Detailed Course Scheme

Bachelor of Science (Hons.)

Agriculture

Semester- VII

(2024- 28)

DOC202410100012

GLOBAL UNIVERSITY

Educating stars for tomorrow

RNB GLOBAL UNIVERSITY

RNB Global City, Ganganagar Road,
Bikaner, Rajasthan 334601

OVERVIEW

RNB Global University follows Semester System along with Choice Based Credit System as per latest guidelines of University Grants Commission (UGC). Accordingly, each academic year is divided into two semesters, **Odd (July-December) and Even (January-June).** Also, the university follows a system of continuous evaluation along with regular updating in course curricula and teaching pedagogy.

The Curriculum for B. Sc Agriculture program for (July-December) Odd Semester 2027 along with examination pattern is as follows:

Course Scheme

Semester –VII

Five Elective Courses (major or minor) each of 4 (3+1) credits or total 20 credits for B.Sc. (Hons) Agriculture degree

S.No.	Course Code	Course Category	Course Name	L	T	P	Credits
1.a	BSAE45000	DSCEC-3a	Agri-Business Management	3	0	0	3
1.b	BSAE45001	DSCEC-3b	Agri-Business Management Lab	0	0	2	1
2.a	BSAE43000	DSCSO-4a	Management of natural resources	3	0	0	3
2.b	BSAE43001	DSCSO-4b	Management of natural resources Lab	0	0	2	1
3.a	BSAE47000	DSCPP-4a	Agrochemicals	3	0	0	3
3.b	BSAE47001	DSCPP-4b	Agrochemicals Lab	0	0	2	1
4.a	BSAE50000	DSCAC-3a	Agricultural Journalism	3	0	0	3
4.b	BSAE50001	DSCAC-3b	Agricultural Journalism Lab	0	0	2	1
5.a	BSAE48000	DSCHO-5a	Landscaping	3	0	0	3
5.b	BSAE48001	DSCHO-5b	Landscaping Lab	0	0	2	1
6.a	BSAE42000	DSCPB-6a	Commercial Plant breeding	3	0	0	3
6.b	BSAE42001	DSCPB-6b	Commercial Plant breeding Lab	0	0	2	1
7.a	BSAE48002	DSCHO-6a	Food safety and standards	3	0	0	3
7.b	BSAE48003	DSCHO-6b	Food safety and standards Lab	0	0	2	1
8.a	BSAE47002	DSCPP-6a	Bioformulation and Nanoformulation	3	0	0	3
8.b	BSAE47003	DSCPP-6b	Bioformulation and Nanoformulation Lab	0	0	2	1
9.a	BSAE47004	DSCPP-7a	Biopesticides and Biofertilizers	3	0	0	3
9.b	BSAE47005	DSCPP-7b	Biopesticides and Biofertilizers Lab	0	0	2	1

10.a	BSAE41005	DSCAG-9a	System Simulation and Agroadvisory	3	0	0	3
10.b	BSAE41006	DSCAG-9b	System Simulation and Agroadvisory Lab	0	0	2	1
11.a	BSAE48004	DSCHO-7a	Hi-tech Horticulture	3	0	0	3
11.b	BSAE48005	DSCHO-7b	Hi-tech Horticulture Lab	0	0	2	1
12.a	BSAE48006	DSCHO-8a	Protected cultivation	2	0	0	2
12.b	BSAE48007	DSCHO-8b	Protected cultivation Lab	0	0	2	1
13.a	BSAE57000	DSCMT-2a	Climate Resilient Agriculture	2	0	0	2
13.b	BSAE57001	DSCMT-2b	Climate Resilient Agriculture Lab	0	0	2	1
14.a	BSAE58000	DSCBT-2a	Biotechnology of Crop Improvement	2	0	0	2
14.b	BSAE58001	DSCBT-2b	Biotechnology of Crop Improvement Lab	0	0	2	1
15.a	BSAE43002	DSCSO-5a	Geoinformatics and remote sensing, precision farming	3	0	0	3
15.b	BSAE43003	DSCSO-5b	Geoinformatics and remote sensing, precision farming Lab	0	0	2	1
16.a	BSAE58002	DSCBT-3a	Micro-propagation Technologies	3	0	0	3
16.b	BSAE58003	DSCBT-3b	Micro-propagation Technologies Lab	0	0	2	1
17.a	BSAE42002	DSCPB-7a	Commercial Seed Production	3	0	0	3
17.b	BSAE42003	DSCPB-7b	Commercial Seed Production Lab	0	0	2	1
18.a	BSAE41007	DSCAG-10a	Principles and Practices of Organic Farming and Conservation Agriculture	1	0	0	1
18.b	BSAE41008	DSCAG-10b	Principles and Practices of Organic Farming and Conservation Agriculture Lab	0	0	2	1
19.a	BSAE49000	DSCBT-4a	Food Science and Nutrition	3	0	0	3
19.b	BSAE49001	DSCBT-4b	Food Science and Nutrition Lab	0	0	2	1
20.a	BSAE48008	DSCHO-9a	Post Harvest Technology and Value Addition	1	0	0	1
20.b	BSAE48009	DSCHO-9b	Post Harvest Technology and Value Addition Lab	0	0	2	1
21.	IAPCC99348	IAPC-II	Summer Internship and Report	-	-	-	4
22.	WHNN99000		Workshop & Seminars / Human Value & Social Service / NSS	-	-	-	1
			Total				**25**

The students will register for online courses of 10 credit hours (as per UGC guidelines for online courses) as a partial requirement for the comprising one or more courses at the approved portals during the third and fourth years with prior approval from the Head of the institution.

