SWAMI VIVEKANAND SUBHARTI UNIVERSITY
UGC Approved Meerut

Ordinance No. :-V-126-B-45

(Approved in Academic council meeting held on 11.03.2026
Proposed to be ratified in forthcoming executive council)

Evaluation Scheme and Syllabus

of

B.Sc. Agriculture

FOUR – YEAR UNDER GRADUATE PROGRAM

(AS PER NEP-2020)

Keral Verma Subharti College of Science

Swami Vivekanand

SUBHARTI UNIVERSITY

Meerut

Effective From 2025-2026

K. V Subharti College of Science
S. V Subharti University
NH-58, Byepass Road, Meerut

PROGRAMME OBJECTIVES:

Students, who choose B. Sc. (Hons.) Agriculture Programme, develop the ability to explore and identify whole spectrum of the agricultural sciences. The program objective is to enrich students with modern scientific equipment and techniques in agriculture, land surveying, soil science, water resource management, animal and poultry management, crop disease management, basics of biotechnology, entrepreneurship development etc. and use these concepts to train them to improve agricultural productivity, find employment in the market or self employment on their family farms. Pursuing a Bachelor degree the Agriculture graduates have high scope of employment in government, public and private sectors, education, research, business sector and industry.

PROGRAM OUTCOME

Students graduating with the "B. Sc. (Hons.) Agriculture" degree should be able to acquire:

PO-1 Agriculture knowledge: Apply the knowledge of horticulture, Agronomy, organic and sustainable agriculture, and integrating pest management to the solution of Agriculture related issues.

PO-2 Subject specific knowledge: Demonstrate knowledge and understanding in horticulture section: The breadth and depth of the profession of horticulture. Basic horticulture biology: taxonomy, anatomy, morphology, and physiology. The characteristics of the environment and their influence on plant growth and development, Current applications of horticultural principles and practices: propagation, pest management, production, maintenance, and business practices. Provide comprehensive knowledge of horticultural production.

PO-3 Analysis of complex problems: To understand and analyze the current events and issues that are occurring in agriculture and how they affect futuristic agriculture. Able to demonstrate critical thinking and problem solving skills as they apply to a variety of animal and or plant production systems.To understand problem solving skills in crop production and animal husbandry.

PO-4 Modern tool usage: Select and apply advanced techniques, resources and IT tools for prediction weather. Knowledge of Weather codes and Symbols, Reading and Recording of weather and climatic data. To get trained for climatologically records, soil data and soil nutrition.

PO-5 The Agriculturist and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal, and cultural issues and the consequent responsibilities relevant to the professional Agricultural practice

PO-6 Environment and sustainability: Understand the impact of the professional agricultural solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO-7 Ethics: To demonstrate research based knowledge of the legal and ethical environment impacting agriculture organizations and exhibit an understanding and appreciation of the ethical implications of decisions. In accordance with high standards of academic integrity (ethics and moral) both in the profession and in society as a whole. To develop competence to work in Government, public and private sectors.

PO-8 Individual and team work: To demonstrate an ability to engage in critical thinking by analyzing situations and constructing and selecting viable solutions to solve problems. Abilities to work effectively with each other. To develops analytical ability and team work spirit.

PO-9 Communication: To demonstrate and understand the impact of globalization and diversity in modern agriculture organizations. Understanding working of SHG, NGO, Govt Extension service agencies. Communicate effectively with the farmer community and with society at large. Be able to comprehend and write effective reports documentation. Make effective presentations, and give and receive clear instructions.

PO-10 Project management and finance: Demonstrate knowledge and understanding of Agriculture and Agri business management principles. Understand how all aspects of agriculture combine and are used by scientists, marketers, producers and understand how employer characteristics and decision-making at various levels enhance the success of an agricultural enterprise. To understand components of agri business and economics of market.

PO-11 Entrepreneurship and employability: Able to recognize and examine the relationships between inputs and outputs in their agricultural field to make effective and profitable decisions. To understand the mechanics of agripreneurship. This programme will also help students to enhance their employability for jobs in different sectors.

PO-12 Life-long learning: To develop critical and self-critical opinion and approach aiming at solving the most important practical problems in the field of sustainable agriculture by applying

K. V Subharti College of Science
S. V Subharti University
NH-58, Byepass Road, Meerut

gained competencies. The graduates will generate a culture of lifelong learning in an inclined environment to achieve personal enrichment and professional ethics.

SWAMI VIVEKANAD SUBHARTI UNIVERSITY MEERUT
KERAL VERMA SUBHARTI COLLEGE OF SCIENCE
Department of Agriculture
B.Sc. (Hons)Agriculture Program offered by Department of Agriculture (Session 2025-26 onwards)

		I	II	III	IV	V	VI	VII	VIII	Total
1	Major (Core)	11	11	14	16	19	21	20		112
2	Minor (Core)									
3	Multi Disciplinary	3		3		3				9
4	Ability Enhancement Course	3	3	2	0					8
5	Skill Enhancement Course	4	4	2	2					12
6	Value Added Course		3		3					6
7	Internship								20	20
8	Research									
	Total	21	21	21	21	22	21	20	20	167

K. V Subharti College of Science
S. V Subharti University
NH-58, Byepass Road, Meerut

Study and Evaluation Scheme (NEP-2020)
As per the ICAR 6th Dean Committee
B.Sc. (Agriculture) I Sem

S.No.	Subject Code	Name of the subject	Periods				Credit	Evaluation Scheme				Total Marks
			Type	L	T	P		Attendance (5)	Quiz/PPT/ Assignment (10)	Mid Sem Test (15)	ESE	
		THEORY SUBJECT I SEMESTER										
1.	BSAG-102	Rural Sociology and Educational Psychology	Core	2	0	0	2	5	10	15	70	100
2.	BSAG-103	Fundamentals of Agronomy	Core	2	0	0	2	5	10	15	70	100
3.	BSAG-104	Fundamentals of Soil Science	Core	2	0	0	2	5	10	15	70	100
4.	BSAG-105	Fundamentals of Horticulture	Core	2	0	0	2	5	10	15	70	100
5.	BSAG-106	Communication Skills	AEC	1	0	0	1	5	10	15	70	100
6.	BSAG-107	Farming-based Livelihood Systems	MDC	2	0	0	2	5	10	15	70	100
7.	BSAG-108A/ BSAG-108B	Introductory Mathematics*/ Introductory Biology*	Non Gradial((Qualifying)	1	0	0	1	5	10	15	70	100
8	VAC-RB/VAC-IKS	IKS / Rastra bodh	Non Gradial((Qualifying)	2	1	0	2	5	5	10	30	50
		PRACTICAL I SEMESTER										
8.	BSAG-103-P	Fundamentals of Agronomy	Core	0	0	2	1	5	10	15	70	100
9.	BSAG-104-P	Fundamentals of Soil Science	Core	0	0	2	1	5	10	15	70	100
10.	BSAG-105-P	Fundamentals of Horticulture	Core	0	0	2	1	5	10	15	70	100
11.	BSAG-106-P	Communication Skills	Core	0	0	2	1	5	10	15	70	100
12.	BSAG-107-P	Farming-based Livelihood Systems	MDC	0	0	2	1	5	10	15	70	100
13.	BSAG-109-P	National Service Scheme (NSS-I) / National Cadet Corps (NCC-I)	AEC	0	0	2	1	5	10	15	70	100
14.	AREA ELECTIVE-I	Skill Enhancement Course-I (#To be offered from the bouquet of SEC Courses)	SEC	0	0	4	2	5	10	15	70	100
15.	AREA ELECTIVE-2	Skill Enhancement Course-II (#To be offered from the bouquet of SEC Courses)	SEC	0	0	4	2	5	10	15	70	100
16.	BSAG-101	Deeksharambh (Induction cum Foundation course)	Non Gradial (1 Weeks) (Qualifying)	1	0	0	1	0	0	50	0	50
TOTAL				**12**	01	20	25=(21+2+2) Nongradial)	75	150	225	1050	1500

K. V Subharti College of Science
S. V Subharti University
NH-58, Byepass Road, Meerut

Study and Evaluation Scheme (NEP)
As per the ICAR 6th Dean Committee
B.Sc. (Agriculture) II Sem

S.No.	Subject Code	Name of the subject	Periods				Credit	Evaluation Scheme				Total Marks
			Type	L	T	P		Attendance (5)	Quiz/PPT/ Assignment (10)	Mid Sem Test (15)	ESE	
		THEORY SUBJECT II SEMESTER										
1.	BSAG-201	Soil Fertility Management	Core	2	0	0	2	5	10	15	70	100
2.	BSAG-202	Fundamentals of Entomology	Core	2	0	0	2	5	10	15	70	100
3.	BSAG-203	Livestock and Poultry Management	Core	1	0	0	1	5	10	15	70	100
4.	BSAG-204	Fundamentals of Plant Pathology	Core	2	0	0	2	5	10	15	70	100
5.	BSAG-205	Environmental Studies and Disaster Management	VAC	2	0	0	2	5	10	15	70	100
6.	BSAG-206	Personality Development	AEC	1	0	0	1	5	10	15	70	100
7	VAC-RB/VAC-IKS	IKS / Rastra bodh	Non Gradial((Qualifying)	2	1	0	2	5	5	10	30	50
		PRACTICAL II SEMESTER										
8	BSAG-201-P	Soil Fertility Management	Core	0	0	2	1	5	10	15	70	100
9.	BSAG-202-P	Fundamentals of Entomology	Core	0	0	2	1	5	10	15	70	100
10.	BSAG-203-P	Livestock and Poultry Management	Core	0	0	2	1	5	10	15	70	100
11.	BSAG-204-P	Fundamentals of Plant Pathology	Core	0	0	2	1	5	10	15	70	100
12.	BSAG-205-P	Environmental Studies and Disaster Management	VAC	0	0	2	1	5	10	15	70	100
13.	BSAG-206-P	Personality Development	AEC	0	0	2	1	5	10	15	70	100
14.	AREA ELECTIVE-3	Skill Enhancement Course-III (#To be offered from the bouquet of SEC Courses)	SEC	0	0	4	2	5	10	15	70	100
15.	AREA ELECTIVE-4	Skill Enhancement Course-IV (#To be offered from the bouquet of SEC Courses)	SEC	0	0	4	2	5	10	15	70	100
16.	BSAG-207-P	National Service Scheme (NSS-II) / National Cadet Corps (NCC-II)	AEC	0	0	2	1	5	10	15	70	100
		Total		**10**	**00**	**22**	**21**	**75**	**150**	**225**	**1050**	1500

K. V Subharti College of Science
S. V Subharti University
NH-58, Byepass Road, Meerut

K. V Subharti College of Science
S. V Subharti University
NH-58, Byepass Road, Meerut

1st Semester

Deeksharambh **(Induction-cum-Foundation Course)- Non-gradial**

Objectives

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

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

i. Discussions on operational framework of academic process in the University, as well as interactions with academic and research managers of the University

ii. Interaction with alumni, business leaders, perspective employers, outstanding achievers in related fields, and people with inspiring life experiences

iii. Group activities to identify the strength and weakness of students (with expert advice for their improvement) as well as to create a platform for students to learn from each other's life experiences

iv. Activities to enhance cultural Integration of students from different backgrounds.

v. Field visits to related fields/ establishments

vi. Sessions on personality development (instilling life and social skills, social awareness, ethics and values, team work, leadership, etc.) and communication skills

1st Semester

Communication Skills

Objectives

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

Theory

Unit -1

Communication Process**:** The magic of effective communication; Building self-esteem and overcoming fears; Concept, nature and significance of communication process;

Unit -2

Meaning, types and models of communication; Verbal and non-verbal communication; Linguistic and non-linguistic barriers to communication and reasons behind communication gap/ miscommunication.

Unit -3

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

Unit -4

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

Practical

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

Suggested readings

1. Allport, G. W.1937. Personality: A Psychological Interpretation. Holt, New York.

2. Brown Michele and Gyles Brandreth. 1994. How to Interview and be Interviewed. Sheldon Press, London.
3. Carnegie Dale. 1997. The Quick and Easy Way to Effective Speaking. Pocket Books, New York.
4. Francis Peter S J. 2012. Soft Skills and Professional Communication. Tata McGraw Hill, New Delhi.
5. Kumar S and Pushpa Lata. 2011. Communication Skills. Oxford University Press.
6. Neuliep James W. 2003. Intercultural Communication A Contextual Approach. Houghton Miffiin 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

1st Semester

Farming based livelihood systems

Objective

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

Theory

Unit -1

Status of agriculture in India and different states, Income of farmers and rural people in India, Livelihood-Definition, concept and livelihood pattern in urban and rural areas, Different indicators to study livelihood systems. Agricultural livelihood systems (ALS): Meaning, approach, approaches and framework, Definition of farming systems and farming based livelihood systems Prevalent Farming systems in India contributing to livelihood.

Unit -2

Types of traditional and modern farming systems. Components of farming system/ farming-based livelihood systems- Crops and cropping systems, Livestock (Dairy, Piggery, Goatry, Poultry, Duckry etc.), Horticultural crops, Agro--forestry systems, Aqua culture Duck/Poultry cum Fish, Dairy cum Fish, Piggery cum Fish etc., Small-, medium- and large- enterprises including value chains and secondary enterprises as livelihood components for farmers, Factors affecting integration of various enterprises of farming for livelihood.

Unit -3

Feasibility of different farming systems for different agro-climatic zones, Commercial farming-based livelihood models by NABARD, ICAR and other organizations across the country, Case studies on different livelihood enterprises associated with the farming. Risk and success factors in farming-based livelihood systems, Schemes and programs by Central and State Government, Public and Private organizations involved in promotion of farming-based livelihood opportunities.

Unit -4

Role of farming-based livelihood enterprises in 21st Century in view of circular economy, green economy, climate change, digitalization and changing life style.

Practical

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

Suggested Readings

1. Ashley, C. and Carney, D. 1999. Sustainable Livelihoods: Lessons from Early Experience; Department for International Development: London, UK; Volume 7. [Google Scholar]
2. Agarwal, A. and Narain, S. 1989. Towards Green Villages: A strategy for Environmentally, Sound and Participatory Rural Development, Center for Science and Environment, New Delhi, India
3. Carloni, A. 2001. Global Farming Systems Study: Challenges and Priorities to 2030 – Regional Analysis: Sub-Saharan Africa, Consultation Document, FAO, Rome, Italy
4. Dixon, J. and A. Gulliver with D. Gibbon. 2001. Farming Systems and Poverty: Improving Farmers' Livelihoods in a Changing World. FAO & World Bank, Rome, Italy & Washington, DC, USA
5. Evenson, R.E. 2000. Agricultural Productivity and Production in Developing Countries'. In FAO, The State of Food and Agriculture, FAO, Rome, Italy
6. Livelihood Improvement of Underprivileged Farming Community: Some Experiences from Vaishali, Samastipur, Darbhanga and Munger Districts of Bihar by B. P. Bhatt, Abhay Kumar,
   P.K. Thakur, AmitavaDeyUjjwal Kumar, Sanjeev Kumar, B.K. Jha, Lokendra Kumar, K. N. Pathak, A. Hassan, S. K. Singh, K. K. Singh and K. M. Singh ICAR Research Complex for Eastern Region ICAR Parisar, P.O. Bihar Veterinary College, Patna - 800 014, Bihar
7. Panwar et al. 2020. Integrated Farming System models for Agricultural Diversification, Enhanced Income and employment, Indian Council of Agricultural Research, New Delhi.
8. Reddy, S.R. 2016. Farming System and Sustainable Agriculture, Kalyani Publishers, New Delhi.
9. Singh, J.P., et al. 2015. Region Specific Integrated Farming System Models, ICAR-Indian Institute of Farming Systems Research, Modipuram.

1st Semester

Rural Sociology and Educational Psychology

Objective

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

Theory

Unit -1

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

Unit -2

Social Stratification: Meaning, definition, functions, basis for stratification, forms of social stratification- characteristics and- differences between class and caste system. Cultural concepts: culture, customs, folkways, mores, taboos, rituals. Traditions: Meaning, definition and their role in Agricultural Extension. Social Values and Attitudes: Meaning, definition, types and role of social values and attitudes in agricultural Extension. Social Institutions: Meaning, definition, major institutions in rural society, functions, and their role in agricultural Extension.

Unit -3

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.

Unit -4

Training of Leaders: Meaning, definition, methods of training, Advantages and limitations in use of local leaders in Agricultural Extension, Psychology and educational psychology: Meaning, definition, scope, and importance of educational psychology in Agricultural Extension. Intelligence: Meaning, definition, types, factors affecting intelligence and importance of intelligence in Agricultural Extension. Personality: Meaning, definition,

types, factors influencing the personality and role of personality in agricultural Extension. Teaching: Learning process: Meaning and definition of teaching, learning, learning experience and learning situation, elements of learning situation and its characteristics. Principles of learning and their implication of teaching.

Suggested readings

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

1st Semester

Fundamentals of Agronomy

Objectives

To impart the basic and fundamental knowledge of Agronomy

Theory

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 method of sowing: broadcasting, drilling, dibbling, transplanting etc. Tillage and tilth: Definition, objectives, types, advantages and disadvantages of tillage including conservation tillage. Crop density and geometry: plant geometry and planting geometry, its effect on growth, yield.

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 /un- combined forms. Manures and fertilizers, nutrient use efficiency: Sources of nutrients: Inorganic (fertilizers), organic (manures) and bio-fertilizers; their classification and characteristics, method of preparation and role of organic manures in crop production. Integrated Nutrient Management (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.

Unit -3

Water management: Water resources of the world, India and the state; Soil Moisture constants: gravitational water, capillary water, hygroscopic water, Soil moisture constants.

Unit -4

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

Practical

1. A visit to Instructional Crop farm and study on field crops.
2. Identification of crops, seeds, fertilizers, pesticides.
3. Crops and cropping systems in different Agro-climatic zones of the state.
4. Study of some preparatory tillage implements, Study of inter tillage implements, Practice of ploughing / puddling.
5. Study and practice of inter cultivation in field crops.
6. Numerical exercises on calculation of seed, plant population and fertilizer requirement.
7. Study of yield contributing characters and yield estimation of crops.
8. Identification of weeds in different crops.
9. Seed germination and viability test of seed.
10. Practice on time and method of application of manures and fertilizers.

Suggested readings

1. Rao V S. 1992. Principles of Weed Science. Oxford and IBH Publishing Co. Ltd. New Delhi.
2. Reddy Yellamanda T and Shankar Reddy G H. 1995. Principles of Agronomy. Kalyani Publishers, Ludhiana.
3. Reddy, S. R. 2008. Principle of Crop Production, Kalyani Publisher, Ludhiana.
4. William L Donn. 1965. Meteorology. McGraw-Hill Book Co. New York.
5. Yawalkar K S and Agarwal J P. 1977. Manures and Fertilizers. Agricultural Horticultural Publishing House, Nagpur.

1st Semester

Fundamentals of Soil Science

Objective

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

Theory

Unit -1

Soil: Pedological and edaphalogical concepts. Rocks and minerals, weathering.

Unit -2

Silicate clays: constitution and properties, sources of charge, ion exchange, cation and anion exchange capacity and base saturation (after buffering capacity), Soil formation, Soil organic matter, Pedogenic processes

Unit -3

Soil colloids: inorganic and organic, Properties of soil colloids and Ion exchange in soils, Soil profile, soil texture, soil structure. Bulk density and particle density, soil consistency, soil temperature, soil air, soil water.

Unit -4

Soil reaction and buffering capacity. Soil taxonomy, keys to soil orders. Soils of India.

Practical

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

Suggested readings

1. Introductory Soil Science – By Dilip Kumar Das, Kalyani Publishers
2. Soil Fertility and Nutrient Management – By S. S. Singh, Kalyani Publishers
3. Soil Fertility and Fertilizers – By Samual L. Tisdale, Werner L. Nelson and James D. Beaton, Macmillan Publishing Company, New York

1st Semester

Fundamentals of Horticulture

Objectives

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

Theory

Unit -1

Horticulture: Its different branches, importance and scope, Horticulture and botanical classification, soil and climate for horticultural crops.

Unit -2

Plant propagation: methods and propagation structures, seed dormancy and seed germination, Merits and demerits of sexual and asexual propagation Stock-scion relationship.

Unit -3

Principles of orchard establishment, principles and methods of training and pruning of fruit crops, Juvenility and flower bud differentiation, unfruitfulness in horticultural crops.

Unit -4

Pollination, pollinizers and pollinators, fertilization and parthenocarpy, importance of bio regulators in horticultural crops, irrigation and its methods, Fertilizer application in horticultural crops.

Practical

1. Identification and nomenclature of fruit.
2. Layout of an orchard, pit making and system of planting.
3. Nursery raising techniques of fruit crops.
4. Understanding of plant propagation structures, Propagation through seeds and plant parts.
5. Propagation techniques for horticultural crops, Container, potting mixture, potting and repotting.
6. Training and pruning methods on fruit crops.
7. Preparation of fertilizer mixture and application.
8. Preparation and application of PGR.
9. Layout of different irrigation systems.

10. Maturity studies, harvesting, grading, packaging and storage.

Suggested readings

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

1st Semester

National Cadet Corps (NCC-1), National Service Scheme (NSS-2)

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

- Aims, objectives, organization of NCC and NCC song. DG's cardinals of discipline.
- Drill- aim, general words of command, attention, stands at ease, stand easy and turning.
- Sizing, numbering, forming in three ranks, open and close order march, and dressing.
- Saluting at the halt, getting on parade, dismissing, and falling out.
- Marching, length of pace, and time of marching in quick/slow time and halt. Side pace, pace forward and to the rear. Turning on the march and wheeling. Saluting on the march.
- Marking time, forward march, and halt. Changing step, formation of squad and squad drill.
- Command and control, organization, badges of rank, honors, and awards
- Nation Building- cultural heritage, religions, traditions, and customs of India. National integration. Values and ethics, perception, communication, motivation, decision making, discipline and duties of good citizens. Leadership traits, types of leadership. Character/ personality development. Civil defense organization, types of emergencies, firefighting, protection. Maintenance of essential services, disaster management, aid during development projects.
- Basics of social service, weaker sections of society and their needs, NGO's and their contribution, contribution of youth towards social welfare and family planning.
- Structure and function of human body, diet and exercise, hygiene and sanitation. Preventable diseases including AIDS, safe blood donation, first aid, physical and mental health. Adventure activities. Basic principles of ecology, environmental conservation, pollution and its control.

