

FACULTY OF AGRICULTURAL SCIENCES



COURSE CURRICULUM

FOR

B.Sc. (Hons.) AGRICULTURE (Program ID - 1) (4 Years Course)

Strictly in accordance with ICAR 6th Dean Committee Recommendations

1st to 8th SEMESTER

Examinations 2025–2026 session

**onwards Applicable for
admissions in 2025**

Faculty of Agricultural Sciences

Vision

- Pass out from Faculty of Agricultural Sciences, shall be able to cater to the needs of stakeholders in academia, industry and public/ private/ farming sector
- Adequate facilities will be created in discipline- specific labs and fields for conducting research addressing to various issues relating to farming at regional- and national levels
- Mobility of the students and faculty to and from national and international institutions will be facilitated

Mission

M1: To make provision for imparting education in different branches of agricultural sciences with focus on inter- disciplinary approach, in line with the NEP-2020

M2: To facilitate job- oriented education to students aiming at producing human resource equipped with necessary abilities to become market- ready or to start their own enterprises

M3: To guide students in understanding challenging issues facing the farming system and finding viable solution for the same

The B.Sc. (Hons.) Agriculture program is a comprehensive undergraduate degree designed to provide students with in-depth knowledge and skills related to agricultural sciences. It typically covers a wide range of subjects including plant and soil sciences, agronomy, horticulture, plant breeding, agricultural economics, pest management, and sustainable farming practices. Students also learn about farm management, animal husbandry, and modern agricultural technologies.

The program is designed to prepare graduates for careers in farming, agricultural research, extension services, and the agricultural industry. It combines theoretical learning with practical hands-on experience, often through fieldwork and internships. This degree aims to produce skilled professionals capable of addressing global food security and environmental challenges.

PROGRAMME EDUCATIONAL OBJECTIVES (PEO's)

PEO1: To encourage students to be creative and innovative to meet the needs of agro based industry by providing a dynamic learning environment

PEO2: To develop competent human resource in teaching and research in crop production, crop improvement, plant protection and marketing to meet national and global challenges

PEO3: Developing entrepreneurial skills in students to be 'Job providers rather than Job seekers'

PEO4: To develop skills of ethical integrity and professional engagement among students to be the voice of farmers and represent them in various national and international forums

PROGRAMME SPECIFIC OUTCOMES (PSO's)

PSO1: Enable students to develop skills to be the leaders of agro industry.

PSO2: To be conversant with the latest state of the art innovations in agricultural sciences.

PSO3: Students acquire skills in subsidiary agriculture occupations like dairy, bee keeping, mushroom cultivation and organic farming etc.

PSO4: In-depth knowledge of agriculture and skills to solve the problems of farming community enable students to be a policy maker by framing policies for the upliftment of farmers.

PROGRAMME OUTCOMES (POs)

After the successful completion of undergraduate course, Agriculture graduates will be able to:

PO1. Critical Thinking: Take informed actions after identifying the assumptions that frame our thinking and actions, checking out the degree to which these assumptions are accurate and valid, and looking at our ideas and decisions (intellectual, organizational, and personal) from different perspectives.

PO2. Effective Communication: Speak, read, write and listen clearly in person and through electronic media in English and in one Indian language, and make meaning of the world by connecting people, ideas, books, media and technology.

PO3. Social Interaction: Elicit views of others, mediate disagreements and help reach conclusions in group settings.

PO4. Effective Citizenship: Demonstrate empathetic social concern and equity centered national development, and the ability to act with an informed awareness of issues and participate in civic life through volunteering.

PO5. Ethics: Recognize different value systems including your own, understand the moral dimensions of your decisions, and accept responsibility for them.

PO6. Environment and Sustainability: Understand the issues of environmental contexts and sustainable development.

PO7. Self-directed and Life-long Learning: Acquire the ability to engage in independent and life-long learning in the broadest context socio-technological changes

**B. Sc. (Hons) Agriculture
Semester 1**

Course Code	Course Name	Course Type	L	T	P	Cr.
AHR112	HORTICULTURE NURSERY MANAGEMENT	SEC	0	0	4	2
APB111	SEED PRODUCTION & TESTING TECHNOLOGY	SEC	0	0	4	2
AAG111	FUNDAMENTALS OF AGRONOMY	CORE	2	0	2	3
AAG112	FARMING BASED LIVELIHOOD SYSTEMS	MDC	2	0	2	3
ABS111*	INTRODUCTORY BOTANY	NG	1	0	0	0
AEX111	COMMUNICATION SKILLS	AEC	1	0	2	2
AEX112	RURAL SOCIOLOGY AND EDUCATION PSYCHOLOGY	CORE	2	0	0	2
AGS105	DEEKSHARAMBH	NG	0	0	4	0
AHR111	FUNDAMENTALS OF HORTICULTURE	CORE	2	0	2	3
ASS111	FUNDAMENTALS OF SOIL SCIENCE	CORE	2	0	2	3
MAT181*	INTRODUCTORY MATHEMATICS	NG	1	0	0	0
NCC001 [#]	NATIONAL CADET CORPS 1	AEC	0	0	2	1
NSS101 [#]	NATIONAL SERVICE SCHEME-I	AEC	0	0	2	1

* and # elective courses

MDC-Multidisciplinary course; AEC-Ability enhancement course; SEC- skill enhancement course; VAC- Value added course; NG- Non gradial

**B. Sc. (Hons) Agriculture
Semester 2**

Course Code	Course Name	Course Type	L	T	P	Cr.
AHR121	PROFESSIONAL LANDSCAPING AND DIGITAL DESIGN TOOLS FOR GREEN SPACES	SEC	0	0	4	2
AEN122	APIARY MANAGEMENT	SEC	0	0	4	2
AAS121	LIVESTOCK AND POULTRY MANAGEMENT	CORE	1	0	2	2
AEN121	FUNDAMENTALS OF ENTOMOLOGY	CORE	2	0	2	3
AEX121	PERSONALITY DEVELOPMENT	AEC	1	0	2	2
APP121	FUNDAMENTALS OF PLANT PATHOLOGY	CORE	2	0	2	3
ASS121	SOIL FERTILITY MANAGEMENT	CORE	2	0	2	3
EVS121	ENVIRONMENTAL STUDIES AND DISASTER RISK MANAGEMENT	VAC	2	0	2	3
NCC002 [#]	NATIONAL CADET CORPS 2	AEC	0	0	2	1
NSS102 [#]	NATIONAL SERVICE SCHEME-II	AEC	0	0	2	1

[#] Elective courses

Post-Semester II (Only for exit option for award of UG-Certificate in Agriculture)	Course Type	L	T	P	Cr.
Internship (10 weeks)	Internship	0	0	20	10

MDC-Multidisciplinary course; AEC-Ability enhancement course; SEC- skill enhancement course; VAC- Value added course; NG- Non gradial

**B. Sc. (Hons) Agriculture
Semester 3**

Course Code	Course Name	Course Type	L	T	P	Cr.
APP212	MUSHROOM CULTIVATION TECHNOLOGY	SEC	0	0	4	2
AEX211	ENTREPRENEURSHIP DEVELOPMENT AND BUSINESS COMMUNICATION	MDC	2	0	2	3
PHE211	PHYSICAL EDUCATION, FIRST AID, YOGA PRACTICES AND MEDITATION	AEC	0	0	4	2
APB211	PRINCIPLES OF GENETICS	CORE	2	0	2	3
AAG211	CROP PRODUCTION TECHNOLOGY-I (<i>KHARIF</i> CROPS)	CORE	1	0	4	3
AHR211	PRODUCTION TECHNOLOGY OF FRUIT AND PLANTATION CROPS	CORE	1	0	2	2
AEX212	FUNDAMENTALS OF EXTENSION EDUCATION	CORE	1	0	2	2
APP211	FUNDAMENTALS OF NEMATOLOGY	CORE	1	0	2	2
AAG212	PRINCIPLES AND PRACTICES OF NATURAL FARMING	CORE	1	0	2	2

MDC-Multidisciplinary course; AEC-Ability enhancement course; SEC- skill enhancement course; VAC- Value added course; NG- Non gradial

**B. Sc. (Hons) Agriculture
Semester 4**

Course Code	Course Name	Course Type	L	T	P	Cr.
AAG221	ORGANIC PRODUCTION TECHNOLOGY	SEC	0	0	4	2
CSA221	AGRICULTURAL INFORMATICS AND ARTIFICIAL INTELLIGENCE	VAC	2	0	2	3
AHR221	PRODUCTION TECHNOLOGY OF VEGETABLES AND SPICES	CORE	1	0	2	2
AEC221	PRINCIPLES OF AGRICULTURAL ECONOMICS AND FARM MANAGEMENT	CORE	2	0	0	2
AAG221	CROP PRODUCTION TECHNOLOGY-II (<i>RABI CROPS</i>)	CORE	1	0	4	3
AEG221	FARM MACHINERY AND POWER	CORE	1	0	2	2
AAG222	WATER MANAGEMENT	CORE	1	0	2	2
ASS221	PROBLEMATIC SOILS AND THEIR MANAGEMENT	CORE	1	0	2	2
APB221	BASICS OF PLANT BREEDING	CORE	2	0	2	3

Post-Semester IV (Only for exit option for award of UG-Diploma in Agriculture)	Course Type	L	T	P	Cr.
Internship (10 weeks)	Internship	0	0	20	10

MDC-Multidisciplinary course; AEC-Ability enhancement course; SEC- skill enhancement course; VAC- Value added course; NG- Non gradial

**B. Sc. (Hons) Agriculture
Semester 5**

Course Code	Course Name	Course Type	L	T	P	Cr.
AEC311	AGRICULTURE MARKETING AND TRADE	MDC	2	0	2	3
AAG311	INTRODUCTION TO AGRO-METEOROLOGY	CORE	1	0	2	2
ABS311	ESSENTIALS OF PLANT BIOCHEMISTRY	CORE	2	0	2	3
AEN311	PEST MANAGEMENT IN CROPS AND STORED GRAINS	CORE	2	0	2	3
APP311	DISEASES OF FIELD & HORTICULTURAL CROPS & THEIR MANAGEMENT	CORE	2	0	2	3
APB311	CROP IMPROVEMENT (KHARIF CROPS) – I	CORE	1	0	2	2
AAG312	WEED MANAGEMENT	CORE	1	0	2	2
AEG311	RENEWABLE ENERGY IN AGRICULTURE AND ALLIED SECTOR	CORE	1	0	2	2
AHR311	ORNAMENTAL CROPS, MAPS AND LANDSCAPING	CORE	1	0	2	2
	EDUCATION TOUR	CORE	0	0	2	2 (Non gradial)

MDC-Multidisciplinary course; AEC-Ability enhancement course; SEC- skill enhancement course; VAC- Value added course; NG- Non gradial

**B. Sc. (Hons) Agriculture
Semester 6**

Course Code	Course Name	Course Type	L	T	P	Cr.
ABS321	FUNDAMENTALS OF AGRI BIOTECHNOLOGY	CORE	2	0	2	3
AEC321	BASIC AND APPLIED AGRICULTURAL STATISTICS	CORE	2	0	2	3
APB321	CROP IMPROVEMENT (RABI CROPS) – II	CORE	1	0	2	2
ABS321	FUNDAMENTALS OF CROP PHYSIOLOGY	CORE	2	0	2	3
AAG321	DRYLAND AGRICULTURE/RAINFED AGRICULTURE AND WATERSHED MANAGEMENT	CORE	1	0	2	2
APP321	AGRICULTURAL MICROBIOLOGY AND PHYTO - REMEDIATION	CORE	1	0	2	2
AEC322	AGRICULTURAL FINANCE & COOPERATION	CORE	1	0	2	2
APB322	FUNDAMENTALS OF SEED SCIENCE & TECHNOLOGY	CORE	1	0	2	2
AAG322	INTRODUCTORY AGROFORESTRY	CORE	1	0	2	2

MDC-Multidisciplinary course; AEC-Ability enhancement course; SEC- skill enhancement course; VAC- Value added course; NG- Non gradial

**B. Sc. (Hons) Agriculture
Semester 7**

Course Code	Course Name	Course Type	L	T	P	Cr.
	ELECTIVE 1*	CORE	3	0	2	4
	ELECTIVE 2*	CORE	3	0	2	4
	ELECTIVE 3*	CORE	3	0	2	4
	ELECTIVE 4*	CORE	3	0	2	4
	ELECTIVE 5*	CORE	3	0	2	4

* From list of elective courses

List of elective courses

S. NO.	Course Name	Course Type	L	T	P	Cr.
1	AGRI-BUSINESS MANAGEMENT	ELECTIVE	3	0	2	4
2	MANAGEMENT OF NATURAL RESOURCES	ELECTIVE	3	0	2	4
3	AGROCHEMICALS	ELECTIVE	3	0	2	4
4	AGRICULTURAL JOURNALISM	ELECTIVE	3	0	2	4
5	LANDSCAPING	ELECTIVE	3	0	2	4
6	COMMERCIAL PLANT BREEDING	ELECTIVE	3	0	2	4
7	FOOD SAFETY AND STANDARDS	ELECTIVE	3	0	2	4
8	BIOFORMULATION AND NANO FORMULATION	ELECTIVE	3	0	2	4
9	BIOPESTICIDES AND BIOFERTILIZERS	ELECTIVE	3	0	2	4
10	SYSTEM SIMULATION AND AGRO ADVISORY	ELECTIVE	3	0	2	4
11	HI-TECH HORTICULTURE	ELECTIVE	3	0	2	4
12	PROTECTED CULTIVATION	ELECTIVE	3	0	2	4
13	CLIMATE RESILIENT AGRICULTURE	ELECTIVE	3	0	2	4
14	BIOTECHNOLOGY OF CROP IMPROVEMENT	ELECTIVE	3	0	2	4
15	GEOINFORMATICS AND REMOTE SENSING, PRECISION FARMING	ELECTIVE	3	0	2	4
16	MICRO-PROPAGATION TECHNOLOGIES	ELECTIVE	3	0	2	4
17	COMMERCIAL SEED PRODUCTION	ELECTIVE	3	0	2	4
18	PRINCIPLES AND PRACTICES OF ORGANIC FARMING/ CONSERVATION AGRICULTURE	ELECTIVE	3	0	2	4
19	FOOD SCIENCE AND NUTRITION	ELECTIVE	3	0	2	4
20	POST-HARVEST TECHNOLOGY AND VALUE ADDITION	ELECTIVE	3	0	2	4

**B. Sc. (Hons) Agriculture
Semester 8**

Course Code	Course Name	Course Type	L	T	P	Cr.
	For B.Sc. (Hons.) Agriculture degree Student READY [RAWE/Industrial Attachment /Experiential Learning/Hands-on Training/Skill Development/Project Work/Internship etc.]	CORE	0	0	40	20

Online course to be taken during 3rd, 4th and 5th, 6th, 7th and 8th Semester

Course Code	Course Name	Course Type	L	T	P	Cr.
	ONLINE COURSES	NG	0	0	0	10

Summary of Credit Distribution

Type of Courses	Credits
Core courses (Major & Minor)	112
Common courses (MDC+VAC+AEC)	23
Skill Enhancement Courses (SEC)	12
Student READY (RAWE/Industrial Attachment /Experiential Learning/ Hands-on Training/Skill Development/ Project Work/Internship etc.)	20
**Online Courses/MOOCs	10 Non gradial

DETAILED SYLLABI**SEMESTER I**

Course Code	AAG111						
Course Title	FUNDAMENTALS OF AGRONOMY						
Hours	48, L:2, T:0, P:2						
Credits	3						
Type	Core Course						
Course Outcomes	On the completion of the course, the student will gain the following knowledge and skills: CO1: Describe the basic principles of Agronomy and explain seed, sowing, tillage, crop geometry, ecology and ecosystem concepts. CO2: Explain the principles of plant nutrition, manures, fertilizers, INM, green manuring and water management. CO3: Identify major weeds, agro climatic zones and cropping systems, and explain factors influencing crop growth, development and productivity. CO4: Explain and apply principles of sustainable crop production, natural resource conservation, pollution management and allelopathy for sustainable agriculture.						
Examination Type	Theory + Practical						
Assessment Tools	Written Quiz	Assignment/Project Work	MSE	MTP	ESE	ETP	ABL/PBL
Weightage	5%		25%	-	40%	25%	5%
Examination Mode	Theory + Practical						
Syllabus							
Unit 1	• 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						CO1

	method of sowing: broadcasting, drilling, dibbling, transplanting etc. • Tillage and tith: 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.	
Unit 2	• 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	CO2
Unit 3	• Water management: Water resources of the world, India and the state; • Soil Moisture constants: gravitational water, capillary water, hygroscopic water	CO3
Unit 4	• 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.	CO4
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.	
Text and Reference Books	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.	

Course Code	AAG-112						
Course Title	FARMING BASED LIVELIHOOD SYSTEMS						
Hours	48, L:2, T:0, P:2						
Credits	3						
Type	Multi-Disciplinary Course						
Course Outcomes	On the completion of the course, the student will gain the following knowledge and skills: CO1- enumerate the status of agriculture and prevailing livelihood patterns in rural and urban India, including regional disparities CO2- explain the concept of livelihood systems, various indicators, and components of farming- based livelihoods CO3- understand the feasibility and integration of multiple farming system components across different agro-climatic zone CO4 - interpret commercial and sustainable livelihood models promoted by organizations like NABARD, ICAR CO5 - relate farming-based livelihood models considering climate change, digitalization, value chains, and circular economy principles						
Examination Type	Theory + Practical						
Assessment Tools	Written Quiz	Assignment/Project Work	MSE	MSP	ESE	ESP	ABL/PBL
Weightage	5%	-	25%	-	40%	25%	5%
Examination Mode	Theory + Practical						
Syllabus							
Unit 1	- Status of agriculture in India& different states, income of farmers and rural people in India - Livelihood: definition, concept and livelihood patterns in urban and rural areas - Agricultural livelihood systems (ALS): meaning, need and significance, approaches and conceptual frameworks - Definition and scope of farming systems and farming-based livelihood systems - Prevalent farming systems in India contributing to livelihood						CO1
Unit 2	- Types of traditional and modern farming systems, - Components of farming systems: crops and cropping systems, horticultural crops, agroforestry systems - Livestock-based enterprises: dairy, piggery, goatry, poultry, duckry - Aquaculture: duck/poultry cum fish, dairy cum fish, piggery cum fish						CO2
Unit 3	Small, medium, and large agri-enterprises including value						CO3

	chains • Secondary enterprises as components of farming-based livelihoods • Factors affecting integration of various, enterprises for enhancing farm-based income • Feasibility of different farming systems across agro-climatic zones	
Unit 4	• Commercial farming-based livelihood models by NABARD, ICAR, and other organizations • Case studies of successful farming-based livelihood enterprises • Risk and success factors in farming-based livelihood systems • Government schemes and programs (Central and State), • Role of public and private organizations in livelihood promotion • Role of farming-based livelihoods in 21st century: circular economy, green economy, climate change adaptation, digitalization and changing lifestyle patterns	CO4&CO5
Practical's	• Survey of farming systems and agricultural-based livelihood enterprises	CO1
	• Study of major components of farming-based livelihood models in different agro-climatic zones.	CO2
	• Assessment of prevalent farming systems across India	CO3
	• Study of crop-based farming systems: productivity and profitability analysis	CO3
	• Study of livestock-based farming systems and allied enterprises	CO2
	• Study of integrated farming systems (IFS): production, resource use efficiency, and profitability	CO3
	• Profitability assessment of Agro-processing-based livelihood models	CO4
	• Field visit to innovative and climate-resilient farming system models	CO2
	• Visit to Agri-based enterprises for study of production, processing, and distribution integration	CO5
	• Study of Agri-enterprises in industry and service sectors (value chain models)	CO5

Text and Reference Books	1. Farming system and Sustainable Agriculture by Reddy, S.R., Kalyani Publishers 2. Farming Based Livelihood Systems by Singh, G., Kumar, A., Mishra, A.K. And Kumar, V., Sura India Publishing House, Buland Shaher, Up 3. Sustainable Livelihoods: Lessons from Early Experience by Ashley, C. And Carney, D., Department for International Development: London, UK 4. Farming Systems And Poverty: Improving Farmers' Livelihoods In A Changing World by Dixon, J. and A. Gulliver With D. Gibbon, FAO and World Bank, Rome, Italy And Washington, DC, USA	
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Course Code	ABS111						
Course Title	INTRODUCTORY BOTANY						
Hours	12, L:1						
Credits	1						
Type	Non Gradiual Course						
Course Outcomes	The students will CO1: Learn basics of plant kingdom CO2: Understand rules of binomial nomenclature in plant and cell division CO3: Understand morphology of angiosperms and seed germination process CO4: Learn about some agriculturally important families and role of animals in agriculture						
Examination Type	Theory + Practical						
Assessment Tools	Written Quiz	Assignment/Project Work	MSE	MSP	ESE	ESP	ABL/PBL
Weightage	20%	10%	25%	-	40%	-	5%
Examination Mode	Theory						
Unit 1: (3 hours)	• Introduction to the plant kingdom, diversity and characteristics • Evolution and Eugenics						CO1
Unit 2: (3 hours)	• Binomial nomenclature and classification of plants • Plant cell and cell division						CO2
Unit 3: (3 hours)	• Morphology of angiosperms • Seed and seed germination						CO3
Unit 4: (3 hour)	• Plant systematics viz, Brassicaceae, Fabaceae and Poaceae, Solanaceae • Role of animals in agriculture						CO4
Reference Books:	1. Biswas, S. and Biswas, A. (2017). Master Your Biology – 2 nd Vol., McGraw Hill Publications. 2. Brooker, R.J. Widmaier, E.P., Graham, L. and Stiling, P. (201). Biology 4 th Edition, McGraw Hill Publications. 3. Miller, K. R. (2010). Prentice Hall Biology, Pearson Education, Incorporated. 4. Verma, V. (2013) Ane's Student Edition. Botany. Ane Books Pvt. Ltd., New Delhi, India.						