EVALUATION SCHEME - THEORY

The evaluation of the theory paper of B.Sc. Agriculture program would be based on Internal and External Assessments. Internal Assessment would consist of 50% of the marks (50 marks) and external assessment (in form of End Term Exam) would consist of remaining 50% marks (50 marks). Detailed scheme of Internal and External Assessments as follows:

Internal Assessment

The distribution of Internal Assessment Marks is as follows:

Type	Details	Marks
Mid Term	Two Mid-term Sessional of 15 marks each (15+15)	30
Marks obtained in various Tests, Assignments, Presentations, Quiz, Tutorials, etc.	Average of marks obtained	15
Academic and course involvement		5
TOTAL	**50**	

External Assessment

Type	Marks
Theory	50

EVALUATION SCHEME - PRACTICAL

The evaluation of the practical paper of B.Sc. Agriculture program would be based on Internal and External Assessments. Internal Assessment would consist of 50% of the marks (50 marks) and external assessment (in form of End Term Exam) would consist of remaining 50% marks (50 marks). Detailed scheme of Internal and External Assessment is as follows:

Internal Assessment

Type	Details	Marks
Marks obtained in various manuals, practical file, participation, any model prepared, output of practical	Average of marks obtained	45
Academic and course involvement		5
TOTAL	**50**	

External Assessment

Type	Marks
Practical	50

1. Vision

Vision of School of Agriculture is to be established as advanced studies and research and skill-based centre for students and scholars.

2. Mission

Mission of School of Agriculture is to cultivate a scholarly mindset and analytical abilities in students, as well as train them in agricultural sphere, to reach the profession's daunting needs by providing dynamic knowledge in the field of agriculture.

3. Program Educational Objectives (PEOs)

After successful completion of the program, the graduates will be

AGPEO 1: Able to apply concepts of basic and applied sciences to Agriculture

AGPEO 2: Able to design and develop interdisciplinary and innovative systems.

AGPEO 3: Able to inculcate effective communication skills, team work, ethics, leadership in preparation for a successful career in agriculture and R&D organizations.

4. Program Outcomes (POs)

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

PO1. Agriculture knowledge: Apply the knowledge of basic and applied sciences to agriculture, agriculture fundamentals and agriculture specialization to the solution of complex agriculture problems. Apply the knowledge of regenerative agriculture with a conservation and rehabilitation approach to food and farming systems.

PO2. Problem analysis: Identify, formulate, review research literature, and analyze complex agriculture problems reaching substantiated conclusions using first principles of basic and applied sciences. Understand rapid appraisal of agricultural innovation systems, a diagnostic tool that can guide the analysis of complex agricultural problems and innovation capacity of the agricultural system towards futuristic agriculture.

PO3. Design/development of solutions: Design solutions for complex agriculture problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, social, and environmental considerations.

PO4. Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO5. Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern agriculture and IT tools including prediction and modelling to complex agriculture activities with an understanding of the limitations. Learning use of GIS, IoT, Automation, Intelligent Systems in Farming & Agriculture development & trading.

PO6. The agriculture graduate and society: Apply reasoning informed by the contextual knowledge to assess social, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional agriculture practices. Recognize, analyze, and evaluate the critical human and social factors impacting agriculture. Understand the social dimensions of agriculture and its connections with food and environmental systems.

PO7. Environment and sustainability: Understand the impact of the professional agriculture solutions in societal and environmental contexts, and demonstrate the knowledge and need for sustainable development.

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

PO9. Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO10. Communication: Communicate effectively on complex agriculture activities with the agriculture community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO11. Project management and finance: Demonstrate knowledge and understanding of the agriculture and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments. Able to design, launch and run a new business, to create job and not to seek for job. Also capable with an effective mix of knowledge, skills, and personal attitudes to be employed initially and function successfully in the required roles.

PO12. Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

5. Program Specific Outcomes (PSOs)

At the end of the program, the student will be able to:

PSO 1. Clearly understand the concepts and applications in the field of agriculture. Apply the knowledge of crop cultivation, crop improvement, soil and crop management for sustainable organic agricultural production and development.

PSO 2. Associate the learning from the courses related to agriculture to arrive at solutions to real world problems. Analyze and identifying complex agricultural problems and formulating ethical solutions using the principles of agricultural science, and business.

PSO 3. Have the capability to comprehend the technological advancements in the usage of modern design tools to analyze and design subsystems/processes for a variety of applications. Develop innovative processes, products, and technologies to meet the challenges in agriculture and farming practices

PSO 4. Possess the skills to communicate in both oral and written forms, the work already done and the future plans with necessary road maps, demonstrating the practice of professional ethics and the concerns for social and environmental wellbeing.

6. Course Outcomes (COs)

Course	Course outcomes: - After completion of these courses students should be able to
BSAE45000-Agri-Business Management	**CO1:** Identify various stakeholders and components of agribusiness systems, their linkages, and the significance of agribusiness in the Indian economy while analyzing the New Agricultural Policy. **CO2:** Classify agro-based industries, explain their importance, and evaluate institutional arrangements and procedures for setting up these industries while addressing potential constraints. **CO3:** Analyze the agri-value chain by understanding primary and support activities and performing PEST and SWOT analyses to assess their linkages and implications for agribusiness. **CO4:** Develop comprehensive business plans incorporating organizational goals, strategies, financial planning, and management functions to enhance agribusiness efficiency. **CO5:** Design marketing strategies by segmenting, targeting, and positioning markets; analyzing consumer behavior; and applying project management techniques to ensure successful implementation and evaluation of agribusiness projects.
BSAE45001-Agri-Business Management Lab	**CO1:** Analyze the structure and functioning of agri-input markets, including seeds, fertilizers, and pesticides, as well as output markets like grains, fruits, vegetables, and value-added products. **CO2:** Examine the operations of product markets, retail trade, commodity trading, and value-added product sectors, and evaluate their roles in agribusiness development. **CO3:** Evaluate the role of financing institutions such as Cooperatives, Commercial Banks, RRBs, Agribusiness Finance Limited, and NABARD in supporting agribusiness initiatives. **CO4:** Prepare feasibility reports and projects for agribusiness entrepreneurs using appraisal and evaluation techniques, including non-discounting methods and net present worth analysis. **CO5:** Apply financial tools such as the internal rate of return and growth trend analysis of agricultural commodity prices to identify viable agribusiness projects and support entrepreneurial decision-making.