National Service Scheme (NSS)

Unit -1

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

Unit -2

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

Unit -3

The entire four courses should be offered continuously for two years. A student enrolled in NSS course should put in at least 60 hours of social work in different activities in a semester other than five regular one-day camp in a year and one special camp for duration of 7 days at any semester break period in the two years.

Unit -4

Different activities will include orientation lectures and practical works. Activities directed by the Central and State Government have to be performed by all the volunteers of NSS as per direction.

Introduction and Basic Components of NSS

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

1st Semester

Course Title: Introductory Mathematics (Non-gradial)

Theory

Unit -1

Algebra: Progressions- Arithmetic, Geometric and Harmonic Progressions. Matrices: Definition of Matrices, Addition, Subtraction, Multiplication, Transpose and Inverse up to 3rd order by adjoint method, Properties of determinants up to 3rd order and their evaluation.

Unit -2

Differential Calculus: Definition - Differentiation of function using first principle, Derivatives of sum, difference, product and quotient of two functions, Methods, Increasing and Decreasing Functions. Application of Differentiation- Growth rate, Average Cost, and Marginal cost, Marginal Cost, Marginal Revenue. Partial differentiation: Homogeneous function, Euler's theorem, Maxima and Minima of the functions of the form $y = f(x)$ and $y = f(x1, x2)$.

Unit -3

Integral Calculus: Integration -Definite and Indefinite Integrals-Methods- Integration by substitution, Integration by parts. Area under simple well-known curves.

Unit -4

Mathematical Models: Agricultural systems - Mathematical models - classification of mathematical models- Fitting of Linear, quadratic and exponential models to experimental data.

1st Semester

Introductory Biology

UNIT-I. Introduction to the living world, basic unit of life – Cell.

UNIT-II. Diversity and characteristics of life, origin of life, Evolution and Eugenics.

UNIT-III. Binomial nomenclature and classification.

UNIT-IV. Morphology of flowering plants, Seed and seed germination.

UNIT-V Plant systematic- viz; Brassicaceae, Fabaceae and Poaceae. Role of animals in Agriculture.

Practical

1. Morphology of flowering plants - root, stem and leaf and their modifications.
2. Inference, flower and fruits.
3. Cell, tissues & cell division.
4. Internal structure of root, stem and leaf.
5. Study of specimens and slides.
6. Description of plants - Brassicaccae. Fabaceac and Poaceae.

References

1. Fundamental of biology, textbook and practice book – By Willey editorial.
2. Introductory plant biology – James bidlade and ShalleyJnsky
3. A text book of botany- B.P. Pandey

2nd Semester

Personality Development

UNIT-1

Personality Definition, Nature of personality, theories of personality and its types.

UNIT-2

The humanistic approach - Maslow's self-actualization theory, shaping of personality, determinants of personality, Myers-Briggs Typology Indicator, Locus of control and performance, Type A and Type B Behaviours, personality and Organizational Behaviour.

UNIT-3

Foundations of individual behavior and factors influencing individual behavior, Models of individual behavior, Perception and attributes and factors affecting perception, Attribution theory and case studies on Perception and Attribution. Learning: Meaning and definition, theories and principles of learning, Learning and organizational behavior, Learning and training, learning feedback.

UNIT-4

Attitude and values, Intelligence- types of Intelligence, theories of intelligence, measurements of intelligence, factors influencing intelligence, intelligence and Organizational behavior, emotional intelligence. Motivation- theories and principles, Teamwork and group dynamics.

Practical-:

1. MBTI personality analysis, Learning Styles and Strategies

2. Motivational needs, Firo-B, Interpersonal Communication, Teamwork and team building, Group Dynamics.

3. Win-win game, Conflict Management, Leadership styles, Case studies on Personality and Organizational Behavior.

Suggested reading

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.

2nd Semester

Environmental Studies and Disaster Management

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. Ecosystems: Concept of an ecosystem - Structure and function of an ecosystem - Energy flow in the ecosystem. Types of ecosystems.

UNIT-2

Biodiversity and its conservation: Introduction, definition, types. Biogeographical classification of India. Importance and Value of biodiversity. Biodiversity hot spots. Threats and Conservation of biodiversity. Environmental Pollution: Definition, cause, effects and control measures of: a. Air pollution. b. Water pollution. c. Soil pollution. d. Marine pollution. e. Noise pollution. f. Thermal pollution h. Light pollution. Solid Waste Management: Classification of solid wastes and management methods, Composting, Incineration, Pyrolysis, Biogas production, Causes, effects and control measures of urban and industrial wastes.

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.

UNIT-4

Wildlife Protection Act. Forest Conservation Act. Human Population and the Environment: Environment and human health: Human Rights, Value Education. Women and Child Welfare. Role of Information Technology in Environment and human health. Disaster management: Disaster definition - Types - Natural Disasters - Floods, drought, cyclone, earthquakes, landslides, avalanches, volcanic eruptions, Heat and cold waves. Man Made Disasters: Nuclear disasters, chemical disasters, biological disasters, building fire, coal fire, forest fire, oil fire, road accidents, rail accidents, air accidents, sea accidents.

UNIT-5

International and National strategy for disaster reduction. Concept of disaster management, national disaster management framework; financial arrangements; role of NGOs, community-based organizations and media in disaster management. Central, state, district and local administration in disaster control; Armed forces in disaster response; Police and other organizations in disaster management.

Practical-:

1. Visit to a local area to document environmental assets river/forest/grassland/hill/mountain. **2**.Energy: Biogas production from organic wastes. Visit to wind mill / hydro power / solar power generation units.

3.Biodiversity assessment in farming system.

4.Floral and faunal diversity assessment in polluted and un polluted system.

5. Visit to local polluted site - Urban/Rural/Industrial/Agricultural to study of common plants, insects and birds.

6. Environmental sampling and preservation. Water quality analysis: pH, EC and TDS. Estimation of Acidity, Alkalinity. Estimation of water hardness.

7. Estimation of DO and BOD in water samples. Estimation of COD in water samples. **8**.Enumeration of *E. coli* in water sample. Assessment of Suspended Particulate Matter (SPM). **9**. Study of simple ecosystem – Visit to pond/river/hills. Visit to areas affected by natural disaster.

Suggested Readings

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

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

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

2nd Semester

Soil Fertility Management

UNIT-1

History of soil fertility and plant nutrition. criteria of essentiality. role, deficiency and toxicity symptoms of essential plant nutrients, Mechanisms of nutrient transport to plants, factors affecting nutrient availability to plants.

UNIT-2

Chemistry of macro and micronutrients. Soil fertility evaluation, Soil testing. Critical levels of different nutrients in soil. Forms of nutrients in soil, plant analysis, rapid plant tissue tests. Indicator plants. Introduction and importance of manures and fertilizers. Fertilizer recommendation approaches. Integrated nutrient management.

UNIT-3

Chemical fertilizers: classification, composition and properties of major fertilizers, secondary and micronutrient fertilizers, Complex fertilizers, Customised fertilisers, water soluble fertilizers nano fertilizers Soil amendments, Fertilizer Storage, Fertilizer Control Order.

UNIT-4

Methods of fertilizer recommendations to crops. Factor influencing nutrient use efficiency (NUE), methods of application under rainfed and irrigated conditions. STCR/RTNM/ IPNS, Carbon sequestration and Carbon Trading, Preparation and properties of major manures (FYM, Compost, Vermicompost, Green manuring, Oilcakes).

Practical

1. Introduction of analytical instruments and their principles, calibration and applications of Colorimetry and flame photometry.
2. Estimation of alkaline hydrolysable N in soils. Estimation of soil extractable P in soils; Estimation of exchangeable K in soils.
3. Estimation of exchangeable Ca and Mg in soils; Estimation of soil extractable S in soils.
4. Estimation of DTPA extractable Zn in soils
5. Estimation of N in plants; Estimation of P in plants; Estimation of K in plants; Estimation of S in plants.

Suggested readings

1. Introductory Soil Science by Dilip Kumar Das, Kalyani Publishers
2. Soil Fertility and Nutrient Management by S. S. Singh, Kalyani Publishers
3. Soil Fertility and Fertilizers by Samual L. Tisdale, Werner L. Nelson and James D. Beaton.

2nd Semester

Fundamentals of Entomology

UNIT-1

History of Entomology in India. Major points related to dominance of Insects in Animal kingdom. Classification of phylum Arthropoda up to classes. Relationship of class Insects with other classes of Arthropoda. Morphology: Structure and functions of insect cuticle and molting.

UNIT-2

Body segmentation. Structure of head, thorax and abdomen. Structure and modifications of insect antennae, mouth parts, legs, Wing venation, modifications and wing coupling apparatus. Metamorphosis and diapause in insects. Types of larvae and pupae. Structure and functions of digestive, circulatory, excretory, respiratory, nervous, secretary (Endocrine) and reproductive system, in insects. Types of reproduction in insects. Major sensory organs. Insect Ecology: Introduction, Environment and its components.

UNIT-3

Effect of abiotic factors and biotic factors. Categories of pests. Systematics: Taxonomy – importance, history and development and binomial nomenclature. Definitions of Biotype, Sub-species, Species, Genus, Family and Order.

UNIT-4

Classification of class Insecta up to Orders, basic groups of present day insects with special emphasis to orders and families of Agricultural importance like Orthoptera: Acrididae, Tettigoniidae, Gryllidae, Gryllotalpidae; Dictyoptera: Mantidae, Blattidae; Odonata; Isoptera: Termitidae; Thysanoptera: Thripidae; Hemiptera: Pentatomidae, Coreidae, Cimicidae, Pyrrhocoridae, Lygaeidae, Cicadellidae, Delphacidae, Aphididae, Coccidae, Lophophidae, Aleurodidae, Pseudococcidae; Neuroptera: Chrysopidae; Lepidoptera: Pieridae, Papiloinidae, Noctuidae, Sphingidae, Pyralidae, Gelechiidae, Arctiidae, Saturnidae, Bombycidae; Coleoptera: Coccinellidae, Chrysomelidae, Cerambycidae, Curculionidae, Bruchidae, Scarabaeidae; Hymenoptera: Tenthridinidae, Apidae. Trichogrammatidae, lchneumonidae, Braconidae, Chalcididae; Diptera: Cecidomyiidae, Tachinidae, Agromyziidae, Culicidae, Muscidae, Tephritidae.

Practical

1.Methods of collection and preservation of insects including immature stages; External features of Grasshopper/Blister beetle.

2. Types of insect antennae, mouthparts and legs; Wingvenation, types of wings and wing coupling apparatus.

3. Types of insect larvae and pupae; Dissection of digestive system in insects (Grasshopper); Study of characters of orders Orthoptera, Dictyoptera, Odonata, Isoptera, Thysanoptera, Hemiptera, Lepidoptera, Neuroptera, Coleoptera, Hymenoptera, Diptera and their families of agricultural importance.

4. Insecticides and their formulations.

5. Pesticide appliances and their maintenance. Sampling techniques for estimation of insect population and damage.

Suggested readings

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

2nd Semester

Livestock and poultry Management

UNIT-1

Role of livestock in the national economy. Reproduction in farm animals and poultry. Housing principles, space requirements for different species of livestock and poultry.

UNIT-2

Management of calves, growing heifers and milch animals. Management of sheep, goat and swine. Incubation, hatching and brooding. Management of growers and layers. Important Indian and exotic breeds of cattle, buffalo, sheep, goat, swine and poultry. Improvement of farm animals and poultry. Digestion in livestock and poultry.

UNIT-3

Classification of feedstuffs. Proximate principles of feed. Nutrients and their functions. Feed ingredients for ration for livestock and poultry. Feed supplements and feed additives. Feeding of livestock and poultry. Introduction of livestock and poultry diseases. Prevention (including vaccination schedule) and control of important diseases of livestock and poultry.

Practical

1. External body parts of cattle, buffalo, sheep, goat, swine and poultry.

2. Handling and restraining of livestock. Identification methods of farm animals and poultry. **3.** Visit to IDF and IPF to study breeds of livestock and poultry and daily routine farm operations and farm records. Judging of cattle, buffalo and poultry.

4. Culling of livestock and poultry. Planning and layout of housing for different types of livestock.

5. Computation of rations for livestock. Formulation of concentrate mixtures.

6. Clean milk production, milking methods. Hatchery operations, incubation and hatching equipment.

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

Suggested Readings

1. A Textbook of Animal Husbandry by G. C Banerjee

2. A text Book of Livestock Production management in Tropic by D. N. Verma.

2nd Semester

Fundamentals of Plant Pathology

UNIT-1

Introduction to Plant Pathology: Concept of disease in plants; Different terms used in Plant Pathology, History of Plant Pathology with special references to India.

UNIT-2

Causes of plant disease: Inanimate and animate causes. Classification of plant disease; Parasitism and pathogenesis; Development of disease in plants:

UNIT-3

Disease Triangle, Disease cycle; Fungi and their morphology, reproduction and classification of fungi; Bacteria: Morphology, reproduction classification of phytopathogenic bacteria; Other plant pathogens: Mollicutes; Flagellant protozoa; FVB; Green algae and parasitic higher plants.

UNIT-4

Viruses and viroids, virus transmission; Principles of Plant disease management: Disease management with chemicals, Host resistance, cultural and biological method of Integrated Disease Management (IDM).

Practical

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

Suggested readings

1. Agrios, G.N. 2010. Plant Pathology. Acad. Press.
2. Alexopoulos, Mims and Blackwel. Introductory Mycology.
3. Dhingra, O.D. and Sinclair, J.B. 1986. Basic Plant Pathology Methods. CRC Press, London, Tokyo.

2nd Semester

National Cadet Corps (NCC-II)

UNIT-1

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

UNIT-2

Characteristics of rifle (.22/.303/SLR), ammunition, fire power, stripping, assembling, care, cleaning, and sight setting. Loading, cocking, and unloading. The lying position and holding. Trigger control and firing a shot. Range Procedure and safety precautions. Aiming and alteration of sight. Theory of groups and snap shooting. Firing at moving targets. Miniature range firing. Characteristics of Carbine and LMG. Introduction to map, scales, and conventional signs. Topographical forms and technical terms.

UNIT-3

The grid system. Relief, contours, and gradients. Cardinal points and finding north. Types of bearings and use of service protractor. Prismatic compass and its use. Setting a map, finding north and own position. Map to ground and ground to map. Knots and lashings, Camouflage and concealment, Explosives and IEDs. Field defences obstacles, mines and mine lying. Bridging, waterman ship. Field water supplies, tracks and their construction. Judging distance. Description of ground and indication of landmarks. Recognition and description of target. Observation and concealment. Field signals. Section formations. Fire control orders. Fire and movement. Movement with/without arms. Section battle drill. Types of communication, media, latest trends and developments.

2nd Semester

National Service Scheme (NSS-II)

UNIT-1

Importance and role of youth leadership. Meaning, types and traits of leadership, qualities of good leaders; importance and roles of youth leadership, Life competencies. Definition and importance of life competencies, problem-solving and decision-making interpersonal communication. Youth development programs.

UNIT-2

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

UNIT-3

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

Study and Evaluation Scheme (NEP)

As per the ICAR 6th Dean Committee
B.Sc. (Agriculture) III Sem

S.No.	Subject Code	Name of the subject	Periods				Credit	Evaluation Scheme				Total Marks
			Type	L	T	P		Attendance (5)	Quiz/PPT/ Assignment (10)	Mid Sem Test (15)	ESE	
		THEORY SUBJECT III SEMESTER										
1.	BSAG-301	Principles of Genetics	Core	2	0	0	2	5	10	15	70	100
2.	BSAG-302	Crop Production Technology-I (Kharif crops	Core	1	0	0	1	5	10	15	70	100
3.	BSAG-303	Production Technology of Fruit and Plantation Crops	Core	1	0	0	1	5	10	15	70	100
4.	BSAG-304	Fundamentals of Extension Education	Core	1	0	0	1	5	10	15	70	100
5.	BSAG-305	Fundamentals of Nematology	Core	1	0	0	1	5	10	15	70	100
6.	BSAG-306	Principles and Practices of Natural Farming	Core	1	0	0	1	5	10	15	70	100
07.	BSAG-307	Entrepreneurship Development and Business Communication	MDC	2	0	0	2	5	10	15	70	100
		PRACTICAL III SEMESTER										
08.	BSAG-301-P	Principles of Genetics	Core	0	0	2	1	5	10	15	70	100
09.	BSAG-302-P	Crop Production Technology-I (Kharif crops	Core	0	0	4	2	5	10	15	70	100
10.	BSAG-303-P	Production Technology of Fruit and Plantation Crops	Core	0	0	2	1	5	10	15	70	100
11.	BSAG-304-P	Fundamentals of Extension Education	Core	0	0	2	1	5	10	15	70	100
12.	BSAG-305-P	Fundamentals of Nematology	Core	0	0	2	1	5	10	15	70	100
13.	BSAG-306-P	Principles and Practices of Natural Farming	Core	0	0	2	1	5	10	15	70	100
14.	BSAG-307-P	Entrepreneurship Development and Business Communication	MDC	0	0	2	1	5	10	15	70	100
15.	BSAG-308	Physical Education, First Aid, Yoga Practices and Meditation	AEC	0	0	4	2	5	10	15	70	100
16.	AREA	Skill Enhancement Course-III (#To be offered from the	SEC	0	0	4	2	5	10	15	70	100

K. V Subharti College of Science
S. V Subharti University
NH-58, Byepass Road, Meerut

	ELECTIVE-5	bouquet of SEC Courses)										
		Total		**09**	**0**	**24**	**21**	**80**	**160**	**240**	**1120**	1600

Study and Evaluation Scheme (NEP)
As per the ICAR 6th Dean Committee
B.Sc. (Agriculture) IVSem

S.No.	Subject Code	Name of the subject	Periods				Credit	Evaluation Scheme				Total Marks
			Type	L	T	P		Attendance (5)	Quiz/PPT/ Assignment (10)	Mid Sem Test (15)	ESE	
THEORY SUBJECT IV SEMESTER												
1.	BSAG-401	Production Technology of Vegetables and Spices	Core	1	0	0	1	5	10	15	70	100
2.	BSAG-402	Principles of Agricultural Economics and Farm Management	Core	2	0	0	2	5	10	15	70	100
3.	BSAG-403	Crop Production Technology-II (Rabi Crops)	Core	1	0	0	1	5	10	15	70	100
4.	BSAG-404	Farm Machinery and Power	Core	1	0	0	1	5	10	15	70	100
5.	BSAG-405	Water Management	Core	1	0	0	1	5	10	15	70	100
6.	BSAG-406	Problematic Soils and their management	Core	1	0	0	1	5	10	15	70	100
7.	BSAG-407	Basics of Plant Breeding	Core	2	0	0	2	5	10	15	70	100
8.	BSAG-408	Agricultural Informatics and Artificial Intelligence	**VAC**	2	0	0	2	5	10	15	70	100
PRACTICAL IV SEMESTER												
9.	BSAG-401-P	Production Technology of Vegetables and Spices Practical	Core	0	0	2	1	5	10	15	70	100
9.	BSAG-403-P	Crop Production Technology-II (Rabi Crops) Practical	Core	0	0	4	2	5	10	15	70	100
10.	BSAG-404-P	Farm Machinery and Power	Core	0	0	2	1	5	10	15	70	100
11.	BSAG-405-P	Water Management	Core	0	0	2	1	5	10	15	70	100
12.	BSAG-406-P	Problematic Soils and their management	Core	0	0	2	1	5	10	15	70	100
13.	BSAG-407-P	Basics of Plant Breeding	Core	0	0	2	1	5	10	15	70	100
14.	BSAG-408-P	Agricultural Informatics and Artificial Intelligence	**VAC**	0	0	2	1	5	10	15	70	100
15.	AREA ELECTIVE-6	Skill Enhancement Course-III (#To be offered from the bouquet of SEC Courses)	SEC	0	0	4	2	5	10	15	70	100
TOTAL				**12**	**0**	**20**	**21**	80	160	240	1120	1600

K. V Subharti College of Science
S. V Subharti University
NH-58, Byepass Road, Meerut

3rd Semester

Entrepreneurship Development and Business Communication

Theory-

Unit I

Development of entrepreneurship, motivational factors, social factors, environmental factors, characteristics of entrepreneurs, entrepreneurial attributes/competencies. Concept, need for and importance of entrepreneurial development. Evolution of entrepreneurship, objectives of entrepreneurial activities, types of entrepreneurs, functions of entrepreneurs, importance of entrepreneurial development, and process of entrepreneurship development.

Unit-II

Environment scanning and opportunity identification need for scanning: spotting of opportunity, scanning of environment identification of product / service: starting a project; factors influencing sensing the opportunities. Infrastructure and support systems: good policies, schemes for entrepreneurship development; role of financial institutions, and other agencies in entrepreneurship development. Steps involved in functioning of an enterprise. Selection of the product / services, selection of form of ownership; registration, selection of site, capital sources, acquisition of manufacturing know how, packaging and distribution.

Unit-III

Planning of an enterprise, project identification, selection, and formulation of project; project report preparation, Enterprise Management. Production management: product, levels of products, product mix, quality control, cost of production, production controls, Material management. Production management: raw material costing, inventory control. Personal management: manpower planning, labour turn over, wages / salaries.