Course Code	AEX111						
Course Title	COMMUNICATION SKILLS						
Hours	24, L:1, T:0, P:2						
Credits	2						
Type	Ability Enhancement Course						
Course Outcomes	On the completion of the course, the student will gain the following knowledge and skills: CO1: Competence in oral, written and non-verbal communication CO2: Develop strong personal and professional communication skills CO3: Apply grammar rules to construct clear, correct, and impactful sentences in written communication.						
Examination Type	Theory + Practical						
Assessment Tools	Written Quiz	Assignment/Project Work	MSE	MSP	ESE	ESP	ABL/PBL
Weightage	-	20%	-	30%	-	50%	-
Examination Mode	Theory + Practical						
Syllabus							
Unit 1	• 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						CO1
Unit 2	• 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						CO2
Unit 3	• 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						CO3
Unit 4	• Correct usage of nouns, pronouns and antecedents, adjectives, adverbs and articles • Agreement of verb with the subject: tense, mood, voice • Writing effective sentences						CO3

	• Basic sentence faults.	
Practicals		
	• 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	
Reference Books	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	

Course Code	AEX112						
Course Title	RURAL SOCIOLOGY AND EDUCATIONAL PSYCHOLOGY						
Hours	24, L:2, T:0, P:0						
Credits	2						
Type	Core Course						
Course Outcomes	On the completion of the course, the student will gain the following knowledge and skills: CO1: After this course, the students will understand the principles of Extension Education and the role of Rural Sociology in rural development. CO2: After this course, the students will know the influence of social structure and cultural practices on rural behavior and their implications CO3: Students will know the role of institutions, organizations, leadership, and social change in transforming rural communities through Extension. CO4: Students will know the assessment of various educational psychology, agricultural extension, learning and teaching situation						
Examination Type	Theory + Practical						
Assessment Tools	Written Quiz	Assignment/Project Work	MSE	MSP	ESE	ESP	ABL/PBL
Weightage	20%	10%	25%	-	40%	-	5%
Examination Mode	Theory+ Practical						
Syllabus							
Unit 1	- Extension Education and Agricultural Extension- Meaning, definition, scope and importance - Sociology and Rural Sociology- Meaning, definition, scope and 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						CO1

Unit 2	• 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.	CO2
Unit 3	• 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,	CO3
Unit 4	• 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.	CO4

Reference Books	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	
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Course Code	AHR111						
Course Title	FUNDAMENTALS OF HORTICULTURE						
Hours	48, L:2, T:0, P:2						
Credits	3						
Type	Core Course						
Course Outcomes	On the completion of the course, the student will gain the following knowledge and skills: CO1: To provide knowledge on different branches of horticulture viz. pomology, olericulture, floriculture and landscaping, spices and medicinal plants. CO2: To provide knowledge on orchard management, propagation methods, cultural operations and nutrient management of horticultural crops CO3: To provide knowledge on different physiological aspects of horticultural crops						
Examination Type	Theory + Practical						
Assessment Tools	Written Quiz	Assignment/Project Work	MSE	MSP	ESE	ESP	ABL/PBL
Weightage	5%	-	25%	-	40%	25%	5%
Examination Mode	Theory						
Syllabus							
Unit 1 (8 hours)	- Horticulture: Its different branches, importance and scope, - Horticulture and botanical classification, - Soil and climate for horticultural crops.						CO1
Unit 2 (8 hours)	- Plant propagation: methods and propagation structures, - Seed dormancy and seed germination. - Merits and demerits of sexual and asexual propagation. - Stock-scion relationship.						CO2
Unit 3 (8 hours)	- 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.						CO3
Unit 4 (8 hours)	- Importance of bio regulators in horticultural crops. - Irrigation and its methods. - Fertilizer application in horticultural crops.						CO3

Practical (20 hours)	• Identification of garden tools • 2-3. Identification and Nomenclature of fruits • Layout of an orchard • Pit making and system of planting • Nursery raising techniques of fruit crops • Understanding of plant propagation structures • Propagation through seeds and plant parts • Propagation techniques for horticultural crops • Container, potting mixture, potting and repotting • Training and pruning methods on fruit crops • Layout of different irrigation systems • 13. Maturity studies and harvesting	
Reference Books	1. Handbook of Horticulture. Vol.-I & II, ICAR Singh Jitendra. 2025. 2. Basic Horticulture. (6th Edn.). Kalyani Publishers.	

Course Code	AHR112						
Course Title	HORTICULTURE NURSERY MANAGEMENT						
Hours	48, L:0, T:0, P:4						
Credits	2						
Type	Skill Enhancement Course						
Course Outcomes	On the completion of the course, the student will gain the following knowledge and skills: CO1: Understanding nursery production of fruit crops: Raising of rootstocks, grafting and budding of rootstocks, management of grafted plants, plant certification, packaging and marketing, quality control CO2: Studying nursery production of ornamentals and vegetables: Production of plantlets, production of potted plants, management and maintenance, sale and marketing CO3: To study protected cultivation of vegetables and flowers: Procurement and transplanting, management and maintenance of the crop, postharvest handling, quality control and marketing CO4: To know role of plastic mulch in polyhouse, drip irrigation and fertigation, staking and training, vegetable grafting, plant protection under protected environment.						
Examination Type	Practical						
Assessment Tools	Written Quiz	Assignment/Project Work	MSE	MSP	ESE	ESP	ABL/PBL
Weightage	-	20%	-	30%	-	50%	-
Examination Mode	Practical						
Syllabus							
Unit 1 (12 hours)	- Nursery production of fruit crops: Raising of rootstocks, - Grafting and budding of rootstocks, - Management of grafted plants, - Plant certification, - Packaging and marketing, - Quality control.						CO1
Unit 2 (12 hours)	- Nursery production of ornamentals and vegetables: Production of plantlets, - Production of potted plants, - Management and maintenance, - Sale and marketing.						CO2
Unit 3 (12 hours)	Protected cultivation of vegetables and flowers: Procurement and transplanting,						CO3

	• management and maintenance of the crop, • postharvest handling, • quality control and marketing.	
Unit 4 (12 hours)	• Role of plastic mulch in polyhouse, • Drip irrigation and fertigation, • Staking and training, • Vegetable grafting, • Plant protection under protected environment.	CO4
Reference Books	1. Dhaliwal M.S. 2008. Handbook of Vegetable Crops, Kalyani Publishers, Ludhiana. 2. Anonymous. 2018. Package of Practices for Vegetable crops, P.A.U. Publications Ludhiana. 3. Purthy, J.S. 1996. Spices and Condiments. National Book Trust. 322p. 4. Bhattacharjee, Supriya. 2007. Ornamental Crop Production Technology. Pointer Publishers. Jaipur. 5. Randhawa, Gurcharan Singh and Mukhopadhyaya, Amitabha. 2001. Floriculture in India. Allied Publishers. 660p. 6. Adams, C.R. and Early, M. P. 2004. Principles of Horticulture. Butterworth – Heinemann, Oxford University Press. 7. Chadha, K.L. 2001, Handbook of Horticulture, ICAR, New Delhi. 8. Bose, T.K. and Mitra, S. K. 2001. Fruits: Tropical and Subtropical. Naya Prokash; 3rd revised edition.	

Course Code	APB111						
Course Title	SEED PRODUCTION AND TESTING TECHNOLOGY						
Hours	48 L:0, T:0, P:4						
Credits	2						
Type	Skill Enhancement Course						
Course Outcomes	On the completion of the course, the student will gain the following knowledge and skills: CO1: They will be well versed with principles and practices seed quality testing CO2: They will understand the methods of seed production in various crops CO3: They will learn the principles of seed storage and seed certification CO4: They will understand the functioning of seed testing laboratories and seed processing units						
Examination Type	Practical						
Assessment Tools	Written Quiz	Assignment/Project Work	MSE	MSP	ESE	ESP	ABL/PBL
Weightage	-	20%	-	30%	-	50%	-
Examination Mode	Practical						
Syllabus							
Unit 1 (15 hours)	- Seed quality -definition, characters of good quality seed - Different classes of seed, seed tagging and labeling - Methods of seed sampling - Physical purity - Moisture determination - Germination testing - Seed Viability by Tz test						CO1
Unit 2 (15 hours)	- Foundation and certified seed production of important vegetables, cereals, pulses, oilseeds and ornamental crops - Field inspection, importance and procedures - Seed harvesting and extraction/threshing - Seed drying						CO2
Unit 3 (10 hours)	- Seed Processing - Seed Packaging - Seed storage - general principles - Seed health testing - Seed certification						CO3

Unit 4 (8 hours)	• Visit to seed production farms and seed processing units • Understanding the functioning of seed testing laboratories • Requirements for establishment of a seed processing plant	CO4
Reference Books	1. Agarwal, R.L. 1995. Seed Technology (2nd edition). Oxford & IBH Publishing Co. Pvt. Ltd. New Delhi, India. 2. Khare, D. and Bhale, M.S. 2019. Seed Technology (2nd revised & enlarged edn), Scientific Publishers, ISBN: 978-81-72338-84-8, New Pali Road, P.O. Box 91, Jodhpur, India 3. Vanangamudi, K. 2014. Seed Technology (An illustrated book), New India Publishing Agency, New Delhi, India. 4. McDonald, M.B. Jr and Copeland, L.O. 1997. Seed Production: Principles and Practices. Chapman & Hall. 5. Tunwar, N.S. and Singh, S.N. 1988. Indian Minimum Seed Certification Standards. CSCB, Ministry of Agriculture, New Delhi.	

Course Code	MAT 181						
Course Title	INTRODUCTORY MATHEMATICS						
Hours	12, L:1, T:0, P:0						
Credits	1						
Type	Non Gradiual						
Course Outcomes	On the completion of the course, the student will gain the following knowledge and skills: CO1: Understand the basics of matrices and determinants CO2: Understand the basics of differentiation CO3: Understand the basics of integration CO4: Understand the concept of models						
Examination Type	Theory						
Assessment Tools	Written Quiz	Assignment/Project Work	MSE	MSP	ESE	ESP	ABL/PBL
Weightage	20%	10%	25%	-	40%	-	5%
Examination Mode	Theory						
Syllabus							
Unit 1 (4 hours)	- Progressions – Arithmetic, Geometric, Harmonic. - Matrices – Addition, Subtraction, Multiplication - Determinants – evaluation up to 3rd order						CO1
Unit 2 (4 hours)	- Differentiation – definition - Derivatives of algebraic, exponential, logarithms, trigonometric functions - Derivatives of sum, difference, product, quotient of two functions						CO2
Unit 3 (4 hours)	- Indefinite integration of polynomials, exponential, trigonometric, logarithmic functions. - Integration of sum, difference and product of two functions						CO3
Unit 4 (4 hours)	- Mathematical models definition - Classification of models - Fitting of linear and quadratic to experimental data						CO4
Reference Books	1. Grewal BS Higher Engineering Mathematics, 44 th edition, Khanna Publishers, New Delhi, 2017. 2. Kapur JN Mathematical Modelling, 2 nd edition, new age International publications, New Delhi, 2005.						

SEMESTER II

Course Code	AAS 121						
Course Title	LIVESTOCK & POULTRY MANAGEMENT						
Hours	36, L:1, T:0, P:2						
Credits	2						
Type	Core Course						
Course Outcomes	On the completion of the course, the student will gain the following knowledge and skills: CO1: To understand the role of livestock in national economy besides housing, reproduction of farm animals and poultry; Management of calves, heifers and milch animals. CO2: To understand the breeds, management and improvement of livestock and poultry in addition to hatching and brooding in poultry. CO3: To understand feeding and digestion in livestock and poultry. CO4: To understand the prevention and control of important diseases of livestock and poultry.						
Examination Type	Theory + Practical						
Assessment Tools	Written Quiz	Assignment/Project Work	MSE	MSP	ESE	ESP	ABL/PBL
Weightage	5%	-	-	20%	40%	30%	5%
Examination Mode	Theory + Practical						
Syllabus	Theory						
Unit 1 (7 hours)	• 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.						CO1
Unit 2 (7 hours)	• 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.						CO2

	• Improvement of farm animals and poultry.	
Unit 3 (7 hours)	• 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.	CO3
Unit 4 (7 hours)	• Introduction of livestock and poultry diseases. • Prevention (including vaccination schedule) and control of important diseases of livestock and poultry.	CO4
Reference Books	1. Singh, H. 2011. Handbook of Animal Husbandry, I.C.A.R. Publications, New Delhi 2. Eigan, W.M., and Paul, R. 2005. Dairy Cattle Feed. Johan Willey & Sons, New York 3. Kumar, A. 2006. Animal Husbandry. Discovery Publishing House, New Delhi	

Course Code	AEN121						
Course Title	FUNDAMENTALS OF ENTOMOLOGY						
Hours	48, L:2, T:0, P:2						
Credits	3						
Type	Core Course						
Course Outcomes	On the completion of the course, the student will gain the following knowledge and skills: CO1: Describe the history of entomology in India, dominance of insects, and classification of Arthropoda with special reference to Class Insecta. CO2: Explain the morphological features of insects including body segmentation, cuticle, appendages, wing modifications, metamorphosis, and diapause. CO3: Illustrate the structure and functions of major physiological systems and discuss insect ecology and reproduction. CO4: Classify and identify important insect orders and economically significant families using principles of taxonomy and binomial nomenclature						
Examination Type	Practical						
Assessment Tools	Written Quiz	Assignment/Project Work	MSE	MSP	ESE	ESP	ABL/PBL
Weightage	5%	-	25%	-	40%	25%	5%
Examination Mode	Practical						
Syllabus							
Unit 1 (6 hours)	History, Dominance and Classification of Insects - History of Entomology in India; - Major points related to dominance of insects in the animal kingdom; - Classification of Phylum Arthropoda up to classes; - Relationship of Class Insecta with other classes of Arthropoda; Introduction to taxonomy including its importance, history and development; - Binomial nomenclature; definitions of biotype, subspecies, species, genus, family and order.						CO1
Unit 2 (6 hours)	Insect Morphology and Development - Structure and functions of insect cuticle and molting; - Body segmentation;						CO2

	• Structure of head, thorax and abdomen; • Structure and modifications of antennae, mouthparts, legs; • Wing venation, wing modifications and wing coupling apparatus; • Metamorphosis and diapause; types of larvae and pupae.	
Unit 3 (6 hours)	Insect Physiology and Ecology • Structure and functions of digestive, circulatory, excretory, respiratory, nervous, endocrine (secretory) and reproductive systems; • Types of reproduction in insects; • Major sensory organs; • Introduction to insect ecology; • Environment and its components; • Effects of abiotic and biotic factors; • Categories of pests	CO3
Unit 4 (6 hours)	Unit IV: Systematics and Economically Important Insect Orders • Classification of Class Insecta up to orders; • Basic groups of present-day insects; • Detailed study of agriculturally important orders and families including Orthoptera, Dictyoptera, Odonata, Isoptera, Thysanoptera, Hemiptera, Neuroptera, Lepidoptera, Coleoptera, Hymenoptera and Diptera with emphasis on their distinguishing characters and economic importance.	CO4
Practical (24 hours)	• Collection and Preservation of Insects (Adults and Immature Stages) • Study of External Morphology of Grasshopper • Study of External Morphology of Blister beetle • Study of Types of Insect Antennae • Study of Types of Insect Mouthparts • Study of Types of Insect Legs • Study of Wing Venation in Insects • Study of Types of Wings and Wing Coupling Apparatus • Study of Types of Insect Larvae • Study of Types of Insect Pupae • Dissection of Digestive System in Grasshopper • Study of Order Orthoptera and Dictyoptera (Important Families) • Study of Order Odonata and Isoptera (Important Families) • Study of Order Thysanoptera and Hemiptera (Important Families) • Study of Order Lepidoptera and Neuroptera (Important Families)	

	• Study of Order Coleoptera and Hymenoptera (Important Families) • Study of Order Diptera and Important Families of Agricultural Importance • Study of Insecticides, Their Formulations, Pesticide Appliances, and Sampling Techniques for Estimation of Insect Population and Damage	
Reference Books	1. Richards, O.W. and Davies, R.G. (1977) Imms General Text Book of Entomology (Vol. I and II). Chapman and Hall, London. 2. Snodgrass, R.E. (2001) Principles of Insect Morphology. CBS Publishers & Distributors, Delhi. 3. Chapman, R.F. (1988) Insects: Structure and Function. Cambridge Univ. Press, UK. 4. Ragumoorthi, K.N., Balasubramani, V., Srinivasan M.R. and Natarajan, N. (2006) Insecta- An Introduction. A.E. Publications, Coimbatore. 5. Richards, O. W., & Davies, R. G. (1977). Imm's General Textbook of Entomology (10th ed.). Chapman & Hall. 6. Insect Physiology and Anatomy. Pant, N.C. and Ghai, S. 198. ICAR, New Delhi. 5. Theory and Practice of Animal Taxonomy. Kapoor, V. C 2008. Oxford and IBH Publishing, New Delhi.	

Course Code	AEN122						
Course Title	APIARY MANAGEMENT						
Hours	48, L:0, T:0, P:4						
Credits	2						
Type	Skill Enhancement Course						
Course Outcomes	On the completion of the course, the student will gain the following knowledge and skills: CO1: to identify different species and castes of honeybees, understand their biology, behavior, and role in crop pollination. CO2: Demonstrate proficiency in handling beekeeping tools, maintaining bee colonies, managing hives seasonally, and performing colony manipulations. CO3: Acquire hands-on experience in the extraction, processing, and value addition of bee products such as honey, wax, pollen, propolis, and royal jelly. CO4: Diagnose and manage common pests and diseases of honeybees and prepare a small-scale beekeeping enterprise plan for entrepreneurship or pollination service.						
Examination Type	Practical						
Assessment Tools	Written Quiz	Assignment/Project Work	MSE	MSP	ESE	ESP	ABL/PBL
Weightage		20%		30%		50%	
Examination Mode	Practical						
Syllabus							
Unit 1 (8 hours)	Honey Bee Biology and Identification • Identification of honey bee species (<i>Apis cerana</i>, <i>A. mellifera</i>, <i>A. dorsata</i>, <i>A. florea</i>) • Morphology of honey bee castes – Queen, Drone, Worker • Study of internal anatomy and wax glands • Life cycle observation of all castes • Study of bee behaviors – foraging, swarming, waggle dance • Identification of major floral sources (nectar and pollen plants) • Dissection of bee body parts under microscope (mouthparts, sting, wax glands) • Bee communication and pheromones (demonstration) • Visit to a natural bee nesting site • Identification of pollination structures of bee-pollinated crops						CO1

