar, O.P. 1998. Education and Communication for Development, Oxford and IBH publishing Co. Pvt. Ltd, New Delhi.

3. Jalihal, K. A. and Veerabhadraiah, V. 2007. Fundamentals of Extension Education and Management in Extension, Concept publishing company, New Delhi.

4. MuthaiahManoraharan, P. and Arunachalam, R., Agricultural Extension, Himalaya Publishing House (Mumbai).

5. Sagar Mondal and Ray, G. L., Text Book on Rural Development, Entrepreneurship and Communication Skills, Kalyani Publications.

6. Rathore, O. S. et al. 2012. Handbook of Extension Education, Agrotech Publishing Academy, Udaipur.

7. Dudhani, C.M., Hirevenkatgoudar, L.V., Manjunath, L. Hanchinal, S.N. and Patil, S.L. 2004. Extension Teaching Methods and Communication Technology, UAS, Dharwad.

8. Sandhu, A.S. 1993. Text book on Agricultural Communication: Process and Methods. Oxford and IBH Publishing Pvt. Ltd, New Delhi.

9. Singh, A.K., Lakhan Singh, R. and Roy Burman. 2006. Dimensions of Agricultural Extension. Aman Publishing House, Meerut

3.8 Fundamentals of Nematology 2(1+1+0) ASNE 2101

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.
- To equip students with skills in nematode sampling, diagnosis, and integrated management practices including cultural, biological, chemical, and resistance-based methods.

Course outcomes

CO1: Understand the habitat, morphology, biology, and classification of plant parasitic nematodes, especially those of economic importance.

CO2: Identify key symptoms and disease interactions caused by nematodes in cereals, pulses, vegetables, oilseeds, and plantation crops.

CO3: Demonstrate skills in nematode sampling, extraction, counting, and identification using standard lab techniques (e.g., Cobb’s method, Baermann funnel).

CO4: Evaluate various nematode management strategies including cultural, physical, chemical, biological, and integrated approaches.

CO5: Apply knowledge of plant-nematode interactions in disease diagnostics, quarantine, and sustainable crop protection practices.

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓				✓			✓			✓	
CO2	✓				✓						✓	
CO3	✓	✓										
CO4	✓											
CO5	✓											✓

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 up to family level with emphasis on groups containing economically important genera. Classification of nematodes on the basis of feeding/ parasitic habit. Symptomatology, role of nematodes in disease development, 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 up to 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

1. Economic Nematology-Edited by J.M. Webster
2. Plant Parasitic Nematodes (Vol-1) by Zukerman, Mai, Rohde

3. Plant Parasitic Nematodes of India: Problems and Progress by - Gopal Swarup, D. R. Dasgupta,

P. K. Koshy.

4. Text book on Introductory Plant Nematology -R.K. Walia and H.K. Bajaj.

3.9 Principles and Practices of Natural Farming 2(1+1+0) ASAG 2104

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.

Course outcomes

CO1: Understand the concept, principles, and historical background of natural farming and its relevance to climate resilience, soil health, biodiversity, and SDGs.

CO2: Analyze the ecological and economic design of natural farms including cropping systems, biodiversity, ecological engineering, and ecosystem services.

CO3: Demonstrate knowledge of nutrient, pest, disease, and weed management practices using natural, farm-based, and indigenous inputs.

CO4: Evaluate the market potential, certification standards, and government/NGO initiatives supporting natural and chemical-free agriculture.

CO5: Apply practical skills in preparing on-farm inputs, managing natural farming operations, and conducting ecosystem and financial budgeting of natural farming systems.

CO-PO mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✔	✔						✔	✔	✔	✔	
CO2	✔	✔							✔		✔	
CO3	✔	✔								✔	✔	
CO4	✔	✔									✔	✔
CO5	✔	✔					✔				✔	✔

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).

Suggested readings

1. Ayachit, S.M. 2002. Kashyapi Krishi Sukti (A Treatise on Agriculture by Kashyapa). Brig Sayeed Road, Secunderabad, Telangana: Asian Agri-History Foundation 4: 205.

2. Boeringa, R. (Eed.). 1980. Alternative Methods of Agriculture. Elsevier, Amsterdam, 199 pp.

3. Das, P., Das, S.K., Arya, H.P.S., Reddy, G. Subba, Mishra, A. and others: Inventory of Indigenous Technical Knowledge in Agriculture: Mission mode Project on Collection, Documentation and Validation of Indigenous Technical Knowledge, Document 1 To 7, Indian Council of Agricultural Research, New Delhi.