Unit-IV

Financial management /accounting: funds, fixed capital and working capital, costing and pricing, long term planning and short-term planning, book keeping, journal, ledger, subsidiary books, annual financial statement, taxation. Marketing management: market, types, marketing assistance, market strategies. Crisis management: raw material, production, leadership, market, finance, natural etc.

Practical

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

Suggested Book

- Charantimath, P.M. 2009, Entrepreneurship Development and Small Business Enterprises. Pearson Publications, New Delhi.
- Desai, V. 2015, Entrepreneurship: Development and Management, Himalaya Publishing House.
- Gupta, C.B. 2001. Management Theory and Practice. Sultan Chand & Sons.

3rd Semester

Physical Education, First Aid, Yoga Practices and Meditation

Unit-I

Physical education; Training and Coaching - Meaning and Concept; Methods of Training; aerobic and aerobic exercises. Calisthenics, weight training, circuit training, interval training, Fartlek training; Effects of Exercise on Muscular, Respiratory, Circulatory and Digestive systems.

Unit-II

Balanced Diet and Nutrition: Effects of Diet on Performance; Physiological changes due to ageing and role of regular exercise on ageing process; Personality, its dimensions and types; Role of sports in personality development; Motivation and Achievements in Sports; Learning and Theories of learning; Adolescent Problems and its Management; Posture; Postural Deformities; Exercises for good posture.

III Unit

Yoga; History of Yog, Types of Yog, Introduction to Yog, Asanas (Definition and Importance) Padmasan,san, Vajrajasan, Shashankasan, Pashchimotasan, Ushtrasan, Tadasan, Padhastasan, Ardhchandrasan, Bhujangasan, Utanpadasan, Sarvangasan, Parvatasan, Patangasan, Shishupalanasan – left leg-right leg, Pavanmuktasan, Halasan, Sarpasan, Ardhdhanurasan, Sawasan, Suryanamskar Pranayama (Definition and Importance) Omkar, Suryabhedan, Chandrabhedan, AnulomVilom, Shitali, Shitkari, Bhastrika, Bhramari, Meditation (Definition and Importance), Yogic Kriyas (Kapalbhati), Tratak, Jalneti and Tribandh, Mudras (Definition and Importance) Gyanmudra, Dhyanmudra, Vayumudra, Akashmudra, Pruthvimudra, Shunyamudra, Suryamudra, Varunmudra, Pranmudra, Apanmudra, Vyanmudra, Uddanmudra, Role of yoga in sports • Teaching of Asanas – demonstration, practice, correction and practice.

IV Unit

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

Unit-V

Need and requirement of first aid. First Aid equipment and upkeep. First aid Techniques, First aid related with Respiratory system. First aid related with Heart, Blood and Circulation. First aid related with Wounds and Injuries. First aid related with Bones, Joints Muscle related injuries. First aid related with Nervous system and Unconsciousness. First aid related with Gastrointestinal Tract. First aid related with Skin, Burns. First aid related with Poisoning. First

aid related with Bites and Stings. First aid related with Sense organs, Handling and transport of injured traumatized persons. Sports injuries and their treatments.

3rd Semester

Principles of Genetics

Unit-I

Pre and post Mendelian concepts of heredity, Mendelian principles of heredity, Study of model organisms (Drosophila, Arabidopsis, Garden pea, E. coli, and mice), Architecture of chromosomes, chromonemata, chromosome matrix, chromomeres, centromere, secondary constriction and telomere, special types of chromosomes, Chromosomal theory of inheritance-cell cycle and cell division-mitosis and meiosis. Probabilit and Chi-square.

Unit-II

Types of DNA and RNA, Dominance relationships, Epistatic interactions with example, Introduction and definition of cytology, genetics and cytogenetics and their interrelation.

Unit-III

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

Unit-IV

Qualitative and quantitative traits, Polygenes and continuous variations, multiple factor hypothesis, Cytoplasmic inheritance, Nature, structure and replication of genetic material, Protein synthesis, Transcription and translational mechanism of genetic material, Gene concept: Gene structure, function and regulation.

Practical

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

Suggested Book

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

3rd Semester

Crop Production Technology-I (Kharif crops)

Theory

Unit-I

Origin, geographical distribution, economic importance, soil and climatic requirements, varieties, cultural practices and yield of Kharif crops.

Unit-II

Cereals- rice, maize, sorghum, pearl millet, finger millet and other minor millets, pulses- pigeonpea, mungbean and urdbean.

Unit-III

oilseeds- groundnut, soybean, sesame, castor; fibre crops- cotton and jute.

Unit-IV

Forage crops- sorghum, cowpea, cluster bean, maize, guinea and napier.

Practical

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

Suggested Book

1. B. Gurarajan, R. Balasubramanian and V. Swaminathan. Recent Strategies on Crop Production. Kalyani Publishers, New Delhi.
2. Chidda Singh.1997. Modern techniques of raising field crops. Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi.
3. Rajendra Prasad. Textbook of Field Crops Production - Commercial Crops. Volume II ICAR Publication.

3rd Semester

Production Technology of Fruit and Plantation Crops

Unit-I

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.

Unit-II

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.

Unit-III

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

Unit-IV

Crop production techniques in palms and plantation crops: Climate and soil requirements, varieties, propagation, nursery management, planting and planting systems, cropping systems, after care, training and pruning for plantation crops, water, nutrient and weed management, intercropping, multi-tier cropping system, mulching, special horticultural practices, maturity indices, harvest and yield, pests and diseases, processing- value addition Palms: Coconut, Arecanut, Oil palm and Palmyrah, Plantation crops: Tea, Coffee, Cocoa, Cashewnut, Rubber.

Practical

1. Propagation techniques. selection of planting material, varieties, important cultural practices for mango, banana, papaya, guava, sapota, grapes, Citrus (mandarin and acid lime), pomegranate, jackfruit, preparation and application of PGR's for propagation
2. Micro propagation, protocol for mass multiplication and hardening of fruit crops.
3. Identification and description of varieties, mother palm and seed nut selection, nursery practices, seedling selection, fertilizers application, nutritional disorders, pests and diseases of Coconut, Arecanut and cocoa, Tea and coffee, Rubber and cashew.
4. Visit to commercial orchard and plantation industries.

Suggested Book

- Banday, F.A. and Sharma, M.K.2010 Advances in temperate fruit production. Kalyani Publishers, Ludhiana.
- Bose, T.K., S.K. Mitra and D. Sanyal 2001. Fruits: Tropical and Subtropical (2 volumes) Naya Udyog, Calcutta.
- Bose, T.K., S.K. Mitra, A.A. Farooqi and M.K. Sadhu (Eds). 1999. Tropical Horticulture Vol.1. Naya Prokash, Calcutta.

3rd Semester

Fundamentals of Extension Education

Theory

UNIT-I

Education: Meaning, definition & 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.

UNIT II-

Extension systems in India: extension efforts in pre-independence era (Sriniketan, Marthandam, Firka Development Scheme, Gurgaon Experiment, etc.) and post-independence era (Etawah Pilot Project, Nilokheri Experiment, etc.); various extension/ agriculture development programmes launched by ICAR/ Govt. of India (IADP, IAAP, HYVP, KVK, IVLP, ORP, ND,NATP, NAIP, etc.).New trends in agriculture extension: privatization extension, cyber extension/ e-extension.

Unit-III

Social Justice and poverty alleviation programme: ITDA, IRDP/SGSY/NRLM. Women Development Programme: RMK, MSY etc. New trends in agriculture extension: privatization extension, cyber extension/ e-extension, market-led extension, farmer-led extension, expert systems, etc., Attributes of Innovation, DWCRA, Commodity Interest Groups (CIGs)., Farmers Producer Group (FPG).market-led extension, farmer-led extension, expert systems, etc. Rural Development: concept, meaning, definition; various rural development programmes launched by Govt. of India. Community Dev.-meaning, definition, concept & principles, Philosophy of C.D.

Unit-IV

Rural Leadership: concept and definition, types of leaders in rural context; Method of identification of Rural Leader. Extension administration: meaning and concept, principles and functions. Monitoring and evaluation: concept and definition, monitoring and evaluation of extension programs; transfer of technology: concept and models, capacity building of extension personnel; extension teaching methods: meaning, classification, individual, group and mass contact methods.

UNIT V

ICT Applications in TOT (New and Social Media), media mix strategies; communication: meaning and definition; Principles and Functions of Communication, models and barriers to communication. Agriculture journalism; diffusion and adoption of innovation: concept and meaning, process and stages of adoption, adopter categories.

Practical:

1. To get acquainted with university extension system.
2. Group discussion- exercise; handling and use of audio visual equipment's and digital camera and LCD projector.
3. Preparation and use of AV aids, preparation of extension literature – leaflet, booklet, folder, pamphlet news stories and success stories; Presentation skills exercise; micro teaching exercise.
4. visit to NGO/FO/FPO and learning from their experience in rural development; understanding PRA techniques and their application in village development planning.

5. visit to community radio and television studio for understanding the process of programme production; script writing, writing for print and electronic media, developing script for radio and television.

Suggested Book

- Adivi Reddy, A. 2001. Extension Education, Sree Lakshmi press, Bapatla.
- Dahama, O. P. and Bhatnagar, O.P. 1998. Education and Communication for Development, Oxford and IBH publishing Co. Pvt. Ltd, New Delhi.
- Jalihal, K. A. and Veerabhadraiah, V. 2007. Fundamentals of Extension Education and Management in Extension, Concept publishing company, New Delhi.

3rd Semester

Fundamentals of Nematology

Objective

1. To impart knowledge on history, economic importance of plant parasitic nematodes, morphology, biology, host parasitic relationship of nematodes.

2. To impart knowledge on nematode pests of different crops of national and local importance and their management.

Theory

Unit-I

Introduction: History of phytonematology, habitat and diversity, economic importance of nematodes. General characteristics of plant parasitic nematodes.

Unit-II

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

Unit-III

Interaction between plant parasitic nematodes and disease-causing fungi, bacteria and viruses. Nematode pests of crops: Rice, wheat, vegetables, pulses, oilseed and fiber crops, citrus and banana, tea, coffee and coconut.

Unit-IV

Different methods of nematode management: Cultural methods, physical; methods, Biological methods, Chemical methods, Plant Quarantine, Plant resistance and INM.

Practical

1. Sampling methods, collection of soil and plant samples.
2. Extraction of nematodes from soil and plant tissues following Cobb's sieving and decanting technique.
3. Baermann funnel technique, Picking and counting of plant parasitic nematode.
4. Identification of economically important plant nematodes up to generic level with the help of keys and description: Meloidogyne, Pratylenchus; Heterodera, Tylenchulus, Xiphinema, and Helicotylenchus etc.
5. Study of symptoms caused by important nematode pests of cereals, vegetables, pulses, plantation crops etc.
6. Methods of application of nematicides and organic amendments.
7.

Suggested Books

- Economic Nematology-Edited by J.M. Webster.
- Plant Parasitic Nematodes (Vol-1) by Zukerman, Mai, Rohde.
- Plant Parasitic Nematodes of India: Problems and Progress by - Gopal Swarup, D. R. Dasgupta, P. K. Koshy.

4th Semester

Agricultural Informatics and Artificial Intelligence (AI)

Objective

1. To acquaint student with the basics of computer applications in agriculture, multimedia, database management, application of mobile app and decision- making processes, etc.
2. To provide basic knowledge of computer with applications in Agriculture
3. To make students familiar with Agricultural-Informatics, its components and applications in agriculture

Theory

Unit-1

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

Unit-2

Computer programming: General concepts, Introduction general programming concepts. Concepts and standard input/output operations. e-Agriculture, Concepts, design and development, Application of innovative ways to use information and communication technologies (IT) in Agriculture. Computer Models in Agriculture: Statistical, weather analysis and crop simulation models, concepts, inputs-outputs files, limitation, advantages and application of models for understanding plant processes, sensitivity, verification, calibration and validation, IT applications for computation of water and nutrient requirement of crops, Computer-controlled devices (automated systems) for Agri-input management.

Unit-3

Smartphone mobile apps in agriculture for farm advice: Market price, post-harvest management etc. Geospatial technology: Concepts, techniques, components and uses for generating valuable agri-information. Decision support systems: Concepts, components and applications in Agriculture. Agriculture Expert System, Soil Information Systems etc., for supporting farm decisions. Preparation of contingent crop-planning and crop calendars using IT tools. Digital India and schemes to promote digitalization of agriculture in India.

Unit-4

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

other food processing applications; Concepts of smart agriculture, use of AI in food and nutrition science etc.

Practical

1. Study of computer components, accessories, practice of important DoS Commands.
2. Introduction of different operating systems such as Windows, Unix/Linux, creating files and folders, File Management.
3. Use of MS-Word and MS Power-point for creating, editing and presenting a scientific document.
4. MS-EXCEL-Creating a spreadsheet, Use of statistical tools.
5. Writing expressions, Creating graphs, Analysis of scientific data.
6. MS-ACCESS: Creating Database, preparing queries and reports, Demonstration of Agri-information system.
7. Introduction to World Wide Web (WWW) and its components.
8. Introduction of programming languages such as Visual Basic, Java, Fortran, C, C++.
9. Hands on practice on Crop Simulation Models (CSM), DSSAT/Crop-Info/Crop Syst/ Wofost.
10. Preparation of inputs file for CSM and study of model outputs, computation of water and nutrient requirements of crop using CSM and IT tools.
11. Use of smartphones and other devices in agro-advisory and dissemination of market information.
12. Introduction of Geospatial technology, AR/ VR demonstration.
13. Preparation of contingent crop planning, India Digital Ecosystem of Agriculture (IDEA).

Suggested Readings

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

4th Semester

Production Technology of Vegetables and Spices

Objectives

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

Theory

Importance of vegetables and spices in human nutrition and national economy, kitchen gardening, brief about origin, area, climate, soil, improved varieties and cultivation practices such as time of sowing, transplanting techniques, planting distance, fertilizer requirements, irrigation, weed management, harvesting and yield, physiological disorders of important vegetable and spices

Unit-1

Tomato, okra, brinjal, chili, capsicum, cucumber, bitter gourd , bottle gourd, sweet potato, cassava and moringa, pumpkin, French bean, peas.

Unit-2

Cole crops such as cabbage, cauliflower, knol-khol.

Unit-3

Bulb crops such as onion, garlic.; Root crops such as carrot, radish, beetroot; tuber crops such as potato.

Unit-4

Leafy vegetables such as amaranth, palak, perennial vegetables.

Unit-5

Spice crops like turmeric, zinger, garlic, coriander, cumin, black pepper, cardamom, fenugreek, fennel, clove, nutmeg, cinnamon, curry leaf, tamarind and herbal spices.

Practical

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

Suggested readings

1. Olericulture, Fundamentals of Vegetable Production (Vol.1) by K.P. Singh, Anant Bahadur
2. Vegetable crops by J. Kabir, T.K. Bose, M.G. Som
3. Vegetable crops (Production technology, Vol II) by M.S. Fagaria, B.R. Choudhury, R.S. Dhaka

4th Semester

Principles of Agricultural Economics and Farm Management

Objectives

1. To aware the students about broad areas covered under agricultural Economics and farm management
2. To impart knowledge on judicious use of resources for optimum production

Theory

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.

Unit-2

Basic concepts: Goods and services, desire, want, demand, utility, cost and price, wealth, capital, income and welfare. Agricultural economics: meaning, definition, characteristics of agriculture, importance and its role in economic development. Agricultural planning and development in the country. Demand: meaning, law of demand, demand schedule and demand curve, determinants, utility theory.

Unit-3

Law of diminishing marginal utility, equi-marginal utility principle. Consumer's equilibrium and derivation of demand curve, concept of consumer surplus. Elasticity of demand: concept and measurement of price elasticity, income elasticity and cross elasticity. Production: process, creation of utility, factors of production, input output relationship. Laws of returns: Law of variable proportions and law of returns to scale. Cost: Cost concepts, short run and long run cost curves. Supply: Stock v/s supply, law of supply, supply schedule, supply curve, determinants of supply, elasticity of supply. Distribution theory: meaning, factor market and pricing of factors of production. Concepts of rent, wage, interest and profit.

Unit-4

National income: Meaning and importance, circular flow, concepts of national income accounting and approaches to measurement, difficulties in measurement. Population: Importance, Malthusian and Optimum population theories, natural and socio-economic determinants, current policies and programs on population control. Money: Barter system of exchange and its problems, evolution, meaning and functions of money, classification of money, money supply, general price index, inflation and deflation. Economic systems: Concepts of economy and its functions, important features of capitalistic, socialistic and mixed economies, elements of economic planning. Forms of business organizations, international trade and balance of payments. GST and its implication on Indian economy.

Suggested Readings

1. Johl, S.S. and T.R Kapur. 2009. Fundamentals of Farm Business Management. Kalyani Publishers
2. S. Subha Reddy, P. Raghu Ram, T.V. Neelakanta and I. Bhvani Devi .2004. Agricultural Economics. Oxford & IBH publishing Co. Pvt. Ltd

4th Semester

Crop Production Technology-II (*Rabi* Crops)

Objectives

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

Theory: Origin, geographical distribution, economic importance, soil and climatic requirements, varieties, cultural practices and yield of *Rabi* crops.

Unit-1

Cereals- wheat and barley. Pulses- chickpea, lentil, peas.

Unit-2

Rabi redgram and, rajmash.

Unit-3

Oilseed- rapeseed, mustard, sunflower, safflower; and linseed.

Unit-4

Sugar crops-sugarcane and sugar beet. Medicinal and aromatic crops- mentha, lemon grass and citronella.

Unit-5

Forage crops –barseem, lucerne and oat; potato, quinoa, tobacco.

Practical:

1. Sowing methods of wheat and sugarcane
2. Identification of weeds in *rabi* season crops.
3. Study of morphological characteristics of *rabi* crops.
4. Study of yield contributing characters of *rabi* season crops.
5. Yield and juice quality analysis of sugarcane
6. Study of important agronomic experiments of *rabi* crops at experimental farms.
7. Study of *rabi* forage experiments; oil extraction of medicinal crops.
8. Visit to research stations of related crops.

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

Suggested Readings

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

2. Chidda Singh.1997. Modern techniques of raising field crops. Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi.
3. Rajendra Prasad. Textbook of Field Crops Production - Commercial Crops. Volume II ICAR Publication.
4. Rajendra Prasad. Textbook of Field Crops Production - Foodgrain Crops. Volume I ICAR Publication.
5. S.R. Reddy. 2009. Agronomy of Field Crops. Kalyani Publishers, New Delhi.
6. S.S. Singh. 2005. Crop Management. Kalyani Publishers, New Delhi.
7. Rajendra Prasad. 2002. Text Book of Field Crops Production, ICAR, New Delhi.
8. Reddy, S.R. 2004. Agronomy of Field crops, Kalyani Publishers, Ludhiana.
9. Subhash Chandra Bose, M. and Balakrishnan, V. 2001. Forage Production South Asian Publishers, New Delhi.
10. UAS, Bangalore. 2011. Package of Practice. UAS, Bengaluru.

4th Semester

Farm Machinery and Power

Objectives

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

Theory

Unit-1

Status of Farm Power in India; Sources of Farm Power, I.C. engines, working principles of I C engines; comparison of two stroke and four stroke cycle engines, Study of different components of I.C. engine, I.C. engine terminology and solved problems.

Unit-2

Familiarization with different systems of I.C. engines: Air cleaning, cooling, lubrication, fuel supply and hydraulic control system of a tractor; Familiarization with Power transmission system : clutch; gear box, differential and final drive of a tractor; Tractor types; Cost analysis of tractor power and attached implement;

Unit-3

Criteria for selection of tractor and machine implements. Familiarization with Primary and Secondary Tillage implement; Implement for hill agriculture; implement for intercultural operations.

Unit-4

Familiarization with sowing and planting equipment; calibration of a seed drill and solved examples; Familiarization with Plant Protection equipment; Familiarization with harvesting and threshing equipment.

Practical

1. Study of different components of I.C. engine.
2. To study air cleaning and cooling system of engine.
3. Familiarization with clutch, transmission, differential and final drive of a tractor.
4. Familiarization with lubrication and fuel supply system of engine; Familiarization with brake, steering, hydraulic control system of engine.
5. Learning of tractor driving; Familiarization with operation of power tiller; Implements for hill agriculture; Familiarization with different types of primary and secondary tillage implements: mould plough, disc plough and disc harrow.

6. Familiarization with seed-cum-fertilizer drills their seed metering mechanism and calibration, planters and trans planter; Familiarization with different types of sprayers and dusters.
7. Familiarization with different inter-cultivation equipment; Familiarization with harvesting and threshing machinery; Calculation of power requirement for different implements.

Suggested readings

1. Jagdiswar Sahay – Elements of Agricultural Engineering
2. Jain, S.C. and C.R. Rai-Farm Tractor and maintenance and repair. Standard Publishers, 1705-B, Naisarak. Delhi- 110006
3. Ojha, T.P. and A.M. Michael, A.M. Principles of Agricultural Engineering. Vol.I. Jain brothers, 16/893, East Park Road, Karol Bagh, New Delhi -110005
4. Surendra Singh- Farm machinery –Principles and applications, ICAR, New Delhi

4th Semester

Water Management

Objectives

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

Theory

Unit-1

Irrigation: definition and objectives; Importance: Function of water for plant growth, water resources and irrigation development for different crops in India; Soil plant water relationships; Available and unavailable soil moisture, distribution of soil moisture, water budgeting, rooting characteristics, moisture extraction pattern, effect of moisture stress on crop growth.

Unit-2

Methods of soil moisture estimation, evapotranspiration and crop water requirement; effective rainfall, different approaches of scheduling of irrigation; Methods of irrigation: surface and sub-surface, pressurized methods, viz., sprinkler and drip irrigation, their suitability, merits and limitations, fertigation, economic use of irrigation water;

Unit-3

Layout of different irrigation systems, Irrigation efficiency and water use efficiency, conjunctive use of water, irrigation water quality and its management. Water management of different crops (rice, wheat, maize, groundnut, sugarcane, mango, banana and tomato).