BSAE43000-Management of natural resources	**CO1:** Classify natural resources based on their types and evaluate the factors influencing their availability, distribution, and uses, while analyzing the interrelationships among different resource types. **CO2:** Analyze land resources and their management issues, including land degradation, soil erosion, desertification, wetland ecology, and landscape impact, to propose sustainable management strategies. **CO3:** Examine the causes and impacts of water resource issues such as over-utilization, floods, droughts, and conflicts, and design sustainable water management and harvesting techniques. **CO4:** Compare renewable and non-renewable energy sources, assess the potential of alternate energy options, and explore the implications of different resource management paradigms and approaches. **CO5:** Apply principles of soil and water conservation, such as contouring, strip cropping, bunding, and terracing, to estimate and control soil and wind erosion using scientific techniques like the Universal Soil Loss Equation.
BSAE43001-Management of natural resources Lab	**CO1:** Identify different types of natural resources and their utility in agricultural and ecological contexts, demonstrating understanding through practical applications like pacing techniques for measurement. **CO2:** Apply survey principles and techniques, including chain surveys and GPS for tracking and area measurement, and use these tools to calculate land area and estimate soil loss and erosion index. **CO3:** Demonstrate the concept of leveling and its practical utility in agriculture, including the preparation of contour maps and the design of vegetative waterways for erosion control. **CO4:** Evaluate wind erosion processes, estimating its impacts on agriculture and natural environments, and develop strategies for wind erosion control based on practical assessment. **CO5:** Design farm ponds, irrigation pumps, and water management systems based on practical constructional principles, visiting farm ponds and erosion sites for hands-on learning and application of strip cropping and contour bunding.

BSAE47000- Agrochemicals	**CO1:** Identify different types of agrochemicals, including herbicides, fungicides, and insecticides, and evaluate their roles in agriculture, assessing both the benefits and risks to the environment, soil, human, and animal health. **CO2:** Analyze the properties, modes of action, and uses of major herbicides, fungicides, and insecticides, including inorganic, organic, and systemic types, to understand their impact on agricultural practices and pest management. **CO3:** Evaluate the environmental fate of agrochemicals, such as herbicides and insecticides, in soil and plants, and apply best management practices for their sustainable use in agriculture. **CO4:** Demonstrate the manufacturing processes and applications of different fertilizers (nitrogenous, phosphatic, potassic, and mixed) and explain their importance in crop production, while understanding the logistics and marketing of fertilizers. **CO5:** Design and propose bio-pesticide solutions for ecological agriculture, including plant bio-insect repellents, while analyzing the effectiveness of reduced-risk and bio-based insecticides as alternatives to chemical pesticides.
BSAE47001- Agrochemicals Lab	**CO1:** Demonstrate the process of sampling fertilizers and pesticides, and conduct quick tests to identify common fertilizers and their anions and cations. **CO2:** Apply pesticide application technology by studying various pesticide appliances and determining the correct doses for insecticides in real-world agricultural contexts. **CO3:** Estimate the nitrogen content in urea and assess the water-soluble and citrate-soluble P2O5 content in single superphosphate through laboratory techniques. **CO4:** Identify and analyze various formulations of insecticides available in the market, evaluating their effectiveness and application methods. **CO5:** Determine the content of copper in copper oxychloride, sulphur in sulphur fungicide, and potassium in Muriate of Potash/Sulphate of Potash using laboratory equipment like the flame photometer.

BSAE50000- Agricultural Journalism	**CO1:** Define and differentiate the meaning, nature, and types of journalism, with a specific focus on agricultural journalism, including its principles, objectives, and scope. Evaluate the role of agricultural journalists in agricultural development and the media's impact on agricultural communication, including the characteristics of newspaper and magazine readers. **CO2:** Identify and apply the principles of writing agricultural news stories, including the differences between news and feature stories, the inverted pyramid structure, and the use of proper content, style, and language. **CO3:** Create effective agricultural stories by gathering information from diverse sources such as research materials, interviews, field studies, and electronic media, and by writing success stories following appropriate guidelines. **CO4:** Demonstrate skills in writing for agricultural journalism, including proofreading, copy reading, headline writing, and layout design **CO5:** understanding readability measures and the importance of visual content such as photographs and artwork.
BSAE50001- Agricultural Journalism Lab	**CO1:** Practice writing agricultural news and feature stories, demonstrating the ability to cover agricultural events, conduct interviews, and abstract information from research and scientific materials. **CO2:** Develop skills in selecting appropriate pictures and artwork for agricultural stories, and integrate visual elements effectively with written content to enhance communication. **CO3:** Apply editing and proofreading techniques by practicing copy reading, headline and title writing, and ensuring content is clear, accurate, and engaging. **CO4:** Create newspaper layouts by following principles of layout and design, organizing materials effectively, and testing copy using readability formulas to enhance the accessibility of agricultural stories. **CO5:** Observe and analyze the operations of a publishing office, gaining practical insights into the production process and editorial mechanisms involved in agricultural journalism.