4. Ecological Farming -The seven principles of a food system that has people at its heart. May 2015, Greenpeace.

5. Ecological Farming, The Seven principles of a food system that has people at its heart. May 2015, Greenpeace

6. FAO. 2018. The 10 elements of agro-ecology: guiding the transition to sustainable food and agricultural system.https://www.fao.org/3/i9037en/i9037en.pdf Agro ecosystem Analysis for Research and Development Gordon R. Conway.1985.

7. Fukuoka, M. 1978. The One-Straw Revolution: An Introduction to Natural Farming. Rodale Press, Emmaus, PA. 181 pp

8. Fukuoka, M. 1985. The Natural Way of Farming: The Theory and Practice of Green Philosophy. Japan Publications, Tokyo, 280 pp.

9. Hill S.B and Ott. P. (Eeds.). 1982. Basic Techniques in Ecological Farming Berkhauser Verlag, Basel, Germany, 366 pp.

10. Hill, S.B. and Ott, P. (Eeds.). 1982. Basic Techniques in Ecological Farming. Berkhauser Verlag, Basel, Germany, 366 pp.

11.HLPE. 2019. Agroeeological and other innovative approaches for sustainable agriculture and food systems that enhance food security and nutrition. A report by the High Level Panel of Experts on Food Security and nutrition of the Committee on World Food Security, Rome. https://fao.org/3/ea5602en/ea5602en.pdf.

12. INFRC. 1988. Guidelines for Nature Farming Techniques. Atami, Japan. 38 pp.

13. Khurana, A. and Kumar, V. 2020. State of Organic and Natural Farming: Challenges and Possibilities, Centre for Science and Environment, New Delhi.

14. Malhotra R. and S.D. Babaji. 2020. Sanskrit Non Translatable- The importance of Sanskritizing English. Amaryllis, New Delhi India.

15. Nalini, S. 1996. Vrikshayurveda (The Science of Plant Life) by Surapala. AAHF Classic Bulletin 1. Asian Agri-History Foundation, Brig Sayeed Road, Secunderabad, AP (now Telengana), India. 94pp.

16. Nalini, S. 1999. Krishi-Parashara (Agriculture by Parashara) by Parashara. Brig Sayeed Road, Secunderabad, Telangana: AAHF Classic Bulletin, Asian Agri-History Foundation. 104pp.

17. Nalini, S. 2011. Upavana Vinoda (Woodland Garden for Enjoyment) by Sarangdhara (13th century CE): AAHF Classic Bulletin 8. Asian Agri-History Foundation, Brig Sayeed Road, Secunderabad, AP (now Telangana), India. 64p

18. Natural Asset Farming: Creating Productive and Biodiverse Farms by David B. Lindenmayer, Suzannah M. Macbeth, et al. (2022)

19. Natural Farming Techniques: Farming without tilling by Prathapan Paramu (2021)

20. Plenty for All: Natural Farming A to Z Prayog Pariwar Methodology by Prof. Shripad A. Dabholkar and Prayog Pariwar Prayog Pariwar (2021)

21. Reyes Tirado. 2015. Ecological Farming- The seven principles of a food system that has people at its heart. Greenpeace Research laboratories. University of Exeter, Ottho Heldringstraat.

22. Shamasastry, R. 1915. Kautilya’s Arthashastra.

23. The Ultimate Guide to Natural Farming and Sustainable Living: Permaculture for Beginners (Ultimate Guides) by Nicole Faires (2016)

24. U. K. Behera. 2013. A text Book of Farming System. Agrotech Publishing House, Udaipur.

SEMESTER IV

4.1 Skill Enhancement course-VI* **2(0+2+0)** **CUTM**

The student can choose any skill course offered by the university

[Refer https://course.cutm.ac.in/skill-courses/]

4.2 Agricultural Informatics and Artificial Intelligence 3(2+1+0) ASAS 2201

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 students familiar with Agricultural-Informatics, its components and applications in agriculture

Course outcomes

After completing of this course, students will be able to:

CO1. Apply computer fundamentals, including MS Office, to effectively perform data presentation and statistical computation.

CO2. Get familiarized on the idea of different basic computer programing names and its uses

CO3. Understand the utilization of ICT devices to enhance agricultural practices.

CO4. Get equipped with computer models, decision support systems, agricultural expert systems, and soil information systems to solve basic agriculture inquiries of farmers.