Unit-4

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

Practical

1. Determination of bulk density by field method
2. Determination of soil moisture content by gravimetric method, tensiometer, electrical resistance block and neutron moisture meter.
3. Determination of field capacity by field method; Determination of permanent wilting point.
4. Measurement of irrigation water by using water measuring devices viz., flumes, weirs, notches, orifices.
5. Calculation of irrigation water requirement (Problems).

6. Determination of infiltration rate.
7. Demonstration of furrow method of irrigation; Demonstration of check basin and basin method of irrigation.
8. Visit to farmers' field and cost estimation of drip irrigation system; Demonstration of filter cleaning, fertigation, injection and flushing of laterals.
9. layout for different methods of irrigation, Erection and operation of sprinkler irrigation system.
10. Measurement of emitter discharge rate, wetted diameter and calculation of emitter discharge variability.
11. Visit to irrigation research centre/ station and visit to command area.

Suggested Readings

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

4th Semester

Problematic Soils and their management

Objectives

1. To acquaint the students about various problem soils like degraded soils, acid soils, saline soils, alkali soils, eroded soils, submerged soils, polluted soils. Also to impart knowledge about remote sensing, GIS, Multipurpose tree and Land capability classification
2. To give hands on training about estimation of various soil and water quality parameters associated with problem soils.

Theory

Unit-1

Soil quality and health, Distribution of Waste land and problem soils in India, Categorization of Problem soils based on properties. Reclamation and management of Acid soils, Saline, Sodic soils, Acid Sulphate soils, Eroded and Compacted soils, polluted soils.

Unit-2

Contaminated soils (Pesticide contamination, Heavy metal contamination), Mined soils (Coal mined, Oil mined), Management of Riverine soils, Waterlogged soils, Irrigation water – quality and standards, utilization of saline water in agriculture.

Unit-3

Use of Remote sensing and GIS in diagnosis and management of problem soils. Irrigation and water quality. Multipurpose tree (MPT) species, bio remediation through MPTs of soils, land capability and classification, land suitability classification.

Practical

1. Determination of pHs and EC of saturation extract of problematic soil.
2. 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.
3. Determination of Gypsum requirement of alkali / sodic soil. Determination of lime requirement of acidic soil.
4. Determination of Quality of irrigation water (pH, EC, Ca, Mg, Na, CO_3, HCO_3, Cl, SAR and RSC).
5. Determination of nitrate (NO_3-) from irrigation water.
6. Determination of dissolved oxygen and free carbon dioxide levels in water samples.

Suggested readings

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

4th Semester

Basics of Plant Breeding

Objectives

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

Theory

Unit-1

Historical development, concept, nature and role of plant breeding, major achievements and future prospects; Genetics in relation to plant breeding, modes of reproduction and apomixes, self- incompatibility and male-sterility-genetic consequences, cultivar options, Plant genetic resources, its utilization and conservation Domestication, Acclimatization and Introduction. Centres of origin/ diversity, Components of Genetic variation. Heritability and genetic advance.

Unit-2

Pre-breeding and Universal Plant Breeder's equation. Genetic basis and breeding methods in self-pollinated crops- mass and pure line selection, hybridization techniques and handling of segregating population. Multiline concept, Concepts of population genetics and Hardy-Weinberg Law, Genetic basis and methods of breeding cross-pollinated crops, modes of selection.

Unit-3

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.

Unit-4

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

Practical

1. Plant Breeder's kit, Study of germplasm of various crops.
2. Study of floral structures of self- pollinated and cross-pollinated crops.
3. Emasculation and hybridization techniques in self and cross-pollinated crops.
4. Consequences of inbreeding on genetic structure of resulting populations.

5. Study of male sterility system, Handling of segregating populations,
6. Methods of calculating mean, range, variance, standard deviation, heritability.
7. Designs used in plant breeding experiments, analysis of Randomized Block Design.
8. To work out the mode of pollination in a given crop and extent of natural out-crossing.
9. Prediction of performance of double cross hybrids
10. Maintenance of breeding records and data collection
11. Screening tests for biotic and abiotic stresses.

Suggested Readings

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

Study and Evaluation Scheme (NEP)
As per the ICAR 6th Dean Committee
B.Sc. (Agriculture) VSem

S.No.	Subject Code	Name of the subject	Periods				Credit	Evaluation Scheme				Total Marks
			Type	L	T	P		Attendance (5)	Quiz/ PPT/ Assignment (10)	Mid Sem Test (15)	ESE	
THEORY SUBJECT V SEMESTER												
1.	BSAG-501	Agricultural Marketing and Trade	MDC	2	0	0	2	5	10	15	70	100
2.	BSAG-502	Introduction to Agro-meteorology	Core	2	0	0	1	5	10	15	70	100
3.	BSAG-503	Fundamentals of Crop Physiology	Core	1	0	0	2	5	10	15	70	100
4.	BSAG-504	Pest management in Crops and Stored Grains	Core	2	0	0	2	5	10	15	70	100
5.	BSAG-505	Diseases of Field & Horticultural Crops & their Management	Core	2	0	0	2	5	10	15	70	100
6.	BSAG-506	Crop Improvement (kharif crops) - I	Core	2	0	0	1	5	10	15	70	100
7.	BSAG-507	Weed Management	Core	1	0	0	1	5	10	15	70	100
8.	BSAG-508	Ornamental Crops, MAPs and Landscaping	Core	1	0	0	1	5	10	15	70	100
9.	BSAG-509	Introductory Agro forestry	Core	1	0	0	1	5	10	15	70	100
PRACTICAL V SEMESTER												
10.	BSAG-501-P	Agricultural Marketing and Trade Practical	Core	0	0	2	1	5	10	15	70	100
11.	BSAG-502-P	Introduction to Agro-meteorology Practical	Core	0	0	2	1	5	10	15	70	100
12.	BSAG-503-P	Fundamentals of Crop Physiology Practical	Core	0	0	2	1	5	10	15	70	100
13.	BSAG-504-P	Pest management in Crops and Stored Grains Practical	Core	0	0	2	1	5	10	15	70	100
14.	BSAG-505-P	Diseases of Field & Horticultural Crops & their Management Practical	Core	0	0	2	1	5	10	15	70	100
15.	BSAG-506-P	Crop Improvement (kharif crops) - I Practical	Core	0	0	2	1	5	10	15	70	100
16.	BSAG-507-P	Weed Management Practical	Core	0	0	2	1	5	10	15	70	100
17	BSAG-508-P	Ornamental Crops, MAPs and Landscaping Practical	Core	0	0	2	1	5	10	15	70	100
18.	BSAG-509-P	Introductory Agro forestry Practical	Core	0	0	2	1	5	10	15	70	100
19.	BSAG-510-P	Educational Tour	Qualifying	0	0	0	2	0	0	50	0	50
TOTAL				**14**	**0**	**18**	**22**	90	180	270	1260	1800

Study and Evaluation Scheme (NEP)

K. V Subharti College of Science
S. V Subharti University
NH-58, Byepass Road, Meerut

As per the ICAR 6th Dean Committee
B.Sc. (Agriculture) Vl Sem

S.No.	Subject Code	Name of the subject	Periods				Credit	Evaluation Scheme				Total Marks
			Type	L	T	P		Attendance (5)	Quiz/PPT/ Assignment (10)	Mid Sem Test (15)	ESE	
THEORY SUBJECT VI SEMESTER												
1.	BSAG-601	Fundamentals of Agri Biotechnology	Core	2	0	0	2	5	10	15	70	100
2.	BSAG-602	Basic and Applied Agril Statistics	Core	2	0	0	2	5	10	15	70	100
3.	BSAG-603	Crop Improvement (Rabi crops) - II	Core	1	0	0	1	5	10	15	70	100
4.	BSAG-604	Renewable energy in Agriculture and Allied Sector	Core	1	0	0	1	5	10	15	70	100
5.	BSAG-605	Dryland agriculture/ Rainfed agriculture and watershed management	Core	1	0	0	1	5	10	15	70	100
6.	BSAG-606	Agricultural Microbiology and Phyto -remediation	Core	1	0	0	1	5	10	15	70	100
7.	BSAG-607	Agricultural Finance & Cooperation	Core	1	0	0	1	5	10	15	70	100
8.	BSAG-608	Essentials of Plant Biochemistry	Core	2	0	0	2	5	10	15	70	100
9.	BSAG-609	Fundamentals of Seed Science & Technology	Core	1	0	0	1	5	10	15	70	100
PRACTICAL VI SEMESTER												
10.	BSAG-601-P	Fundamentals of Agri Biotechnology Practical	Core	0	0	2	1	5	10	15	70	100
11.	BSAG-602-P	Basic and Applied Agril Statistics Practical	Core	0	0	2	1	5	10	15	70	100
12.	BSAG-603-P	Crop Improvement (Rabi crops) - II Practical	Core	0	0	2	1	5	10	15	70	100
13.	BSAG-604-P	Renewable energy in Agriculture and Allied Sector Practical	Core	0	0	2	1	5	10	15	70	100
14.	BSAG-605-P	Dryland agriculture/ Rainfed agriculture and watershed management Practical	Core	0	0	2	1	5	10	15	70	100
15.	BSAG-606-P	Agricultural Microbiology and Phyto -remediation Practical	Core	0	0	2	1	5	10	15	70	100
16.	BSAG-607-P	Agricultural Finance & Cooperation Practical	Core	0	0	2	1	5	10	15	70	100
17	BSAG-608-P	Essentials of Plant Biochemistry Practical	Core	0	0	2	1	5	10	15	70	100
18.	BSAG-609-P	Fundamentals of Seed Science & Technology Practical	Core	0	0	2	1	5	10	15	70	100
TOTAL				**12**	**0**	**18**	**21**	90	180	270	1260	1800

K. V Subharti College of Science
S. V Subharti University
NH-58, Byepass Road, Meerut

5th Semester

Agriculture Marketing and Trade 3 (2+1)

Theory

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.

Unit-II

Pricing and promotion strategies: pricing considerations and approaches – cost based and competition based pricing; market promotion – advertising, personal selling, sales promotion and publicity – meaning, merits and demerits; Marketing process and functions: Marketing process concentration, dispersion and equalization; exchange functions – buying and selling; physical functions – storage, transport and processing; facilitating functions – packaging, branding, grading, quality control and labelling (Agmark).

Unit-III

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.

Unit-IV

Role of Govt. in agricultural marketing: Public sector institutions- CWC, SWC, FCI, CACP and DMI – their objectives and functions; cooperative marketing in India; Risk in marketing: Types of risk in marketing; speculation and hedging; an overview of futures trading; Agricultural prices and policy: Meaning and functions of price; administered prices; need for innovations in agricultural price policy.

Unit-V

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.

Practical

1. Plotting and study of demand and supply curves and calculation of elasticities.
2. Study of relationship between market arrivals and prices of some selected commodities.
3. Computation of marketable and marketed surplus of important commodities
4. Study of price behaviour over time for some selected commodities.
5. Visit to a local market to study various marketing functions performed by different agencies
6. Visit to market institutions –NAFED, SWC, CWC, cooperative marketing society, etc.
7. Study their organization and functioning. Application of principles of comparative advantage of international trade.

Suggested 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, N Delhi.
3. Dominic Salvatore, Micro Economic Theory
4. Kohls Richard, L. and Uhl Josheph, N. 2002. Marketing of Agricultural Products, Prentice-Hall of India Private Ltd., New Delhi.
5. Kotler and Armstrong, 2005. Princ.

5th Semester

Introduction to Agro-meteorology 2 (1+1)

Theory

Unit-I

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.

Unit-II

Nature and properties of solar radiation, solar constant, depletion of solar radiation, short wave, longwave and thermal radiation, net radiation, albedo; Atmospheric temperature, temperature inversion, lapse rate, daily and seasonal variations of temperature, vertical profile of temperature.

Unit-III

Application of Thermal time concept and Crop/Pest weather calendar; Energy balance of earth; 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.

Unit-IV

Artificial rainmaking. Monsoon- mechanism and importance in Indian agriculture; Weather hazards - drought, floods, frost, tropical cyclones and extreme weather conditions such as heat-wave and cold-wave; Agriculture and weather relations; Modifications of crop microclimate, climatic normal for crop and livestock production.

Unit-V

Weather forecasting- types of weather forecast and their uses. Climate change, climatic variability, global warming, causes of climate change and its impact on regional and national agriculture.

Practical

1. Visit of Agrometeorological Observatory.
2. site selection of observatory, exposure of instruments and weather data recording.
3. Measurement of total, shortwave and long wave radiation, and its estimation using Planck's intensity law.
4. Measurement of albedo and sunshine duration, computation of Radiation Intensity using BSS.
5. Measurement of maximum and minimum air temperatures, its tabulation, trend and variation analysis.

6. Measurement of soil temperature and computation of soil heat flux.
7. Determination of vapor pressure and relative humidity.
8. Determination of dew point temperature.
9. Measurement of atmospheric pressure and analysis of atmospheric conditions.
10. Measurement of wind speed and wind direction, preparation of windrose, Measurement, tabulation and analysis of rain.
11. Measurement of open pan evaporation and evapotranspiration.
12. Computation of weather reports, weather forecasting-types and methods, crop weather calendar.

Suggested 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.

5th Semester

Fundamentals of Crop Physiology

Theory

Unit-I

Definitions of plant physiology and crop physiology; Importance of crop physiology; Relationship of crop physiology with other branches of crop science; Diffusion and osmosis; Physiological roles of water to crop plants; Definition of water potential and components of water potential; Water absorption by plants: Concept of active and passive absorption; Water loss by plants: Types of water loss: transpiration, stomatal physiology and guttation; Water use efficiency; Essential and beneficial elements; Passive and active transport of mineral element; Functions of essential elements;

Unit-II

Criteria of essentiality of nutrients; Correction measures for nutrient deficiency symptoms; Foliar nutrition and root feeding – significance; Aeroponics Imbibition; Field capacity, permanent wilting point and available soil moisture; Apoplast, symplast and transmembrane, Ascent of sap – theories and mechanism; Soil-plant-atmospheric continuum. Significance of transpiration. Stomatal opening and closing mechanisms. Definition of Cavitation and embolism. Antitranspirants - types and examples. Hydroponics and sand culture.

Unit-III

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

Unit-IV

Introduction to light reaction of photosynthesis, Light absorption by photosynthetic pigments and transfer of energy. Source of O2 during photosynthesis: Hill reaction; Brief introduction to cyclic and non-cyclic photo-phosphorylation: production of assimilatory powers; Introduction to C3 , C4 and CAM pathways: Calvin Cycle, Hatch and Slack Cycle, CAM Cycle; Significance of these pathways (concept of photorespiration, absence of photorespiration in C4 plant: Productivity of C4 plant, CAM: an adaptive mechanism); Factors affecting photosynthesis (light, temperature, CO_2 , O_2 etc.). Outline of the process of respiration: Definition and importance, Glycolysis, Kreb Cycle and ETC, Factors affecting respiration (O_2 , temperature, CO_2 etc.).

Unit-V

Terminologies / Definitions: Growth, Development and Differentiation. Measurement of plant growth (fresh weight, dry weight, linear dimension, area etc.). Introduction to CGR, RGR, NAR etc. Photoperiodism: Photoperiodic Classification of plants: Short Day Plant, Long Day Plant, Day Neutral plant etc. Introduction to Photoperiodic induction site of photo-inductive perception, Role of Phytochrome Introduction to Vernalization (What is vernalization, devernalization etc.), Meaning, classification (seasonal, sequential etc), relation with abscission.

Unit-VI

Physiological and biochemical changes during senescence, Abscission and its significance, Concept of stay green, Hormonal regulation of senescence. Terminologies / Definitions: Plant hormone, Plant growth regulators (PGR), Plant growth inhibitor. Recognized classes of PGR (Auxins, Gibberellins, Cytokinins, Ethylene and Abscisic acid) and their major physiological roles, Agricultural uses of PGRs (IBA, NAA, 2, 4 –D, GAs, Kinetin etc).

Practical

1. Study on structure and distribution of stomata;
2. Demonstration of imbibition, osmosis, plasmolysis,
3. Estimation of water potential, relative water content;
4. Tissue test for mineral nutrients.
5. Identification of nutrient deficiency and toxicity symptoms in plant.
6. Identification of nutrients by hydroponics
7. Estimation of photosynthetic pigments, rate of photosynthesis, respiration and transpiration.
8. Plant growth analysis
9. Study on senescence and abscission, hormonal regulation of senescence
10. Demonstration of the effects of different PGRs on plants
11. Leaf anatomy of C3 and C4 plants.

Suggested Books

1. A Textbook of Insect Pest and Disease Management, 2021. Somnath Sen, and Mohd. Sameer, S. Kataria & Sons publish.
2. Agricultural Pests of India and South east Asia, A.S. Athwal, Kalyani Publishers.
3. A Textbook of Applied Entomology, K.P. Srivastava and G. S. Dhaliwal, Kalyani Publish.

5th Semester

Pest management in crops and stored grains

Objectives

Diagnosis and management of major insect and non- insect pests of crops in field and storage

Theory

Unit-I
General description on nature and type of damage by different arthropod pests; Scientific

name, order, family, host range, distribution, biology and bionomics;

Unit-II
Nature of damage and management of major insect pests of various field crops, vegetable crops, fruit crops, plantation crops, ornamental crops, spices and condiments. Structural entomology and important household pests, their nature of damage and management. Factors affecting loss of stored grains.

Unit-III
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.

Unit-IV
Management of non insect pest of mites, snails and slugs, 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.

Practical

1. Field visit, identification of major insect pests and their damage symptoms.
2. Collection and preservation of major insect pests;
3. collection of damage samples, their identification and herbarium preparation.
4. Methods of monitoring of pest incidence in situ. Management strategies of insect pests of different crops.
5. Study on structural entomology and household pests.

6. Storage structures and methods of grain storage. Spraying techniques for selected field and horticultural crops.
7. Vertebrate pest management, Mass multiplication of NPV and entomopathogenic nematodes.

Suggested readings

1. A Textbook of Insect Pest and Disease Management, 2021. Somnath Sen, and Mohd. Sameer,

S. Kataria & Sons publish.

2. Agricultural Pests of India and South east Asia, A.S. Athwal, Kalyani Publishers.

3. A Textbook of Applied Entomology, K.P. Srivastava and G. S. Dhaliwal, Kalyani Publish.

5th Semester

Diseases of Field and Horticultural Crops and their Management

Theory

Unit I

Symptoms, etiology, disease cycle and management of major diseases of following crops: Field Crops: Rice: blast, brown spot, bacterial blight, sheath blight, false smut, khaira and tungro; 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); Groundnut (early and late leaf spots, rust, wilt)

Unit II

Symptoms, etiology, disease cycle and management of major diseases of following crops: Soybean: Rhizoctonia blight, bacterial spot, seed and seedling rot and mosaic; Pigeonpea: Phytophthora blight, wilt and sterility mosaic; Finger millet: Blast and leaf spot; black & green gram: Cercospora leaf spot and anthracnose, web blight and yellow mosaic; 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). Sugarcane (red rot, smut, grassy shoot, ratoon stunting, Pokah Boeng); Mustard (Alternaria blight, white rust, downy mildew, sclerotinia stem rot) and Sunflower (sclerotinia stem rot, Alternaria blight); Cotton (anthracnose, vascular wilts, black arm).

Unit III

Symptoms, etiology, disease cycle and management of major diseases of following crops: Castor: Phytophthora blight; Tobacco: black shank, black root rot and mosaic. Horticultural Crops: Citrus (canker, gummosis) Guava: wilt and anthracnose; Banana: Panama wilt, bacterial wilt, Sigatoka and bunchy top; Papaya: foot rot, leaf curl and mosaic, Pomegranate: bacterial blight;

Unit IV

Symptoms, etiology, disease cycle and management of major diseases of following crops: Cruciferous vegetables: Alternaria leaf spot and black rot; Brinjal: Phomopsis blight and fruit rot and Sclerotinia blight; Tomato: damping off, wilt, early and late blight, buck eye rot and leaf curl and mosaic; Apple (scab, powdery mildew, fire blight, crown gall) and Peach (leaf curl); Grapevine (downy mildew, powdery mildew, anthracnose) and Strawberry (leaf spot); Coconut (bud rot, Ganoderma wilt). Mango (anthracnose, malformation, bacterial blight, powdery mildew); 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)

Unit V

Symptoms, etiology, disease cycle and management of major diseases of following crops: Okra: Yellow Vein Mosaic; Beans: anthracnose and bacterial blight; Ginger: soft rot; Colocasia: Phytophthora blight; Coconut: wilt and bud rot; Tea: blister blight; Coffee: rust, Turmeric (leaf Spot) and Coriander (stem gall); Rose (dieback, powdery mildew, black leaf spot) and Marigold (botrytis blight, leaf spots)

Practical

1. Identification and histopathological studies of selected diseases of field and horticultural crops covered in theory.
2. Field visit for the diagnosis of field problems.
3. Collection and preservation of plant diseased specimens for Herbarium;
4. Note: Students should submit 50 pressed and well-mounted specimens.

Reference Books:

1. Integrated Plant Disease Management By R.C. Sharma
2. Plant Diseases By R.S. Singh
3. Plant Disease Management:

5th Semester

Crop Improvements Kharif Crop-I

Theory

UNIT-I Centers of origin. Distribution of species.

UNIT-II wild relatives in different cereals (Rice, Maize, Sorghum and Pear[millet); pulses (Pigeonpea, Urdbean and Mungbean); oilseeds (Groundnut); fibre (Cotton). fibres; fodders and cash crops; vegetable and other horticultural crops of kharif season.