Unit 2 (8 hours)	Apiary Tools, Hive Management, and Seasonal Operations • Identification and use of bee-keeping tools • Study of different types of bee hives (Newton, Langstroth, Indigenous) • Handling and inspecting live colonies • Construction and fitting of frames in hives • Hive manipulation techniques – frame shifting, checking for queen • Supering and de-supering practice • Division and uniting of colonies • Queen introduction techniques • Artificial feeding methods (sugar syrup preparation, protein supplement) • Cleaning and sterilization of hive components • Seasonal management – summer, winter, monsoon • Record-keeping: colony strength, honey yield, health status • Apiary layout and site selection	CO2
Unit 3 (8 hours)	Bee Products and Value Addition • Honey extraction using centrifugal extractor • Filtration, grading, bottling, and labeling of honey • Wax extraction and purification • Making bee wax foundation sheets • Collection and processing of pollen • Extraction of propolis and royal jelly • Preparation of value-added products • Testing of honey quality (moisture, color, aroma – demo only) • Packaging and shelf-life extension techniques • Visit to a honey processing unit or exhibition stall (if feasible)	CO3
Unit 4 (12 hours)	Bee Health, Pest & Disease Management, and Enterprise Setup • Identification of bee enemies: wax moth, ants, wasps, birds • Detection and control of Varroa mites and Tropilaelaps mites • Symptoms and control of brood and adult bee diseases • Fumigation and disinfection of hives • Queen rearing: grafting technique and cell cup preparation (demo) • Nucleus colony preparation and queen marking • Field visit to a commercial apiary unit • Preparation of a simple project plan for a beekeeping startup	CO4
Reference Books	1. Tarpy, D. R. (2021). Apiculture. In Encyclopedia of social insects (pp. 72-79). Cham: Springer International Publishing. 2. Sharma, R., Kumar, R. K., & Vaijinath, P. (2023). The	

	beekeeper's hand book: A comprehensive guide to apiculture. Shineeks Publishers. 3. Sathe, T. V. (2006). Fundamentals of Beekeeping. Daya Books. 4. Abrol, D. P. (2013). Beekeeping: a compressive guide to bees and beekeeping. Scientific publishers.	
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Course Code	AEX121						
Course Title	PERSONALITY DEVELOPMENT						
Hours	36, L:1, T:0, P:2						
Credits	2						
Type	Ability Enhancement Course						
Course Outcomes	On the completion of the course, the student will gain the following knowledge and skills: CO1: Understand personality types, theories and their impact on behaviour at work CO2: Analyze how perception and attribution shape individual behaviour CO3: Apply learning principles to improve performance and training CO4: Evaluate how intelligence, motivation, and group dynamics influence organizational behaviour						
Examination Type	Theory + Practical						
Assessment Tools	Written Quiz	Assignment/Project Work	MSE	MSP	ESE	ESP	ABL/PBL
Weightage	5%	-	-	20%	40%	30%	-
Examination Mode	Theory + Practical						
Syllabus	Theory						
Unit 1	• Personality: definition, nature, theories and its types • The humanistic approach - Maslow's self-actualization theory • Shaping and determinants of personality • Myers-Briggs Typology Indicator • Locus of control, Type A and Type B Behaviours • Personality and Organizational Behaviour.						CO1
Unit 2	• Foundations, models and factors influencing individual behavior • Perception: meaning, attributes and factors affecting perception • Attribution theory • Case studies on Perception and Attribution						CO2
Unit 3	• Learning: Meaning, definition, theories and principles • Learning in organizational behavior and training, • Feedback in learning processes • Attitude and values						CO3
Unit 4	• Intelligence- types, theories, intelligence and factors influencing intelligence						CO4

	• Intelligence and organizational behavior • Emotional intelligence • Motivation- theories and principles • Teamwork and group dynamics	
Practical (24 hours)	• 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	
Reference Books	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. Kumar, Pravesh. 2005. All about Self- Motivation. New Delhi. Goodwill Publishing House - 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. Smith, B. 2004. Body Language. Delhi: Rohan Book Company. 7. Shaffer, D. R. 2009. Social and Personality Development (6th Edition). Belmont, CA: Wadsworth	

Course Code	AHR121						
Course Title	PROFESSIONAL LANDSCAPING AND DIGITAL DESIGN TOOLS FOR GREEN SPACES						
Hours	48, L:0, T:0, P:4						
Credits	2						
Type	Skill Enhancement Course						
Course Outcomes	On completion of this course, the learner will acquire the following skills to become employable or start an enterprise in the floriculture and landscaping sector: CO1: Ability to identify and classify landscaping plants and select suitable species for different landscape situations. CO2: Competence in planning, designing, and executing landscape projects for residential, commercial, and institutional spaces. CO3: Skills in value addition techniques of ornamental plants (bouquet making, floral arrangements, dried flower products). CO4: Knowledge of marketing, costing, and entrepreneurship opportunities in landscaping and floral value addition.						
Examination Type	Practical						
Assessment Tools	Written Quiz	Assignment/Project Work	MSE	MSP	ESE	ESP	ABL/PBL
Weightage	-	20%	-	30%	-	50%	
Examination Mode							
Practical Syllabus (45- 48 Hours)	Theory						
Unit 1	• Components of Landscaping • Identification and classification of ornamental trees, shrubs, climbers, groundcovers, hedges, and lawn grasses. • Selection criteria for various landscaping situations (avenues, home gardens, commercial spaces).						CO1
Unit 2	• Planning and Layout • Study of garden styles: Mughal, Japanese, Formal, Informal. • Design and layout of home, institutional, and commercial gardens. • Placement of hardscape features: paths, borders, water bodies, seating spaces.						CO2
Unit 3	• Value Addition of Ornamental Plants • Techniques of floral arrangement (Western, Japanese Ikebana).						CO3

	• Preparation of bouquets, garlands, and floral baskets. • Production of dried flower products: wall hangings, greeting cards, potpourri.	
Unit 4	• Entrepreneurship and Marketing • Cost estimation for landscaping and floral value-added products. • Packaging, branding, and marketing strategies. • Business models for landscape consultancy and floral products.	CO4
Reference Books	1. Randhawa, G.S. & Mukhopadhyay, A. Floriculture in India. 2. Bose, T.K., et al. Commercial Floriculture. 3. Hunter, N. The Art of Floral Design. 4. Auto CAD manuals & online resources.	

Course Code	APP121						
Course Title	FUNDAMENTALS OF PLANT PATHOLOGY						
Hours	48 L:2, T:0, P:2						
Credits	3						
Type	Core Course						
Course Outcomes	On the completion of the course, the student will gain the following knowledge and skills: CO1: They will understand the importance of plant diseases and know various causal agents of plant diseases. CO2: They will learn about the general characters and reproduction in fungi and bacteria. CO3: They will know the biology of plant parasitic nematodes, phanerogamic parasites and plant viruses. CO4: They will learn about understand various techniques used in plant disease management.						
Examination Type	Theory + Practical						
Assessment Tools	Written Quiz	Assignment/Project Work	MSE	MSP	ESE	ESP	ABL/PBL
Weightage	5%		25%	-	40%	25%	5%
Examination Mode	Theory + Practical						
Syllabus	Theory						
Unit 1 (6 hours)	- Importance of plant diseases, scope and objectives of Plant Pathology - History of Plant Pathology with special reference to Indian work. - Terms and concepts in Plant Pathology. - Pathogenesis. - Cause and classification of plant diseases. Important plant pathogenic organisms, different groups: fungi, bacteria, fastidious vesicular bacteria, phytoplasmas, spiroplasmas, viruses, viroids, algae, protozoa, phanerogamic parasites and nematodes with examples of diseases caused by them. - Diseases and symptoms due to abiotic causes.						CO1
Unit 2 (8 hours)	- Fungi: General characters, definition of fungus, somatic structures, types of fungal thalli, fungal tissues, modifications of thallus, reproduction (asexual and sexual). - Nomenclature, Binomial system of nomenclature, rules of nomenclature, classification of fungi.						CO2

	• Key to divisions, sub-divisions, orders and classes of Fungi. • Bacteria and Mollicutes: General morphological characters. • Basic methods of classification and reproduction of bacteria.	
Unit 3 (8 hours)	• Viruses: Nature, architecture, multiplication and transmission. • Study of phanerogamic plant parasites. • Nematodes: General morphology and reproduction, classification, symptoms and nature of damage caused by plant nematodes (<i>Heterodera</i>, <i>Meloidogyne</i>, <i>Anguina</i> etc.).	CO3
Unit 4 (8 hours)	• Principles and methods of plant disease management. • Nature, chemical combination, classification, mode of action and formulations of fungicides and antibiotics.	CO4
Practical (18 hours)	• Acquaintance with various laboratory equipment and microscopy • Collection and preservation of disease specimen • Preparation of media, isolation and Koch's postulates • General study of different structures of fungi • Study of symptoms of various plant diseases • Study of representative fungal genera • Study of morphological features and identification of plant parasitic nematodes • Study of fungicides and their formulations. Methods of pesticide application and their safe use. Calculation of fungicide sprays concentrations	
Reference Books	1. Agrios, G.N. 1998. Plant Pathology, 3rd Edition Academic Press, New York. 2. Alexopolus, C.J. and Mims. 1989. Introductory Mycology, Willey Eastern Ltd., New Delhi. 3. Singh, R., S. 2012. Introduction to Plant Pathology, 3rd Edition, Oxford and IBH, New Delhi. 4. Mehrotra, R.S. 2018. Fundamentals of Plant Pathology, McGraw Hill, New Delhi. 5. Singh R., S. 2019. Introduction to Principles of Plant Pathology. Scientific Press, New Delhi. 6. Dube, H., C. 2018. Modern Plant Pathology. Agrobios, Jodhpur	

Course Code	ASS121						
Course Title	SOIL FERTILITY MANAGEMENT						
Hours	48, L:2, T:0, P:2						
Credits	3						
Type	Core Course						
Course Outcomes	On the completion of the course, the student will gain the following knowledge and skills: CO1: They will understand the fundamental concepts of soil fertility and the factors affecting it, including soil physical, chemical and biological properties that influence nutrient availability. CO2: They will learn the role and functions of essential plant nutrients, diagnose nutrient deficiencies, and understand nutrient interactions within different crop production systems. CO3: They will get demonstrative knowledge of different types of fertilizers (organic, inorganic and biofertilizers), their nutrient composition, methods of application, and their impact on soil health and crop productivity. CO4: Students will learn to develop and apply integrated nutrient management strategies that enhance nutrient use efficiency, sustain soil fertility, and promote environmentally sustainable agriculture.						
Examination Type	Theory + Practical						
Assessment Tools	Written Quiz	Assignment/Project Work	MSE	MSP	ESE	ESP	ABL/PBL
Weightage	5%		25%		40%	25%	5%
Examination Mode	Theory + Practical						
Syllabus							
Unit 1 (8 hours)	- History of soil fertility and plant nutrition - Criteria of essentiality - Factors affecting nutrient availability to plants - Forms of nutrients in soil - Soil fertility evaluation - Soil testing - Critical levels of different nutrients in soil - Chemistry of macro and micronutrients						CO1
Unit 2 (4 hours)	- Role, deficiency, and toxicity symptoms of essential plant nutrients - Mechanisms of nutrient transport to plants - Nutrient interactions in soil–plant systems - Plant analysis and rapid plant tissue tests - Indicator plants						CO2

Unit 3 (8 hours)	• Introduction and importance of manures and fertilizers • Classification, composition, and properties of major fertilizers • Secondary and micronutrient fertilizers • Complex fertilizers, Customized fertilizers, Water-soluble fertilizers, Nano fertilizers • Preparation and properties of major manures (FYM, Compost, Vermicompost, Green manuring, Oilcakes) • Soil amendments • Fertilizer storage and Fertilizer Control Order • Methods of fertilizer application under rainfed and irrigated conditions	CO3
Unit 4 (4 hours)	• Integrated nutrient management (INM) • Fertilizer recommendation approaches • Methods of fertilizer recommendations to crops • Factors influencing nutrient use efficiency (NUE) • STCR (Soil Test Crop Response) • RTNM (Real-Time Nitrogen Management) • IPNS (Integrated Plant Nutrient System) • Carbon sequestration and carbon trading	CO4
Practical (24 hours)	• Introduction to analytical instruments and their working principles used in soil and plant nutrient analysis.	CO1, CO2
	• Calibration and applications of colorimetry in nutrient estimation.	CO1, CO2
	• Calibration and applications of flame photometry for the determination of alkali and alkaline earth metals.	CO1, CO2
	• Estimation of alkaline hydrolysable nitrogen (N) in soils to assess available nitrogen content.	CO1, CO2
	• Estimation of extractable phosphorus (P) in soils using appropriate chemical methods.	CO1, CO2
	• Estimation of exchangeable potassium (K) in soils through flame photometry or other suitable methods.	CO1, CO2
	• Estimation of exchangeable calcium (Ca) and magnesium (Mg) in soils using titration or spectrophotometric techniques.	CO1, CO2
	• Estimation of extractable sulphur (S) in soils to evaluate available sulphur for plant uptake.	CO1, CO2
	• Estimation of DTPA-extractable zinc (Zn) in soils to determine micronutrient availability.	CO1, CO2
	• Estimation of total nitrogen (N) content in plant tissues using Kjeldahl or other methods.	CO2, CO3
	• Estimation of phosphorus (P) in plant samples by spectrophotometry after acid digestion.	CO2, CO3
	• Estimation of potassium (K) in plants using flame photometry after digestion.	CO2, CO3

	• Estimation of sulphur (S) in plant tissues through turbidimetric or other chemical methods.	CO₂, CO₃
Reference Books	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 Samuel 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.	

Course Code	EVS121						
Course Title	ENVIRONMENTAL STUDIES AND DISASTER MANAGEMENT						
Hours	48, L:2, T:0, P:2						
Credits	3						
Type	Value Added Course						
Course Outcomes	On the completion of the course, the student will gain the following knowledge and skills: CO1: Understand the fundamental concepts of environmental studies, including ecosystems, biodiversity, natural resources, and pollution. CO2: Analyze environmental problems and evaluate solutions related to pollution control, waste management, climate change, and sustainable development. CO3: Explain the types, causes, and effects of various natural and man-made disasters, and understand global and national strategies for disaster reduction. CO4: Apply disaster management principles and assess the roles of government, NGOs, and local bodies in disaster preparedness, response, and recovery.						
Examination Type	Theory + Practical						
Assessment Tools	Written Quiz	Assignment/Project Work	MSE	MSP	ESE	ESP	ABL/PBL
Weightage	5%	-	25%	-	40%	25%	5%
Examination Mode	Theory + Practical						
Syllabus							
Unit 1	• 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						CO1, CO2
Unit 2	• Ecosystems: Concept of an ecosystem - Structure and function of an ecosystem- Energy flow in the ecosystem. Types of ecosystems. • Biodiversity and its conservation: Introduction, definition, types. • Biogeographical classification of India.						CO1, CO2

	• Importance and Value of biodiversity. • Biodiversity hotspots. • Threats and Conservation of biodiversity. • Environmental Pollution: Definition, cause, effects and control measures of: a. Air pollution. b. Water pollution. c. Soil pollution. d. Marine pollution. e. Noise pollution. f. Thermal pollution 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.	
Unit 3	• 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.	CO2
Unit 4	• Disaster management: Disaster definition - Types - Natural Disasters - Floods, drought, cyclone, earthquakes, and slides, 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.	CO3, CO4
Practical	• Visit to a local area to document environmental assets river/ forest/ grassland/ hill/ mountain.	CO1
	• Energy: Biogas production from organic wastes. Visit to wind mill / hydro power / solar power generation units.	CO4
	• Biodiversity assessment in farming system. Floral and faunal diversity assessment in polluted and unpolluted system.	CO1
	• Visit to local polluted site-Urban/ Rural/ Industrial/ Agricultural to study of commonplants, insects and birds.	CO4

	• Environmental sampling and preservation.	C02
	• Water quality analysis: pH, EC and TDS. Estimation of Acidity, Alkalinity.	C02
	• Estimation of water hardness. Estimation of DO and BOD in water samples. Estimation of COD in water samples. Enumeration of <i>E. coli</i> in water sample.	C02
	• Assessment of Suspended Particulate Matter (SPM). Study of simple ecosystem.	C02
	• Visit to pond/river/hills.	C01
	• Visit to areas affected by natural disaster.	C03
Reference Books	1. De, A.K. 2010. Environmental chemistry. Published by New Age International Publishers, New Delhi.ISBN:13–9788122426175.384pp 2. Dhar Chakrabarti, P.G. 2011. Disaster management - India's risk management policy frame works 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.	

SEMESTER III

Course Code	APP 212						
Course Title	MUSHROOM PRODUCTION TECHNOLOGY						
Hours	48; L:0, T:0, P:2						
Credits	2						
Type	Skill Enhancement Course						
Course Outcomes	On the completion of the course, the student will gain the following knowledge and skills: CO1: To get familiar with various types of edible mushrooms and their life cycle CO2: To understand the techniques of spawn production, substrate preparation and pasteurization in mushroom cultivation CO3: To understand the cultivation technologies of various edible mushrooms CO4: To get familiar with different pest and disease of mushroom						
Examination Type	Practical						
Assessment Tools	Written Quiz	Assignment/Project Work	MSE	MSP	ESE	ESP	ABL/PBL
Weightage	-	20%	-	30%	-	50%	-
Examination Mode	Practical						
Syllabus							
Unit 1 (6 hours)	• Introduction to Mushroom Cultivation: Current status and scope of mushroom cultivation in India and Punjab • Important features of edible fungi, • Nutritional and medicinal value of mushrooms Familiarization with different types of edible mushrooms, their classification, and nutritional value • Identification and study of the life cycle of button and oyster mushrooms. • Understanding the layout and equipment required for a small-scale mushroom farm. • Visit to commercial mushroom farm						CO1
Unit 2 (6 hours)	• Preparation and Multiplication of Spawn: • Introduction to mushroom spawn Preparation of media • Tissue culture and pure culture preparation • Sub-culturing for culture maintenance and its preservation • Spawn preparation, quality assessment and storage • Substrate Preparation and Pasteurization:						CO2

	• Substrate selection and preparation for mushroom cultivation. • Learning different methods of pasteurization of substrate. • Sterilization techniques for oyster mushroom substrate (e.g., hot water treatment, chemical sterilization). • Demonstration and student practice of spawning techniques for both button and oyster mushrooms.	
Unit 3 (8 hours)	• Mushroom farm design and infrastructure required for commercial unit • Cultivation techniques of Oyster mushroom (<i>Pleurotus florida</i>) • Raw material formulations for <i>Agaricus bisporus</i> (button mushroom), Composting (long method and short method) • Casing preparation, Crop management practices • Cultivation techniques of <i>Lentinula edodes</i> (shiitake) • Cultivation techniques of <i>Calocybe indica</i> (milky) • Cultivation techniques of <i>Volvariella volvacea</i> (paddy straw) mushrooms • Preparation, pasteurization and application of casing soil for button mushrooms. • Aftercare and harvesting for button and oyster mushrooms. • Grading and post-harvest handling of fresh mushrooms.	CO3
Unit 4 (4 hours)	• Pest, Disease, and Economic Aspects: • Identification and management of common pests and diseases in mushroom cultivation. • Preparation of value-added mushroom products (e.g., dried mushrooms, pickles). • Calculation of cost of production and analysis of profitability for a small-scale mushroom farm.	CO4
Reference Books	1. Suman, B. C., & Sharma, V. P. (2007). Mushroom cultivation in India. Daya Books. 2. Thakur, M. P., Singh, R. P., Singh, H. K., & Mishra, K. K. (Eds.). (1967). Compendium of Mushroom Diseases. In International Conference on Mushroom Biology and Mushroom Products (ICMBMP8). pp (Vol. 330, p. 336). By: Indian Phytopathological Society.	

Course Code	AEC211						
Course Title	ENTREPRENEURSHIP DEVELOPMENT AND BUSINESS COMMUNICATION						
Hours	48, L:2, T:0, P:2						
Credits	3						
Type	Core Course						
Course Outcomes	On the completion of the course, the student will gain the following knowledge and skills: CO1: Understand the concepts, characteristics, types, and process of entrepreneurship development. CO2: Identify the entrepreneurial opportunities, and understand support systems for entrepreneurship development. CO3: Understand the steps involved in establishing and planning an enterprise. CO4: Understand and apply basic principles of enterprise management.						
Examination Type	Theory + Practical						
Assessment Tools	Written Quiz	Assignment/Project Work	MSE	MSP	ESE	ESP	ABL/PBL/ATT
Weightage	5%	-	25%	-	40%	25%	5%
Examination Mode	Theory + Practical						
Syllabus							
Unit 1	• 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 • Process of entrepreneurship development.						CO1
Unit 2	• 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,						CO2

	schemes for entrepreneurship development • Role of financial institutions and other agencies in entrepreneurship development.	
Unit 3	• 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	CO3
Unit 4	• 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.	CO4
Practical (24 hours)	• 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.	
Reference Books	1. Charantimath, P.M. 2009. Entrepreneurship Development and Small Business Enterprises. Pearson Publications, New Delhi. 1. Desai, V. 2015, Entrepreneurship: Development and Management, Himalaya Publishing House. 2. Gupta, C.B. 2001. Management Theory and Practice. Sultan Chand & Sons. 3. Indu Grover. 2008. Handbook on Empowerment and Entrepreneurship. Agrotech Public Academy. 4. Khanka, S.S. 1999. Entrepreneurial Development. S. Chand & Co.	