BSAE48000- Landscaping	**CO1:** Understand and apply the principles and scope of landscaping, including the design and creation of various garden types **CO2:** Analyze the selection, propagation, and planting schemes of different plant species, including trees, shrubs, herbaceous perennials, climbers, annuals, and other garden plants **CO3:** Create bio-aesthetic plans for landscaping in urban, rural, and peri-urban areas, as well as specialized spaces such as schools, hospitals, and public places, considering factors like environment, functionality, and aesthetic value. **CO4:** Demonstrate effective management techniques for specific landscaping features **CO5:** Utilize CAD applications in the planning and design of landscapes, applying principles of landscape architecture to create digital representations and optimize space usage in various settings.
BSAE48001- Landscaping Lab	**CO1:** Identify and classify various types of trees, shrubs, annuals, and pot plants, and apply appropriate propagation techniques for each, ensuring proper growth and development of plants in landscape designs. **CO2:** Demonstrate the care and maintenance of plants, including potting, repotting, and the proper use of tools and implements in landscape design, ensuring the long-term health and aesthetic quality of plants. **CO3:** Apply training and pruning techniques to plants, creating special effects through design and plant management to achieve desired visual and structural outcomes in landscaping. **CO4:** Design and layout different types of gardens, including formal, informal, sunken, terrace, and rock gardens, and create structures such as conservatories and lathe houses, integrating principles of aesthetics and functionality. **CO5:** Utilize computer software for landscape design, incorporating technology into the planning and visualizing of gardens, and participate in field visits to important gardens, parks, and institutes to gain practical knowledge and inspiration.

BSAE42000-Commercial Plant breeding	**CO1:** Identify different types of crops and modes of plant reproduction, and distinguish between self-pollinated and cross-pollinated crops, including line development and maintenance breeding systems. **CO2:** Apply advanced breeding techniques, such as A/B/R and two-line systems, haploid inducers, tissue culture, and biotechnological tools, for hybrid development and quality seed production in major crops like maize, rice, and sunflower. **CO3:** Analyze advancements in breeding management systems, including speed breeding and high-throughput phenotyping/genotyping platforms, to improve efficiency in hybrid development and seed production under various environmental conditions. **CO4:** Evaluate intellectual property rights (IPR) issues in plant breeding, focusing on DUS testing, registration of varieties under the PPV and FR Act, and the procedures for variety testing, release, and notification in India. **CO5:** Demonstrate the principles and techniques of quality seed production, including types of seeds, quality testing, and strategies for seed production in self- and cross-pollinated crops, while adhering to regulatory standards.
BSAE42001-Commercial Plant breeding Lab	**CO1:** Explain the floral biology of self- and cross-pollinated species and demonstrate selfing and crossing techniques, **CO2:** Apply techniques for hybrid seed production using male sterility in field crops, identifying challenges in the process and employing tools and strategies to optimize hybrid seed production outcomes. **CO3:** Analyze the concepts of rouging, line multiplication, and purification in hybrid seed production **CO4:** Demonstrate hybrid seed production techniques in crops such as sorghum, pearl millet, maize, and sunflower, as well as vegetable crops **CO5:** Understand and implement seed processing techniques, including drying, grading, packaging, and storage, while visiting and observing public

BSAE48002- Food safety and standards	**CO1:** Define and explain the importance, scope, and factors affecting food safety, including the types of hazards (biological, chemical, and physical) and their potential risks to public health. **CO2:** Apply management tools such as PRPs, GHPs, GMPs, SSOPs, and HACCP for hazard control, temperature management, food storage, and hygiene in food service establishments to ensure food safety. **CO3:** Analyze food safety management systems, including TQM components, Kaizen principles, risk analysis, and the role of accreditation, auditing, and water and surface sanitation in maintaining food quality. **CO4:** Understand Indian and international food laws and standards, including FSSA, CAC, and other regulations, and evaluate their implications for food safety, packaging, product labeling, and emerging concerns such as GM foods and organic foods. **CO5:** Investigate recent food safety concerns, such as new pathogens and foodborne outbreaks, and propose newer approaches to food safety while adhering to established standards for food production and labeling.
BSAE48003- Food safety and standards Lab	**CO1:** Perform water quality analysis through physico-chemical and microbiological methods to evaluate the suitability of water for food production and processing. **CO2:** Demonstrate the preparation of various microbiological media and conduct microbiological examinations of different food samples to detect contamination and ensure food safety. **CO3:** Assess surface sanitation and personal hygiene using swab/rinse methods and biochemical tests for identifying bacteria, ensuring adherence to food safety standards. **CO4:** Design and implement schemes for the detection of food borne pathogens, employing systematic microbiological and biochemical testing techniques. **CO5:** Prepare comprehensive plans for the implementation of Food Safety Management Systems (FSMS), including HACCP and ISO:22000, to enhance safety protocols in food production environments.

BSAE47002-Bioformulation and Nanoformulation	**CO1:** Explain the history and principles of biological control of pests and diseases, and differentiate between phytopathogenic and entomopathogenic biocontrol agents based on their modes of action. **CO2:** Assess the production, quality evaluation, and application methods of microbial inoculants, biopesticides, and biofertilizers, focusing on their role in sustainable and organic agriculture. **CO3:** Examine the regulatory framework for biopesticides in India and explore formulations of plant essential oils, botanicals, pheromones, and parapheromones for effective pest management. **CO4:** Apply the concepts of nanotechnology in pest and disease management, including the production of nano biopesticides and nano fertilizers, while evaluating their importance and environmental benefits. **CO5:** Develop green synthesis techniques for producing slow-release nano fertilizers, such as urea-modified hydroxyapatite nanoparticles, and design innovative approaches to enhance their efficiency in agriculture.
BSAE47003-Bioformulation and Nanoformulation Lab	**CO1:** Demonstrate proficiency in laboratory techniques, including the preparation of culture media, isolation, purification, and microscopic examination of microbial bioagents from soil and insect samples. **CO2:** Conduct in vitro assays to assess the effectiveness and compatibility of microbial bioagents against plant pathogens and among different bioagents. **CO3:** Perform mass multiplication, population enumeration, and preparation of biopesticides, as well as test the efficacy of plant extracts against insect pests. **CO4:** Utilize pheromones and parapheromones for monitoring and managing insect pests and bioassay entomopathogenic biocontrol agents for pest management applications. **CO5:** Prepare microbial inoculants of biofertilizer microbes, ensuring compatibility, and formulate solid and liquid consortia to enhance their agricultural utility.