UNIT-III Plant genetic resources, its utilization and conservation, study of genetics of qualitative and quantitative characters; Important concepts of breeding self-pollinated, cross-pollinated and vegetatively propagated crops.

UNIT-IV 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 and quality (physical, chemical, nutritional).

UNIT-V Hybrid seed production technology in maize, rice, sorghum, pearl millet and pigeopea etc. Ideotype concept, climate resilient crop varieties for future.

Practical

1. Floral biology, emasculation and hybridization techniques in different crop species; viz., Rice, Jute , Maize, Sorghum, Pearl millet, Pigeonpea, Urdbean, Mungbean, Groundnut, sesame, castor, cotton, cowpea, tabacco, brinjal, okra and cucurbitaceous crops.
2. Maintenance breeding of different kharif crops.
3. Handling of germplasm and segregating populations by different methods like pedigree, bulk and single seed decent methods;
4. Study of field techniques for seed production and hybrid seeds production in Kharif crops;
5. Estimation of heterosis.
6. Inbreeding depression and heritability;
7. Layout of field experiments;
8. Study of quality characters, donor parents for different characters;
9. Visit to seed production plots;
10. Visit to AICRP plots of different field crops.

Books Suggested

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. Kharif crop Production (Hindi), by - Arya R.L. 2019
5. Crop Production at a Glance by - Sah, Akhilesh 2018

5th Semester

Weed Management

Theory

Unit-I

Introduction to weeds, characteristics of weeds their harmful and beneficial effects on ecosystem. Classification, reproduction and dissemination of weeds. crop-weed completion, factors of competition, factors affecting growth and development, Studies on weed seed bank, weed shifts,

Unit-II

Concepts of weed management: physical, cultural, chemical and biological; principles and methods, integrated weed management. Implements for weed control, robotic weed control, weed management in organic/ natural farming.

Unit-III

Herbicide classification and properties of important herbicides, concept of adjuvant, surfactant, herbicide formulation and their use. Introduction to mode of action of herbicides and selectivity. concept of adjuvants, surfactants, herbicide formulation and their use, Nano herbicides, precision weed management

Unit-IV

Mode of action of herbicides and selectivity phenomenon, Concept of herbicide mixture and utility in agriculture. Herbicide compatibility with agro-chemicals and their application.

Unit-V

Herbicide Resistance and its management. Weed management in different field and horticultural crops; aquatic weed management, weed management in cropping systems

Practical's

- Techniques of weed preservation.
- Weed identification and their losses study.
- Biology of important weed.
- Study of herbicide formulations and mixture of herbicide.
- Herbicide application equipment- their parts, use, maintenance and calibration.
- Weed control implements
- Shift of weed flora study in long term experiments.
- Phytotoxicity of herbicides, Weed management in fallow lands
- Study of methods of herbicide application
- Calculations of herbicide doses and weed control efficiency and weed index.

Suggested Book

1. Crafts, A.S. and Robbins, W.W. 1973. Weed Control. Tata McGraw-Hill Publishing Co. Ltd., New Delhi.
2. Gupta, O.P. 1984. Scientific Weed Management. Today and Tomorrow Printers and Publishers, New Delhi.
3. Gupta, O.P. 2015. Modern Weed Management. Agro Bios (India), Jodhpur.

5th Semester

Ornamental Crops, MAPs and Landscaping

Theory

Unit-I

Production technology of important medicinal plants like ashwagandha, asparagus, aloe, costus, Cinnamomum, periwinkle, isabgoland aromatic plants like mint, lemongrass, citronella, palmarosa, ocimum, rose, geranium, vetiver.

Unit-II

Importance and scope of ornamental crops, medicinal and aromatic plants and landscaping. Principles of landscaping. Landscape uses of trees, shrubs and climbers. Style of gardening and lawn making and maintenance.

Unit-III

Production technology of important cut flowers like rose, gerbera, carnation, lilium and orchids user protected conditions and gladiolus, tuberose, chrysanthemum under open conditions.

Unit-IV

Package of practices for loose f lowers like marigold and jasmine under open conditions.

Unit-IV

Brief concept of Home landscaping, Carpet bedding, Topiary, Bonsai, Lawn, flower arrangement, Herbaceous Border, Hedge, Edge etc.; Processing and value addition imp ornamental crops; Processing and value addition of MAPs produce.

Practical's

- Identification of Ornamental plants, Medicinal and Aromatic Plants.
- Nursery bed preparation and seed sowing.
- Propagation of Medicinal and Aerometric Plants.
- Propagation of ornamental plants by terminal/herbaceous cuttings
- Planning and layout of garden.
- Bed preparation and planting of MAP.
- Preparation of flower preservatives and their use in extending the vase life of cut flowers; Training and pruning of ornamental plants and raising of hedge and edge
- Harvesting and post harvest handling of cut and loose flowers extraction of essentials oils.

Suggested Book

- 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

5th Semester

Introductory Agro forestry

Theory

Unit-I

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, MPTS of India.

Unit-II

Ecological aspects of Agroforestry system, tree -crop interaction – competition, nutrient recycling; Traditional Agroforestry as a viable choice to conserve Agro biodiversity of India. Management of Agro-forestry system; Role of agroforestry in soil and water conservation; windbreak; Shelterbelt definition, objectives.; Socio- economic aspects of Agroforestry system; Design and Diagnostic study of agroforestry system.

Unit-III

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.

Unit-IV

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.

Unit-V

Horticulture and forage crops-based agroforestry models developed by ICAR-IGFRI; Agroforestry models developed by Indian council of Forestry Research and Education.

Practical's

1. Identification of tree species in agro-forestry.
2. Study of tree growth measurement.
3. Study of environmental parameters affecting AF System.
4. Plant propagation methods,
5. Preparation of nursery bed exercise, practicing propagation techniques for trees,
6. Afforestation method, practical training, pruning, coppicing, pollarding etc.
7. Planting pattern and designs for plantation, natural and artificial regeneration.
8. Design and diagnostic survey of agro forestry system.

9. Evaluation of agro-forestry system in different agro climatic zones, Exposure.
10. Visit to prevailing agroforestry systems of the state and related important institutions, Virtual visit of agroforestry models developed by ICAR-IGFRI, ICFRE.

Suggested Book

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).

6th Semester

Fundamentals of Agricultural Biotechnology

Theory

Unit-I

Introduction to Plant Tissue Culture and Genetic Engineering: History; Cellular tot potency and cytodifferentiation; Callus culture, Single-cell/suspension culture and their applications; Organogenesis and somatic embryogenesis; Somaclonal variation and its use in crop improvement; Embryo rescue technique and its significance in hybrid development; In vitro fertilization, ovule culture and its significance in hybrid development

Unit-II

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; Synthetic seeds and its applications; National certification and Quality management of TC plants-secondary metabolite production- in vitro germplasm conservation.

Unit-III

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**.**

Unit-IV

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.

Practical's

1. Introduction to Plant Tissue Culture Laboratory.
2. Good Laboratory Practices; Media Preparation and sterilization; Glassware sterilization;
3. Micropropagation, Callus induction and culture; Anther culture, Apical meristem culture.
4. Preparation of synthetic seeds.
5. Isolation of plasmid DNA; Quantification of DNA; Agarose Gel Electrophoresis and visualization of plasmid DNA.

6. Restriction digestion of plasmid DNA and agarose gel electrophoresis.
7. Isolation of Plant genomic DNA; PCR amplification of DNA.
8. Gel electrophoresis of amplified DNA.
9. Visit to tissue culture units /biotech labs.

- **Suggested Book**
- Bhojwani SS. 1983. Plant Tissue Culture: Theory and Practice. Elsevier.
- Singh BD. 2007. Biotechnology: Expanding Horiozon. Kalyani.
- Primrose SB. 2001. Molecular Biotechnology. Panima.

6th Semester

Basic and Applied Agricultural Statistics

Theory

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

Unit-II

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

UNIT-III

Measures of Dispersion. Characteristics for an Ideal Measure of Dispersion. Different Types of Measures of Dispersions. Definition of Range, Interquartile Range, Quartile Deviation and Mean Deviation. Standard Deviation- Definition, Properties. S.D. and Variance for Grouped and Ungrouped Data. Variance of Combined Series. Co-efficients of Dispersions. Co-efficient of Variation. Measures of Skewness and Kurtosis. Definition of Symmetrical Distribution. Definition of Skewness, Measures of Skewness. Definition of Kurtosis. Measure of Kurtosis. Relationship between Mean, Median and Mode for Symmetrical and Skewed Distribution. Probability Theory and Normal Distribution. Introduction to Probability. Basic Terminologies. Classical Probability-Definition and Limitations. Empirical Probability- Definition and Limitations. Axiomatic Probability.

UNIT- IV

Addition and Multiplication Theorem (without proof). Conditional Probability. Independent Events. Simple Problems based on Probability. Definition of Random Variable. Discrete and Continuous Random Variable. Normal Distribution- Definition, Prob. Distribution, Mean and Variance. Assumptions of Normal Distribution. Normal Probability Curve. Correlation and Regression. Definition of Correlation. Scatter Diagram. Karl Pearson's Coefficient of Correlation. Types of Correlation Coefficient. Properties of Correlation Coefficient. Definition of Linear Regression. Regression Equations. Regression Coefficients. Properties of Regression Coefficients. Tests of Significance. Definition. Null and Alternative Hypothesis. Type I and Type II Error.

UNIT-V

Critical Region and Level of Significance. One Tailed and Two Tailed Tests. Test Statistic. One Sample, Two Sample and Paired t-test with Examples. F-test for Variance. ANOVA and Experimental Designs. Definition of ANOVA. Assignable and Non assignable Factors. Analysis

of One-way Classified Data. Basic Examples of Experimental Designs. Terminologies. Completely Randomized Design (CRD). Sampling Theory. Introduction. Definition of Population, Sample, Parameter and Statistic. Sampling Vs Complete Enumeration. Sampling Methods. Simple Random Sampling with Replacement and without Replacement. Use of Random Number Table.

Practical

1. Diagrammatic and Graphical representation of data.
2. Calculation of A.M., Median and Mode (Ungrouped and Grouped data).
3. Calculation of S.D. and C.V. (Ungrouped and Grouped data). Correlation and Regression analysis.
4. Correlation and Regression analysis.
5. Application of t-test (one sample, two sample independent and dependent).
6. & Kurtosis (Grouped Data).
7. Analysis of Variance One Way Classification.
8. Selection of random sample using Simple Random Sampling.

Book Suggested

1. Fundamentals of Statistics by D. N. Elhance, Kitab Mahal Publishers.
2. Fundamentals of Applied Statistics by S.C. Gupta and V. K. Kapoor, Sultan Chand and Sons.
3. Basic Statistics by B. L. Agarwal, New Age International Publishers.

6th Semester

Crop Improvement (Rabi crops)- II

Theory

Unit-I

Centres of origin, distribution of species, wild relatives in different cereals; pulses; oilseeds; f ibres; fodders and cash crops; vegetable and other horticultural crops.

Unit-II

Plant genetic resources, its utilization and conservation, study of genetics of qualitative and quantitative characters.

Unit-III

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).

Unit-IV

Hybrid seed production technology in wheat, oat, chickpea, rapeseed and mustard etc. Ideotype concept, climate resilient crop varieties for future.

Practical's

1. Botany of crops, Floral biology, emasculation and hybridization techniques in different crop species, viz. wheat, oat, rapeseed and mustard, pulses, potato, sugarcane, tomato, chilli, onion etc.
2. Study of field techniques for seed production and hybrid seed production in rabi crops.
3. Estimation of heterosis, inbreeding depression and heritability.
4. Study of quality characters, donor parents for different characters
5. Visit to seed production plots.
6. Visit to AICRP breeding plots of different crops.

Suggested Book

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

6th Semester

Renewable energy in Agriculture and Allied Sector

Theory

Unit-I

Classification of energy sources, contribution of these of sources in agricultural sector; Familiarization with biomass utilization for biofuel production and their application.

Unit-II

Familiarization with types of biogas plants and gasifiers, biogas, bioalcohol, biodiesel and biooil production and their utilization as bioenergy resource.

Unit-III

Introduction of solar energy, collection and their application; Familiarization with solar energy gadgets: solar cooker, solar water heater, application of solar energy: solar drying, solar pond, solar distillation, solar photovoltaic system and their application.

Unit-IV

Introduction of wind energy and their application. Availability of bio mass and their application in different places.

Practical's

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

Suggested Book

1. C.S. Solanki. 2011. Solar Photovoltaic – Fundamentals, Technologies and Applications. PHI Learning Pvt. Ltd. S.
2. Sukhatme and J. Nayak. 2008. Solar Energy: Principles of Thermal Collection and Storage. T hird Edition (Tata McGraw-Hill).

6th Semester

Dryland agriculture/ Rainfed agriculture and watershed management

Theory

Unit-I

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.

Unit-II

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; Crop adaptation and mitigation to drought.

Unit-III

Water harvesting: importance, its techniques, 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-IV

Contingent crop planning for aberrant weather conditions; Concept, history, objective, principles and components of watershed management, factors affecting watershed management.

Unit-V

Log 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.

Practical's

1. Studies on climate classification.
2. studies on rainfall pattern in rainfed areas of the country and pattern of onset and withdrawal of monsoons.
3. Calculation of Length of Growing Period (LGP) and Soil Moisture Availability (SMA)
4. Studies on cropping pattern of different rainfed areas in the country and demarcation of rainfed area on map of India.
5. Interpretation of meteorological data and scheduling of supplemental irrigation on the basis of evapo-transpiration demand of crops.
6. Critical analysis of rainfall and possible drought period in the country.
7. Effective rainfall and its calculation.
8. Studies on cultural practices for mitigating moisture stress including mechanical and agronomic measure.
9. Soil moisture determination under different land situations, Importance of seed priming to mitigate drought.
10. Assessment of meteorological drought.
11. Characterization and delineation of model watershed.

12. Seed treatment, viz., seed hardening and seed priming techniques for all the agricultural crops
13. Field demonstration on soil and moisture conservation measures.
14. Field demonstration on construction of water harvesting structures.
15. Visit to rainfed research station/watershed

Suggested Book

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.

6th Semester

Agricultural Microbiology and Phyto-remediation

Theory

Unit-I

Introduction to Microbiology: Definition, applied areas of Microbiology and Importance of Microbiology. History of Microbiology: Discovery of microorganisms, spontaneous generation theory, Germ theory of diseases, Immunization, fermentation, and origin of life. Bacteria: cell structure, chemoautotrophy, photo autotrophy, growth.

Unit-II

Bacterial genetics: Genetic recombination- transformation, conjugation and transduction, genetic engineering. Soil Microbiology: Nutrient mineralization and transformation, Air Microbiology: Phyllosphere microflora, Phylloplane microflora, microflora of floral parts etc.

Unit-III

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.

Unit IV

Biological control: Microbial biopesticides for plant disease management Concepts of rhizosphere microbiology- Rhizodeposits -biochemical nature, release mechanism in rhizosphere, function, Carbon flow in rhizosphere, Rhizosphere microbiome residents and their roles.

Unit V

Potential of plant growth promoting rhizobacteria (PGPR) and endophytes on soil health and sustainability. Bioremediation of polluted soils using microbial mediators. Phytoremediation of polluted soils.

Practical's

1. Study of the microscope; Acquaintance with laboratory material and equipment.
2. Microscopic observation of different groups of microorganisms: moulds (Fungi); Direct staining of bacteria by crystal violet.
3. Negative or indirect staining of bacteria by nigrosine.
4. Gram staining of bacteria; Study of phyllosphere and rhizosphere microflora.
5. Measurement of microorganisms.
6. Preparation of culture media; Isolation and purification of rhizospheric microbes.
7. Isolation and purification of N-fixers.
8. Isolation and purification of Nutrient solubilizers.
9. Isolation and purification of Endophytes

Suggested Book

1. Pelczar, M.J., Chan, E.C.S. and Kreig, N.R. 2002. Microbiology. 5th Edition, Tata McGraw-Hill, New Delhi.
2. Rangaswami, G. and Bagyaraj, D. J. 2005. Agricultural Microbiology. Prentice-Hall of India Pvt. Ltd., New Delhi.
3. Mukherjee, N. and Ghosh, T. 2004. Agricultural Microbiology. Kalyani Publishers, Calcutta.

6th Semester

Agricultural Finance and Cooperation

Theory

UNIT I- Agricultural Finance- meaning, scope and significance, credit needs and its role in Indian agriculture.

UNIT II - Agricultural credit: meaning, definition, need, classification. Credit analysis: 4 R's, and 3C's of credits.

UNIT III -Sources of agricultural finance: institutional and non-institutional sources, commercial banks, social control and nationalization of commercial banks, Micro financing including KCC. Lead bank scheme, RRBs, Scale of finance and unit cost. An introduction to higher financing institutions – RBI, NABARD, ADB, IMF, world bank, Insurance and Credit Guarantee Corporation of India.

UNIT IV - Cost of credit. Recent development in agricultural credit. Preparation and analysis of financial statements – Balance Sheet and Income Statement. Basic guidelines for preparation of project reports- Bank norms – SWOT analysis.

UNIT V - Agricultural Cooperation – Meaning, brief history of cooperative development in India, objectives, principles of cooperation, significance of cooperatives in Indian agriculture. Agricultural Cooperation in India- credit, marketing, consumer and multi-purpose cooperatives, farmers' service cooperative societies, processing cooperatives, farming cooperatives, cooperative warehousing; role of ICA, NCUI, NCDC, NAFED. 3 R's, 5 C's and 7 P's of credit. Crop insurance: its scope, significance and limitations and the potential of the newly launched 'Pradhan Mantri Fasal Bima Yojana' (Prime Minister's Crop Insurance

Practical

1. Determination of most profitable level of capital use.
2. Optimum allocation of limited amount of capital among different enterprise.
3. Analysis of progress and performance of cooperatives using published data.
4. Analysis of progress and performance of commercial banks and RRBs using published data.
5. Visit to a commercial bank, cooperative bank and cooperative society to acquire firsthand knowledge of their management, schemes and procedures.
6. Estimation of credit requirement of farm business -
7. A case study. Preparation and analysis of balance sheet –
8. A case study. Preparation and analysis of income statement –
9. A case study. Appraisal of a loan proposal –
10. 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.

References :-

1. Reddy, S. and Raghu Ram, P. “Agricultural Finance and Management” Oxford and IBH, New Delhi.
2. Singh, J.P. 1990. “Agricultural Finance – Theory and Practice” Ashish Publishing House, New Delhi
3. Pandey, U.K. “An Introduction to Agricultural Finance” Kalyani Publishes, New Delhi
4. Pandey, Mukesh and Tewari, Deepali “Rural and Agriculture Marketing”

6th Semester

Essentials of Plant Biochemistry

Theory

Unit-I

Biochemistry – 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.

Unit-II

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.

Unit-III

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

Unit-IV

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.

Practical

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

Suggested Book

1. Nelson and Cox. 2008. Lehninger Principles of Biochemistry. Fourth/Fifth edition. Freeman (Can be downloaded)
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. Pearson/Prentice Hall (Can be downloaded).

6th Semester

Fundamentals of Seed Science and Technology

Theory

Unit-I

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.

Unit-II

Foundation and certified seed production of important cereals, pulses and oilseed, field inspection, importance and procedures.

Unit-III

Post-harvest seed quality management; seed processing procedures, seed drying; Seed treatment, its importance, method of application and seed packing; seed storage - general principles, stages and factors affecting seed longevity during storage; Seed health management during storage.

Unit-IV

Seed Certification and legislation; Seed Act and Seed Act enforcement, duty and powers of seed inspector, offences and penalties. Seeds Control Order 1983, basics of seed quality testing; New Seed Bill 2019; Seed quality enhancement techniques.

Practical's

1. Practical Seed Structure.
2. Seed sampling.
3. Physical purity.
4. Moisture determination, Germination test, Seed and seedling vigour test
5. Seed Viability
6. Genetic purity test
7. Grow out test.
8. Field inspection.
9. Seed health testing using blotter and agar plate method.
10. Visit to seed production farms, seed testing laboratories and seed processing plant.

Suggested Book

1. Agarwal, R.L. 1995. Seed Technology (2nd edition). Oxford & IBH Publishing Co. Pvt. Ltd. New Delhi.
2. 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.
3. Vanangamudi, K. 2014. Seed Technology (An illustrated book), New India Publishing Agency, New Delhi, India.