	7. Mehra, P. 2016. Business Communication for Managers. Pearson India, New Delhi. 8. Pandey, M. and Tewari, D. 2010. The Agribusiness Book. IBDC Publishers, Lucknow. 9. Singh, D. 1995. Effective Managerial Leadership. Deep & Deep Publ. 10. Singhal, R.K. 2013. Entrepreneurship Development & Management, Katson Books. 11. Tripathi, P.C. and Reddy, P.N. 1991. Principles of Management. Tata McGraw Hill. 12. Vasant Desai, 1997. Small Scale Industries and Entrepreneurship. Himalaya Publ. House.	
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Course Code	APB211						
Course Title	PRINCIPLES OF GENETICS						
Hours	48, L:2, T:0, P:2						
Credits	3						
Type	Core Course						
Course Outcomes	On the completion of the course, the student will gain the following knowledge and skills: CO1: to make the students acquainted with both principles and practices in the areas of Mendelian genetics, CO2: to study the structure of nucleic acids and concept of cytogenetics CO3: to understand the concept of lineage, crossing over and chromosomal aberrations CO4: to understand the concept of quantitative genetics and gene expression						
Examination Type	Theory + Practical						
Assessment Tools	Written Quiz	Assignment/Project Work	MSE	MSP	ESE	ESP	ABL/PBL
Weightage	5%	-	25%	-	40%	25%	5%
Examination Mode	Theory and Practical						
Syllabus							
Unit 1 (8 hours)	• Pre and post Mendelian concepts of heredity, • Mendelian principles of heredity, • Study of model organisms (<i>Drosophila</i>, <i>Arabidopsis</i>, Garden pea, <i>E. coli</i>, 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.						CO1
Unit 2 (8 hours)	• Probability 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.						CO2
Unit 3 (8 hours)	• 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,						CO3

	chromosome mapping, • Structural and numerical variations in chromosomes and their implications,	
Unit 4 (8 hours)	• 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.	CO4
Practical (18 hours)	• 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.	
Reference Books	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	

Course Code	AAG211						
Course Title	CROP PRODUCTION TECHNOLOGY-I (<i>Kharif</i> Crops)						
Hours	60, L:1 T:0 P:4						
Credits	3						
Type	Core Course						
Course Outcomes	On the completion of the course, the student will gain the following knowledge and skills: CO1: Cultivation practices of cereal crops, their benefits, constraints in their production and their remedies. CO2: Cultivation practices of pulses their benefits, constraints in their production and their remedies. CO3: Cultivation practices of oil seeds their benefits, constraints in their production and their remedies. CO4: Cultivation practices of fibre and forage crops, their benefits, constraints in their production and their remedies.						
Examination Type	Theory + Practical						
Assessment Tools	Written Quiz	Assignment/Project Work	MSE	MSP	ESE	ESP	ABL/PBL
Weightage	5%	-	-	25%	30%	35%	5%
Examination Mode	Theory + Practical						
Syllabus							
Unit 1	Origin, geographical distribution, economic importance, soil and climatic requirements, varieties, cultural practices and yield of <i>Kharif</i> crops: Cereals- rice, maize, sorghum						CO1
Unit 2	Origin, geographical distribution, economic importance, soil and climatic requirements, varieties, cultural practices and yield of <i>Kharif</i> crops: Millets:-pearl millet, finger millet and other minor millets						CO2
Unit 3	Origin, geographical distribution, economic importance, soil and climatic requirements, varieties, cultural practices and yield of <i>Kharif</i> crops: pulses and oilseeds - pigeon pea, mung bean and urdbean; oilseeds- groundnut, soybean, sesame, castor						CO3

Unit 4	• Origin, geographical distribution, economic importance, soil and climatic requirements, varieties, cultural practices and yield of <i>Kharif</i> crops: Fibre and forage crops: fibre crops cotton & Jute and forage crops-cowpea, cluster bean, napier hybrid and guinea grass	CO4
Practical	• Rice nursery preparation, • Transplanting of Rice, • Sowing of soybean, pigeonpea and mungbean, maize, groundnut and cotton, • Effect of seed size on germination and seedling vigour of <i>kharif</i> season crops, • Effect of sowing depth on germination of <i>kharif</i> crops, • Identification of weeds in <i>kharif</i> season crops, • top dressing and foliar feeding of nutrients, • Study of yield contributing characters and yield calculation of <i>kharif</i> season crops, • Study of crop varieties and important agronomic experiments at experimental farm, • Study of forage experiments, morphological description of <i>kharif</i> season crops, • Visit to research centres of related crops.	
Reference Books	1. Gurarajan, R. Balasubramanian and V. Swaminathan. Recent Strategies on Crop Production. Kalyani Publishers, New Delhi. 2. Chidida 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.	

Course Code	AHR211						
Course Title	PRODUCTION TECHNOLOGY FOR FRUIT AND PLANTATION CROPS						
Hours	36, L:1, T:0, P:2						
Credits	2						
Type	Theory + Practical						
Course Outcomes	On the completion of the course, the student will gain the following knowledge and skills: CO1: To educate about the different forms of classification of fruit crops CO2: To educate about the origin, area, climate, soil, improved varieties and cultivation practices of fruit and plantation crops CO3: To educate about the physiological disorders of fruit crops, palms and plantation crops						
Examination Type	Theory + Practical						
Assessment Tools	Written Quiz	Assignment/Project Work	MSE	MSP	ESE	ESP	ABL/PBL
Weightage	5%	-	-	20%	40%	30%	5%
Examination Mode	Theory + Practical						
Syllabus							
Unit 1 (4 hours)	- 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						CO1
Unit 2 (2 hours)	Production technologies for the cultivation of pineapple, pomegranate, apple, pear, peach, strawberry						CO2

Unit 3 (3 hours)	• Crop production techniques in 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 of Tea, Coffee, Cocoa, Cashewnut, Rubber, Coconut, Arecanut	CO3
Unit 4 (3 hours)	• Crop production techniques in palm 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 of Oil palm and Palmyrah.	CO4
Practical (24 hours)	• Seed propagation. • Scarification and stratification of seeds. • Propagation methods for fruit and plantation crops. • Description and identification of fruit. • Important pests, diseases and physiological disorders of above fruit and plantation crops, • Visit to commercial orchards.	
Reference Books	1. Chadha, K. L. 2020. Hand book of Horticulture. ICAR. 2. Bal, J. S. 2014. Fruit growing. 3rd edition Kalyani Publishers. 3. Saini, G. S. 2020. Modern Production Technology of Plantation Medicinal Aromatic and Spices Crops. Aman Pub. 4. Kumar, N. 2022. Spices, Plantation Crops, Medicinal and Aromatic Plants. CBS Publishers & Distributors Pvt Ltd. 5. Bose T K, Mitra S K and Sanyal D. 2001. Fruits: Tropical and Subtropical (2 volumes) Naya Udyog, Calcutta. 6. Chadha T R. 2001. Textbook of temperate fruits. ICAR, New Delhi.	

Course Code	AEX 211						
Course Title	FUNDAMENTALS OF EXTENSION EDUCATION						
Hours	36, L:1, T:0, P:2						
Credits	2						
Type	Core Course						
Course Outcomes	On the completion of the course, the student will gain the following knowledge and skills: CO1: Understand different concepts of Agricultural Extension Education and follow its principles in planning and implementing extension activities/programs CO2: Interpret the process of community/rural development and important agricultural/rural development programs in India. CO3: Understand the difference between transfer of technology and extension education, communication and diffusion and adoption and innovation- decision process. CO4: Apply the rural leadership, extension administration and ICT application in agricultural extension CO5: Evaluation and monitoring of extension programs.						
Examination Type	Theory + Practical						
Assessment Tools	Written Quiz	Assignment/ Project Work	MSE	MSP	ESE	ESP	ABL/PBL
Weightage	5%	-	-	20%	40%	30%	5%
Examination Mode	Theory + Practical						
Syllabus	Theory						
Unit 1 (4 hours)	- Foundations of Education and Extension Education - 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						CO1
Unit 2 (6 hours)	- Extension Systems, Programs & Innovations - Extension systems in India - Pre-independence era: Sriniketan, Marthandam, Firka Development Scheme, Gurgaon Experiment - Post-independence era: Etawah Pilot Project, Nilokheri Experiment - Reorganised Extension System (T&V system) - Agricultural development programmes by ICAR/Government of India: - IADP, IAAP, HYVP, KVK, IVLP, ORP, ND, NATP, NAIP - Social justice & poverty alleviation programmes: ITDA, IRDP,						CO2

	SGSY, NRLM • Women development programmes: RMK, MSY • New trends in agricultural extension: • Privatization, cyber/e-extension, market-led, farmer-led extension • Expert systems • Innovation & organizations: • Attributes of innovation • DWCRA, Commodity Interest Groups (CIGs), Farmer Producer Groups (FPGs)	
Unit 3 (4 hours)	• Rural & Community Development and Leadership • Rural Development: Concept, meaning and definition • Rural development programmes by Government of India • Community Development: Meaning, definition, concept, principles and philosophy • Rural Leadership: • Concept and definition • Types of rural leaders • Methods of identification of rural leaders	CO4
Unit 4 (6 hours)	• Extension Communication, Administration & Technology Transfer • Extension Administration: Meaning, concept, principles and functions • Monitoring and Evaluation: Concept and definition; evaluation of extension programmes • Transfer of Technology (TOT): Concept and models • Capacity building of extension personnel • Extension Teaching Methods: • Meaning and classification • Individual, group and mass contact methods • ICT Applications in TOT: New and social media, media mix strategies • Communication: • Meaning and definition • Principles, functions, models and barriers • Agricultural Journalism • Diffusion and Adoption of Innovation: • Concept and meaning • Process and stages of adoption • Adopter categories	CO3/CO5
Practical (40 hours)	• To get acquainted with university extension system. • Group discussion-exercise • Identification of rural leaders in village situation • Preparation of extension literature (leaflet, booklet, folder, pamphlet new stories and success stories) • Presentation skills exercise • Micro teaching exercise • Visit to village to understand the problems being encountered by the villagers/farmers • To study organization and functioning of DRD/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.	
Reference Books	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. Sagar Mondal and Ray, G. L., Text Book on Rural Development, Entrepreneurship and Communication Skills, Kalyani Publications. 5. Rathore, O. S. et al. 2012. Handbook of Extension Education, Agrotech Publishing Academy, Udaipur. 6. Dudhani, C.M., Hirevenkatgoudar, L.V., Manjunath, L. Hanchinal, S.N. and Patil, S.L. 2004. Extension Teaching Methods and Communication Technology, UAS, Dharwad. 7. Sandhu, A.S. 1993. Text book on Agricultural Communication: Process and Methods. Oxford and IBH Publishing Pvt. Ltd, New Delhi. 8. Singh, A.K., Lakhan Singh, R. and Roy Burman. 2006. Dimensions of Agricultural Extension. Aman Publishing House, Meerut	

Course Code	APP 211						
Course Title	FUNDAMENTALS OF NEMATOLOGY						
Hours	36, L:1, T:0, P:2						
Credits	2						
Type	Core Course						
Course Outcomes	On the completion of the course, the student will gain the following knowledge and skills: CO1: They will understand the history and general characteristics of plant parasitic nematodes CO2: They will learn about the symptomatology, classification and interaction of nematodes with other microorganisms CO3: They will know the various diseases of crop plants caused by nematodes CO4: They will understand various methods of management of plant parasitic nematodes						
Examination Type	Theory + Practical						
Assessment Tools	Written Quiz	Assignment/Project Work	MSE	MSP	ESE	ESP	ABL/PBL
Weightage	5%	-	-	20%	40%	30%	5%
Examination Mode	Theory + Practical						
Syllabus	Theory						
Unit 1 (3 hours)	• Introduction: History of phytonematology • Habitat and diversity, economic importance of nematodes • General characteristics of plant parasitic nematodes. • Nematode: definition, general morphology and biology						CO1
Unit 2 (3 hours)	• 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						CO2
Unit 3 (3 hours)	• Nematode pests of crops: Rice, wheat, vegetables, pulses, oilseed and fiber crops, citrus and banana, tea, coffee and coconut						CO3

Unit 4 (3 hours)	Different methods of nematode management: Cultural methods, Physical methods, Biological methods, Chemical methods, Plant Quarantine, Plant resistance and INM.	CO4
Practical (24 hours)	- 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: <i>Meloidogyne</i>, <i>Pratylenchus</i>; <i>Heterodera</i>, <i>Tylenchulus</i>, <i>Xiphinema</i>, and <i>Helicotylenchus</i> etc. - Study of symptoms caused by important nematode pests of cereals, vegetables, pulses, plantation crops etc. - Methods of application of nematicides and organic amendments	
Reference Books	- Jonathan E., I. 2010. Nematology: Fundamentals and Applications, New India Publishing Agency, New Delhi. - Bajaj H., K., Kanwar, R., S. and Gupta, D., C. 2011. Handbook of practical Nematology, Scientific Publishers (India), Jodhpur Rajasthan, India. - Walia, R., K. and Bajaj H., K. 2020. Textbook on Introductory Plant Nematology, 5th edition, Indian Council of Agricultural Research, New Delhi. - Swarup, G., Dasgupta, D., R., and Koshy, P., K. 1986. Plant Parasitic Nematodes of India: Problems and Progress, Indian Agricultural Research Institute, New Delhi	

Course Code	AAG212						
Course Title	PRINCIPLES AND PRACTICES OF NATURAL FARMING						
Hours	36, L:1 T:0 P:2						
Credits	2						
Type	Core Course						
Course Outcomes	On the completion of the course, the student will gain the following knowledge and skills: CO1- know about the historical, cultural and ecological foundations of natural farming CO2- understand the principles and methods of natural farming in various agro-ecological zones CO3- explain the ecological, economic, and social benefits of natural farming systems CO4- demonstrate various nutrient, pest and weed management practices under natural farming CO5-explore entrepreneurial strategies for natural farming promotion						
Examination Type	Theory + Practical						
Assessment Tools	Written Quiz	Assignment/Project Work	MSE	MTP	ESE	ETP	ABL/PBL
Weightage	5%		-	20%	40%	30%	5%
Examination Mode	Theory + Practical						
Syllabus							
Unit 1	- Indian heritage of ancient agriculture and history of natural farming - Importance of natural farming in view of climate change, soil health, water use, carbon sequestration, biodiversity conservation, food security, 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						CO1 & CO2
Unit 2	- 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						CO3

	foot prints. • Concept and evaluation of ecosystem services	
Unit 3	• 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	CO4
Unit 4	• 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	CO5
Practical	• Visit of natural farm and chemical-free traditional farms to study the various components and operations of natural farming principles at the farm	CO1
	• Indigenous technical knowledge (ITK) for seed, tillage, water, nutrient, insect-pest, disease and weed management	CO1
	• On-farm inputs preparation methods and protocols	CO2
	• Studies in green manuring in-situ and green leaf manuring	CO2 & CO3
	• 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	CO2
	• Weed Management practices in natural farming	CO4
	• Techniques of Indigenous seed production- storage and marketing	CO4
	• Partial and complete nutrient and financial budgeting in natural farming	CO3 & CO5
	• Evaluation of ecosystem services in natural farming (Crop, Field and System)	CO3
Text and Reference Books	1. Ayachit S M. 2002. Kashyapi Krishi Sukti (A Treatise on Agriculture by Kashyapa). Agri-History 2. Bulletin No.4. Asian Agri-History Foundation. 3. Boeringa R. (Ed.). 1980. Alternative Methods of Agriculture. Elsevier, Amsterdam.	

	4. Dabholkar Shripad A and Prayog Pariwar. 2021. Plenty for All: Natural Farming A to Z Prayog Pariwar Methodology. Mehta Publishing House, 1941, Sadashiv Peth, Madiwale Colony, Pune. 5. Faires Nicole. 2016. The Ultimate Guide to Natural Farming and Sustainable Living: Permaculture for Beginners (Ultimate Guides). Skyhorse Pub Co Inc. 6. FAO. 2018. The 10 elements of agro-ecology: Guiding the transition to sustainable food and agricultural system. FAO. https://www.fao.org/3/i9037en/i9037en.pdf 7. Khurana A and Kumar V. 2020. State of Organic and Natural Farming: Challenges and Possibilities. Centre for Science and Environment, New Delhi. 8. Lindenmayer David B, Macbeth Suzannah M, et al. 2022. Natural Asset Farming: Creating Productive and Biodiverse Farms. CSIRO Publishing. 9. Malhotra R and Babaji S D. 2020. Sanskrit Non Translatable- The importance of Sanskritizing English. Amaryllis, New Delhi India. 10. Nalini S. 1999. Krishi-Parashara (Agriculture by Parashara). Parashara, Brig Sayeed Road, Secunderabad, Telangana: AAHF Classic Bulletin, Asian Agri-History Foundation. 11. 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. 12. Tirado Reyes. 2015. Ecological Farming – The Seven principles of a food system that has people at its heart. Baker, M., Kramb, D. [Eds]. Publ. Greenpeace International. 13. Behera U K. 2013. A Textbook of Farming System. Agrotech Publishing House, Udaipur.	
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SEMESTER IV

Course Code	AHR221						
Course Title	PRODUCTION TECHNOLOGY FOR VEGETABLE AND SPICES						
Hours	36, L:1, T:0, P:2						
Credits	2						
Type	Core Course						
Course Outcomes	On the completion of the course, the student will gain the following knowledge and skills to enable them to be Agri - entrepreneur: CO1: Knowledge about the importance and scientific cultivation of solanaceous and cucurbitaceous vegetable crops CO2: Knowledge about the importance and scientific cultivation of leguminous and Cole crops CO3: Knowledge about the importance and scientific cultivation of bulb and root crops CO4: Knowledge about the importance and scientific cultivation of tuber and leafy vegetable crops						
Examination Type	Theory + Practical						
Assessment Tools	Written Quiz	Assignment/Project Work	MSE	MSP	ESE	ESP	ABL/PBL
Weightage	5%	-	-	20%	40%	30%	5%
Examination Mode	Theory + Practical						
Syllabus							
Unit 1	- Importance of vegetables & spices in human nutrition and national economy - Classification of vegetables, types of vegetable gardens, - Origin, area, climate, soil, improved varieties and cultivation practices such as time of sowing, sowing, transplanting techniques, plant spacing, fertilizer requirements, irrigation, weed management, harvesting and yield, physiological disorders of Solanaceous and Cucurbitaceous vegetables						CO1
Unit 2	Origin, area, climate, soil, improved varieties and cultivation practices such as time of sowing, sowing, transplanting techniques, plant spacing, fertilizer requirements, irrigation, weed management, harvesting and yield, physiological disorders of Okra, French bean, Peas; Cole crops						CO2
Unit 3	Origin, area, climate, soil, improved varieties and						CO3

	cultivation practices such as time of sowing, sowing, transplanting techniques, plant spacing, fertilizer requirements, irrigation, weed management, harvesting and yield, physiological disorders of bulb and root crops	
Unit 4	• Origin, area, climate, soil, improved varieties and cultivation practices such as time of sowing, sowing, transplanting techniques, plant spacing, fertilizer requirements, irrigation, weed management, harvesting and yield, physiological disorders, of important spices, tuber crops: Potato; leafy vegetables	CO4
Practical (24 hours)	• Identification of vegetables & spice crops and their seeds. • Nursery raising and transplanting • Direct seed sowing • Methods of planting of important vegetable crops • Fertilizers applications. • Harvesting & preparation for market. • Economics of vegetables and spices cultivation.	
Reference Books	1. Dhaliwal M.S. 2008. Handbook of vegetable crops, Kalyani Publishers, Ludhiana. 2. Das, P.C. 1993. Vegetable crops of India, Kalyani Publishers, Ludhiana. 3. Chauhan, D.V. 1993. Vegetable production in India, S. Ram Prasad and Sons, Agra. 4. Package of Practices for Vegetable crops, P.A.U. Publications Ludhiana, Corresponding year. 5. Purthy, J.S. 1996. Spices and Condiments. National Book Trust.	

Course Code	AEC221						
Course Title	PRINCIPLES OF AGRICULTURAL ECONOMICS AND FARM MANAGEMENT.						
Hours	24, L:2, T:0, P:0						
Credits	2						
Type	Core						
Course Outcomes	On the completion of the course, the student will gain the following knowledge and skills: CO1: To familiarize with various concepts and scope of agricultural economics CO2: To understand the importance and concept of farm management CO3: To understand the various aspects of natural resources CO4: To enable the student to develop on judicious use of resources for optimum production.						
Examination Type	Theory						
Assessment Tools	Written Quiz	Assignment/Project Work	MSE	MTP	ESE	ETP	ABL/PBL
Weightage	20%	10%	25%	-	40%	-	5%
Examination Mode	Theory						
Syllabus							
Unit 1	• 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.						CO1
Unit 2	• 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.						CO2

Unit 3	• 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	CO3
Unit 4	• 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.	CO4
Reference Books	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	

Course Code	AAG221						
Course Title	CROP PRODUCTION TECHNOLOGY-I (<i>Rabi</i> Crops)						
Hours	60, L:1, T:0, P:4						
Credits	3						
Type	Core Course						
Course Outcomes	On the completion of the course, the student will gain the following knowledge and skills: CO1- About various requirements and cultivation practices for rabi cereal crops CO2- About various requirements and cultivation practices for rabi oilseed crops CO3- About various requirements and cultivation practices for rabi medicinal and aromatic crops CO4- About various requirements and cultivation practices for rabi forage crops						
Examination Type	Theory + Practical						
Assessment Tools	Written Quiz	Assignment/ Project Work	MSE	MSP	ESE	ESP	ABL/PBL
Weightage	5%	-	-	25%	30%	35%	5%
Examination Mode	Theory + Practical						
Syllabus							
Unit 1	Origin, geographical distribution, economic importance, soil and climatic requirements, varieties, cultural practices and yield of <i>Rabi</i> crops: Cereals- wheat and barley, Pulses- chickpea, lentil, peas, <i>Rabi</i> redgram and, rajmash.						CO1
Unit 2	Origin, geographical distribution, economic importance, soil and climatic requirements, varieties, cultural practices and yield of <i>Rabi</i> crops: Oilseeds- rapeseed, mustard, sunflower, safflower; and linseed.						CO2
Unit 3	Origin, geographical distribution, economic importance, soil and climatic requirements, varieties, cultural practices and yield of <i>Rabi</i> crops: Sugar crops-sugarcane and sugar beet. Medicinal and aromatic crops- mentha, lemon grass and citronella						CO3

Unit 4	• Origin, geographical distribution, economic importance, soil and climatic requirements, varieties, cultural practices and yield of <i>Rabi</i> crops: Forage crops –barseem, lucerne and oat; potato, quinoa, tobacco.	CO4
Practical	• Sowing methods of wheat and sugarcane, • Identification of weeds in <i>rabi</i> season crops, • Study of morphological characteristics of <i>rabi</i> crops, • Study of yield contributing characters of <i>rabi</i> season crops, yield and juice quality analysis of sugarcane, • Study of important agronomic experiments of <i>rabi</i> crops at experimental farms. • Study of <i>rabi</i> forage experiments, oil extraction of medicinal crops, • Visit to research stations of related crops	
Text and Reference Books	1. 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. Text book 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.	