CO5. Gain basic knowledge on GIS, GPS and RS

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✔						✔		✔			
CO2	✔	✔										
CO3	✔											
CO4	✔	✔										
CO5	✔											

Theory

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

Computer programming: General concepts, Introduction general programming concepts. Concepts and standard input/output operations. e-Agriculture, Concepts, design and development, Application of innovative ways to use information and communication technologies (IT) in Agriculture. Computer Models in Agriculture: Statistical, weather analysis and crop simulation models, concepts, inputs-outputs files, limitation, advantages and application of models for understanding plant processes, sensitivity, verification, calibration and validation, IT applications for computation of water and nutrient requirement of crops, Computer-controlled devices (automated systems) for Agri-input management. Smartphone mobile apps in agriculture for farm advice: Market price, post-harvest management etc. Geospatial technology: Concepts, techniques, components and uses for generating valuable agri-information. Decision support systems: Concepts, components and applications in Agriculture. Agriculture Expert System, Soil Information Systems etc., for supporting farm decisions. Preparation of contingent crop- planning and crop calendars using IT tools. Digital India and schemes to promote digitalization of agriculture in India.

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

Practical

Study of computer components, accessories, practice of important DoS Commands, Introduction of different operating systems such as Windows, Unix/Linux, creating files and folders, File Management .Use of MS-Word and MS Power-point for creating, editing and presenting a scientific documents, MS-EXCEL-Creating a spreadsheet, Use of statistical tools, Writing expressions, Creating graphs, Analysis of scientific data, MS-ACCESS: Creating Database, preparing queries and reports, Demonstration of Agri- information system, Introduction to World Wide Web (WWW) and its components, Introduction of programming languages such as Visual Basic, Java, Fortran, C, C++, Hands on practice on Crop Simulation Models (CSM), DSSAT/Crop-Info/Crop Syst/ Wofost, Preparation of inputs file for CSM and study of model outputs, computation of water and nutrient requirements of crop using CSM and IT tools, Use of smartphones 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).

Suggested Readings

1. Concepts and Techniques of Programming in C by Dhabal Prasad Sethi and Manoranjan, Wiley India.
2. Fundamentals of Computer by V. Rajaroman.
3. Introduction to Information Technology by Pearson.
4. Introduction to Database Management System by C. J. Date.
5. Introductory Agri-Informatics by Mahapatra, Subrat K et al, Jain Brothers Publication.

4.3 Production Technology of Vegetables and Spices 2(1+1+0) ASHO 2209

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

Course outcomes

CO1: Understand the nutritional, economic, and ecological importance of vegetables and spices in Indian agriculture and human diet.

CO2: Describe the origin, climate, soil requirements, and improved varieties of major vegetables and spices.

CO3: Apply knowledge of cultivation practices including sowing, transplanting, spacing, fertilization, irrigation, weed and pest management.

CO4: Identify physiological disorders, propagation methods, and post-harvest handling techniques for vegetable and spice crops.

CO5: Demonstrate practical skills in nursery management, seed identification, crop economics, and field operations through farm visits and hands-on training.

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓	✓	✓	✓				✓	✓	✓	✓	✓
CO2		✓	✓		✓	✓		✓		✓	✓	
CO3	✓	✓	✓		✓	✓		✓		✓	✓	✓
CO4	✓	✓	✓					✓		✓	✓	
CO5	✓	✓	✓	✓			✓	✓		✓	✓	✓

Theory

Importance of vegetables and spices in human nutrition and national economy, kitchen gardening, brief about origin, area, climate, soil, improved varieties and cultivation practices such as time of sowing, transplanting techniques, planting distance, fertilizer requirements, irrigation, weed management, harvesting and yield, physiological disorders of important vegetable and spices (tomato, okra, brinjal, chili, capsicum, cucumber, bitter gourd , bottle gourd, sweet potato, cassava and moringa, pumpkin, French bean, peas; cole crops such as cabbage, cauliflower, knol-khol; bulb crops such as onion, garlic; root crops such as carrot, radish, beetroot; tuber crops such as potato; leafy vegetables such as amaranth, palak, perennial vegetables, spice crops like turmeric, zinger, garlic, coriander, cumin, black pepper,

cardamom, fenugreek, fennel, clove, nutmeg, cinnamon, curry leaf, tamarind and herbal spices).