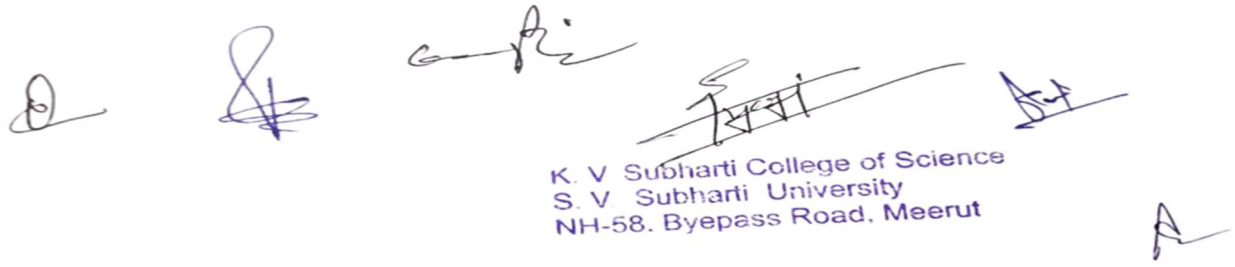
Elective courses for 7th Semester

To be selected only five courses from the following elective courses Each of 4 (3+1) credits for B.Sc. (Hons) Agriculture degree

S.No.	Subject Code	Name of the subject	Periods				Credit	Evaluation Scheme				Total Marks
			Type	L	T	P		Attendance (5)	Quiz/PPT/ Assignment (10)	Mid Sem Test (15)	ESE	
		ELECTIVE THEORY SUBJECT FOR 7TH SEMESTER										
1.	BSAG-701	Agri-Business Management	Elective	3	0	0	3	5	10	15	70	100
2.	BSAG-702	Management of natural resources	Elective	3	0	0	3	5	10	15	70	100
3.	BSAG-703	Agrochemicals	Elective	3	0	0	3	5	10	15	70	100
4.	BSAG-704	Agricultural Journalism	Elective	3	0	0	3	5	10	15	70	100
5.	BSAG-705	Landscaping	Elective	3	0	0	3	5	10	15	70	100
6.	BSAG-706	Commercial Plant breeding	Elective	3	0	0	3	5	10	15	70	100
7.	BSAG-707	Food safety and standards	Elective	3	0	0	3	5	10	15	70	100
8.	BSAG-708	Bioformulation and Nano formulation	Elective	3	0	0	3	5	10	15	70	100
9.	BSAG-709	Biopesticides and Biofertilizers	Elective	3	0	0	3	5	10	15	70	100
10.	BSAG-710	System Simulation and Agro advisory	Elective	3	0	0	3	5	10	15	70	100
11.	BSAG-711	Hi-tech Horticulture	Elective	3	0	0	3	5	10	15	70	100
12.	BSAG-712	Protected cultivation	Elective	3	0	0	3	5	10	15	70	100
13.	BSAG-713	Climate Resilient Agriculture	Elective	3	0	0	3	5	10	15	70	100
14.	BSAG-714	Biotechnology of Crop Improvement	Elective	3	0	0	3	5	10	15	70	100
15.	BSAG-715	Geoinformatics and Remote Sensing, precision farming	Elective	3	0	0	3	5	10	15	70	100
16.	BSAG-716	Micro-propagation Technologies	Elective	3	0	0	3	5	10	15	70	100
17.	BSAG-717	Commercial Seed Production	Elective	3	0	0	3	5	10	15	70	100
18.	BSAG-718	Principles and Practices of Organic Farming/ Conservation Agriculture	Elective	3	0	0	3	5	10	15	70	100

K. V Subharti College of Science
S. V Subharti University
NH-58, Byepass Road, Meerut

19.	**BSAG-719**	Food Science and Nutrition	Elective	3	0	0	3	5	10	15	70	100
20.	**BSAG-720**	Post-Harvest Technology and Value Addition	Elective	3	0	0	3	5	10	15	70	100
ELECTIVE PRACTICAL SUBJECT FOR 7TH SEMESTER												
21.	**BSAG-701-P**	Agri-Business Management Practical	Elective	0	0	2	1	5	10	15	70	100
22.	**BSAG-702-P**	Management of natural resources Practical	Elective	0	0	2	1	5	10	15	70	100
23.	**BSAG-703-P**	Agrochemicals Practical	Elective	0	0	2	1	5	10	15	70	100
24.	**BSAG-704-P**	Agricultural Journalism Practical	Elective	0	0	2	1	5	10	15	70	100
25.	**BSAG-705-P**	Landscaping Practical	Elective	0	0	2	1	5	10	15	70	100
26.	**BSAG-706-P**	Commercial Plant breeding Practical	Elective	0	0	2	1	5	10	15	70	100
27.	**BSAG-707-P**	Food safety and standards Practical	Elective	0	0	2	1	5	10	15	70	100
28.	**BSAG-708-P**	Bioformulation and Nano formulation Practical	Elective	0	0	2	1	5	10	15	70	100
29.	**BSAG-709-P**	Biopesticides and Biofertilizers Practical	Elective	0	0	2	1	5	10	15	70	100
30.	**BSAG-710-P**	System Simulation and Agro advisory Practical	Elective	0	0	2	1	5	10	15	70	100
31.	**BSAG-711-P**	Hi-tech Horticulture Practical	Elective	0	0	2	1	5	10	15	70	100
32.	**BSAG-712-P**	Protected cultivation Practical	Elective	0	0	2	1	5	10	15	70	100
33.	**BSAG-713-P**	Climate Resilient Agriculture Practical	Elective	0	0	2	1	5	10	15	70	100
34.	**BSAG-714-P**	Biotechnology of Crop Improvement Practical	Elective	0	0	2	1	5	10	15	70	100
35.	**BSAG-715-P**	Geoinformatics and Remote Sensing, precision farming Practical	Elective	0	0	2	1	5	10	15	70	100
36.	**BSAG-716-P**	Micro-propagation Technologies Practical	Elective	0	0	2	1	5	10	15	70	100
37.	**BSAG-717-P**	Commercial Seed Production Practical	Elective	0	0	2	1	5	10	15	70	100
38.	**BSAG-718-P**	Principles and Practices of Organic Farming/ Conservation Agriculture Practical	Elective	0	0	2	1	5	10	15	70	100
39.	**BSAG-719-P**	Food Science and Nutrition Practical	Elective	0	0	2	1	5	10	15	70	100
40.	**BSAG-720-P**	Post-Harvest Technology and Value Addition Practical	Elective	0	0	2	1	5	10	15	70	100



Study and Evaluation Scheme (NEP)

As per the ICAR 6th Dean Committee
B.Sc. (Agriculture) VIII Sem*

STUDENT READY PROGRAME

*** RAWE: RURAL AGRICULTURAL WORK EXPERIENCE AND AGRO INDUSTRIAL ATTACHMENT/INTERNSHIP**

(RAWE & AIA)

S.No.	Subject Code	Name of the subject	Periods				credit	Evaluation Scheme		Total Marks
			Type	L	T	P		CCA	ESE	
THEORY SUBJECT VIII SEMESTER										
1.	**BSAG-801**	General orientation & On campus training by different faculties and Village attachment	SEC	0	0	12	9	9 Week	-	100
2.	**BSAG-802**	Unit attachment in Univ./ College. KVK/ Research Station Attachment	SEC	0	0	4	5	5 Week	-	100
3.	**BSAG-803**	Plant clinic	SEC	0	0	4	2	2 Week	-	100
4.	**BSAG-804**	Agro-Industrial Attachment/ Internship	SEC	-	0	-	2	2 Week	-	100
5.	**BSAG-805**	Project Report Preparation, Presentation and Evaluation	SEC	0	0	24	2	2 Week	-	100
TOTAL					**0**	**44**	**20**	**-**	**-**	**500**

1. **Agro Industrial Attachment**
   - Students shall be placed in Agro-and Cottage industries and Commodities¬ Boards for 02 weeks.
   - Industries include Seed/Sapling production, Pesticides-insecticides. Postharvest-processing- value addition, Agri-finance institutions. etc.
2. **Activities and Tasks during Agro-Industrial Attachment Programme**
   - Acquaintance with industry and staff
   - Study of structure, functioning, objective and mandates of the industry

K. V Subharti College of Science
S. V Subharti University
NH-58, Byepass Road, Meerut

- Study of various processing units and hands-on trainings under supervision of industry staff Ethics of industry
- Employment generated by the industry
- Contribution of the industry promoting environment
- Learning business network including outlets of the industry
- Skill development in all crucial tasks of the industry
- Documentation of the activities and task performed by the students
- Performance evaluation appraisal and ranking of students

Skill Enhancement Course

S.No.	Subject Code	Name of the subject	Type	Period			Credit	Evaluation Scheme		Total Marks
				L	T	P		CCA	ESE	
1.	BSAG-11	Biofertilizer and Biopesticide Production	Elective	0	0	2	2	30	70	100
2.	BSAG-12	Mushroom Production Technology	Elective	0	0	2	2	30	70	100
3.	BSAG-13	Seed Production Technology	Elective	0	0	2	2	30	70	100
4.	BSAG-14	Post-harvest Processing Technology	Elective	0	0	2	2	30	70	100
5.	BSAG-15	Beneficial Insect Farming	Elective	0	0	2	2	30	70	100
6.	BSAG-16	Horticulture Nursery Management	Elective	0	0	2	2	30	70	100
7.	BSAG-17	Plantation Crops Production and Management	Elective	0	0	2	2	30	70	100

7th Semester

Elective course 1

Agri-Business Management

Objectives

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

Theory

Unit: - 01

Transformation of agriculture into agribusiness, various stakeholders and components of agribusiness systems. Importance of agribusiness in the Indian economy and New Agricultural Policy. Distinctive features of Agribusiness Management: Importance and needs of agro-based industries. Classification of industries and types of agro based industries. Institutional arrangement, procedures to set up agro based industries.

Unit: - 02

Constraints in establishing agro-based industries. Agri-value chain: Understanding primary and support activities and their linkages. Business environment: PEST and SWOT analysis. Management functions: Roles and activities, Organization culture. Planning, meaning, definition, types of plans. Purpose or mission, goals or objectives, Strategies, polices procedures, rules, programs and budget.

Unit: - 03

Components of a business plan, Steps in planning and implementation. Organization staffing, directing and motivation. Ordering, leading, supervision, communications, control. Capital management and Financial management of Agribusiness. Financial statements and their importance. Marketing Management: Segmentation, targeting and positioning. Marketing mix and marketing strategies.

Unit: - 04

Consumer behaviour analysis, Product Life Cycle (PLC). Sales and Distribution Management. Pricing policy, various pricing methods. Project Management definition, project cycle, identification, formulation, appraisal, implementation, monitoring and evaluation. Project Appraisal and evaluation techniques.

Practical

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

Suggested readings

1. Broadway, A.C. and Broadway, Arif, A. 2002. A textbook of Agri-Business Management. Kalyani Publishers
2. Bairwa, S.L. 2016. Objective on Fundamentals of Agri-business Management. Kalyani Publishers
3. Anjan Nishra, Debasish Biswas and Arunangshu Giri. 2019. Agribusiness Management, Himalaya Publishing House, 220p.
4. Shoji Lal Bairwa, Chandra Sen, L.K. Meena and Meera Kumari. 2018. Agribusiness Management
Theory and Practices, Write and Print Publications.
5. Virender Kamalvanshi. Agribusiness Management. Random.

7th Semester

Elective course 2

Management of natural resources

Objectives

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

Theory

Unit: - 01

Introduction to Natural Resource Bases: Concept of resource, classification of natural resources. Factors influencing resource availability, distribution and uses. Interrelationships among different types of natural resources. Concern on Productivity issues. Ecological, social and economic dimension of resource management.

Unit: - 02

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

Unit: - 03

Water ecology and management. Energy resources: Growing energy needs, renewable and nonrenewable 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.

Unit: - 04

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.

Unit: - 05

Wind erosion - Mechanics of wind erosion, types of soil movement - Principles of wind erosion control and its control measures, Water harvesting techniques - Lining of ponds, tanks and canal systems.

Practical

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

Suggested readings

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 Natura

7th Semester

Elective course 3

Agrochemicals

Objectives

To impart knowledge on different classes of agrochemicals.

Theory

Unit: - 01

An introduction to agrochemicals, their type and role in agriculture, effect on environment, soil, human and animal health, merits and demerits of their uses in agriculture, management of agrochemicals for sustainable agriculture. Herbicides -Major classes, properties and important herbicides. Fate of herbicides.

Unit: - 02

Fungicides- classification –Inorganic fungicides-characteristics, preparation and use of sulphur and copper. Mode of action- Bordeaux mixture and copper oxychloride. Organic fungicides – Mode of action –Dithiocarbamates- characteristics, preparation and use of Zineb and maneb. Systemic fungicides- Benomyl, carboxin, oxycarboxin, Metalaxyl, Carbendazim, characteristics and use.

Unit: - 03

Introduction and classification and insecticides: inorganic and organic insecticides organochorine, Ogranophosphates, Carbamates, Synthetic pyrethriods Neonicotinoids, Biorationals. Insecticide Act and rules, Insecticides banned, withdrawn and restricted use. Fate of insecticides in soil and plant. IGR Biopesticides, Reduced risk insecticides, Botanical, Plant and animal systemic insecticides their characteristics and uses. Fertilizers and their importance.

Unit: - 04

Nitrogenous fertilizers: Feedstocks and Manufacturing of ammonium sulphate, ammonium nitrate, ammonium chloride, urea. Slow release N-fertilizers. Phosphatic fertilizers: feedstock and manufacturing of single superphosphate. Preparation of bone meal and basic slag. Potassic fertilizers: Natural sources of potash, manufacturing of potassium chloride, potassium sulphate and potassium nitrate.

Unit: - 05

Mixed and complex fertilizers: Sources and compatibilitypreparation of major, secondary and micronutrient mixtures. Complex fertilizers: Manufacturing of ammonium phosphates, nitrophosphates and NPK complexes. Fertilizer control order. Fertilizer logistic and marketing. Plant bio-pesticides for ecological agriculture, Bio-insect repellent.

Practical

Sampling of fertilizers and pesticides. Pesticides application technology to study about various pesticides appliances. Quick tests for identification of common fertilizers. Identification of anion and cation in fertilizer. Calculation of doses of insecticides to be used. To study and identify various formulations of insecticide available kin market. Estimation of nitrogen in Urea. Estimation of water soluble P2 O5 and citrate soluble P2 O5 in single super phosphate.

Estimation of potassium in Muraite of Potash/ Sulphate of Potash by flame photometer. Determination of copper content in copper oxychloride. Determination of sulphur content in sulphur fungicide.

Suggested readings

1. Buchel, K.H. (Ed.). 1992. Chemistry of pesticides. John Wiley & Sons
2. Panda, H. 2022.The Complete Technology Book on Pesticides, Insecticides, Fungicides and Herbicides (Agrochemicals) with Formulae, Manufacturing Process, Machinery & Equipment Details. 2nd Revised Edition. NPCS
3. Biswas, D. R. 2021. A Text Book of Fertilizers. New India Publishing Agency
4. Singh, A. 2022. Basics of Agrochemical Formulations, Brillion Publishing, 176p.
5. Larramendy, M.L. 2017. Toxicity and Hazard of Agrochemicals, INTECH, 170p.

7th Semester

Elective course 4

Agricultural Journalism

Objectives

To impart knowledge and skill in agricultural journalism

Theory

Unit: - 01

Journalism – Meaning, nature, importance, and types of journalism. Agricultural Journalism – Meaning, definition, principle, objectives, types, and scope. Similarities and difference between agricultural journalism and other types of journalism. Role of agricultural journalist, Training of agricultural journalist.

Unit: - 02

Qualities of journalist, Role of journalist /journalism in agricultural development and development of newspaper and magazines readers. Newspaper and magazines as communication media: Characteristics, kinds and functions of newspaper and magazines, Characteristics of newspaper and magazines readers. Form, content, style and language of newspaper and magazines, Standard part of newspaper and magazines.

Unit: - 03

The agricultural story: Types of Agriculture stories, subject matter of the agricultural story, structure of the agricultural story. Gathering farm information -Sources of farm information: abstracting from research and scientific materials, interviews, coverage of events. Other sources: electronic media, field study. Success storiesdefinition, nature, components, guidelines of writing a success story.

Unit: - 04

Writing a news story difference between news and feature story, the principle of writing a news story, Inverted pyramid structure. Organizing the material, treatment of the story, writing the news lead and the body. Readability measure-readability ease score, automated readability index, gunning fog index, How to improve readability of articles and stories.

Unit: - 05

Use of photograph in agricultural journalism- Basic principles of photography – composition, exposure, lens, light. Use of artwork (Graphs, charts maps, etc.). Writing the captions. Editorial mechanism: Copy reading, headline and title writing. Proofreading: definition, signs and symbols of proofreading, level of proofreading, duties of a proof-reader. Layout – meaning, principles of layout and design.

Practical

Practice in writing an agricultural news story. Practice in writing an agricultural feature story. Covering agricultural events for the information collection. Practice in interviewing for the information collection. Abstracting stories from research and scientific materials and wire services. Selecting pictures and artwork for the agricultural story. Practice in editing, copy

reading. Practice in headline and title writing. Practising proof reading. Practice in lay outing of newspaper. Testing copy with a readability formula. Visit a publishing office.

Suggested readings

1. Introduction to Journalism by Carole Fleming, Emma Hemmingway, and Gillian Moore.
2. Basic Journalism by Rangaswami Parthasarathy.
3. News Reporting and Editing by K. M. Shrivastava.
4. Professional Journalism by M.V. Kamath.
5. The Journalist's Handbook Book by M.V. Kamath.
6. Farm Journalism and Media Management – Bhaskaran et al.
7. Agricultural Extension and farm Journalism – A K Singh.
8. Farm Journalism – Jana and Mitra.
9. Web Materials.
10. Prepared You Tube videos.

7th Semester

Elective course 5

Landscaping

Objectives

1. To educate the students on designing different styles and types of gardens
2. To enable the students to identify different ornamental plants and their utilization in landscaping design
3. To enable students to design landscapes in softwares like AUTOCAD, ARCHCADE etc.

Theory

Unit: - 01

Importance and scope of landscaping. Principles of landscaping, garden styles and types terrace gardening, vertical gardening, garden components, adornments, lawn making, rockery water garden, walk-paths, bridges, other constructed features etc.

Unit: - 02

Gardens for special purposes. Trees: selection, propagation, planting schemes, canopy management. Shrubs and herbaceous perennials: selection, propagation, planting schemes, architecture.

Unit: - 03

Climber and creepers importance, selection, propagation, planting. Annuals: selection, propagation, planting scheme. Other garden plants: palms, ferns, grasses and cacti succulents. Pot plants: selection, arrangement, management. Bioaesthetic planning: definition, need, planning.

Unit: - 04

Landscaping of urban and rural areas, Peri-urban landscaping, Landscaping of schools, public places like bus station, railway station, townships, river banks, hospitals, play grounds, airports, industries, institutions, Bonsai principles and management. Lawn: establishment and maintenance. CAD application.

Practical

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

Suggested readings

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.

7th Semester

Elective course 6

Commercial Plant breeding

Objectives

1. To discuss about hybrid development and various crop improvement aspects of field crops viz.,
rice, wheat, maize, pearl millet, sorghum, pigeonpea, chickpea, green gram, black gram, lentil, soybean, groundnut, rapeseed-mustard, cotton etc.
2. To provide understanding on tissue culture and biotechnological approaches as alternative strategies for development of line and cultivars
3. To impart knowledge on seed production, release and notification of varieties and PPV&FR Act, 2001

Theory

Unit: - 01

Types of crops and modes of plant reproduction. Line development and maintenance breeding in self- and cross- pollinated crops (A/B/R and two-line system) for development of hybrids and seed production. Genetic test of commercial hybrids.

Unit: - 02

Advances in hybrid seed production of maize, rice, sorghum, pearl millet, castor, sunflower, cotton pigeon pea, Brassica etc. Speed Breeding, Breeding Management systems, High-throughput phenotyping and genotyping platforms,

Unit: - 03

Quality seed production of vegetable crops under open and protected environment. Alternative strategies for the development of the line cultivators: haploid inducer, tissue culture techniques and biotechnological tools.

Unit: - 04

IPR issues in commercial plant breeding: DUS testing and registration of verities under PPV and FR Act. Variety testing, release and notification systems in India. Principles and techniques of seed production, types of seeds, quality testing in self- and cross- pollinated crops.

Practical

Floral biology in self- and cross- pollinated species, selfing and crossing techniques. Techniques of seed production in self- and cross- pollinated crops using A/B/R and two-line system. Learning techniques in hybrid seed production using male- sterility in field crops. Understanding the difficulties in hybrid seed production. Tools and techniques for optimizing hybrid seed production. Concept of rouging in seed production plot. Concept of line its multiplication and purification in hybrid seed production. Role of pollinators in hybrid seed production. Hybrid seed production techniques in sorghum, pearl millet, maize, rice, rapeseed-mustard, sunflower, castor, pigeon pea, cotton and vegetable crops. Sampling and analytical procedures for purity testing and detection of spurious seed. Seed drying and storage structure in quality seed management. Screening techniques during seed processing, viz. grading and packaging. Visit to public private seed production and processing plants.

Suggested readings

1. Commercial Plant Breeding at a glance by Phundan Singh, Pratibha Bisen, Reshu Tiwari. Daya
Publishing House.
2. Plant Breeding: Principles and Methods by B. D. Singh. Kalyani Publishers.
3. Principles of Plant Breeding (1st & 2nd Edition) by R.W. Allard.
4. Breeding Field Crops by J.M. Poehlman.
5. Commercial Plant Breeding Objective: Phundan Singh, Mridula Billore and Monika Singh. Astral Publishing, 160p.
6. Breeding and Crop Production: H. Padmalatha, Random.
7. Biotechnology for Agricultural Breeding: Mangal, S. K. GeneTech Books.

7th Semester

Elective course 7

Food safety and standards

Objectives

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

Theory

Unit: - 01

Food safety –Definition, Importance, Scope and Factors affecting Food Safety. Hazards and Risks, Type of Hazards - Biological, Chemical Physical hazards. Management of hazards – Need.

Unit: - 02

Control of Parameters. Temperature Control. Food Storage. Production Design. Hygiene and Sanitation in Food Service Establishments- Introduction. Sources of contamination and their control. Waste Disposal. Pest and Rodent Control. Personnel Hygiene. Food safety Measures.

Unit: - 03

Food Safety Management Tool- Basic concepts. PRPs, GHPs, GMPs, SSOPs etc. HACCP.ISO series. TQM- concept and need for quality, components of TQM, Kaizen. Risk Analysis. Accreditation and Auditing, Water Analysis, Surface Sanitation and Personal Hygine.

Unit: - 05

Food laws and Standards Indian Food Regulatory Regime, FSSA. Global Scenario CAC. Other laws and standards related to food. Recent concerns -New and Emerging Pathogens.

Unit: - 06

Packaging, Product labelling and Nutritional labelling. Genetically modified food/transgenic. Organic foods. Newer approaches to food safety. Recent Outbreaks. Indian and International Standards for food products.

Practical

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

Suggested readings

1. Text book of Food Science and Technology: Avantina Sharma.
2. Handbook of Food Safety: D.S.L. Khatekar and N. Sarkate. Step Up Academy, 576p.