Course Code	AEG221						
Course Title	Farm machinery and Power						
Hours	36, L:1, T:0, P:2						
Credits	2						
Type	Skill Enhancement						
Course Outcomes	On the completion of the course, the student will gain the following knowledge and skills: CO1: To understand the status farm machinery in India. To study the working principle of IC engines. CO2: To understand the working principles of air cleaner, water cooling system, lubrication system, power transmission system. CO3: To understand the working principles of primary and secondary tillage implements. CO4: To understand the working of sowing implements, inter-culture implements, plant protection equipment, harvesting implements and threshing implements.						
Examination Type	Theory + Practical						
Assessment Tools	Written Quiz	Assignment/Project Work	MSE	MTP	ESE	ETP	ABL/PBL
Weightage	5%	-	-	20%	40%	30%	5%
Examination Mode	Theory + Practical						
Syllabus	Theory						
Unit 1 (8 hours)	- To understand the status farm machinery in India. To study the working principle of IC engines: - To study IC engines. To study SI, CI engines. To study two stroke and four stroke engines. Comparison between two stroke and four stroke engines.						CO1
Unit 2 (8 hours)	- To understand the working principles of air cleaner, water cooling system, lubrication system, power transmission system: - To study air cleaner system of tractor, cooling system, lubrication system, transmission and steering system of tractor.						CO2
Unit 3 (8 hours)	- To understand the working principles of primary and secondary tillage implements: - To study tractor types, cost analysis of tractor operation, primary tillage implements like MB plough, disc plough, land leveller, bund maker.						CO3

Unit 4 (8 hours)	- To understand the working of sowing implements, inter-culture implements, plant protection equipment, harvesting implements and threshing implements: ➤ To study seed cum fertilizer drill, calibration of seed cum fertilizer drill, to study knap sack sprayer and power sprayers, to study inter-culture implements, to study harvesters, combine harvesters and threshing implements.	CO4
Reference Books	1. Jain S C and Rai C R. 2019. Farm tractor maintenance and repair, Standard Publishers, 1705-B, Nai Sarak. Delhi-110006. 2. Singh Surendra. 2007. Farm machinery- Principles and applications. ICAR, New Delhi. 3. Sahay Jagdiswar. 2020. Elements of agricultural engineering. Standard publishers and distributors Pvt Ltd.	

Course Code	ASS 221						
Course Title	PROBLEMATIC SOILS AND THEIR MANAGEMENT						
Hours	36, L:1, T:0, P:2						
Credits	2						
Type	Core Course						
Course Outcomes	On the completion of the course, the student will gain the following knowledge and skills: CO1: They will understand the basic concepts, types and causes of soil problems such as salinity, alkalinity, acidity, waterlogging and others. CO2: They will identify various categories of problematic soils based on physical, chemical and biological properties. CO3: They will understand the impact of problematic soils on crop growth and soil health. CO4: They will learn to apply appropriate soil and water management practices and recommend suitable amendments, cropping systems, and land-use strategies for the effective reclamation and sustainable use of problematic soils.						
Examination Type	Theory						
Assessment Tools	Written Quiz	Assignment/Project Work	MSE	MSP	ESE	ESP	ABL/PBL
Weightage	5%	-	-	20%	40%	30%	5%
Examination Mode	Theory						
Syllabus							
Unit 1 (3 hours)	• Soil quality and health • Distribution of wasteland and problem soils in India • Categorization of problem soils based on physical, chemical, and biological properties						CO1
Unit 2 (3 hours)	• Acid soils, saline soils, sodic soils, acid sulphate soils • Eroded and compacted soils • Polluted soils • Contaminated soils (pesticide contamination, heavy metal contamination) • Mined soils (coal mined, oil mined) • Riverine soils • Waterlogged soils						CO2
Unit 3 (3 hours)	• Impact of acid, saline, sodic and polluted soils on crop productivity and soil fertility						CO3

	- Consequences of irrigation water quality (standards and utilization of saline water in agriculture) - Effects of soil contamination (pesticides, heavy metals, industrial pollutants) on crops and environment - Effects of soil erosion, compaction and mining on soil health	
Unit 4 (3 hours)	- Reclamation and management of acid, saline, sodic, acid sulphate, eroded, compacted, polluted, contaminated, mined, riverine, and waterlogged soils - Irrigation water management – quality standards, use of saline water in agriculture - Use of Remote Sensing and GIS in diagnosis and management of problem soils - Multipurpose tree (MPT) species and bioremediation of soils through MPTs - Land capability classification and land suitability classification	CO4
Practical (24 hours)	- 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.	
Reference Books	- Agarwal, R.R., Yadav, J.S.P. and Gupta, R.N. (1982). Saline Alkali soils of India, ICAR, AGROBIOS (India). - Buckman, H. O., & Brady, N. C. (1960). The nature and properties of soils: A college text of edaphology (6th ed.). Macmillan. - Cirsan J. Paul., 1985. Principles of Remote Sensing. Longman, New York - Indian Society of Soil Science., 2002. Fundamentals of Soil Science. IARI, New Delhi. - Osman, Khan Towhid., 2018. Management of Soil Problems. Springer publication - Srivastava, V. C., 2002. Management of Problem Soils - Principles and Practices New Delhi	

Course Code	APB221						
Course Title	BASICS OF PLANT BREEDING						
Hours	48, L:2, T:0, P:2						
Credits	4						
Type	Core Course						
Course Outcomes	On the completion of the course, the student will gain the following knowledge and skills: CO1: They will be well versed basic concepts of plant breeding CO2: They will learn about various methods of breeding of self- pollinated crops CO3: They will learn about various methods of breeding of cross- pollinated crops CO4: They will learn about various techniques for breeding new varieties, which are higher yielding, resistant to biotic and abiotic stresses for ensuring food security.						
Examination Type	Theory + Practical						
Assessment Tools	Written Quiz	Assignment/ Project Work	MSE	MSP	ESE	ESP	ABL/ PBL
Weightage	5%	-	25%	-	40%	25%	5%
Examination Mode	Theory + Practical						
Syllabus							
Unit 1 (15 hours)	• 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						CO1
Unit 2 (12 hours)	• 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						CO2

Unit 3 (12 hours)	• 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.	CO3
Unit 4 (9 hours)	• 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.	CO4
Practical (24 hours)	• Plant Breeder's kit	CO1
	• Study of germplasm of various crops	CO1
	• Study of floral structures of self- pollinated and cross-pollinated crops	CO2
	• Emasculation and hybridization techniques in self and cross pollinated crops	CO2
	• Consequences of inbreeding on genetic structure of resulting populations	CO1
	• Study of malesterility system	CO1
	• Handling of segregating populations	CO3
	• Methods of calculating mean ,range, variance ,standard deviation, heritability	CO2
	• Designs used in plant breeding experiments ,analysis of Randomized Block Design	CO4
	• To work out the mode of pollination in a given crop and extent of natural out-crossing	CO1
	• Prediction of performance of double cross hybrids	CO4
	• Maintenance of breeding records and data collection	CO4
	• Screening tests for biotic and abiotic stresses	CO4
Text & Reference Books	1. Allard, R. W., 2000. Principles of Plant Breeding. John Willey & Sons, New York. 2. Singh, P., 2001. Essentials of Plant Breeding- Principles and Methods. Kalyani Publishing House, New Delhi.	

	3. Singh, B. D., 2015. Plant Breeding: Principles and Methods. Kalyani Publishers, New Delhi. 4. Chahal, G. S. and S. S. Ghosal, 2002. Principles and Procedures of Plant Breeding – Biotechnological and Conventional Approaches. Narosa Publishing House, New Delhi. 5. George Acquaah. 2012. Principles of Plant Genetics and Breeding. Wiley-Blackwell	
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SEMESTER V

Course Code	AEC311						
Course Title	AGRICULTURAL MARKETING AND TRADE						
Hours	48, L:2, T:0, P:2						
Credits	3						
Type	Multi-Disciplinary Course						
Course Outcomes	On the completion of the course, the student will gain the following knowledge and skills: CO1: To understand the fundamentals of agricultural marketing and trade CO2: To analyze the factors influencing supply and demand in agricultural markets CO3: To explore different marketing channels and strategies in agriculture CO4: To examine the role of government policies and regulations in agricultural markets						
Examination Type	Theory + Practical						
Assessment Tools	Written Quiz	Assignment/Project Work	MSE	MSP	ESE	ESP	ABL/PBL
Weightage	5%	-	25%	-	40%	25%	5%
Examination Mode	Theory + Practical						
Syllabus							
Unit 1	• Agricultural Marketing: Concepts and definitions of market, marketing, agricultural marketing, market structure, marketing mix and market segmentation, classification and characteristics of agricultural markets; • Demand, supply and producer's surplus of agri commodities: nature and determinants of demand and supply of farm products, producer's surplus –meaning and its types, marketable and marketed surplus, factors affecting marketable surplus of agri-commodities.						CO1
Unit 2	• Pricing and promotion strategies: pricing considerations and approaches – cost based and competition based pricing; • Market promotion – advertising, personal selling, sales promotion and publicity – meaning, merits and demerits; • Marketing process and functions: Marketing process concentration, dispersion and equalization; exchange functions – buying and selling; physical functions – storage, transport and processing;						CO2

	Facilitating functions – packaging, branding, grading, quality control and labelling (Agmark)	
Unit 3	- Market functionaries and marketing channels: Types and importance of agencies involved in agricultural marketing; - Meaning and definition of marketing channel; number of channel levels; marketing channels for different farm products; - Integration, efficiency, costs and price spread: Meaning, definition and types of market integration; - Marketing efficiency; - Marketing costs, margins and price spread; factors affecting cost of marketing; - Reasons for higher marketing costs of farm commodities; ways of reducing marketing costs; - Role of Govt. in agricultural marketing: Public sector institutions- CWC, SWC, FCI, CACP and DMI - their objectives and functions; cooperative marketing in India	CO3
Unit 4	- Risk in marketing: Types of risk in marketing; speculation and hedging; - An overview of futures trading; Agricultural prices and policy; - Meaning and functions of price; administered prices; - Need for innovations in agricultural price policy; - Trade: Concept of International Trade and its need, theories of absolute and comparative advantage. - Present status and prospects of international trade in agri-commodities; - WTO; - Agreement on Agriculture (AoA) and its implications on Indian agriculture; - IPR; - Role of government in agricultural marketing; - Role of APMC and its relevance in the present day context.	CO4

Practical	• Plotting and study of demand and supply curves and calculation of elasticities; • Study of relationship between market arrivals and prices of some selected commodities; • Computation of marketable and marketed surplus of important commodities; • Study of price behaviour overtime for some selected commodities; • Construction of index numbers; • Visit to a local market to study various marketing functions performed by different agencies, identification of marketing channels for selected commodity, collection of data regarding marketing costs, margins and Price spread and presentation of report in the class; • Visit to market institutions–NAFED, SWC, CWC, cooperative marketing society, etc. to study their organization and functioning. • Application of principles of comparative advantage of international trade.	
Reference Books	1. Acharya, S. S. and Agarwal, N. L. 2006. Agricultural Marketing in India, Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi. 2. Chinna, S. S. 2005. Agricultural Economics and Indian Agriculture. Kalyani Pub, NDelhi. 3. Dominic Salvatore, Kohls Richard, L. and Uhl Josheph, N. 2002. Marketing of Agricultural Products, Prentice-Hall of India Private Ltd., New Delhi. 4. Kotler and Armstrong, 2005. Principles of Marketing, Pearson Prentice-Hall. 5. Lekhi, R. K. and Joginder Singh. 2006. Agricultural Economics. Kalyani Publishers, Delhi. 6. Memoria, C. B., Joshi, R. L. and Mulla, N. I. 2003. Principles and Practice of Marketing in India, Kitab Mahal, New Delhi. 7. Pandey Mukesh and Tewari, Deepali. 2004. Rural and Agricultural Marketing, International Book Distributing Co. Ltd, New Delhi. 8. Sharma, R. 2005. Export Management, Laxmi Narain Agarwal, Agra.	

Course Code	AAG311						
Course Title	INTRODUCTION TO AGRO-METEOROLOGY						
Hours	36, L:1, T:0, P:2						
Credits	2						
Type	Core Course						
Course Outcomes	On the completion of the course, the student will gain the following knowledge and skills: CO1: Students will be able to understand basic concepts of agricultural meteorology and atmospheric weather variables. CO2: Students will be able to understand solar radiation, temperature, thermal time and earth's energy balance. CO3: Students will be able to understand atmospheric humidity, precipitation, clouds and monsoon. CO4: Students will be able to understand weather hazards, weather forecasting and climate change impacts on agriculture.						
Examination Type	Theory + Practical						
Assessment Tools	Written Quiz	Assignment/Project Work	MSE	MSP	ESE	ESP	ABL/PBL
Weightage	5%	-	-	20%	40%	30%	5%
Examination Mode	Theory + Practical						
Syllabus	Theory						
Unit 1 (3hours)	- Meaning and scope of agricultural meteorology; Earth atmosphere: its composition, extent and structure; - Atmospheric weather variables; Atmospheric pressure, its variation with height; - Wind, types of wind, daily and seasonal variation of wind speed, cyclone, anticyclone, land breeze and sea breeze;						CO1
Unit 2 (3 hours)	- Nature and properties of solar radiation, solar constant, depletion of solar radiation, short wave, long wave and thermal radiation, net radiation, albedo; - Atmospheric temperature, temperature inversion, lapse rate, daily and seasonal variations of temperature, vertical profile of temperature, - Application of Thermal time concept and Crop/ Pest weather calendar; Energy balance of earth;						CO2

Unit 3 (3 hours)	• Atmospheric humidity, concept of saturation, vapour pressure, process of condensation, formation of dew, fog, mist, frost, cloud; • Precipitation, process of precipitation, types of precipitation such as rain, snow, sleet, and hail, cloud formation and classification; • Artificial rain making. • Monsoon-mechanism and importance in Indian agriculture;	CO3
Unit 4 (3 hours)	• Weather hazards - drought, floods, frost, tropical cyclones and extreme weather conditions such as heat-wave and cold-wave; Agriculture and weather relations; • Modifications of crop microclimate, climatic normal for crop and livestock production. Weather forecasting-types of weather forecast and their uses. • Climate change, climatic variability, global warming, causes of climate change and its impact on regional and national agriculture.	CO4
Practical (24 hours)	• Visit of Agrometeorological Observatory, site selection of observatory, exposure of instruments and weather data recording, • Measurement of total, shortwave and long wave radiation, and its estimation using Planck's intensity law, • Measurement of albedo and sunshine duration, computation of Radiation Intensity using BSS; • Measurement of maximum and minimum air temperatures, its tabulation, trend and variation analysis, • Measurement of soil temperature and computation of soil heat flux, • Determination of vapor pressure and relative humidity, Determination of dew point temperature, • Measurement of atmospheric pressure and analysis of atmospheric conditions, • Measurement of wind speed and wind direction, preparation of wind rows, • Measurement, tabulation and analysis of rain, • Measurement of open pan evaporation and evapotranspiration, • Computation of PET and AET, • Use of synoptic charts, weather reports, weather forecasting-types and methods, crop weather calendar.	
Reference Books	1. Agricultural Meteorology by G.S.L.H.V. Prasado Rao 2. Fundamentals of Agrometeorology and Climate Change by G. S. Mahi and P. K. Kingra 3. Introduction to Agrometeorology and Climate Change by Alok Kumar Patra	

	4. Introduction to Agrometeorology by H. S. Mavi 5. Text Book of Agricultural Meteorology by M. C. Varshneya and P.B. Pillai	
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Course Code	ABS311						
Course Title	ESSENTIALS OF PLANT BIOCHEMISTRY						
Hours	48, L:2, T:0, P:2						
Credits	3						
Type							
Course Outcomes	On the completion of the course, the student will gain the following knowledge and skills: CO1: Understand basic biochemical principles, cell structure, and biomolecules. CO2: Explain roles of vitamins and enzyme properties, kinetics, and functions CO3: Describe metabolic energy generation and major catabolic pathways. CO4: Understand biosynthetic pathways, metabolic regulation, and secondary metabolites.						
Examination Type	Theory + Practical						
Assessment Tools	Written Quiz	Assignment/Project Work	MSE	MSP	ESE	ESP	ABL/PBL
Weightage	5%	-	25%	-	40%	25%	5%
Examination Mode	Theory + Practical						
Syllabus	Theory						
Unit 1 (6 hours)	• Introduction and importance, Properties of water, pH and buffer, • Plant cell and its components. • Bio-molecules - Structure, classification, properties and function of carbohydrates, amino acids, proteins, lipids and nucleic acids.						CO1
Unit 2 (6 hours)	• Vitamins – physiological and metabolic role. • Enzymes: General properties; Classification; • Mechanism of action; • Michaelis and Menten and Line Weaver Burk equation and plots; • Introduction to allosteric enzymes, use of enzymes.						CO2
Unit 3 (6 hours)	• Metabolic energy and its generation - Metabolism - Basic concepts, • Glycolysis, • Citric acid Cycle, • Pentose phosphate pathway, oxidative phosphorylation, • Fatty acid oxidation.						CO3

Unit 4 (6 hours)	• Biosynthetic Pathways – Photosynthesis, • Gluconeogenesis, • Nitrogen fixation, • Fatty acid and starch formation. • Regulation of metabolic pathways. • Secondary metabolites, Terpenoids, Alkaloids, Phenolic and their applications in food and pharmaceutical industries.	CO4
Practical (24 hours)	• Preparation of standard solutions and reagents and determination of pH • Qualitative tests of carbohydrates • Qualitative tests of amino acids • Quantitative estimation of soluble sugars and starch • Estimation of protein by Kjeldhal method and Lowry's method • Preparation of mineral solution from ash • Estimation of fat by Soxhlet method • Determination of acid value and saponification value • Determination of iodine number • Estimation of ascorbic acid • Qualitative tests of secondary metabolites • Quantitative tests of secondary metabolites	
Reference Books	1. Nelson and Cox. 2008. Lehninger Principles of Biochemistry. Fourth/Fifth edition. Freeman 2. Conn, Stumpf, Bruening and Doi. 2006. Outlines of Biochemistry. Fifth Edition. Wiley 3. Horton, Moran, Rawn, Scrimgeour, Perry. 2011. Principles of Biochemistry. Fifth Edition. 1. Pearson/Prentice Hall (Can be downloaded) 4. Heldt. 2005. Plant Biochemistry. Elsevier (Can be downloaded) 2. 5. Goodwin and Mercer. 2005. Introduction to Plant Biochemistry. 2nd edition. CBS.	