BSAE47004-Biopesticides and Biofertilizers	**CO1:** Explain the history, concepts, and classification of biopesticides, including pathogens, botanical pesticides, and biorationals, while analyzing their scope, importance, and potential in sustainable agriculture. **CO2:** Demonstrate knowledge of the mass production technology of biopesticides and apply quality control techniques to assess virulence, pathogenicity, and efficacy against target pests. **CO3:** Describe the structure, characteristics, and nitrogen-fixing mechanisms of bacterial, cyanobacterial, and fungal biofertilizers, including their roles in phosphate and potassium solubilization. **CO4:** Develop production protocols for biofertilizers, including strain selection, fermentation, and mass production of carrier-based and liquid formulations, while adhering to FCO specifications. **CO5:** Implement effective application technologies for seeds, seedlings, and other planting materials, and evaluate the factors influencing biofertilizer efficiency, storage, shelf life, and marketing strategies.
BSAE47005-Biopesticides and Biofertilizers Lab	**CO1:** Perform the isolation and purification of key biopesticides, such as Trichoderma, Pseudomonas, Bacillus, and Metarhizium, and demonstrate their production techniques. **CO2:** Identify botanicals with pesticidal properties and evaluate entomopathogenic entities under laboratory and field conditions through exploratory visits and natural observations. **CO3:** Assess the quality of biopesticides through established quality control protocols to ensure their efficacy and compliance with standards. **CO4:** Isolate and purify beneficial microbial biofertilizers, such as Azospirillum, Azotobacter, Rhizobium, P-solubilizers, and cyanobacteria, and produce their inoculums through mass multiplication techniques **CO5:** Apply wet sieving and sucrose gradient methods to isolate AM fungi and develop mass production protocols for AM inoculants suitable for agricultural applications.

BSAE41005- System Simulation and Agroadvisory	**CO1:** Describe the system approach for representing the soil-plant-atmosphere continuum, including system boundaries and their application in crop models. **CO2:** Analyze crop responses to weather elements using elementary crop growth models and perform calibration, validation, and sensitivity analysis to enhance model accuracy. **CO3:** Evaluate potential and achievable crop production under moisture and nutrient-limited conditions by applying soil water and nutrient balance techniques. **CO4:** Develop weather forecasts and agro-advisory bulletins by utilizing forecasting tools, methods, and ITK techniques, ensuring effective dissemination to stakeholders **CO5:** Apply crop simulation models to prepare agro-advisories and assess their impact on agricultural decision-making processes.
BSAE41006- System Simulation and Agroadvisory Lab	**CO1:** Develop crop weather calendars and agro-advisories by integrating weather forecast data and utilizing synoptic charts. **CO2:** Simulate crop growth using statistical and simulation models to analyze potential and achievable production under various environmental conditions. **CO3:** Evaluate insect and disease forecasting models to improve prediction accuracy and crop management strategies. **CO4:** Analyze the impact of water and nutrient management limitations on crop production using sensitivity analysis and simulation techniques. **CO5:** Organize and interpret historical meteorological data using statistical approaches to prepare medium-range weather forecasts and gather farmer feedback to refine agro-advisories.
BSAE48004- Hi-tech Horticulture	**CO1:** Explain the principles and importance of nursery management and mechanization. **CO2:** Demonstrate modern field preparation and planting techniques for horticultural crops. **CO3:** Apply EC and pH-based fertilizer scheduling and canopy management techniques for effective high-density orcharding. **CO4:** Evaluate the components of precision farming, including the use of remote sensing, GIS, DGPS, and Variable Rate Applicators (VRA). **CO5:** Assess the effectiveness of mechanized harvesting techniques for horticultural crops, including fruits, vegetables, and ornamental crops.

BSAE48005- Hi-tech Horticulture Lab	**CO1:** Identify and differentiate between various types of polyhouses and shade net houses, and understand their applications in horticultural production. **CO2:** Demonstrate the correct use of tools and equipment for intercultural operations in horticulture, including their application for effective crop management. **CO3:** Practice micropropagation techniques in a controlled nursery environment and apply micro-irrigation, EC, and pH-based fertilizer scheduling for optimal crop growth. **CO4:** Analyze canopy management techniques in high-density orchards and their role in improving the productivity of horticultural crops. **CO5:** Visit a hi-tech orchard/nursery and evaluate the implementation of modern techniques, such as micropropagation and precision irrigation, to assess their practical applications and effectiveness.
BSAE48006- Protected cultivation	**CO1:** Explain the importance, scope, and status of protected cultivation in India and globally, including the different types of protected structures based on site and climate. **CO2:** Identify and evaluate various cladding materials used in greenhouse/polyhouse construction and their impact on environmental control, including the role of artificial lights and automation. **CO3:** Demonstrate effective soil and substrate management techniques for protected cultivation, including the use of proper irrigation and fertigation systems for optimal plant growth. **CO4:** Practice the propagation and production of quality planting material for horticultural crops under protected environments, focusing on flowers, vegetables, and medicinal plants. **CO5:** Assess pest and disease management strategies in protected cultivation environments for a variety of crops, including flowers, vegetables, and medicinal plants, with a focus on off-season production.