3. Food and Beverage Management: Bernard Davis. Andrew Lockwood, Ioannis Pantelidis, Peter
Alcott Routle.dge
4. Food safety and Quality Control: Pulkit Mathur. The Orient Blackswan.332p.
5. Safe Food Handling: HACCP booklet for Food Handlers. Cletus Fernandes, Notion Press.

7th Semester

Elective course 8

Bioformulation and Nanoformulation

Objectives

1. To enable students to acquire expertise and skill to develop bioformulation and Nanoformulation
2. To know the importance of biopesticides and biofertilizers
3. To make the students know about various techniques involved in biofertilizers and biopesticides production
4. To get knowledge on essential oils, botanicals, predators, parasitoids, pheromones, and parapheromone and their application in insect pest management
5. To get concepts on agrochemical formulations with nanoparticles and acquaint them with nanotechnology.

Theory

Unit: - 01

Introduction and history of biological control of pests and diseases; Microbial biopesticides: the global and Indian market scenario; biopesticides for organic agriculture; Different phytopathogenic

Unit: - 02

biocontrol agents: Mode of action; Different entomopathogenic biocontrol agents: Mode of action; Microbial inoculants as biofertilizer candidates, Production, quality assessment and methods of application of biopesticides and biofertilizers; Regulatory system of biopesticides in India; Formulations of plant essential oils, botanicals, pheromone, and parapheromone and their application in insect pest management; Use of predators and parasitoids for insect pest management;

Unit: - 03

Nanotechnology: its applications in pest and disease diagnosis and management; Nano biopesticides: Concept and importance, different techniques of producing nano biopesticides;

Unit: - 01

Nano Fertilizers: Concept and importance, Types of nano fertilizers; Different techniques of producing nano fertilizers; Green synthesis of nano fertilizers; green slow-release fertilizer composition based on urea-modified hydroxyapatite nanoparticles

Practical

Introduction and acquaintance with biopesticide laboratory; Preparation of culture media; Isolation and purification of bioagent from soil and infected insects; Microscopic study of different microbial bioagents; In vitro assay of microbial bioagents against plant pathogens. In vitro compatibility study among different microbial bioagents; Mass multiplication of biopesticides; Population enumeration of biocontrol agents in different biopesticides; Preparation

of plant extracts and their efficacy test against insect pests; Use of pheromone parapheromone for monitoring and management of insect pests; Bioassay of Entomopathogenic biocontrol agents on insect pests; Preparation of microbial inoculants of biofertilizer microbes; Compatibility of biofertilizer microbes; Preparation of solid and liquid consortia of biofertilizer microbes

Suggested readings

1. Baker, E.F. and James, R.C. 1982. Biological Control of Plant Pathogens. American Phytopathological Society.
2. Borkar, S.G. 2015. Beneficial Microbes as Biofertilizers and its Production Technology.
3. Boland, G.J. and David, L.1998. Plant microbe interactions and Biological Control. Kuykendall Marel Dekker, INC.
4. Ciancia, A. and Mukerji, K.J. 2007. General Concepts of Integrated Pest and Disease Management. Edited Published by Springer.
5. Cincholkar, S.B. and Mukherji, K.G. 2007. Biological Control of Plant Diseases. Hawarth Food and Agricultural products.
6. Gnanamanickam, S.S. 2002. Biological Control of Crop Disease. Kuykendall Marel Dekker, INC.
7. Ramanujam, B. and Rabindra, R.J. 2006. Current Status of Biological Control of Plant Disease using Antagonistic Organisms in India. Precision Fototype Services, Bengaluru.
8. Singh, S.P. and Hussanini, S.S. 1998. Biological Suppression of Plant Disease, Phytoparasitic Nematodes and Weeds. Precision Fototype Services, Bengaluru.
9. Allhoff, Fritz and Lin, Patrick (Eds). 2009. Nanotechnology and Society. ISBN: 978-1-4020-6208-7 Springer Publications, UK.
10. Prasad, Ram, Vivek Kumar, Manoj Kumar and Devendra Choudhary Eds, 2019. Nanobiotechnology in Bioformulations, Kindle Edition
11. Koul, Opender Ed, 2019. Nano-biopesticides Today and Future Perspectives. Academic Press.
12. Shah, M. A. and Tokeer Ahmad. Nano Science and Technology, Wiley India.

7th Semester

Elective course 9

Biopesticides and Biofertilizers

Objectives

1. To provide knowledge on principles, methods, and mechanisms of bio-control agents and their use against plant diseases
2. To provide knowledge on principles, methods, and mechanism of biofertilizers and their use in agriculture

Theory

Unit: - 01

History and concept of bio pesticides. Importance, scope and potential of bio pesticides. Definitions, concepts and classification of bio pesticides viz. Pathogen, botanical pesticides, and bio rationales. Botanicals and their uses.

Unit: - 02

Mass production technology of bio-pesticides. Virulence, pathogenicity and symptoms of entomopathogenic pathogens and nematodes, Methods of application of bio pesticides. Methods of quality control and Techniques of bio pesticides. Impediments and limitation in production and use of bio pesticides.

Unit: - 03

Biofertilizers - Introduction, status and scope. Structure and characteristics features of bacterial biofertilizers – Azospirillum, Azotobacter, Bacillus, Pseudomonas, Rhizobium and Frankia; Cynobacterial bio fertilizers- Anabaena, Nostoc, Hapalosiphon and fungal biofertilizers – AM mycorrhiza and ectomycorhiza.

Unit: - 03

Nitrogen fixation –Free living and symbiotic nitrogen fixation. Mechanism of phosphate solubilisation and phosphate mobilization, K solubilisation. Production Technology: Strain selection, sterilization, growth and fermentation, mass production of carrier based and liquid biofertilizers. FCO specifications and quality control of biofertilizers.

Unit: - 04

Application technology for seeds, seedlings, tubers, sets etc. Biofertilizers-Storage, shelf life, quality control and marketing. Factors influencing the efficiency of biofertilizers.

Practical

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

Suggested readings

1. Baker, E.F. and James, R.C. 1982. Biological Control of Plant Pathogens. American Phytopathological Society
2. Bhatnagar, R.K. and Palta, R.K. Earthworm Vermiculture and Vermicomposting. Kalyani Publishers.
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. Cincholkar, S.B. and Mukherji, K.G. 2007. Biological Control of Plant Diseases. Hawarth Food
and Agricultural Products.
7. Gehlot, Dushyent. Organic Farming: Standards, Accreditation, Certification and Inspection. Agrobios (India).
8. Gnanamanickam, S.S. 2002. Biological Control of Crop Disease. Kuykendall Marel Dekker, INC.
9. Nehra, Sampat. Biofertilizers for Sustainable Agriculture. Aavishkar Publishers, Jaipur, India.
10. Ramanujam, B. and Rabindra, R.J. 2006. Current Status of Biological Control of Plant Disease

7th Semester

Elective course 10

System Simulation and Agroadvisory

Objectives

1. To impart the knowledge of statistical and simulation modelling in crop yield estimation
2. To get acquainted with different weather forecasting techniques and their usability analysis
3. To study about the preparation and dissemination of agro-advisory bulletin

Theory

Unit: - 01

System approach for representing soil-plant-atmospheric continuum, system boundaries. Crop models, concepts and techniques, types of crop models, data requirements, relational diagrams. Evaluation of crop responses to weather elements; Elementary crop growth models; calibration, validation, verification and sensitivity analysis.

Unit: - 02

Potential and achievable crop production- concept and modelling, techniques for their estimation. Crop production in moisture and nutrients limited conditions; components of soil water and nutrients balance.

Unit: - 03

Weather forecasting, types methods, tools and techniques, forecast verification; Value added weather forecast, ITK for weather forecast and its validity; Crop- Weather Calendars; Preparation of agro-advisory bulletin based on weather forecast.

Unit: - 04

Use of crop simulation model for preparation of Agro- advisory and its effective dissemination.

Practical

Preparation of crop weather calendars. Preparation of agro-advisories based on weather forecast using various approaches and synoptic charts. Working with statistical and simulation models for crop growth. Potential and achievable production; yield forecasting, insect and disease forecasting models. Simulation with limitations of water and nutrient management options. Sensitivity analysis of varying weather and crop management practices. Use of statistical approaches in data analysis and preparation of historical, past and present meteorological data for medium range weather forecast. Feedback from farmers about the agro- advisory.

Suggested readings

1. Introduction to Agrometeorology by H. S. Mavi.
2. Agricultural Meteorology by G.S.L.H.V. Prasado Rao.
3. Advances in Plant Atmospheric Interactions (Eds. Rao, V.U.M., Rao, A.V.M.S., Rao, G.G.S.N.,

Ramana Rao, B.V., Vijaya Kumar, P. and Venkateswarlu, B), Central Research Institute for Dryland Agriculture (CRIDA), Santoshnagar, Hyderabad.
4. Text Book of Agricultural Meteorology by M.C. Varshneya and P.B. Pillai. ICAR.
5. Principles of Agricultural Meteorology by OP Bishnoi.

7th Semester

Elective course 11

Hi-tech Horticulture

Objectives

1. To educate the students on the latest technology of hi-tech horticulture
2. To educate students on the concepts and prospects of hi-tech horticulture

Theory

Unit: - 01

Introduction and importance; Nursery management and mechanization; micro propagation of horticultural crops; Modern field preparation and planting methods; Protected cultivation: advantages, controlled conditions, method and techniques;

Unit: - 02

Micro irrigation systems and its components; EC, pH based fertilizer scheduling; canopy management; high density orcharding; Components of precision farming:

Unit: - 03

Remote sensing; Geographical Information System (GIS); Differential Geo-positioning System (DGPS); Variable Rate Applicator (VRA); application of precision farming in horticultural crops (fruits, vegetables and ornamental crops); mechanized harvesting of produce.

Practical

Types of polyhouses and shade net houses, Intercultural operations, tools and equipment identification and application, Micro propagation, Nursery- portrays, micro-irrigation, EC, pH based fertilizer scheduling, canopy management, visit to hi-tech orchard/nursery.

Suggested readings

1. Hi-tech Horticulture by T.A. More.
2. Greenhouse Operation and Management by Paul V. Nelson.
3. Hi Tech Horticulture (Pb) by S. Prasad, Dharam Singh and R.L. Bharadwaj. Agrobios
4. Instant Horticulture by S.N. Gupta. Jain Brothers. 488p.
5. Hydroponics for Beginners and Advanced: The Ultimate Hydroponic and Aquaponic Gardening Guide by Tom Garden, Webb Eleanor.

7th Semester

Elective course 12

Protected cultivation
Objective
To educate students on the scientific and commercial cultivation of important value-added products in protected cultivation

Theory
Unit: - 01
Protected cultivation- importance and scope, status of protected cultivation in India and World, types of protected structure based on site and climate. Cladding material involved in greenhouse/ poly house. Greenhouse design, environment control, artificial lights, Automation.

Unit: - 02
Soil preparation and management, Substrate management. Types of benches and containers, Irrigation and fertigation management. Propagation and production of quality planting material of horticultural crops.

Unit: - 03
Greenhouse cultivation of important horticultural crops-rose, carnation, chrysanthemum, gerbera, orchid, anthurium, lilium, tulip, tomato, bell pepper, cucumber, strawberry, pot plants etc.

Unit: - 04
Cultivation of economically important medicinal and aromatic plants. Off- season production of flowers and vegetables. Insect pest and disease management.

Practical
Raising of seedlings and saplings under protected conditions, Use of portrays in quality planting material production, Bed preparation and planting of crop for production. Inter cultural operations, Soil EC and pH measurement. Regulation of irrigation and fertilizers through drip, fogging and misting.

Suggested readings
1. Greenhouse operation and management by Paul V. Nelson.
2. Protected cultivation of Horticultural crops by Madan Kr. Jha, Sujan Singh Paikra and Manju Rani Sahu.
3. Protected Cultivation of Horticulture Crops by Itigi Prabhakar. IBPSS.
4. Advances in Protected Cultivation by Brahma Singh and Balraj Singh. NIPA,252p.
5. Protected Cultivation and Smart Agriculture by Eds. Sagar Maitra, Dinkar J. Gaikwad and Tanmoy Shankar. New Delhi Publishers, 263p.
6. Textbook of Protected Cultivation and Precision Farming for Horticultural Crops by B. Ashok Kumar, Eggadi Ramesh and Sindhu V. Jain Brothers.

7th Semester

Elective course 13

Climate Resilient Agriculture

Objectives

1. To impart the concept of climate resilient agriculture under the present context of climate change
2. To study the integrated role of different sectors in building resilience to climate change in Agriculture

Theory

Unit: - 01

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.

Unit: - 02

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; risk assessment strategies, preparedness for weather and climate risks in agriculture;

Unit: - 03

application of geospatial tools and techniques for sustainable agriculture. Climate resilient agriculture (CRA) – concept, scope and importance with special reference to India, climate resilient technologies for enhancing crop productivity and sustainability – role of weather and climatic information, agroadvisories, ICTs and simulation models; climate resilient agronomic practices – crop/cultivar selection, crop diversification/ crop mixtures;

Unit: - 04

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, harnessing microbial biodiversity, biomass recycling;

Unit: - 05

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.

Practical

Acquaintance with meteorological instruments including AWS, Statistical techniques to study trend of climatic parameters, Analysis of extreme weather events using non-parametric 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, Analysing carbon sequestration potential of different agro-ecosystems; Designing climate smart village model considering the availability of resources. Awareness programme on climate change and climate resilient agriculture among farming community.

Suggested readings

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.

7th Semester

Elective course 14

Biotechnology of Crop Improvement

Objectives

1. To acquaint with biotechnological tools of crop improvement
2. To know about direct and indirect methods of gene transfer
3. To introduce about gene editing in plants
4. To provide knowledge about marker assisted breeding and genomic selection

Theory

Unit: - 01

Impact of Biotechnology on crop improvement and the perspective of society; Various biotechnological techniques available for crop improvement – Plant Tissue Culture, Genetic Engineering, Genome editing, Marker Assisted breeding and Genomic Selection.

Unit: - 02

Biosafety regulations and their application in Agricultural Biotechnology. Somaclonal variation and its use in crop improvement; embryo culture; anther/pollen culture; somatic embryogenesis; artificial seeds; techniques of protoplast culture, regeneration and somatic cell hybridization, achievements and limitations, utility in the improvement of crop plants.

Unit: - 03

Direct and Indirect methods of gene transfer in plants - Agrobacterium-mediated gene transfer in dicots and monocots; Direct DNA delivery methods (microinjection, particle gun method, electroporation); gene targeting; Gene silencing techniques; introduction to siRNA; siRNA technology; Micro RNA; construction of siRNA vectors;

Unit: - 04

principle and application of gene silencing; creation of transgenic plants; debate over GM crops; introduction to methods of genetic manipulation in different model systems. Introduction to genome editing – Various tools of genome editing; CRISPR-Cas9 with specific emphasis on Indian regulations;

Unit: - 05

Cloning genomic targets into CRISPR/Cas9 plasmids; electroporation of Cas9 plasmids into cells; purification of DNA from Cas9 treated cells and evaluation of Cas9 gene editing; in vitro synthesis of single guide RNA (sgRNA); using Cas9/sgRNA complexes to test for activity on DNA substrates; evaluate Cas9 activity by T7E1 assays and DNA sequence analysis; Applications of CRISPR/cas9 technology in crop plants. Marker Assisted Breeding and

Unit: - 06

Genomic Selection: Introduction to various DNA-based markers and their use in marker-assisted breeding; Foreground Selection, Recombinant Selection and background Selection; Marker-assisted backcross breeding, marker-assisted selection – success stories; Introduction to Genomic Selection.

Practical

Agrobacterium-mediated transformation in Tobacco – preparation of construct, transfer to binary vector, transform Agrobacterium, prepare explant, Inoculation and Co-cultivation, antibiotic based selection of putative transformants, validation using PCR; Genome editing- preparation of CRISPR/CAS construct, direct transfer to plant, analysis of the targets; Planning of a MABB programme – selection of parents, crossing strategies, marker analysis.

Suggested readings

1. Brown, T. A. 2006. Genomes (3rd edn). Garland Science Pub, New York.
2. Gene Cloning and DNA Analysis. 2010. Retrieved from http://biolab.szu.edu.cn/ otherweb/ lzc/genetic%20engineering/courseware/b1.pdf
3. Green, M. R. and Sambrook, J. 2012. Molecular Cloning: a Laboratory Manual. Cold Spring Harbor, NY: Cold Spring Harbor Laboratory Press.
4. Kumar, Pranav and Mina, Usha. 2015. Biotechnology: A Problem Approach. Pathfinder Publication.
5. Old, R. W., Primrose, S. B. and Twyman, R. M. 2001. Principles of Gene Manipulation and Genomics 7th Edition: Oxford: Blackwell Scientific Publications.
6. Ram, Hari Har. 2019. Crop Breeding and Biotechnology. Kalyani Publications.
7. Rastogi, S.C. 2020. Biotechnology: Principles and Applications. Narosa.
8. Sander, J.D. and Joung, J.K. 2014. CRISPR-Cas systems for Editing, Regulating and Targeting
Genomes. Nat Biotechnol. 32:347-355.
9. Singh, K.H., Kumar, Ajay and Parmar, Nehanjali. 2019. Agricultural Biotechnology at a Glance,
science technology.
10. Slater. 2008. Plant Biotechnology:

7th Semester

Elective course 15

Geoinformatics and remote sensing, precision farming

Objectives

1. Enabling students acquire knowledge on basics of remote sensing technique for precision farming applications
2. Provide a comprehensive knowledge of remote sensing, precision farming and its benefits in improving crop production and soil health management

Theory

Unit: - 01

Introduction and history of remote sensing; sources, 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;

Unit: - 02

Advantages and disadvantages of remote sensing; Remote sensing institutes in India; 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; Software Agents; Impact of Block chain and it's concepts;

Unit: - 03

Probability and Statistics: Bayes Theorem, correlation and Covariance, Continuous Random variables and probability distribution function, various forms of distributions, central limit theorem;

Unit: - 04

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.

Practical

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 toposheets, Digital soil mapping with different variables, Basics of multivariate data analytics, Principal component analysis and regression applications, clustering methods and geostatistics are essential in agricultural studies.

Suggested readings

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.

7th Semester

Elective course 16

Micro-propagation Technologies

Objectives

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

Theory

Unit: - 01

Introduction, History, Advantages and limitations. Types of cultures (seed, embryo, organ, callus, cell); Stages of micro propagation;

Unit: - 02

Axillary bud proliferation (Shoot tip and meristem culture, bud culture); Organogenesis (calluys and direct organ formation); Somatic embryogenesis; Cell suspension cultures; production of secondary metabolites; Somaclonal variation; Cryopreservation.

Practical

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

Suggested readings

1. Basics of Horticulture by Jitendra Singh
2. Introduction to Horticulture by N. Kumar
3. Handbook of Horticulture by ICAR.
4. Plant Tissue Culture: Basic and Applied by Timir Baran Jha and Biswajit Ghosh. Platinum Publishers. 439p.

7th Semester

Elective course 17

Commercial Seed Production

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

Theory

Unit: - 01
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.

Unit: - 02
General Principles of Seed Processing: Introduction, Objectives of Seed Processing, Seed Drying, Principles of Drying, Water vapour equilibrium, Methods of drying seeds, Cleaning and grading, Air and screen machines, Dimensional separators, Density separators, Surface texture separators, Colour separators, Spiral separators, Electric separators, Vibrator separators, Separation based on Affinity to liquids, Seed treatment, Temperature treatment, Chemical treatment, Bagging and 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.

Unit: - 03
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. 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;

Unit: - 04

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.

Unit: - 05

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.

Practical

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

Suggested readings

1. Agarwal, R.L. 1997. Seed Technology. 2nd edn. Oxford & IBH.
2. McDonald, M.B. Jr and Copeland, L.O. 1997. Seed Production: Principles and Practices. Chapman & Hall
3. Thompson, J.R. 1979. An Introduction to Seed Technology. Leonard Hill.
4. Singhal, N.C. 2003. Hybrid Seed Production in Field Crops. Kalyani.
5. Justice, O.L. and Bass, L.N. 1978. Principles and Practices of Seed Storage. Castle House Publ. Ltd.
6. Tunwar, N.S. and Singh S.N. 1988. Indian Minimum Seed Certification Standards. CSCB,

Ministry of Agriculture, New Delhi.
7. Chawla, H.S. 2008. Introduction to Plant Biotechnology. 2nd edn. Oxford &IBH publishing Co. Ltd. 113-B Shahpur Jat, New Delhi-110049.

7th Semester

Elective Course 18

Principles and Practices of Organic Farming and Conservation Agriculture

Objectives

1. To teach students the principles of crop production under organic and conservation agriculture situation
2. To impart practical knowledge of organic and conservation agriculture practices

Theory

Unit: - 01

Concept of organic farming, principles and its scope in India; Choice of crops and varieties in organic farming; Nutrient management in organic farming and their sources; Fundamentals of insect, pest, disease and weed management under organic mode of production; Operational structure of NPOP;

Unit: - 02

Certification process and crop standards of organic farming; Processing, labelling, economic considerations and viability, marketing and export potential of organic products. Initiatives taken by Government (central/state), NGOs and other organizations for promotion of organic agriculture. Conservation agriculture: definition, origin, principles, advantages, challenges;

Unit: - 03

Primary practices in conservation agriculture: minimum soil disturbance, crop residue retention, and crop diversification, complementary practices, conservation agriculture vis a vis Climate Smart.

Unit: - 04

Agriculture; Organic manures- recommended doses and application in comparison to inorganic fertilizers for major crops.