Course Code	AEN311						
Course Title	PEST MANAGEMENT IN CROPS AND STORED GRAINS						
Hours	48, L:2, T:0, P:2						
Credits	3						
Type	Core Course						
Course Outcomes	On the completion of the course, the student will gain the following knowledge and skills: CO1: Identify major insect pests and describe their classification, biology, bionomics, host range, nature of damage and management in different crops. CO2: Explain major household and stored-grain pests, their nature of damage, factors affecting storage losses, and appropriate methods of storage and pest management. CO3: Apply the principles of Integrated Pest Management (IPM) and understand the classification, toxicity and formulations of insecticides for effective pest control. CO4: Explain the role of biorational pesticides, repellents, antifeedants, drones and Artificial Intelligence (AI) in sustainable and modern pest management.						
Examination Type	Theory + Practical						
Assessment Tools	Written Quiz	Assignment/ Project Work	MSE	MSP	ESE	ESP	ABL/PBL
Weightage	5%	-	25%	-	40%	25%	5%
Examination Mode	Theory+ Practical						
Syllabus	Theory						
Unit 1	- General description on nature and type of damage by different arthropod pests; - Scientific name, order, family, host range, distribution, biology and bionomics						CO1
Unit 2	Nature of damage and management of major insect pests of various field crops, vegetable crops, fruit crops, plantation crops, ornamental crops, spices and condiments.						CO2
Unit 3	- Structural entomology and important household pests, their nature of damage and management. - Factors affecting loss of stored grains. Insect pests, mites, rodents, birds and microorganisms associated with stored grains and their management. - Storage structures and methods of grain storage and fundamental principles of stored grains management. - Management of non-insect pest of mites, snails and slugs						CO3

Unit 4	• Concept of IPM, Practices, scope and limitations of IPM. • Classification of insecticides, toxicity of insecticides and formulations of insecticides, • Biorational pesticides including insect repellents, antifeedants, • Use of drones and AI in pest management	CO4
Practical	• Field visit and identification of major insect pests and their damage symptoms. • Collection, mounting, labeling and preservation of major insect pests. • Collection and identification of insect-damaged plant samples. • Preparation of herbarium specimens showing insect damage symptoms. • Monitoring of pest incidence and population in situ. • Study of management strategies for major insect pests of different crops. • Study of structural entomology and identification of important insect structures. • Identification, damage assessment and management of major household pests. • Study of storage structures and methods of grain storage. • Study and demonstration of spraying techniques for selected field and horticultural crops. • Identification and management of major vertebrate pests. • Mass multiplication and application of Nuclear Polyhedrosis Virus (NPV). • Mass multiplication and application of entomopathogenic nematodes.	
Reference Books	1. Dhaliwal G S and Arora Ramesh. 2022. Integrated pest Management Concept and Approaches. (3rd Edn.). Kalyani Publishers. 2. Srivastava K P and Dhaliwal G S. 2010. A Textbook of Applied Entomology. Kalyani Publishers. 3. Athwal A S. 1986. Agricultural Pests of India and South-East Asia. Kalyani Publishers. 4. Prakash Rambhat Thalya and Ravi Chandra. 2022. Essentials of Pest Management: Key Information on Pest Identification and its Management. Wings Publication. 5. Sen Somnath and Mohd. Sameer. 2021. A Textbook of Insect Pest and Disease Management. S. Kataria & Sons publish. 6. Tarique Hassan Askary. 2022. Pest Management: Methods, Applications and Challenges. Nova Science Publishers.	

Course Code	APP 311						
Course Title	DISEASES OF FIELD AND HORTICULTURAL CROPS AND THEIR MANAGEMENT						
Hours	48, L:2, T:0, P:2						
Credits	3						
Type	Core Course						
Course Outcomes	On the completion of the course, the student will gain the following knowledge and skills: CO1: They will understand the symptoms, etiology, disease cycle, epidemiology and management of major diseases of the following field crops CO2: They will understand the symptoms, etiology, disease cycle, epidemiology and management of major diseases of the following cash crops CO3: They will understand the symptoms, etiology, disease cycle, epidemiology and management of major diseases of the following horticultural/ plantation crops CO4: They will understand the symptoms, etiology, disease cycle, epidemiology and management of major diseases of the following vegetable and ornamental crops						
Examination Type	Theory + Practical						
Assessment Tools	Written Quiz	Assignment/Project Work	MSE	MSP	ESE	ESP	ABL/PBL
Weightage	5%		25%	-	40%	25%	5%
Examination Mode	Theory + Practical						
Syllabus							
Unit 1 (8 hours)	Symptoms, etiology, disease cycle, epidemiology and management of major diseases of the following field crops: - Field crops- Rice (blast, brown spot, sheath blight, false smut, bacterial leaf blight, bacterial leaf streak, tungro, khaira); Wheat (rusts, loose smut, Karnal bunt); Maize (banded leaf and sheath blight, southern and northern blight, downy mildew); Sorghum (smuts, grain mold, anthracnose); Bajra (downy mildew, ergot) and Finger millet (blast, leaf spot) - Grams (Ascochyta blight, wilt, grey mold); Pea (downy mildew, powdery mildew, rust); Black gram and Green gram (web blight, Cercospora leaf spot, anthracnose, yellow mosaic)						CO1

Unit 2 (6 hours)	Symptoms, etiology, disease cycle, epidemiology and management of major diseases of the following cash crops: • Groundnut (early and late leaf spots, rust, wilt); Soybean (rhizoctonia blight, bacterial spot, seed and seedling rot, mosaic) • Mustard (Alternaria blight, white rust, downy mildew, sclerotinia stem rot) and Sunflower (sclerotinia stem rot, Alternaria blight) • Sugarcane (red rot, smut, grassy shoot, ratoon stunting, Pokah-Boeng) • Cotton (anthracnose, vascular wilts, black arm)	CO2
Unit 3 (7 hours)	Symptoms, etiology, disease cycle, epidemiology and management of major diseases of the following horticultural/ plantation crops: • Citrus (canker, gummosis) and Guava (wilt, anthracnose); Banana (sigatoka, Panama wilt, bacterial wilt, bunchy top); Papaya (foot rot, leaf curl, mosaic); Pomegranate (bacterial blight); Apple (scab, powdery mildew, fire blight, crown gall); Peach (leaf curl); Grapevine (downy mildew, powdery mildew, anthracnose); Strawberry (leaf spot); Mango (anthracnose, malformation, bacterial blight, powdery mildew) • Coconut (bud rot, Ganoderma wilt) • Tea (blister blight) and Coffee (rust)	CO3
Unit 4 (7 hours)	Symptoms, etiology, disease cycle, epidemiology and management of major diseases of the following vegetable and ornamental crops: • Potato (early and late blight, black scurf, leaf roll, mosaic) and Tomato (damping off, wilt, early and late blight, leaf curl, mosaic); Brinjal (Phomopsis blight and fruit rot, Sclerotinia blight) and Chilli (anthracnose and fruit rot, wilt, leaf curl); Cucurbits (powdery and downy mildew, wilts) and Cruciferous vegetables (Alternaria leaf spot, black rot, cauliflower mosaic); Beans (anthracnose, bacterial blight) and Okra (yellow vein mosaic); Ginger (soft rot), Turmeric (leaf Spot) and Coriander (stem gall) • Rose (dieback, powdery mildew, black leaf spot) and Marigold (botrytis blight, leaf spots)	CO4
Practical (16 hours)	• To study the symptoms of Blast and brown spot of rice, sheath blight and bacterial leaf blight of rice, • To study the symptoms of downy mildew and powdery of cucurbits, rhizoctonia and Cercospora leaf spot of green gram / black gram • To study the symptoms of Alternaria blight and downy mildew of mustard • To study the symptoms of early blight of late blight of potato and tomato • To study the symptoms of Phomopsis blight of brinjal,	

	• To study the symptoms of powdery mildew and rust of pea • To study the symptoms of stem gall of coriander, anthracnose and fruit rot of chilli • To study the symptoms of Taphrina leaf spot of turmeric, red rot of sugarcane, • Field visit for the diagnosis of field problems, Collection and preservation of plant diseased specimens for herbarium	
Reference Books	1. Agrios, G.N. 1998. Plant Pathology, 3rd Edition Academic Press, New York 2. Singh, R., S. 2012. Introduction to Plant Pathology, 3rd Edition, Oxford and IBH, New Delhi 3. Mehrotra, R.S. 2018. Fundamentals of Plant Pathology, McGraw Hill, New Delhi 4. Kharayat, B., S. 2024. Diseases of Field and Horticultural Crops and their Management Vol- II, PHI Learning Pvt. Ltd., New Delhi 5. Srivastava, J., N. and Singh, A., K. 2022. Diseases of Horticultural Crops, Apple academic press, Burlington 6. Rangaswami, G. 2011. Diseases of crop plants in India 4th edition, PHI publishers, New Delhi 7. Chaube, H., S. 2023. Crop diseases and their management, PHI learning Pvt. Ltd.	

Course Code	APB 311						
Course Title	CROP IMPROVEMENT-I (KHARIF CROPS)						
Hours	36 L:1, T:0, P:2						
Credits	2						
Type	Core Course						
Course Outcomes	On the completion of the course, the student will gain the following knowledge and skills: CO1: To learn about origin and distribution of <i>kharif</i> crops CO2: To gain knowledge about Self-pollinated and cross pollinated <i>kharif</i> crops CO3: To design breeding objectives and methods of major <i>kharif</i> crops CO4: To understand the concept of hybrid seed production of major <i>kharif</i> crops						
Examination Type	Theory + Practical						
Assessment Tools	Written Quiz	Assignment/Project Work	MSE	MSP	ESE	ESP	ABL/PBL
Weightage	5%	-	-	20%	40%	30%	5%
Examination Mode	Theory + Practical						
Syllabus							
Unit 1 (10 hours)	- Centres of origin - Distribution of species - Wild relatives in different cereals; pulses; oilseeds; fibres; fodders and cash crops vegetable and other horticultural crops of <i>kharif</i> season						CO1
Unit 2 (10 hours)	- Plant genetic resources, its utilization and conservation - Study of genetics of qualitative and quantitative characters						CO2
Unit 3 (8 hours)	- Important concepts of breeding self-pollinated, cross-pollinated and vegetatively propagated crops - Major breeding objectives and procedures including conventional and modern innovative approaches for development of hybrids and varieties for yield, adaptability, stability, abiotic and biotic stress tolerance and quality (physical, chemical, nutritional)						CO3
Unit 4 (8 hours)	- Hybrid seed production technology in maize, rice, sorghum, pearl millet and pigeon pea etc - Ideotype concept, climate resilient crop varieties for future						CO4
Practical (24 hours)							CO1

	• Floral biology, emasculation and hybridization techniques in different crop species, viz. rice, jute, maize, sorghum, pearl millet, ragi, pigeonpea, urdbean, mungbean, soybean, groundnut, sesame, castor, cotton, cowpea, tobacco, brinjal, okra and cucurbitaceous crops.	CO1
	• Maintenance breeding of different <i>kharif</i> crops.	CO2
	• Handling of germplasm and segregating populations by different methods like pedigree, bulk and single seed decent method	CO2
	• Study of field techniques for seed production and hybrid seed production in <i>kharif</i> crops;	CO4
	• Consequences of inbreeding on genetic structure of resulting populations	CO3
	• Study of male sterility system,	CO1
	• Handling of segregating populations	
	• Methods of calculating mean, range, variance, standard deviation, heritability	CO1,2,3,4
	• Estimation of heterosis, inbreeding depression and heritability	CO1
	• Layout of field experiments	CO1,2,3,4
	• Study of quality characters, donor parents for different characters;	CO2
	• Visit to seed production plots;	CO1,2,3,4
	• Visit to AICRP breeding plots of different crops.	CO1,2,3,4
Reference Books	1. Breeding Field Crops-I by V. L. Chopra 2. Genetic Improvement of Field Crops by C. B. Singh and D. Khare 3. Genetics and Breeding of Pulse Crops by D. P. Singh 4. Vegetable Breeding– Principles and Practices by Hari Har Ram 5. Breeding Field Crops by D. A. Sleper and J. M. Poehlman 6. Plant Breeding– Theory and Practice by S .K. Gupta 7. Breeding Asian Field Crops by J. M. Poehlman and D. N. Barthakur 8. Practical manuals on Crop Improvement-I (<i>Kharif</i> Crops) by Rajendra Kumar Yadav	

Course Code	AEG311						
Course Title	RENEWABLE ENERGY IN AGRICULTURE AND ALLIED SECTOR						
Hours	36, L:1, T:0, P:2						
Credits	2						
Course Outcomes	On the completion of the course, the student will gain the following knowledge and skills: CO1- About energy sources and their contribution in agriculture sector CO2- About biogas, bio-alcohol, bio-diesel and bio-oil CO3- About solar energy and its application CO4- About solar gadgets, wind energy and their application						
Examination Type	Theory + Practical						
Assessment Tools	Written Quiz	Assignment/Project Work	MSE	MSP	ESE	ESP	ABL/PBL
Weightage	5%	-	-	20%	40%	30%	5%
Examination Mode	Theory + Practical						
Syllabus							
Unit1:(3 hours)	Classification of energy sources, contribution of these of sources in agricultural sector, familiarization with biomass utilization for bio-fuel production and their application.						CO1
Unit2:(3 hours)	Familiarization with types of biogas plants and gasifier's bio-gas, bio-alcohol, bio-diesel and bio-oil production and their utilization as bio-energy resource.						CO2
Unit3:(3 hours)	Introduction to solar energy, collection and their application, familiarization with solar energy gadgets: solar cooker, solar water heater, application of solar energy.						CO3
Unit4:(3 hours)	Solar drying, solar pond, solar distillation, solar photovoltaic system and their application, introduction to wind energy and their application.						CO4
Practical (24hours)	- Familiarization with renewable energy gadgets. - To study bio-gas plants, - To study gasifiers, - To study the production process of bio-diesel, - To study briquetting machine, - To study the production process of bio-fuels. - Familiarization with different solar energy gadgets. - To study solar photovoltaic system: solar light, solar pumping, and solar fencing. - To study solar cooker, to study solar drying system.						

	To study solar distillation and solar pond.	
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Reference Books	1. Tiwari, G. N. and Mishra Rajeev Kumar. 2012. Advanced Renewable Energy Sources. Royal Society of Chemistry 2. Kishore V. V. N. 2008. Renewable Energy Engineering and Technology. Principles and Practice. Teri, India. 3. Solanki C. S. 2011. Solar Photovoltaic- Fundamentals, Technologies and Applications. PHI Learning Pvt. Ltd. 4. Sukhatme S. and Nayak J. 2008. Solar Energy: Principles of Thermal Collection and Storage. (3rd Edn.). Tata McGraw-Hill.	
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Course Code	AHR311						
Course Title	ORNAMENTAL CROPS, MEDICINAL AND AROMATIC PLANTS AND LANDSCAPING						
Hours	48, L:2, T:0, P:2						
Credits	3						
Type	Theory+ Practical						
Course Outcomes	On the completion of the course, the student will gain the following knowledge and skills: CO1: Understand the importance, scope, origin, climate, soil requirements and production technology of major ornamental crops and medicinal and aromatic plants. CO2: Acquire knowledge about the cultivation practices of important flower crops such as rose, gerbera, gladiolus, chrysanthemum, tuberose, lilium, carnation, marigold and jasmine. CO3: Understand the principles, components and applications of landscaping including the use of trees, shrubs, climbers and garden features. CO4: Gain practical knowledge about post-harvest management, processing and value addition of ornamental crops and medicinal and aromatic plants.						
Examination Type	Theory+ Practical						
Assessment Tools	Written Quiz	Assignment/Project Work	MSE	MSP	ESE	ESP	ABL/PBL
Weightage	5%	-	25%	-	40%	25%	5%
Examination Mode	Theory+ Practical						
Syllabus							
Unit 1 (6 hours)	- Importance and scope of ornamental crops, medicinal and aromatic plants and landscaping. - Origin, climate and soil requirements of ornamental crops and MAPs. - Production technology of medicinal and aromatic plants such as Ashwagandha, Costus, Isabgol, Mint, Aloe, Ocimum, Coleus, Glory lily and Periwinkle.						CO1
Unit 2 (6 hours)	- Production technology of aromatic plants including lemongrass, citronella, vetiver and palmarosa. - Production technology of important cut flowers such as rose, gerbera and orchids. - Production technology of gladiolus, tuberose and lilium. Production technology of chrysanthemum and carnation.						CO2

	Package of practices for loose flowers such as marigold and jasmine under open conditions.	
Unit 3 (6 hours)	- Principles of landscaping: unity, balance, proportion, harmony and rhythm. - Landscape uses of trees, shrubs and climbers. - Concept of home landscaping. - Important Garden components such as carpet bedding, topiary, bonsai, lawn, flower arrangement, herbaceous border, hedge and edge.	CO3
Unit 4 (6 hours)	- Physiological disorders of commercial flowers. - Post-harvest management of cut flowers. - Preparation and use of flower preservatives for extending vase life. - Processing and value addition of ornamental crops and medicinal and aromatic plants.	CO4
Practical (20 hours)	- Identification of medicinal and aromatic plants and ornamental plants (trees, shrubs, climbers, seasonal flowers and house plants) - Propagation of MAPs, nursery bed preparation and sowing of seasonal flower seeds - Propagation of ornamental plants by terminal/herbaceous cuttings, propagation of anthurium, orchids and bougainvillea - Planting of gerbera suckers and gladiolus corms - Establishment and maintenance of lawn - Preparation of flower preservatives and study of vase life extension - Training and pruning of ornamental plants - Raising of hedge and edge - Planning and layout of garden	
Reference Books	- Floriculture in India by G.S. Randhawa and Mukopadhyay - Introduction to spices, plantation crops, medicinal and aromatic plants by N. Kumar, Abdul Khadder, P. Rangaswamy, I. Irulappam - Textbook of floriculture and landscaping by Anil K. Singh and Anjana Sisodia - Commercial flowers (Vol 1 and 2) by T.K. Bose.	

SEMESTER VI

Course Code	ABS321						
Course Title	FUNDAMENTALS OF AGRICULTURAL BIOTECHNOLOGY						
Hours	48, L:2, T:0, P:2						
Credits	3						
Type	Core Course						
Course Outcomes	On the completion of the course, the student will gain the following knowledge and skills: CO1: Fundamentals of plant tissue culture and its applications. CO2: Advanced tissue culture techniques and crop improvement strategies. CO3: Basics of molecular biology and gene expression. CO4: Genetic engineering, molecular markers and crop improvement.						
Examination Type	Theory + Practical						
Assessment Tools	Written Quiz	Assignment/Project Work	MSE	MSP	ESE	ESP	ABL/PBL
Weightage	5%	-	25%	-	40%	25%	5%
Examination Mode	Theory + Practical						
Syllabus							
Unit 1 (6 hours)	• Introduction to Plant Tissue Culture and Genetic Engineering: History; • Cellular totipotency and cyto-differentiation; • Callus culture, Single-cell/suspension culture and their applications; • Organogenesis and somatic embryogenesis; • Somaclonal variation and its use in crop improvement;						CO1
Unit 2 (6 hours)	• Embryo rescue technique and its significance in hybrid development; • <i>In vitro</i> fertilization, ovule culture and its significance in hybrid development; • Protoplast isolation, culture and regeneration; • Somatic hybridization (somatic hybrids and cybrids) and its application in crop improvement; • Anther and pollen culture for haploid production; • Development of disease-free (virus free) plants through apical meristem culture; • Micropropagation technique for the generation of quality planting material;						CO2

	• Synthetic seeds and its applications; • National certification and Quality management of TC plants-secondary metabolite production- in vitro germplasm conservation.	
Unit 3 (6 hours)	• Introduction to Molecular Biology: DNA structure, structure and function; • DNA replication, transcription and translation, RNA, types and function; • Structure of prokaryotic and eukaryotic gene; • Central dogma of life - DNA replication, transcription, genetic codes translation and protein synthesis; • Lac Operon concept - Nucleic acid hybridization; • Polymerase chain reaction- DNA sequencing – Sanger method; • PCR and its applications.	CO3
Unit 4 (6 hours)	• Introduction to recombinant DNA technology: DNA modifying enzymes and vectors; • Plant genetic transformation – physical (Gene gun method), chemical (PEG mediated) and Agrobacterium-mediated gene transfer methods; • Transgenic and its importance in crop improvement with successful stories; • Biosafety. • Introduction to various molecular markers: RFLP, RAPD, SSR, SNP etc.; • Marker-assisted breeding in crop improvement	CO4
Practical (24 hours)	• Introduction to Plant Tissue Culture Laboratory and Good Laboratory Practices • Media preparation, sterilization, and glassware sterilization • Micropropagation technique • Callus induction and culture • Anther culture • Apical meristem culture (virus-free plant production) • Preparation of synthetic seeds • Isolation of plasmid DNA and its quantification • Agarose gel electrophoresis and visualization of plasmid DNA • Restriction digestion of plasmid DNA and agarose gel electrophoresis • Isolation of plant genomic DNA, PCR amplification, and gel electrophoresis of amplified DNA • Visit to tissue culture units / biotech labs	
Reference Books	• Bhojwani SS. 1983. Plant Tissue Culture: Theory and Practice. Elsevier. • Singh BD. 2007. Biotechnology: Expanding Horizon. Kalyani	

	• Christou P and Klee H. 2004. Handbook of Plant Biotechnology. John Wiley & Sons. • Lewin B. 2008. Gene IX. Peterson Publications/ Panima. W.H. Freeman & Co. • 5. Primrose SB. 2001. Molecular Biotechnology. Panima.	
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Course Code	APB321						
Course Title	Crop Improvement (<i>Rabi</i> Crops) – II						
Hours	36, L:1, T:0, P:2						
Credits	2						
Type	Core Course						
Course Outcomes	On the completion of the course, the student will gain the following knowledge and skills: CO1: To learn about origin and distribution of <i>Rabi</i> crops CO2: To gain knowledge about Self-pollinated and cross pollinated <i>Rabi</i> crops CO3: To design breeding objectives of major <i>Rabi</i> crops CO4: To understand the concept of hybrid seed production of major <i>Rabi</i> crops						
Examination Type	Theory + Practical						
Assessment Tools	Written Quiz	Assignment/Project Work	MSE	MSP	ESE	ESP	ABL/PBL
Weightage	5%	-	-	20%	40%	30%	5%
Examination Mode	Theory + Practical						
Syllabus							
Unit 1 (10 hours)	Centres of origin, distribution of species, wild relatives in different cereals; pulses; oilseeds; fibres; fodders and cash crops; vegetable and other horticultural crops;						CO1
Unit 2 (8 hours)	- Plant genetic resources, its utilization and conservation, - Study of genetics of qualitative and quantitative characters;						CO2
Unit 3 (8 hours)	- Important concepts of breeding self-pollinated, cross-pollinated and vegetatively propagated crops. - Major breeding objectives and procedures including conventional and modern innovative approaches for development of hybrids and varieties for yield, adaptability, stability, abiotic and biotic stress tolerance and quality (physical, chemical, nutritional)						CO3
Unit 4 (10 hours)	- Hybrid seed production technology in wheat, oat, chickpea, rapeseed and mustard etc. - Ideotype concept, climate resilient crop varieties for future.						CO4
Practical							CO1