BSAE48007- Protected cultivation Lab	**CO1:** Demonstrate the techniques of raising seedlings and saplings under protected conditions, including the use of portrays for quality planting material production. **CO2:** Develop the skills required for bed preparation and planting of crops for production under controlled environments, ensuring optimal growth conditions. **CO3:** Evaluate the effectiveness of various intercultural operations, including soil preparation, management, and maintenance practices for protected cultivation. **CO4:** Measure soil EC and pH levels and apply appropriate adjustments for optimal growth, along with regulating irrigation and fertilizers using drip, fogging, and misting systems. **CO5:** Assess and manage irrigation and fertilization strategies using advanced methods such as drip irrigation, fogging, and misting to enhance plant growth in protected cultivation.
BSAE57000- Climate Resilient Agriculture	**CO1:** Analyze the impact of climate change on agriculture and food security, including the effects of extreme weather events such as drought, floods, pest outbreaks, and disease. (Analyzing, Evaluating) **CO2:** Evaluate different climate adaptation and mitigation strategies in agriculture, focusing on assessing climate vulnerability, identifying risks, and recommending adaptation options. (Evaluating, Creating) **CO3:** Apply geospatial tools and techniques for analyzing and addressing climate risks in agriculture to promote sustainable agricultural practices. (Applying, Analyzing) **CO4:** Assess and implement climate-resilient agricultural practices such as crop diversification, water management, organic farming, integrated farming systems (IFS), and conservation agriculture technologies. (Assessing, Applying) **CO5:** Design breeding strategies to develop climate change-resilient crops and varieties that are tolerant to biotic and abiotic stresses, ensuring sustainability under changing climatic scenarios.

BSAE57001- Climate Resilient Agriculture Lab	**CO1:** Demonstrate the use of meteorological instruments, including Automated Weather Stations (AWS), and apply statistical techniques to study the trends of climatic parameters. (Applying, Demonstrating) **CO2:** Analyze extreme weather events using non-parametric tests and build climate change scenarios under different emission pathways of greenhouse gases (GHGs). (Analyzing, Evaluating) **CO3:** Design strategies to mitigate the impact of climate change by utilizing climate-resilient crops and cultivars, manipulating cropping patterns, and applying climate-resilient technologies. (Creating, Applying) **CO4:** Evaluate the potential of different agro-ecosystems for carbon sequestration and develop climate-smart village models based on available resources to enhance sustainability. (Evaluating, Designing) **CO5:** Implement Information and Communication Technologies (ICTs) for the effective dissemination of local weather information and agro-advisories, and organize awareness programs on climate change and climate-resilient agriculture for farming communities.
BSAE58000- Biotechnology of Crop Improvement	**CO1:** Demonstrate an understanding of various biotechnological techniques used in crop improvement, including plant tissue culture, genetic engineering, genome editing, and marker-assisted breeding. **CO2:** Analyze the impact of biotechnology on crop improvement, including its ethical implications and societal perspective, and evaluate the achievements **CO3:** Design and apply different methods of gene transfer in plants, including Agrobacterium-mediated gene transfer **CO4:** Evaluate the principles and applications of gene silencing techniques, including siRNA, microRNA, and the creation of transgenic plants, and understand their role in improving crop traits. **CO5:** Implement marker-assisted breeding and genomic selection techniques to enhance crop breeding programs, utilizing DNA markers for foreground selection,

BSAE58001-Biotechnology of Crop Improvement Lab	**CO1:** Demonstrate the process of Agrobacterium-mediated transformation in tobacco, including preparing constructs, transferring them to a binary vector, transforming Agrobacterium, and performing inoculation and co-cultivation for successful transformation. **CO2:** Analyze the transformation process by performing antibiotic-based selection to identify putative transformants and validating the results using PCR to confirm successful genetic integration. **CO3:** Design and apply genome editing techniques using CRISPR/Cas9, including the preparation of CRISPR constructs, direct transfer to plants, and analyzing the editing targets to achieve specific gene modifications **CO4:** Plan and execute a Marker-Assisted Backcross Breeding (MABB) program, including selecting parents, determining crossing strategies, and performing marker analysis for selecting improved traits. **CO5:** Evaluate and validate the effectiveness of transformation and genome editing techniques in improving specific traits in plants by assessing genetic changes and their impacts on crop performance.
BSAE43002-Geoinformatics and remote sensing, precision farming	**CO1:** Demonstrate an understanding of the principles of remote sensing, including the propagation of radiation, interaction with matter, and applications in land use, soil surveys, and crop yield forecasting. **CO2:** Evaluate the advantages and disadvantages of remote sensing techniques in agriculture and environmental analysis, and assess their role in land and crop management. **CO3:** Explain the fundamental concepts of geoinformatics, expert systems, and their applications in agriculture, including rule-based systems and the use of software agents. **CO4:** Apply statistical and machine learning techniques, such as Bayes Theorem, Random Forest, SVM, and ensemble methods, to analyze remote sensing data and crop management scenarios. **CO5:** Investigate the use of hyperspectral and thermal remote sensing, as well as proximal soil and crop sensors, for monitoring crop health and environmental conditions in agricultural settings.