Practical

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

Suggested readings

1. Olericulture, Fundamentals of Vegetable Production (Vol.1) by K.P. Singh, Anant Bahadur

2. Vegetable crops by J. Kabir, T.K. Bose, M.G. Som

3. Vegetable crops (Production technology, Vol II) by M.S. Fagaria, B.R. Choudhury, R.S. Dhaka

4.4 Principles of Agricultural Economics and Farm Management 2(2+0+0)
ASEC 2201

Objectives

- To aware the students about broad areas covered under agricultural Economics and farm management
- To impart knowledge on judicious use of resources for optimum production
- To develop an understanding of agricultural planning, economic policies, and their implications on agricultural development and trade.

Course outcomes

CO1: Understand and explain fundamental economic concepts such as demand, supply, utility, cost, and equilibrium in both micro and macroeconomic contexts.
CO2: Analyze consumer behavior using utility theory, elasticity concepts, and derive consumer equilibrium and surplus.
CO3: Interpret production processes, cost structures, laws of returns, and factor pricing under agricultural settings.

CO4: Understand national income accounting, population theories, money supply, inflation, and their impact on the agricultural economy.

CO5: Evaluate various economic systems, forms of business organizations, and recent reforms like GST and their implications for the Indian agricultural sector and trade.

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✔											
CO2	✔	✔										
CO3	✔											
CO4	✔	✔										
CO5	✔											

Theory

Economics: Meaning, scope and subject matter, definitions, activities, approaches to economic analysis; micro- and macro-economics, positive and normative analysis. Nature of economic theory; rationality assumption, concept of equilibrium, economic laws as generalization of human behavior. Basic concepts: Goods and services, desire, want, demand, utility, cost and price, wealth, capital, income and welfare. Agricultural economics: meaning, definition, characteristics of agriculture, importance and its role in economic development. Agricultural planning and development in the country. Demand: meaning, law of demand, demand schedule and demand curve, determinants, utility theory; law of diminishing marginal utility, equi-marginal utility principle. Consumer's equilibrium and derivation of demand curve, concept of consumer surplus. Elasticity of demand: concept and measurement of price elasticity, income elasticity and cross elasticity. Production: process, creation of utility, factors of production, input output relationship. Laws of returns: Law of variable proportions and law of returns to scale. Cost: Cost concepts, short run and long run cost curves. Supply: Stock v/s supply, law of supply, supply schedule, supply curve, determinants of supply, elasticity of supply. Distribution theory: meaning, factor market and pricing of factors of production. Concepts of rent, wage, interest and profit. National income: Meaning and importance,circular flow, concepts of national income accounting and approaches to measurement, difficulties in measurement. Population: Importance, Malthusian and Optimum population theories, natural and socio-economic determinants, current policies and 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.

Suggested Readings

1. Johl, S.S. and T.R Kapur. 2009. Fundamentals of Farm Business Management. Kalyani Publishers

2. S. Subha Reddy, P. Raghu Ram, T.V. Neelakanta and I. Bhvani Devi .2004. Agricultural Economics. Oxford & IBH publishing Co. Pvt. Ltd

4.5 Crop Production Technology-II (Rabi Crops) 3(1+2+0) ASAG 2204

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.
- To educate students on package of practices of Rabi crops

Course outcomes

CO 1: Gain knowledge on origin, geographical distribution, soil and climatic requirements of Rabi crops.
CO 2: Get hands on training skills on raising of Rabi field crops.
CO 3: Summarize economic importance, soil and climatic requirements of Rabi crops.
CO 4: Understand the varieties, cultural and chemical weed management, fertilizer management and requirements of different Rabi crops.
CO 5: Learn the yield estimation of different Rabi crops.

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✔	✔									✔	
CO2	✔	✔	✔		✔		✔		✔	✔		
CO3	✔	✔									✔	
CO4	✔	✔					✔			✔	✔	
CO5	✔	✔					✔		✔		✔	

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. Rabi redgram and, rajmash. Oilseed- rapeseed, mustard, sunflower, saffiower; and linseed. Sugar crops-sugarcane and sugar beet. Medicinal and aromatic crops- mentha, lemon grass and citronella. Forage crops –barseem, lucerne and oat; potato, quinoa, tobacco.

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.

*** Practical Crop Production-One (1) credit from practical of the course is allotted for Practical Crop Production of selected rabi crops covered under this course.**

Suggested Readings

1. B. Gurarajan, R. Balasubramanian and V. Swaminathan. Recent Strategies on Crop Production. Kalyani Publishers, New Delhi.