	Floral biology, emasculation and hybridization techniques in different crop species, viz. wheat, oat, rapeseed and mustard, pulses, potato, sugarcane, tomato, chilli, onion	CO1
	Study of field techniques for seed production and hybrid seed production in <i>rabi</i> crops	CO2
	Estimation of heterosis, inbreeding depression and heritability	CO2
	Study of quality characters	CO3
	Donor parents for different characters	CO4
	Visit to AICRP breeding plots of different crops	CO1, 2, 3, 4
Reference Books	- Breeding Field Crops-I by V. L. Chopra - Genetic Improvement of Field Crops by C. B. Singh and D. Khare - Genetics and Breeding of Pulse Crops by D. P. Singh - Vegetable Breeding– Principles and Practices by Hari Har Ram - Breeding Field Crops by D. A. Sleper and J. M. Poehlman - Plant Breeding– Theory and Practice by S.K. Gupta - Breeding Asian Field Crops by J. M. Poehlman and D. N. Barthakur - Practical Manual on Crop Improvement I(<i>Rabi</i> crops) by Rajendra Kumar Yadav	

Course Code	AAG321						
Course Title	DRYLAND AGRICULTURE/RAINFED AGRICULTURE AND WATERSHED MANAGEMENT						
Hours	36, L:1, T:0, P:2						
Credits	2						
Type	Core Course						
Course Outcomes	On the completion of the course, the student will gain the following knowledge and skills: CO1: understand the fundamentals of rainfed agriculture, including its history, types, and the role of watersheds in India's agricultural landscape. CO2: analyze the challenges and opportunities in rainfed agriculture, and develop strategies for improving productivity in these regions. CO3: gain knowledge on drought impacts, crop adaptation strategies, and effective water harvesting techniques to mitigate the effects of water deficit on crop growth. CO4: learn the principles and practices of watershed management, and efficient water utilization to enhance sustainability in rainfed areas.						
Examination Type	Theory + Practical						
Assessment Tools	Written Quiz	Assignment/Project Work	MSE	MTP	ESE	ETP	ABL/PBL
Weightage	5%	-	-	20%	40%	30%	5%
Examination Mode	Theory + Practical						
Syllabus							
Unit 1	- Dryland/ Rainfed agriculture: Introduction, types and characteristics; History of dry land/ rainfed agriculture in India - Problems and prospects of dry land / rainfed agriculture in India - Soil and climatic conditions prevalent in dry land/ rainfed areas						CO1
Unit 2	- Length of Growing Period (LGP) and Soil Moisture Availability (SMA) and its impact on crop and cropping system - Soil and water conservation techniques - Drought: types, effect of water deficit on physio- morphological characteristics of the plants						CO2
Unit 3	Crop adaptation and mitigation to drought; Water harvesting: importance, its techniques						CO3

	• Efficient utilization of water through soil and crop management practices. • Crops and cropping systems in dry land/rainfed areas; Management of crops in dry land/rainfed areas	
Unit 4	• Contingent crop planning for aberrant weather conditions; Concept, history, objective, principles and components of watershed management, factors affecting watershed management • Long term rainfall analysis in relation to simple mathematical models and forecasting the weather abnormalities • Alternate land use system location; regional and crop specific dryland principles and practices for profitable and sustainable dryland farming and allied enterprises.	CO4
Practical	• Studies on climate classification, • Studies on rainfall pattern in rainfed areas of the country and pattern of onset and withdrawal of monsoons. • Calculation of Length of Growing Period (LGP) and Soil Moisture Availability (SMA) • Studies on cropping pattern of different rainfed areas in the country and demarcation of rainfed area on map of India. • Interpretation of meteorological data and scheduling of supplemental irrigation on the basis of evapo-transpiration demand of crops. • Critical analysis of rainfall and possible drought period in the country. Effective rainfall and its calculation. • Studies on cultural practices for mitigating moisture stress including mechanical and agronomic measure. • Soil moisture determination under different land situations, Importance of seed priming to mitigate drought. • Assessment of meteorological drought. Characterization and delineation of model watershed. • Seed treatment, viz., seed hardening and seed priming techniques for all the agricultural crops. • Field demonstration on soil and moisture conservation measures. Field demonstration on construction of water harvesting structures • Visit to rainfed research station/watershed.	
Text and Reference Books	1. A.K. Srivastava and P.K. Tyagi. 2011. Practical Agricultural Meteorology. New Delhi Publishing Agency, New Delhi. 2. D. Lenka. 2006. Climate, Weather and Crops in India. Kalyani Publishers, New Delhi. 3. G.S.L.H.V. Prasad Rao.2008. Agricultural Meteorology. Prentice Hall of India Pvt. Ltd., New Delhi. 4. H.S. Mavi and Graeme J. Tupper. 2005. Agrometeorology – Principles and applications of climate studies in agriculture. International Book Publishing Co., Lucknow. 5. H.S. Mavi.1994. Introduction to Agrometeorology. Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi.	

	6. H.V. Nanjappa and B. K. Ramachandrappa.2007. Manual on Practical Agricultural Meteorology. Agrobios India. Jodhpur. 7. S.R. Reddy. 1999. Principles of Agronomy. Kalyani Publishers, New Delhi. 8. T. Yellamanda Reddy and G.H. Sankara Reddi. 2010. Principles of Agronomy. Kalyani Publishers, New Delhi	
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Course Code	APP 321						
Course Title	AGRICULTURAL MICROBIOLOGY AND PHYTO-REMEDIATION						
Hours	36, L:1, T:0, P:2						
Credits	2						
Type	Core Course						
Course Outcomes	On the completion of the course, the student will gain the following knowledge and skills: CO1: They will understand the history, scope and significance of agricultural microbiology CO2: They will understand the bacterial structure and reproduction CO3: They will know the different fields of microbiology CO4: They will learn about bioremediation, biological control and biopesticides						
Examination Type	Theory + Practical						
Assessment Tools	Written Quiz	Assignment/Project Work	MSE	MSP	ESE	ESP	ABL/PBL
Weightage	5%	-	-	20%	40%	30%	5%
Examination Mode	Theory + Practical						
Syllabus							
Unit 1 (2 hours)	• Introduction to Microbiology: Definition, applied areas of Microbiology and Importance of Microbiology. • History of Microbiology: Discovery of microorganisms, spontaneous generation theory, • Germ theory of diseases, immunization, fermentation, and origin of life.						CO1
Unit 2 (3 hours)	• Bacteria: cell structure, chemoautotrophy, photo autotrophy, growth. • Bacterial genetics: genetic recombination- transformation, conjugation and transduction, genetic engineering.						CO2
Unit 3 (4 hours)	• Soil Microbiology: Nutrient mineralization and transformation, • Air Microbiology: phyllosphere microflora, phylloplane microflora, microflora of floral parts etc. • Food Microbiology: microbial spoilage and principles of food preservations, food poisoning. • Water Microbiology: Types of water, water microorganisms, and microbial analysis of water e.g. coliform test, Purification of water. • Industrial Microbiology: microbial products, biodegradation, biogas production, biodegradable plastics etc.						CO3

Unit 4 (3 hours)	• Biological control: Microbial biopesticides for plant disease management • Concepts of rhizosphere microbiology- Rhizo deposits - biochemical nature, release mechanism in rhizosphere, function, Carbon flow in rhizosphere, Rhizosphere microbiome- residents and their roles. • Potential of plant growth promoting rhizobacteria (PGPR) and endophytes on soil health and sustainability. • Bioremediation of polluted soils using microbial mediators. Phytoremediation of polluted soils.	CO4
Practical (24 hours)	• Study of the microscope; Acquaintance with laboratory material and equipment • Microscopic observation of different groups of microorganisms: moulds (Fungi) • Direct staining of bacteria by crystal violet; Negative or indirect staining of bacteria by nigrosin; Gram staining of bacteria • Study of phyllosphere and rhizosphere microflora; Measurement of microorganisms • Preparation of culture media; Isolation and purification of rhizospheric microbes • Isolation and purification of N-fixers • Isolation and purification of Nutrient solubilizers • Isolation and purification of Endophytes.	
Reference Books	1. Dubey R., C. 2010. A textbook of microbiology, S Chand, New Delhi 2. Hogg, S. 2013. Essential microbiology: A1-5, Wiley-Blackwell, New Jersey 3. Heritage, J. 2007. Introductory Microbiology, Cambridge publishers, New Delhi 4. Willey and Joanne, M. 2011. Prescott Microbiology: R-8 8th edition, McGraw Hill, Singapore	

Course Code	AEC322						
Course Title	AGRICULTURAL FINANCE AND COOPERATION						
Hours	36, L:1, T:0, P:2						
Credits	2						
Type	Core						
Course Outcomes	On the completion of the course, the student will gain the following knowledge and skills: CO1: To Familiarization with various concepts of agricultural finance CO2: To understand the importance and need of finance in agriculture CO3: To understand the various aspects of lending and priority sector credit CO4: To enable the students to develop credit management and financial risk management techniques						
Examination Type	Theory + Practical						
Assessment Tools	Written Quiz	Assignment/Project Work	MSE	MSP	ESE	ESP	ABL/PBL
Weightage	5%	-	-	20%	40%	30%	5%
Examination Mode	Theory + Practical						
Syllabus							
Unit 1	• Agricultural Finance-meaning, scope and significance, credit needs and its role in Indian agriculture. • Agricultural credit: meaning, definition, need ,classification. • Credit analysis: 4 R's, and 3C's of credits. • Sources of agricultural finance: institutional and non-institutional sources, commercial banks, social control and nationalization of commercial banks.						CO1
Unit 2	• Microfinancing including KCC. • Lead bank scheme, RRBs, Scale of finance and unit cost. • An introduction to higher financing institutions–RBI, NABARD, ADB, IMF, world bank, Insurance and Credit Guarantee Corporation of India. • Cost of credit. • Recent development in agricultural credit. • Preparation and analysis of financial statements – Balance						CO2

	Sheet and Income Statement.	
Unit 3	- Basic guidelines for preparation of project reports. Bank norms – SWOT analysis. - Agricultural Cooperation – Meaning, brief history of cooperative development in India, objectives, principles of cooperation, significance of cooperatives in Indian agriculture.	CO3
Unit 4	- Agricultural Cooperation in India-credit, marketing, consumer and multi-purpose cooperatives, farmers' service cooperative societies, processing cooperatives, farming cooperatives, cooperative warehousing; - Role of ICA, NCUI, NCDC, NAFED. 3 R's, 5C's and 7P's of credit. - Crop insurance: its scope, significance and limitations and the potential of the newly launched 'Pradhan Mantri Fasal Bima Yojana'(Prime Minister's Crop Insurance Scheme). - Successful cooperative systems in Gujarat (AMUL), Tamil Nadu (Aavin), Karnataka (Nandini), Maharashtra and Punjab. - Optimum allocation of limited amount of capital among different enterprise. - Analysis of progress and performance of cooperatives using published data. - Analysis of progress and performance of commercial banks and RRBs using published data. - Visit to a commercial bank, cooperative bank and cooperative society to acquire first-hand knowledge of their management, schemes and procedures. - Estimation of credit requirement of farm business – A case study. - Preparation and analysis of balance sheet – A case study. Preparation and analysis of income statement – A case study. - Appraisal of a loan proposal – A case study. - Techno-economic parameters for preparation of projects. - Preparation of Bankable projects for various agricultural products and its value-added products. - Seminar on selected topics. - Different types of repayment plans.	CO4
Practical		
Reference Books	- Gittinger, J.P.1982. Economic Analysis of Agricultural Projects. The Johns Hopkins Univ. Press. - Reddy, S.S. and Ram., P.R. 1996.Agricultural Finance and Management. Oxford & IBH.	

Course Code	AGS 322						
Course Title	FUNDAMENTALS OF SEED SCIENCE AND TECHNOLOGY						
Hours	36, L:1, T:0, P:2						
Credits	2						
Type	Core Course						
Course Outcomes	On the completion of the course, the student will gain the following knowledge and skills: CO1: They will be well versed with basic and fundamental knowledge on principles and practices seed science and technology CO2: They will understand the concept of scientific seed production and post-harvest quality management CO3: They will learn the principles of seed storage and seed certification CO4: They will learn about seed legislations in India						
Examination Type	Theory + Practical						
Assessment Tools	Written Quiz 0	Assignment/Project Work	MSE	MSP	ESE	ESP	ABL/PBL
Weightage	5%	-	25%	-	40%	25%	5%
Examination Mode	Theory + Practical						
Syllabus							
Unit 1 (10 hours)	• Introduction to seed technology, definition and importance • Seed quality -definition, characters of good quality seed • Causes of deterioration of varietal purity and assessment of genetic purity • Different classes of seed						CO1
Unit 2 (10 hours)	• Foundation and certified seed production of important cereals, pulses and oilseeds • Field inspection, importance and procedures • Post-harvest seed quality management • Seed processing procedures • Seed drying • Seed treatment, its importance • Method of application and seed packing						CO2

Unit 3 (8 hours)	- Seed storage-general principles - Stages and factors affecting seed longevity during storage - Seed health management during storage - Seed Certification and legislation	CO3
Unit 4 (8 hours)	- Seed Act and Seed Act enforcement - Duty and powers of seed inspector - Offences and penalties - Seeds Control Order 1983 - Basics of seed quality testing - New Seed Bill 2019 - Seed quality enhancement techniques.	CO4
Practical (24 hours)	Methods of seed sampling	CO1
	Physical purity testing	CO1
	Moisture determination and Germination test	CO1
	Seed and seedling vigour test	CO1
	Genetic purity test: Grow out test	CO1
	Concept of field inspection	CO2
	Seed health testing using blotter and agar plate method	CO2
	Visit to seed production farms, seed testing laboratories and seed processing plant	CO1,2,3
Reference Books	- Agarwal, R. L. 1995. Seed Technology (2nd edition). Oxford & IBH Publishing Co. Pvt. Ltd. New Delhi, India. - Khare, D. and Bhale, M.S. 2019. Seed Technology (2nd revised & enlarged edn), Scientific Publishers, ISBN: 978-81-72338-84-8, New Pali Road, P.O.Box 91, Jodhpur, India - Vanangamudi, K. 2014. Seed Technology (An illustrated book), New India Publishing Agency, New Delhi, India. - Bhojwani, S. S. and Bhatnagar, S. P. 1999. The Embryology of Angiosperm. Vikas Publ - McDonald, M. B. Jr and Copeland, L. O. 1997. Seed Production: Principles and Practices. Chapman & Hall. - Tunwar, N.S. and Singh, S.N. 1988. Indian Minimum Seed Certification Standards. CSCB, Ministry of Agriculture, New Delhi.	

Course Code	AAG322						
Course Title	INTRODUCTORY AGROFORESTRY						
Hours	36, L:1, T:0, P:2						
Credits	2						
Type	Theory + Practical						
Course Outcomes	On the completion of the course, the student will gain the following knowledge and skills: CO1: Learn about forestry, its importance, various terms related to forestry CO2: Identify the various forest tree species CO3: Understand the methods of multiplication of forest trees and also factors those affects the growth of trees CO4: They will also know the economic importance of forests						
Examination Type	Theory + Practical						
Assessment Tools	Written Quiz	Assignment/Project Work	MSE	MSP	ESE	ESP	ABL/PBL
Weightage	5%	-	-	20%	40%	30%	5%
Examination Mode	Theory + Practical						
Syllabus							
Unit 1 (8 hours)	- Agro-forestry: Definition and scope of Agroforestry system, - Type of Agroforestry system, potential of Agroforestry in India - Prevailing agroforestry system in India; - MPTS- definition, role of MPTS in agroforestry system, its selection for different agroforestry system						CO1
Unit 2 (8 hours)	- MPTS of India, - Ecological aspects of Agroforestry system, tree -crop interaction – competition, nutrient recycling - Traditional Agroforestry as a viable choice to conserve Agro biodiversity of India. - Agro-forestry system; Role of agroforestry in soil and water conservation - Windbreak; Shelterbelt– definition, objectives; - Socio- economic aspects of Agroforestry system; Design and Diagnostic						CO2

Unit 3 (8 hours)	• Study of agroforestry system; • Silviculture: Definition and scope, • Propagation of tree species, regeneration by seed, coppice, root suckers, transplanting, stump, branch cutting, rhizomes; • Nursery bed preparation and management • Cultural practices for bare root and seedling, field handling of nursery stock; • Management of tree species	CO3
Unit 4 (8 hours)	• Silviculture of important tree species, choice of species-site factors, root, crown and bole characteristics, phenology, nutritional and water requirement, ground operation, tending, harvesting utility etc. • Horticulture and forage crops-based agroforestry models developed by ICAR-IGFRI; • Agroforestry models developed by Indian council of Forestry Research and Education.	CO4
Practical (20 hours)	• Identification of tree species in agro-forestry, • Study of tree growth measurement, Study of environmental parameters affecting AF System, • Plant propagation methods, Pre-sowing seed treatment • Preparation of nursery bed exercise, practicing propagation techniques for trees • Afforestation method • Practical training, pruning, coppicing, pollarding etc. • Planting pattern and designs for plantation, natural and artificial regeneration, • Design and diagnostic survey of agro- forestry system, • Evaluation of agro-forestry system in different agro climatic zones, • Exposure Visit to prevailing agroforestry systems of the state and related important institutions, • Virtual visit of agroforestry models developed by ICAR-IGFRI, ICFRE.	
Reference Books	1. Nair, P.K. R. 1993. An Introduction to Agroforestry, Kluar Academic Publisher 2. Chundawat D. S. and S.K. Gautham. 2017. Textbook of Agroforestry. Oxford & IBH Publishing, (ISBN: 9788120408326) 3. Parthiban, K. T, N. Krishnakumar and M. Karthick. 2018. Introduction to Forestry, Scientific Publisher, Jodhpur. 350p 4. Divya M. P. and K. T. Parthiban. 2005. A Textbook on Social Forestry and Agroforestry. Satish Serial Publishing, New Delhi (ISBN: 9384988952)	

SEMESTER VII**ELECTIVE COURSES**

Course Code	AAG411						
Course Title	MANAGEMENT OF NATURAL RESOURCES						
Hours	60, L:3, T:0, P:2						
Credits	4						
Type	Elective Course						
Course Outcomes	On the completion of the course, the student will gain the following knowledge and skills: CO1: Students will be able to understand the concept, classification and management dimensions of natural resources. CO2: Students will be able to analyze land and water resource issues and their management strategies. CO3: Students will be able to understand energy resources and different approaches to natural resource management. CO4: Students will be able to understand soil erosion processes and apply soil and water conservation measures.						
Examination Type	Theory + Practical						
Assessment Tools	Written Quiz	Assignment/Project Work	MSE	MSP	ESE	ESP	ABL/PBL
Weightage	5%	-	25%		40%	25%	5%
Examination Mode	Theory + Practical						
Syllabus							
Unit 1 (7 hours)	• Introduction to Natural Resource Bases: Concept of resource, classification of natural resources. • Factors influencing resource availability, distribution and uses. • Interrelationships among different types of natural resources. Concern on Productivity issues. • Ecological, social and economic dimensions of resource management.						CO1
Unit 2 (10 hours)	• Land resources: Land as a resource. • Dry land, land use classification, land degradation, man induced landslides, soil erosion and desertification. • Landscape impact analysis, wetland ecology and management, wetland ecology and management.						CO2

	Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems. Water ecology and management	
Unit 3 (7 hours)	- Energy resources: Growing energy needs, renewable and non-renewable energy sources, use of alternate energy sources. - Resource Management Paradigms: Resource management the evolution and history of resource management paradigms. - Resource conflicts: Resource extraction, access and control system. - Approaches in Resource Management: Ecological approach; economic approach; ethnological approach; implications of the approaches; integrated resource management strategies.	CO3
Unit 4 (12 hours)	- Introduction to soil and water conservation and causes of soil erosion, - Definition and agents of soil erosion, water erosion - Forms of water erosion, Gully classification and control measures. - Soil loss estimation by universal soil loss equation - Soil loss measurement techniques. - Principles of erosion control - Introduction to contouring, strip cropping, Contour bund - Graded bund and bench terracing. - Wind erosion - Mechanics of wind erosion, types of soil movement - Principles of wind erosion control and its control measures, Water harvesting techniques - Lining of ponds, tanks and canal systems.	CO4
Practical (24 hours)	- Identifying natural resources and their utility. - Practicing survey - Principles and educating to use pacing technique for measurement. - Area calculations through chain survey - GPS demo for tracking and area measurement. - Estimation of soil loss and calculation of erosion index. - Leveling concepts and its practical utility in agriculture. - Preparation of contour maps. - Concept of vegetative water ways and design of grassed water ways. - Wind erosion and estimation process.	