BSAE43003-Geoinformatics and remote sensing, precision farming Lab	**CO1:** Demonstrate proficiency in using remote sensing equipment and interpreting data products, including the interpretation of aerial photographs and satellite data for land resource mapping. **CO2:** Apply Global Positioning System (GPS) techniques and Geographic Information System (GIS) tools for georeferencing toposheets and creating spatially accurate maps for agricultural applications. **CO3:** Evaluate the use of digital soil mapping techniques, incorporating various variables, to assess soil health and suitability for agricultural practices. **CO4:** Utilize multivariate data analytics methods, including Principal Component Analysis (PCA), regression applications, clustering methods, and geostatistics, to analyze complex agricultural datasets. **CO5:** Interpret and synthesize data from remote sensing, GPS, and GIS technologies to provide actionable insights for agricultural decision-making and land resource management.
BSAE58002-Micro-propagation Technologies	**CO1:** Describe the history, advantages, limitations, and types of cultures in plant tissue culture, including seed, embryo, organ, callus, and cell cultures. **CO2:** Explain the stages of micropropagation, including axillary bud proliferation (shoot tip and meristem culture, bud culture), organogenesis, and somatic embryogenesis. **CO3:** Demonstrate techniques of somatic embryogenesis, callus formation, and organogenesis for plant propagation and the production of plant tissues. **CO4:** Identify and apply methods for the production of secondary metabolites, cell suspension cultures, and somaclonal variation in tissue culture processes. **CO5:** Evaluate the use of cryopreservation for the long-term storage of plant genetic material and assess its role in conserving plant biodiversity.

BSAE58003-Micro-propagation Technologies Lab	**CO1:** Identify and demonstrate the use of equipment in a tissue culture laboratory, including the preparation of sterilized media, containers, and explants. **CO2:** Explain the process of preparing nutritional media for tissue culture, including the composition of stock and working solutions, and the sterilization techniques used for media, containers, and instruments. **CO3:** Prepare and cultivate explants (seeds, shoot tip, and single node) by following sterilization, media preparation, and inoculation protocols **CO4:** Induce callus formation and somatic embryogenesis from various explants, and regenerate whole plants using proper techniques. **CO5:** Evaluate and apply hardening procedures for tissue-cultured plants to ensure successful acclimatization to the external environment.
BSAE42002-Commercial Seed Production	**CO1:** Understand the principles and practices of seed production, including crop selection, isolation distance, hybrid seed production techniques, and the role of apomixis, male sterility, and self-incompatibility in horticultural crops. **CO2:** Analyze the methodologies of seed processing, including drying, cleaning, grading, and separation techniques, as well as seed treatment procedures for maintaining seed quality during packaging and storage. **CO3:** Apply seed testing techniques to evaluate genetic, physical, physiological, and health attributes, incorporating concepts of viability, vigour, dormancy, and germination for assessing seed performance. **CO4:** Evaluate seed certification standards and processes, including the role of organizations like IMSCS, field and seed standards for GM and non-GM crops, and compliance with global seed certification norms. **CO5:** Create innovative seed marketing strategies using biotechnology advancements such as synthetic seed production and micro-propagation while addressing market dynamics like demand forecasting, seed pricing, and the role of public and private players in the seed industry.

BSAE42003-Commercial Seed Production Lab	**CO1:** Understand the principles and requirements for seed production in field and cross-pollinated crops, including planning, land selection, isolation, planting ratios, and synchronization of parental lines. **CO2:** Analyze the effects of drying temperature, duration, and seed processing techniques on seed germination, storability, and overall seed quality. **CO3:** Apply advanced techniques such as supplementary pollination, pollen collection, storage, viability testing, and gametocide application for hybrid seed production, including hands-on practices like detasseling and rogue identification. **CO4:** Evaluate seed health by examining seed-borne microorganisms, quantifying infection percentages, and identifying fungi, bacteria, and viruses, along with implementing seed treatment and sterilization methods to ensure quality. **CO5:** Create synthetic seeds and micro-propagation systems by preparing MS medium, inducing callus from selected explants, and regenerating plantlets for field and horticultural crops, ensuring aseptic conditions and effective tissue culture techniques.
BSAE41007-Principles and Practices of Organic Farming and Conservation Agriculture	**CO1:** Understand the concept, principles, and scope of organic farming in India, including crop selection, nutrient management, and pest and disease control practices under organic production systems. **CO2:** Analyze the operational framework of the National Programme for Organic Production (NPOP), including certification processes, crop standards, and compliance with labeling and marketing regulations. **CO3:** Apply knowledge of conservation agriculture practices, such as minimum soil disturbance, crop residue retention, and crop diversification, to promote sustainable and climate-smart agricultural systems. **CO4:** Evaluate the economic viability, export potential, and marketing strategies for organic products, along with the comparative benefits of organic manures versus inorganic fertilizers for major crops. **CO5:** Create innovative approaches to integrate government initiatives, NGO programs, and conservation agriculture principles to enhance the adoption and success of organic farming and sustainable agricultural practices.

BSAE41008- Principles and Practices of Organic Farming and Conservation Agriculture Lab	**CO1:** Understand the principles and practices of organic farming, including its components, utilization, and conservation agriculture techniques for sustainable agricultural production. **CO2:** Analyze the quality and efficacy of organic inputs such as enriched compost, vermicompost, bio-fertilizers, and botanicals for nutrient management, weed control, and insect-pest management. **CO3:** Apply indigenous technological knowledge (ITK) and green manuring techniques, including in-situ and green leaf manuring, to improve soil fertility and promote eco-friendly pest and disease management. **CO4:** Evaluate the economic aspects of organic farming systems, including the cost of production, to assess their viability and sustainability in comparison to conventional farming methods. **CO5:** Create strategies for integrating organic farming practices with modern conservation agriculture techniques to enhance productivity
BSAE49000- Food Science and Nutrition	**CO1:** Understand the fundamentals of foods and human nutrition, including basic food groups, balanced diets, RDAs for different age groups, and the biochemical composition and energy values of various food items. **CO2:** Analyze the nutritional, physico-chemical, and functional characteristics of carbohydrates, proteins, fats, vitamins, minerals, and nutraceuticals, as well as their roles in human health and metabolism. **CO3:** Apply knowledge of digestion, absorption, transport, and metabolism of essential nutrients to assess nutritional requirements, protein quality, and the effects of cooking, processing, and preservation on food quality. **CO4:** Evaluate the impact of post-harvest storage, biochemical changes, and food spoilage on nutrient retention and overall food safety, incorporating food safety and quality standards. **CO5:** Create innovative approaches to enhance nutritional quality and functionality in plant-based, animal-derived, dairy, marine, and fermented products, leveraging enzymes, food additives, and biochemical insights.