2. Chidda Singh.1997. Modern techniques of raising field crops. Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi.

3. Rajendra Prasad. Textbook of Field Crops Production - Commercial Crops. Volume II ICAR Publication.

4. Rajendra Prasad. Textbook of Field Crops Production - Foodgrain Crops. Volume I ICAR Publication.

5. S.R. Reddy. 2009. Agronomy of Field Crops. Kalyani Publishers, New Delhi.

6. S.S. Singh. 2005. Crop Management. Kalyani Publishers, New Delhi.

7. Rajendra Prasad. 2002. Text Book of Field Crops Production, ICAR, New Delhi.

8. Reddy, S.R. 2004. Agronomy of Field crops, Kalyani Publishers, Ludhiana.

9. Subhash Chandra Bose, M. and Balakrishnan, V. 2001. Forage Production South Asian Publishers, New Delhi.

10. UAS, Bangalore. 2011. Package of Practice. UAS, Bengaluru.

4.6 Farm Machinery and Power 2 (1+1+0) ASAE 2201

Objectives

- To enable the students to understand the basic principles and parts internal combustion engine.
- To impart knowledge about different tillage, sowing, intercultural, plant protection equipment.
- To familiarize on the working principles of threshers, harvesting of field and horticultural crops.

Course Outcomes:

At the end of this course, students will be able to

CO1: Design and evaluate the performance of harvesting, threshing and special equipment for various farm operations.

CO2: Understand the principles of farm machinery used for different soil, crops and operations.

CO3: Apply the principles of hydraulics, kinematics and dynamics for the design and development of farm machines.

CO4: Get familiarized with different systems of I.C. engines and tractor systems

CO5: Learn the working principle of different systems and parts of internal combustion engines and intercultural and plant protection machinery needed for agricultural farms.

CO-PO mapping

	PO 1	PO 2	P03	P04	P05	P06	P07	P08	P09	PSO 1	PSO 2	PSO 3	PSO 4
CO 1					✔					✔	✔		
CO 2		✔								✔			
CO 3						✔					✔		
CO 4	✔												
CO 5	✔	✔									✔		

Theory

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

Practical

Study of different components of I.C. engine. 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 trans planter; 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

1. Jagdiswar Sahay – Elements of Agricultural Engineering

2. Jain, S.C. and C.R. Rai-Farm Tractor and maintenance and repair. Standard Publishers, 1705-B, Naisarak. Delhi- 110006

3. Ojha, T.P. and A.M. Michael, A.M. Principles of Agricultural Engineering. Vol.I. Jain brothers, 16/893, East Park Road, Karol Bagh, New Delhi -110005

4. Surendra Singh- Farm machinery –Principles and applications, ICAR, New Delhi

4.7 Water Management **2 (1+1+0)** **ASAG 2205**

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.

Course outcomes

After completing of this course, students will be able to:

CO1: Understand soil-water-plant relationship
CO2: Gain knowledge on crop water requirement and soil moisture measurements.
CO3: Get familiarized with different irrigation methods.
CO4: Gain knowledge on water quality and its management.
CO5: Understand the irrigation and water use efficiency, water logging and agricultural drainage.

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✔	✔									✔	
CO2	✔	✔					✔		✔	✔	✔	
CO3	✔	✔					✔		✔		✔	
CO4	✔	✔					✔		✔		✔	
CO5	✔	✔					✔		✔		✔	

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); quality of irrigation water, irrigation management practices for different soils and crops, drip, sprinkler. Layout of underground pipeline system, Irrigation automation, Artificial Intelligence and climate-based irrigation practices and its management.

Practical

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

Suggested Readings

1. 1. Rao, Y.P. and Bhaskar, S.R. Irrigation technology. Theory and practice. Agrotech publishing Academy, Udaipur.
2. Dilipkumar Mujmdar. Irrigation water management: Principles and Practices. Prentice Hall of India Pvt. Ltd.,
3. S.V. Patil &Rajakumar, G. R., Water Management in Agriculture and Horticultural Crops. Satish serial publishing House, Delhi.
4. Carr M. K. V. and Elias Fereres. Advances in Irrigation Agronomy. Cambridge University Press.
5. Michael, A.M. Irrigation Theory and practice. Vikas publishing house Pvt, Ltd.