Practical:

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

Suggested readings

1. A.C. Gaur. Handbook of Organic farming and biofertilizers.
2. A.K. Dahama. Organic Farming for Sustainable Agriculture. Agrobios (India), Jodhpur.
3. Arun. K. Sharma. Handbook of Organic Farming. Agrobios (India), Jodhpur.
4. S.P. Palaniappan and K. Annadurai. Organic Farming – Theory and Practice. Scientific Publishers. Jodhpur.
5. U. Thapa and P. Tripathy. Organic Farming in India- Problems and Prospects. Agrotech

publishing agency, Udaipur.
6. G.K. Veeresh. Organic Farming. Foundation Books. New Delhi.
7. Purshit, S.S. Trends in Organic Farming in India. AgrosBios (India), Jodhpur.
8. Thampan, P.K. Organic Agriculture. Peckay tree Crops Development Foundation, Cochin, Kerala.
9. Sathe, T.V. Vermiculture and Organic Farming. Days Publishing House, New Delhi.
10. Singh, Abhinandan, Pankaj Kumar Ojha and Rahul Kumar, 2018. Conservation Agriculture Technologies. Biotech Books.
11. Acharya Sankar Kr, Sreemoyee Bera, Cornea Saha, Prabhat Kumar, Monirul Haque, Riti Chatterjee and Anwesha Mandal. 2022. Conservation Agriculture Approach and Application. Scholars World. 292p.

7th Semester

Elective Course 19

Food Science and Nutrition

Objectives
To impart knowledge on the biochemical aspects of various nutrients and their interactions in foods during processing, storage and deterioration

Theory
Unit: - 01
Introduction on fundamentals of foods and human nutrition; Basic food groups; Concept of balanced diets; Recommended Daily Allowances (RDA) for various age groups; Biochemical composition, energy and food value of various food grains, fruits and vegetables;

Unit: - 02
Carbohydrates, proteins, fats as nutrients and their interactions; Physio-chemical, functional and nutritional characteristics of essential nutrients- sources and functions, Nutritional requirements, malnutrition, inborn errors of metabolism, deficiency diseases; Digestion, absorption, transport and metabolism of nutrients in human system; Protein quality evaluation.

Unit: - 03
Biochemical and nutritional aspects of vitamins, minerals, nutraceuticals, antioxidant, antinational factors and biochemistry of postharvest storage, losses during processing. Effect of cooking, processing and preservation on nutrients of different food products, biochemical aspects of food spoilage;

Unit: - 04
Food fads, food safety and quality standards. Enzymes in food industry, food additives, nutritional quality of plant, animal, dairy, marine and fermented products.

Practical
Proximate analysis of foods; calorific value of foods; Estimation of vitamins, phenols and flavonoids, carotenoids, antinutrients like Phytate/ Oxallate, Trypsin and Chymotrypsin inhibitor activities, limiting amino acids in food stuff.

Suggested readings
1. Damodaran, S. and Parkin, K.L. (Ed.). 2017. Fennema's Food Chemistry. CRC Press
2. Gibney, M.J., Lanham-New, S.A., Cassidy, A. and Voster, H.H. (Ed.). 2009. Introduction to Human Nutrition. Wiley-Blackwell.
3. Trueman, P. 2007. Nutritional Biochemistry. MJP Publishers.
4. Rekhi, Tejmeet and Yadav, Heena. 2014. Fundamentals of Food and Nutrition. Elite Publishing House. 257p.
5. Dharmesh Kumar. Food Science and Nutrition. Random.

7th Semester

Elective Course 20

Post Harvest Technology and Value Addition

Objectives

1. To educate about the different pre-harvest, harvest and post-harvest factors affecting the postharvest life of fruits and vegetables
2. To educate about preparation techniques of value-added products
3. To educate about the different dehydration techniques of horticultural crops

Theory

Unit: - 01

Importance of post –harvest processing of fruits and vegetables, extent and possible causes of post-harvest losses: Pre-harvest factors affecting post-harvest quality, maturity, ripening and changes occurring during ripening;

Unit: - 02

Respiration and factors affecting respiration rate; Harvesting and field handling; Storage (ZECC, cold storage, CA, MA and hypobaric); Value addition concept; Principles and methods of preservation;

Unit: - 03

Intermediate moisture food (jam, jelly, marmalade, preserve, candy) - concepts and standards; Fermented and non-fermented beverages.

Unit: - 04

Tomato products -concepts and standards; Drying /Dehydration of fruits and vegetables –concept and methods, osmotic drying. Canning – concepts and standards, packaging of products.

Practical

Applications of different types of packing, containers for shelf-life extension. Effect of temperature on shelf life and quality of produce. Demonstration of chilling and freezing injury in vegetables and fruits. Extraction and preservation of pulps and juices. Preparation of jam, jelly, RTS, nectar, squash, osmotically dried products, fruit bar candy and tomato products, canned products. Quality evaluation of products- Physico-chemical and sensory. Visit to processing unit/industry.

Suggested readings

1. Post-harvest technology of horticultural crops by S.K. Sharma and M.C Nautiyal.
2. Post-Harvest Technology by Suja Nabi Qureshi, Kounser Javeed and Abhay Kumar Sinha. Bioscientific Publishers.
3. Postharvest Technology of Horticultural Crops by K.P. Sudheer and V. Indira. New India Publishing Agency. 320p.
4. Postharvest Management and Value Addition by Aswini Kumar Goel, Rajender Kumar and Satwinder S. Mann. Daya Publishing House.

5. Postharvest Management and Value Addition of Fruits and Vegetables by Kureel M.K. Biotech,
181p.

8th Semester

S. No	Course tilte	Total credits
01	For student opting 4 year BSc. (Hons.) degree Student READY (RAWE) / Experiential Learning / Hands on Training / Industrial Attachment /Project Work / Internship etc.	20
	Total	20

Skill Enhancement Courses

Biofertlizer and biopesticide production

Course Objective

1. To learn about the importance of Bio pesticides
2. To provide knowledge of Mass production technology of bio-pesticides
3. To learn about the importance of Bio fertilizers
4. To learn Nitrogen fixation -Free living and symbiotic nitrogen
5. To study the Structure and characteristic features of bio fertilizers

Theory

UNIT-I History and concept of biopesticides. Importance, scope and potential of biopesticide. Definitions, concepts and classification of biopesticides viz. pathogen, botanical pesticides, and biorationales. Botanicals and their uses. Mass production technology of bio-pesticides. Virulence, pathogenicity and symptoms of entomopathogenic pathogens and nematodes.

UNIT-II Methods of application of biopesticides. Methods of quality control and Techniques of biopesticides. Impediments and limitation in production and use of biopesticide. Biofertilizers - Introduction, status and scope. Structure and characteristic features of bacterial biofertilizers- Azospirillum, Azotobacter, Bacillus, Pseudomonas, Rhizobium and Frankia.

UNIT-III Cynobacterial biofertilizers- Anabaena, Nostoc, Hapalosiphon and fungal biofertilizers- AM mycorrhiza and ectomycorhiza. Nitrogen fixation -Free living and symbiotic nitrogen fixation. Mechanism of phosphate solubilization and phosphate mobilization, K solubilization. Production technology: Strain selection, sterilization, growth and fermentation, mass production of carrier based and liquid biofertiizers.

UNIT-IV 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 efficacy of biofertilizers.

Practical

1. Isolation and purification of *Trichoderma biopesticides* and its production.
2. Isolation and purification of *Pseudomonas* biopesticides and its production.

3. Isolation and purification of *Bacillus* biopesticides and its production.
4. Isolation and purification of *Metarhyzium* biopesticides and its production.
5. Identification of important botanicals
6. Quality control of biopesticides
7. Visit to biopesticides laboratory and field visit to explore naturally infected cadavers. Identification of entomopathogenic entities in field conditions
8. Isolation and purification of *Azospirillum*
9. Isolation and purification of *Azotobacter*
10. Isolation and purification of *Rhizobium*
11. Isolation and purification of P-solubilizers
12. Isolation and purification of *Cyanobacteria*
13. Mass multiplication and inoculums production of biofertilizers
14. Isolation of AM fungi- wet sieving method and sucrose gradient method

Mushroom production technology

Course Objectives:

1. Enable the students to identify edible and poisonous mushrooms
2. Provide hands on training for the preparation of bed for mushroom cultivation and spawn production
3. Give the students exposure to the experiences of experts and functioning mushroom farms
4. Help the students to learn a means of self employment and income generation

Syllabus

Unit-1: Introduction to mushrooms- Taxonomical rank -History and Scope of mushroom cultivation - Edible and Poisonous Mushrooms-Vegetative characters

Unit-2: Common edible mushrooms Button mushroom (Agaricus bisporus), Milky mushroom (Calocybe indica), Oyster mushroom (Pleurotus sajorcaju) and paddy straw mushroom (Volvariella volvcea).

Unit- 3: Principles of mushroom cultivation; Structure and construction of mushroom house. Sterilization of substrates. Spawn production - culture media preparation- production of pure culture, mother spawn, and multiplication of spawn. Composting technology, mushroom bed preparation. Spawning, spawn running, harvesting. Cultivation of oyster and paddy straw mushroom.Problems in cultivation - diseases, pests and nematodes, weed moulds and their management strategies.

Unit- 4: Health benefits of mushrooms; Nutritional and medicinal values of mushrooms. Therapeutic aspects- antitumor effect

Unit- 5: Post harvest technology: Preservation of mushrooms - freezing, dry freezing, drying, canning, quality assurance and entrepreneurship.Value added products of mushrooms. Sterilization and sanitation of mushroom house, instruments and substrates Preparation of mother culture, media preparation, inoculation, incubation and spawn production Cultivation of oyster mushroom using paddy straw/agricultural wastes

Course outcome:

By successfully completing the course, students will be able to:

1. Identify edible types of mushroom
2. Gain the knowledge of cultivation of different types of edible mushrooms and spawn production
3. Manage the diseases and pests of mushrooms
4. Learn a means of self-employment and income generation

Practical

1. Introduction to Mushroom

2. Viable spawn production of oyster mushroom Preparation of PDA media Isolation of mother culture from mushroom fruiting body Preparation of spawn media Preparation of mother spawn Preparation of commercial spawn

3. Cultivation technique of oyster mushroom Preparation of substrate for Oyster mushroom cultivation Preparation of mushroom bed Maintenance of mushroom bed Harvesting of Oyster mushroom Preparation of balance sheet

4. Viable spawn production of Paddy straw mushroom Preparation of PDA media Isolation of mother culture from mushroom fruiting body Preparation of spawn media Preparation of mother spawn Preparation of commercial spawn

5. Cultivation technique of Paddy straw mushroom Preparation of substrate for Oyster mushroom cultivation Preparation of mushroom bed Maintenance of mushroom bed Harvesting of Oyster mushroom Preparation of balance sheet

6. By-product from mushroom A. Preparation of mushroom pickle B. Preparation of mushroom powder

Seed production technology

Unit-I

Seed and seed technology: introduction, definition and importance. Deterioration causes of crop varieties and their control; Maintenance of genetic purity during seed production, seed quality.

Unit-II

Definition and Characters of good quality seed, different classes of seed. Foundation and certified seed production of important cereals, pulses, oilseeds, fodder and vegetables. Seed certification, phases of certification, procedure for seed certification, field inspection. Seed Act and Seed Act enforcement.

Unit-III

Duty and powers of seed inspector, offences and penalties. Seeds Control Order 1983, Varietal Identification through Grow Out Test. History and development of Seed Industry in India.

Unit-IV

Seed drying, processing and their steps, seed testing for quality assessment, seed treatment, its importance, method of application and seed packing. Seed storage; general principles, stages and factors affecting seed longevity during storage.

Unit-V

Measures for pest and disease control during storage. Seed marketing, Private and public sectors and their production and marketing strategies.

Practical's

- Seed production in major cereals: Wheat, Rice, Maize, Sorghum and Bajra.
- Seed production in major pulses: Urd, Mung, Pigeonpea, Lentil, Gram, Field bean, pea.
- Seed production in major oilseeds: Rapeseed and Mustard and in important vegetable crops.
- Seed sampling and testing: Physical purity, germination, viability, etc.
- Seed and seedling vigour test. Genetic purity test: Grow out test.
- Seed certification: Procedure, Field inspection, Preparation of field inspection report.
- Visit to seed production farms, seed testing laboratories and seed processing plant.

Text books

- Seed Technology,Agrawal, Oxford and IBH Publishing

- **Reference books**
- Seed Technology, Agarwal Rattan Lal, Oxford and IBh Publishing Company Pvt. Ltd.

- Seed Production Technology, J. P. Srivastava, L. T. Simarski, International Centre for Agricultural Research in the Dry Areas.

Post-Harvest Technology

Unit 1 Green house technology: Introduction, Types of Green Houses; Plant response to Green house environment, Planning and design of greenhouses, Design criteria of green house for cooling and heating purposes.

Unit 2 Green house equipments, materials of construction for traditional and low cost green houses. Irrigation systems used in greenhouses, typical applications, passive solar green house, hot air green house heating systems, green house drying.

Unit 3 Cost estimation and economic analysis. Important Engineering properties such as physical, thermal and aero & hydrodynamic properties of cereals, pulses and oilseed, their application in PHT equipment design and operation.

Unit 4 Drying and dehydration; moisture measurement, EMC, drying theory, various drying method, commercial grain dryer (deep bed dryer, flat bed dryer, tray dryer, fluidized bed dryer,

Unit 5 Recirculatory dryer and solar dryer). Material handling equipment; conveyer and elevators, their principle, working and selection.

Practical:

1. Study of different type of green houses based on shape.
2. Determine the rate of air exchange in an active summer winter cooling system.
3. Determination of drying rate of agricultural products inside green house.
4. Study of green house equipments.
5. Visit to various Post Harvest Laboratories.
6. Determination of Moisture content of various grains by oven drying & infrared moisture methods.
7. Determination of engineering properties (shape and size, bulk density and porosity of biomaterials).
8. Determination of Moisture content of various grains by moisture meter.
9. Field visit to seed processing plant.3. Greenhouse Technology and Management, Nicolas Castilla, CABI

Reference:-

1. Post Harvest Technology of Cereals, Pulses and Oil Seeds.1999. Chakravarty, A. Oxford and IBH Pub. New Delhi.
2. Agricultural Process Engineering. 1955. Henderson, S.M. and R.L. Perry. John Willy and Sons, New York.
3. Principles of Agricultural Engineering, Vol. I. 1993. Michael, A.M. and T. P. Ojha . Jain Brothers, New Delhi.

Beneficial insect farming

Unit-I

Theory Importance of beneficial Insects, Beekeeping and pollinators, beebiology, commercialmethods of rearing, equipment used, seasonal management, bee enemies and disease. Bee pasturage, bee foraging and communication. Insect pests and diseases of honey bee. Role of pollinators in cross pollinated plants.

Unit-II

Types of silkworm, voltinism and biology of silkworm. Mulberry cultivation, mulberry varieties and methods of harvesting and preservation ofleaves. Rearing, mounting and harvesting of cocoons. Pest and diseases of silkworm, management, rearing appliances of mulberry silkworm and methods of disinfection.

Unit-III

Species of lac insect, morphology, biology, host plant, lac production – seed lac, button lac, shellac, lac- products. Identification of major parasitoids and predators commonly being used in biological control.

Unit-IV

Insect orders bearing predators and parasitoids used in pest control and their mass multiplication techniques. Important species of pollinator,weed killers and scavengers with their importance.

Practical

1. zation with different body regions of honeybee
2. To study different species of honey bee
3. To get familiarize with
4. different castes of honey bee
5. Acquaintance with bee hive and various beekeeping appliances
6. Seasonal management of bee hive
7. Familiarization with enemies of honey bee and bee hives
8. Familiarization with the disease of bee and their symptoms
9. To study bee pasturage and bee foraging
10. To understand the communication in honeybee
11. To get well acquainted with types of silkworm species
12. Biology of mulberry silkworm, Bombyx mori on mulberry, Morus alba
13. Cultivation of mulberry, selection ofmulberry varieties and method of harvesting and preservation of leaves
14. To study the cultivation of lac insect and host plant identification 14 Identification of important pollinators

15. Identification of important weed killers and scavengers.
16. Identification of important parasitoids and predators
17. Mass multiplication of an important parasitoid -Trichogramma sp
18. Mass multiplication of an important predator-Chrysoperla carnea
19. To visit research and training institutions devoted to beekeeping, sericulture, lac culture and natural enemies

K. V Subharti College of Science
S. V Subharti University
NH-58, Byepass Road, Meerut

Horticulture Nursery Management

Unit 1:

Introduction to Horticulture Nursery, Scope and Importance of Plant Propagation, Role of Nurseries in Horticulture Development, Types of Plant Propagation Nurseries, Physical and Financial Resources for Nursery , Mother Plants: Selection and Maintenance Sexual and Asexual Propagation, Seed Production and Seed Propagation, Vegetative Propagation ,Budding, Layering and Grafting in Horticultural Plants, Micro-Propagation and Hardening of Nursery Plants.

Unit 2:

Plant Nutrition and management in Nursery: Plant Nutrients and Their Requirements, Manures and Fertilizers Application in Nursery, Growth Media and Media Preparation in Nursery, Water qualities and Water Management in Nursery,

Unit 3:

Plant Protections and management in Nursery: Integrated Nutrient Management in Nursery Pest Management in Nursery, Disease Management in Nursery, Weeds and Weed Management in Nursery ,Bio-pesticide Application in Nursery , Integrated Pest Management in Nursery

Unit 4:

Management Practices in Horticulture Nursery; Sanitation, Drainage, Training and Pruning in Nursery, Potting, Re-potting, De-potting and Mulching in Nursery, Plant Growth Regulators in Nursery, Packing and Transport of Nursery Plants, Customer Services in Nursery Plants.

Unit 5:

Ornamental Horticulture Nursery; Selection and Collection of Regional Ornamental Plants, Regional Demand and Supply Situation in Ornamental Plants, Ornamental Plants Mass Production System and Operations, Nursery Plant Branding, Exhibition and Marketing, Economics of Ornamental Plant Nursery.

Practical

1 Identification of Garden Tools
2 Identification of Horticultural crops
3 Preparation of seed bed/ nursery bed
4 Study of sexual methods of propagation
5 Study on propagation by Cuttings
6 Study on propagation by Layering
7 Study on propagation by Grafting
8 Study on propagation by Budding
9 Propagation through specialized Vegetative structures
10 Micro-propagation technique
11 Layout and planting of orchard
12 Training and Pruning of fruit plants
13 Preparation of potting mixture
14 Fertilizer application in different crops

15 Visit to commercial nurseries/orchard

Plantation crops production and Management2 (0+2)

Theory

Unit I Plantation crops, History, scope and importance, area and production, export and import potentials, role of plantation crops in economy of our country.

Unit II Introduction, importance, area and production, origin and distribution, uses, soil, climate, propagation, preparation of pits, spacing and planting, planting systems, care of young palm, irrigation, soil moisture conservation, manuring and fertilization, methods of application of fertilizers, weeding, cropping system, physiological disorder, harvesting, yield, processing, deficiency disorders and byproducts for the following crops Crops: Coconut, Arecanut, Oil Palm and Palmyrah

Unit III Introduction, area and production, origin and distribution, uses, varieties, classification, climate, soil, propagation, preparation of land, shade regulation, spacing, planting, intercropping, irrigation, manuring, weeding, types of branching, pruning, topworking harvesting, processing, physiological disorder and byproducts . Crops: Cocoa and Coffee.

Unit IV Introduction, area, origin and distribution, production, export, soil, climate, types, varieties, propagation, preparation of main field and planting, shade regulation, irrigation, manuring, training and pruning inter cultural practices, mulching, weeding, cropping pattern, harvesting and processing. Crops: Tea and Cashew

Unit V Introduction, origin and distribution, area and production, uses, climate and soil, varieties and types of clones, propagation, spacing, planting, polyclonal seed garden manuring, cover crops, irrigation, weeding, tapping, tapping, use of growth regulators for latex flow, rain guarding, latex collection, yield of latex, processing and storage of rubber.

Practical

1 Study and identification of different fruits crops
2 Study and identification of different plantation crops
3 Study about the seed Propagation of fruits and plantation crops
4 Study about different types of cutting methods in fruit and plantation crops by cutting.
5 Study about different types of Layering of fruits and plantation crops
6 Study about different types of grafting techniques used in propagation of fruits and plantation crops
7 Study about different types of budding techniques used in propagation of fruits and plantation crops
8 Study about seed Scarification and Stratification fruits and plantation crops
9 Study about the preparation of growth regulators and its application in fruits and plantation crops
10 Study about the physiological disorders in fruits and plantation crop
11 Study about the different diseases of fruits and plantation crops
12 Study about the different pests of fruits and plantation crops.

Distribution of Credits in Different Semesters	
Semesters	**Total Credits**
Semester 1st	21+(2+2 Non-gradial)
Semester 2nd	21
Semester 3rd	21
Semester 4th	21
Semester 5th	22
Semester 6th	21
7th Semester (Elective Courses)	20
8th Semester (Student Ready Program.) (Rural Agricultural Work Experience (RAWE) and Agri-Industrial Attachment (AIA)	20
Grant Total	**167**+4 Non-gradial
Online Courses: student will make his own planning and execution of online courses	**10 Credits** Non-gradial

Summary of Credit Distributions	
Type of courses	**Total Credits**
Core courses (Major & Minor/s)	112
Common courses (MDC+VAC+AEC)	23
Skill Enhancement Courses (SEC)	12
Internship/ Student READY	20
**MOOCS/SWAYAM	10 Non-gradial

Note: online courses can be from any field such as Agriculture and allied sciences, Basic Sciences, Humanities, Psychology, Anthropology, Economics, Business Management, Languages including foreign language, Communication skills/ Music, etc. and can be taken from NPTEL, Mook IT, edX, Coursera, SWAYAM or any other such reputed portal.

K. V Subharti College of Science
S. V Subharti University
NH-58, Byepass Road, Meerut