	• Different irrigation pumps and their constructional differences. • Farm pond construction and its design aspects. • Visit to a nearby farm pond, • Visit to an erosion-affected site. • Exposure to strip cropping/contour bunding.	
Reference Books	1. Sustainable Natural Resource Management by Danill R. Lynch. 2. Management of Natural Resource for Sustainable Development, by Vijay Singh Rathor and B S Rathor, Daya Publishing House. 3. Managing Natural Resources: Focus on Land and Water. Ed. Harikesh N. Mishra. PHI, Learning, 496p. 4. Management of Resources for Sustainable Development: Sushma Goel. The Orient Blackswan 284p. 5. Natural Resources: Their Conservation and Management by Arvindrai Upadhyay. Aspiration Academy, 320p. 6. Natural Resource Management for Growth Development and Sustainability by Vasudeva Srishti Pal. Today & Tomorrows Printers and Publishers, 336p.	

Course Code	AAG412						
Course Title	CLIMATE RESILIENT AGRICULTURE						
Hours	60, L:3, T:0, P:2						
Credits	4						
Type	Elective Course						
Course Outcomes	On the completion of the course, the student will gain the following knowledge and skills: CO1: Students will be able to understand climate change impacts on agriculture and evaluate vulnerability, adaptation and mitigation strategies. CO2: Students will be able to assess climate vulnerability and weather risks in agriculture using geospatial tools and techniques. CO3: Students will be able to understand climate resilient agriculture and related technologies for sustainable crop production. CO4: Students will be able to understand climate resilient pest management and breeding strategies for sustainable agriculture.						
Examination Type	Theory + Practical						
Assessment Tools	Written Quiz	Assignment/Project Work	MSE	MSP	ESE	ESP	ABL/PBL
Weightage	5%	0%	25%		40%	25%	5%
Examination Mode	Theory + Practical						
Syllabus							
Unit 1 (6 hours)	- Climate change and impacts of climate change on agriculture and food security - Crop productivity under different climate change scenarios including extreme events such as drought, flood, pest and disease outbreak etc. - Basics of adaption and mitigation in the agricultural sectors - Analyzing and assessing climate vulnerability to identify vulnerable sectors and possible adaptation options in agriculture - Assessing biophysical and socio- economic impacts on agricultural sector						CO1
Unit 2 (6 hours)	- Risk assessment strategies, preparedness for weather and climate risks in agriculture - Application of geospatial tools and techniques for sustainable agriculture - Climate resilient agriculture (CRA) – Concept, scope and importance with special reference to India						CO2

	• Climate resilient technologies for enhancing crop productivity and sustainability • Role of weather and climatic information, agro-advisories, ICTs and simulation models	
Unit 3 (6 hours)	• Climate resilient agronomic practices – crop/cultivar selection, crop diversification/crop mixtures • Water management practices – Rain water harvesting, micro-irrigation, deficit irrigation and drainage management • Organic/natural farming, integrated farming systems (IFS) • Site specific nutrient management (SSNM), conservation agriculture technologies to build soil organic carbon	CO3
Unit 4 (6 hours)	• Harnessing microbial biodiversity, biomass recycling; Use of renewable sources of energy • Climate resilient pest-disease management strategies • Breeding strategies for development of climate change resilient crops and varieties • Development of biotic and abiotic stress tolerant/resistant cultivars under changed climatic scenarios including extreme weather events	CO4
Practical (24 hours)	• Acquaintance with meteorological instruments including Automatic Weather Station (AWS), Statistical techniques to study trends of climatic parameters. • Analysis of extreme weather events using non-parametric statistical tests. • Building climate change scenarios under different futuristic emission of GHGs. • Designing strategies to mitigate the effect of climate change using climate resilient crops/cultivars. • Climate resilient technologies and manipulation of cropping patterns. • Acquaintance with ICTs for effective dissemination of local weather information and agro- advisories. • Analysis of carbon sequestration potential of different agro-ecosystems. • Designing a climate-smart village model considering availability of resources. • Awareness programme on climate change and climate resilient agriculture among farming communities.	
Reference Books	1. Climate Resilient Animal Agriculture by GSLHV Prasada Rao. New India Publishing Agency. 2. Climate Resilient Agriculture Adaptation and Mitigation Strategies by Bhan Manish. New India Publishing Agency 3. Climate-Smart Agriculture Sourcebook. FAO (2013).	

	4. Implications for Climate Smart Agriculture by Wahid Hasan, Sachin G. Mundhe, Abdul Majid Ansari and Shivani Kumari. Biotech Books, 357p. 5. Climate Resilient Agriculture, Adaptation and Mitigation Strategies by Manish Bhan. New India Publishing Agency, 294p. 6. Climate Change and Agriculture Over India by Prasad Rao. PHI Learning, 352p. 7. Climate Smart Agriculture for Sustaining Crop Productivity and Improving Livelihood Security by Prakash M. Satish Serial Publishing House.178p.	
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Course Code	AAG413						
Course Title	GEOINFORMATICS AND REMOTE SENSING, PRECISION FARMING						
Hours	60 L:3, T:0, P:2						
Credits	4						
Type	Elective Course						
Course Outcomes	On the completion of the course, the student will gain the following knowledge and skills: CO1: Students will be able to understand the principles, processes and applications of remote sensing in agriculture. CO2: Students will be able to understand geoinformatics and data sharing and expert systems along with their applications in agriculture. CO3: Students will be able to understand the fundamental concepts of probability and statistics used in agricultural data analysis. CO4: Students will be able to explain the basic concepts and applications of machine learning, deep learning and advanced sensing technologies in agriculture						
Examination Type	Theory + Practical						
Assessment Tools	Written Quiz	Assignment/Project Work	MSE	MSP	ESE	ESP	ABL/PBL
Weightage	5%		25%		40%	25%	5%
Examination Mode	Theory + Practical						
Syllabus							
Unit 1 (10 hours)	• Introduction and history of remote sensing; • Sources and principles of remote sensing, • Propagation of radiations in atmosphere; Interaction with matter • Application of remote sensing techniques land use soil surveys, crop stress and yield forecasting, • Advantages and disadvantages of remote sensing, Remote sensing institutes in India,						CO1
Unit 2 (8 hours)	• Basic concepts about geoinformatics. • Data sharing; Expert System: Introduction to expert system, Characteristics and features of expert system, • Applications of Expert System, Importance of Expert system, Rule based system architecture;						CO2

	• Software Agents; Impact of Block chain and it's concepts.	
Unit 3 (8 hours)	• Probability and Statistics: Bayes Theorem, correlation and Covariance, • Continuous Random variables and probability distribution function, • Various forms of distributions, central limit theorem.	CO3
Unit 4 (10 hours)	• Basics of Machine Learning: Random Forest, SVM, ensemble methods; • Basics of Deep learning: various model architectures and it's training aspects; • Hyperspectral and Thermal Remote Sensing; • Proximal Soil and Crop Sensors.	CO4
Practical (24 hours)	• Familiarization with different remote sensing equipments and data products • Interpretation of aerial photographs and satellite data for mapping of land resources • Global Positioning System (GPS) • Basics of Geographic Information System (GIS), • Georeferencing of topo sheets • Digital soil mapping with different variables, • Basics of multivariate data analytics • Principal component analysis and regression applications • Clustering methods and geo-statistics are essential in agricultural studies	
Reference Books	1. Data Analytics in Bioinformatics: A Machine Learning Perspective. Editor (s): Rabinarayan Satpathy, Tanupriya Choudhury, Suneeta Satpathy and Sachi Nandan. 2. Machine Learning Approaches to Bioinformatics by Zheng Rong Yang. 3. Text Book of Remote Sensing and Geographical Information Systems by M. Anji Reddy. 4. Precision Agriculture Technologies for Food Security and Sustainability by A. El-Kader, M Sherine, M El-Basioni and M Basma. 5. Principles and Theory of Geoinformatics by P.K. Garg. Khanna Publishers. 296p 6. Advances in Geoinformatics Remote Sensing and GIS by Bhunia, Gouri Sankar, Uday Chatterjee and Gopal Krishna Panda. BIO GREEN 7. Artificial Intelligence: Machine Learning, Deep Learning, and Automation Processes by John Adamssen. Efalon	

	Acies. 8. Remote Sensing and Image Interpretation, 6th edn (WSE) Paperback – 1 January 2011, Willey Student Edition. 9. Remote Sensing and Geographic Information by A.M. Chandra and S.K. Ghosh. Narosa.	
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Course Code	AHR411						
Course Title	LANDSCAPING						
Hours	60, L:3, T:0, P:2						
Credits	4						
Type	Elective Course						
Course Outcomes	On the completion of the course, the student will gain the following knowledge and skills: CO1: Understand the importance, scope, principles and different styles and types of gardens used in landscaping CO2: Identify and select trees, shrubs, climbers, annuals, palms, ferns, grasses and other ornamental plants for landscape design. CO3: Develop knowledge about planning and landscaping of urban, rural and public spaces such as schools, parks, institutions, hospitals and industrial areas. CO4: Gain practical skills in landscape planning, lawn establishment, bonsai management and application of computer software such as CAD in landscape designing.						
Examination Type	Theory+ Practical						
Assessment Tools	Written Quiz	Assignment/Project Work	MSE	MSP	ESE	ESP	ABL/PBL
Weightage	5%		25%		40%	25%	5%
Examination Mode	Theory+ Practical						
Syllabus							
Unit 1 (8 hours)	- Importance and scope of landscaping, principles of landscaping. Garden styles and types. - Terrace gardening and vertical gardening. - Garden components and garden adornments such as lawns, rockeries, water gardens, walk paths, bridges and other constructed features, gardens for special purposes.						CO1
Unit 2 (8 hours)	- Trees: selection, propagation, planting schemes and canopy management. - Shrubs and herbaceous perennials: selection, propagation, planting schemes and architecture. - Climbers and creepers importance, selection, propagation and planting schemes. - Annuals selection, propagation and planting schemes.						CO2
Unit 3 (8 hours)	- Other garden plants such as palms, ferns, grasses, cacti and succulents. - Pot plants selection, arrangement and management.						CO3

	Bio-aesthetic planning definition, need and planning. Landscaping of urban and rural areas and peri-urban landscaping.	
Unit 4 (6 hours)	• Landscaping of schools, public places, hospitals, playgrounds, airports, industries and institutions. • Bonsai principles and management. • Lawn establishment and maintenance. • Application of CAD software (AutoCAD, ArchiCAD etc.) in landscape design.	CO4
Practical (20 hours)	• Identification of trees, shrubs, annuals and pot plants • Propagation of trees, shrubs and annuals • Care and maintenance of plants • Potting and repotting of plants • Identification of tools and implements used in landscape design • Training and pruning of plants for special effects • Lawn establishment and maintenance • Layout of formal gardens and informal gardens • Layout of special gardens such as sunken garden, terrace garden and rock garden • Designing of conservatory and lathe house • Use of computer software for landscape design • Visit to important gardens, parks and institutes	
Reference Books	1. Textbook of floriculture and landscaping by Anil K. Singh and Anjana Sisodia 2. Principles of Landscape Gardening: Y. Chandrasekhar and Hemla Naik B. 2020. ICAR. 3. Introductory Ornamental Horticulture and Landscape Gardening: Rajaneesh Singh and Brijendra Kumar Singh. 2020, Bio-Green Books. 4. Principles of Landscape Architecture: Pragnyashree Mishra and Bhimasen Naik. 2022. New India Publishing Agency. 5. Landscape Gardening: Sudhir Pradhan. 2018. Scientific Publishers India.	

Course Code	APB411						
Course Title	COMMERCIAL SEED PRODUCTION						
Hours	60, L:3, T:0, P:2						
Credits	4						
Type	Elective Course						
Course Outcomes	On the completion of the course, the student will gain the following knowledge and skills: CO1: They will be well versed the principles of seed production and their importance in commercial seed production CO2: They will understand the concept of seed processing, storage and seed certification CO3: They will learn the concept of seed marketing CO4: They will learn about the role of biotechnology in seed industry						
Examination Type	Theory + Practical						
Assessment Tools	Written Quiz	Assignment/Project Work	MSE	MSP	ESE	ESP	ABL/ PBL
Weightage	5%	-	25%	-	40%	25%	5%
Examination Mode	Theory + Practical						
Syllabus							
Unit 1 (15 hours)	- General Principles of Seed Production - Raising the seed crop, Introduction, Procurement of a class of Improved seeds - Reporting to Monitoring or certification Agency - Principles and practices of selection of area and agronomic requirement of seed production of field crops - Importance of isolation distance and rouging - Principles of hybrid seed production in field crops - Principles and practices of selection of area and agronomic requirement of seed production of horticultural crops - Concept of apomixes, male sterility and self-incompatibility and its application in hybrid seed production of horticultural crops - Farmers participatory seed production						CO1
Unit 2 (20 hours)	- General Principles of Seed Processing - Introduction, Objectives of Seed Processing - Seed Drying, Principles of Drying, Water vapour equilibrium, Methods of drying seeds - Cleaning and grading, Air and screen machines, Dimensional separators, Density separators, Surface texture separators, Colour separators, Spiral separators, Electric separators, Vibrator separators, Separation based on Affinity to liquids						CO2

	- Seed treatment, Temperature treatment, Chemical treatment - Bagging and Labelling. - General Principles of Seed Testing - Seed Testing-Introduction, Procedure of Seed testing, components of seed quality testing genetic, physical, physiological and seed health testing - Seed sampling, Types of seed sampling, Requirements of sampling - Concept of seed viability and vigour; dormancy, types and principles of seed dormancy - Physiological quality of seed, Principles of seed Germination, types of germination, biochemical and genetic basis - Seed Certification: History, concept and objectives of seed certification; seed certification agency/ organization and staff requirement - Indian Minimum Seed Certification Standards (I.M.S.C.S.)- general and specific crop standards including GM varieties, field and seed standards	
Unit 3 (10 hours)	- Seed Industry and Seed Marketing: Introduction, Evolution of the seed industry, Development of the vegetable and Flower seed industry - Seed marketing – concept, definition and purpose, importance and promotion of quality seed, formal and informal seed supply systems - Seed marketing intelligence and product mix, sales promotion, distribution channels, marketing costs and margins; packaging and labelling, Seed Associations, Factors influencing seed marketing - Seed marketing programs, Seed industry organizations, Marketing of public versus private players, Demand and supply of seed; role of seed replacement rate (SRR), seed multiplication ratio (SMR), economics of seed production; determining seed needs - Seed pricing and price policy, seed processing and / packaging, demand forecasting and factors affecting demand for seeds, effect of price and farm income on seed demand - Role of WTO in seed marketing	CO3
Unit 4 (11 hours)	- Biotechnology in Seed Technology - History of plant tissue culture, Laboratory organization, Composition of nutrient medium - Micro-propagation, Axillary bud proliferation approach, Meristem and shoot tip culture, Bud culture, Advantages of Micro-propagation - Problems associated with micro-propagation - Synthetic seed production, Types of synthetic seeds, methods of development of synthetic seeds, Components of nutrient media for synthetic seed development, Storage of synthetic seeds - Advantages and limitations of synthetic seed production	CO4
Practical (24 hours)	Planning of Seed Production, requirements for different classes of seeds in field crops - unit area and rate	CO1
	- Operation and handling of mechanical drying equipment; effect of drying temperature and duration on seed germination and storability - seed processing equipment; seed treating equipment	CO2

	Seed production in cross pollinated crops with special reference to land, isolation, supplementary pollination, pollen storage, hand emasculation and pollination in tomato	CO1
	Planting ratio of male and female lines, synchronization of parental lines and methods to achieve synchrony	CO1
	Hybrid seed production in Maize, detasseling in maize, identification of rogues and pollen shedders	CO1
	Pollen collection, storage, viability and stigma receptivity; gametocide application and visits to seed production plots etc.	CO2
	Visit to seed processing plant and commercial controlled and uncontrolled	CO2
Reference Books	- Agarwal, R. L. 1997. Seed Technology. 2nd edn. Oxford & IBH. - McDonald, M. B. Jr and Copeland, L. O. 1997. Seed Production: Principles and Practices. Chapman & Hall - Thompson, J. R. 1979. An Introduction to Seed Technology. Leonard Hill. - Singhal, N. C. 2003. Hybrid Seed Production in Field Crops. Kalyani. - Justice, O. L. and Bass, L. N. 1978. Principles and Practices of Seed Storage. Castle House Publ. Ltd. - Tunwar, N.S. and Singh S.N. 1988. Indian Minimum Seed Certification Standards. CSCB, Ministry of Agriculture, New Delhi. - Chawla, H.S. 2008. Introduction to Plant Biotechnology. 2nd edn. Oxford & IBH publishing Co. Ltd. 113-B Shahpur Jat, New Delhi-110049.	

Course Code	APP 411						
Course Title	Biopesticides and Biofertilizers						
Hours	60, L:3, T:0, P:2						
Credits	4						
Type	Elective Course						
Course Outcomes	On the completion of the course, the student will gain the following knowledge and skills: CO1: To understand the history and basic concepts of biopesticides and biofertilizers CO2: To learn about principles, methods, and mechanisms of biopesticides and their use against plant diseases CO3: To understand the types and mechanism of action of various biofertilizers CO4: To learn about the production technology, quality control and application of biofertilizers in agriculture						
Examination Type	Theory + Practical						
Assessment Tools	Written Quiz	Assignment/Project Work	MSE	MSP	ESE	ESP	ABL/PBL
Weightage	5%		25%		40%	25%	5%
Examination Mode	Theory + Practical						
Syllabus	Theory						
Unit 1 (8 hours)	- History and concept of bio pesticides, - Importance, scope and potential of biopesticides, - Definitions, concepts and classification of biopesticides viz. Pathogen, botanical pesticides, and bio rationales. - Botanicals and their uses.						CO1
Unit 2 (8 hours)	- Mass production technology of bio-pesticides, - Virulence, pathogenicity and symptoms of entomopathogenic pathogens and nematodes. - Methods of application of biopesticides. - Methods of quality control and Techniques of bio pesticides. - Impediments and limitation in production and use of biopesticides.						CO2
Unit 3 (8 hours)	- Biofertilizers - Introduction, status and scope. - Structure and characteristics features of bacterial biofertilizers – Azospirillum, Azotobacter, Bacillus, Pseudomonas, Rhizobium and Frankia; - Cynobacterial bio fertilizers- Anabaena, Nostoc,						CO3

	Hapalosiphon and fungal biofertilizers – AM mycorrhiza and ectomycorrhiza. • Nitrogen fixation –Free living and symbiotic nitrogen fixation. • Mechanism of phosphate solubilisation and phosphate mobilization, K solubilisation.	
Unit 4 (8 hours)	• Production technology: Strain selection, sterilization, growth and fermentation, mass production of carrier based and liquid biofertilizers, • FCO specifications and quality control of biofertilizers. • Application technology for seeds, seedlings, tubers, sets etc. • Biofertilizers: Storage, shelf life, quality control and marketing. • Factors influencing the efficiency of biofertilizers	CO4
Practical (20 hours)	• Isolation and purification of important biopesticides: <i>Trichoderma</i>, <i>Pseudomonas</i>, <i>Bacillus</i>, <i>Metarhizium</i> etc. and its production. • Identification of important botanicals • Visit to biopesticide laboratory in nearby area • Field visit to explore naturally infected cadavers • Identification of entomopathogenic entities in field condition, • Quality control of biopesticides, • Isolation and purification of <i>Azospirillum</i>, <i>Azotobacter</i>, <i>Rhizobium</i>, P-solubilizers and cyanobacteria, • Mass multiplication and inoculums production of biofertilizers, • Isolation of AM fungi- Wet sieving method and sucrose gradient method, • Mass production of AM inoculants.	
Reference Books	1. Baker, E.F. and James, R.C. 1982. Biological Control of Plant Pathogens. American Phytopathological Society. 2. Biofertilizers for Sustainable Agriculture- Sampat Nehra, Aavishkar Publishers, Jaipur, India. 3. Boland, G.J. and David, L.1998. Plant microbe interactions and Biological Control. Kuykendall Marel Dekker, INC. 4. Borkar, S.G. 2015. Beneficial Microbes as Biofertilizers and its Production Technology. 5. Ciancia, A. and Mukerji, K.J. 2007. General Concepts of Integrated Pest and Disease Management. Edited Published by Springer 6. Handbook of Microbial Biofertilizers by Dr Awani Kr. Singh, Agrotech Press, Jaipur, India	