4.8 Problematic Soils and their management 2 (1+1+0) ASSS 2203

Objectives

- To know different soil problems occurring during crop cultivation.
- To determine the different characteristics of problem soils
- To learn different reclamation methods of problem soil to improve soil health and soil fertility

Course Outcome

After completion of this course, students will be able to:

CO 1: Gain knowledge on waste land and problem soils
CO 2: Asses different reclamation and management practices for the improvement of the acid and salt affected soils.
CO 3: Estimate different quality of irrigation water
CO 4: Analyze various parameters of problematic soils, interpret results.
CO 5: Understand reclamation and management practices

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓											
CO2	✓						✓		✓			
CO3	✓						✓		✓			
CO4	✓	✓										
CO5	✓									✓		

Theory

Soil quality and health, Distribution of Waste land and problem soils in India, Categorization of Problem soils based on properties. Reclamation and management of Acid soils, Saline, Sodic soils, Acid Sulphate soils, Eroded and Compacted soils, polluted soils. Contaminated soils (Pesticide contamination, Heavy metal contamination), Mined soils (Coal mined, Oil mined), Management of Riverine soils, Waterlogged soils, Irrigation water –

quality and standards, utilization of saline water in agriculture. Use of Remote sensing and GIS in diagnosis and management of problem soils. Irrigation and water quality. Multipurpose tree (MPT) species, bio remediation 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, CO3, HCO3, Cl, SAR and RSC), Determination of nitrate (NO3-) from irrigation water, Determination of dissolved oxygen and free carbon dioxide levels in water samples.

Suggested readings

1. Agarwal, R.R., Yadav, J.S.P. and Gupta, R.N. (1982). Saline Alkali soils of India, ICAR, AGROBIOS (India).

2. Brady Nyle C and Ray R Well., 2014. Nature and properties of soils. Pearson Education Inc., New D Delhi.

3. Cirsan J. Paul., 1985,. Principles of Remote Sensing. Longman, New York

4. Indian Society of Soil Science., 2002. Fundamentals of Soil Science. IARI, New Delhi.

5. Osman, Khan Towhid., 2018., Management of Soil Problems. Springer publication

6. Srivastava, V. C., 2002. Management of Problem Soils -Principles and Practices New Delhi

4.9 Basics of Plant Breeding 3(2+1+0) ASPG 2202

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.

- To impart skill on the development of the high yielding varieties/hybrids with the help of various conventional and molecular breeding approaches

Course Outcomes:

After completing of this course, students will be able to:

CO1: Learn the basic concept of plant breeding

CO2: Acquire the concept of analysis of the different selections and breeding methods applied in crop improvement

CO3: Gain knowledge on the development of varieties resistant to biotic and abiotic stresses and quality improvement

CO4: Understand the rights related to research, varietal development and seed production

CO5: Get familiarized with the process of development, release and notification of varieties

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓	✓						✓			✓	
CO2	✓	✓			✓		✓	✓	✓	✓		
CO3	✓	✓	✓			✓	✓	✓	✓	✓		
CO4	✓	✓				✓					✓	
CO5	✓	✓			✓			✓			✓	

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, Plant genetic resources, its utilization and conservation Domestication, Acclimatization and Introduction. Centres of origin/ diversity, Components of Genetic variation. Heritability and genetic advance. Pre-breeding and Universal Plant Breeder's equation. Genetic basis and breeding methods in self-pollinated crops- mass and pure line selection, hybridization techniques and handling of segregating population. Multiline concept, Concepts of population genetics and Hardy-Weinberg Law, Genetic basis and methods of breeding cross-pollinated crops, modes of selection. Population movement schemes- Ear to Row method, Modified Ear to Row, recurrent selection schemes. Heterosis and inbreeding depression, development of inbred lines and hybrids, composite and synthetic

varieties. Breeding methods in asexually propagated crops, clonal selection and hybridization. Wide hybridization and pre-breeding. Polyploidy in relation to plant breeding, mutation breeding- methods and uses. Breeding for important biotic and abiotic stresses. Participatory plant breeding. Variety Release and notification. Intellectual Property Rights, Patenting, Plant Breeders and Farmer's Rights.

Practical

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

Suggested Readings

1. Principles of Plant Breeding (1st & 2nd Edition) by RW Allard.
2. Plant Breeding: Principles & Practices by JR Sharma.
3. Plant Breeding- B.D. Singh.
4. Principles and Procedures of Plant Breeding - Biotechnical and Conventional Approaches by GS Chahal and SS Gosal.
5. Principles of Plant Genetics and Breeding by George Acquaah.