BSAE49001- Food Science and Nutrition Lab	**CO1:** Understand the principles of proximate analysis and calorific value estimation to evaluate the nutritional composition and energy content of various food items. **CO2:** Analyze the content of vitamins, phenols, flavonoids, carotenoids, and antinutrients like phytates and oxalates in food materials to determine their nutritional and anti-nutritional profiles. **CO3:** Apply laboratory techniques for the quantitative estimation of limiting amino acids and enzyme inhibitors such as Trypsin and Chymotrypsin inhibitors in food products to assess their nutritional adequacy and safety. **CO4:** Evaluate the relationship between the proximate composition, calorific value, and bioactive compound levels in foodstuffs, considering their dietary significance and health impacts. **CO5:** Create analytical protocols and experimental setups for the comprehensive assessment of nutrients and antinutrients in diverse food matrices, ensuring accuracy and reliability in food quality testing.
BSAE48008- Post Harvest Technology and Value Addition	**CO1:** Understand the significance of post-harvest processing and the causes and extent of post-harvest losses in fruits and vegetables, as well as the factors influencing their quality during pre- and post-harvest stages. **CO2:** Analyze the physiological and biochemical changes during fruit and vegetable ripening, including the role of respiration and factors affecting respiration rates, to optimize quality and shelf life. **CO3:** Apply principles and methods of preservation, such as drying, canning, and osmotic drying, to produce value-added products like jam, jelly, etc **CO4:** Evaluate the effectiveness of various storage techniques, including ZECC, cold storage, controlled atmosphere (CA), modified atmosphere (MA), and hypobaric storage, for maintaining post-harvest quality and minimizing losses. **CO5:** Create innovative packaging and processing solutions for fermented and non-fermented beverages, as well as preserved

BSAE48009- Post Harvest Technology and Value Addition Lab	**CO1:** Understand the role of different packaging types and containers in extending the shelf life of fresh produce and preserving its quality under various environmental conditions. **CO2:** Analyze the impact of temperature variations on the shelf life, quality, and occurrence of chilling and freezing injuries in fruits and vegetables. **CO3:** Apply methods for the extraction and preservation of pulps, juices, and the preparation of value-added products such as jam, jelly, RTS, nectar, squash, osmotically dried products, fruit bars, candies, and canned products. **CO4:** Evaluate the physico-chemical and sensory quality of preserved and processed food products to ensure compliance with industry standards and consumer preferences. **CO5:** Create innovative strategies for processing and preservation through hands-on demonstrations and visits to food processing units/industries, incorporating sustainable and efficient practices.
WHNN99000- Workshop & Seminars / Human Value & Social Service / NSS	**CO1:** Relate to the concept of cognitive development and Big Five personality characteristics. Explain the basic fundamentals of Emotional Intelligence. **CO2:** Develop ability to practice new problem-solving skills in a group and use these skills in personal life. Build coping strategies and adapt balanced self- determined behaviour. **CO3:** Find about the working and mechanism of human nature. Classify and explain group behavior at organizational level and individual level. **CO4:** Organize and plan organizational change and stress management practices. Discover various human values and their importance in real world. **CO5:** Create leadership skills to be effective leader and evaluate the hierarchy of human values.

7. Mapping

BSAE45000	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	3		2	3	3	2		2	
CO2	2	3	3	2		2	2		3	3	3	3
CO3	3	2		2	3	2	3	2	2		2	3
CO4	3	3	2	2	2		2		3	2	3	2
CO5		3			3	2	3	3	3	2	3	2

BSAE45001	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	2		2	2			2	2	2	3
CO2	2		2		3	3	2		2	2	2	3
CO3	3	3	3	3	3		3	2	2	3	3	2
CO4	2	3	3	3		2	2	3	3	2		2
CO5	2	3	3	3	3	2	2	2	2	2	2	2

BSAE43000	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	3	2	2	2	3	3	2	2		3
CO2	3	3		2				2	2	2		2
CO3	3	3	2	2		2		2		2	2	
CO4	3	2			2		2	2			2	2
CO5	2	2	3	2	2	2	3	3	2	2		3

BSAE43001	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	3		2		2	2	2	2	2
CO2	3	2	3	2	2			3	3		3	
CO3	2	3	2	3			2	3	3	2		2
CO4	3	2			3	2	3			2	2	3
CO5	2		3	3	3	2		3	3	2	3	3

BSAE47000	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	2	3		2		3	2	3	2	2
CO2				2	2		3	3	3		3	
CO3	3	3	2		3		2	2	3	2		2
CO4	3	2	2	3		2			2	3	2	2
CO5	2		3	3	3	3		3	3	3	3	3

BSAE47001	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	3	3	3		2	2	2		3	2
CO2		2		3	2	3	2	2	2	3	2	2
CO3	3	3	3		3	3	3		3	3	3	
CO4	3		2	2	2	3	3	2		3	3	2
CO5	3	3	3	3	3	3		2	3		3	

BSAE50000	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	3		3	3		2	3	3	3
CO2	3		3		2	2	3	2	2	2	3	2
CO3		3	3	3		3	3	3		3	3	3
CO4	2	2	2	3	3	2	3		2			3
CO5	2	2		3	3	2	3		2		3	3

BSAE50001	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	3			2	2		3	2
CO2			3		2	2	3	3		2	3	2
CO3	3	3	3	3		3	3	3		3	3	3
CO4	2	2		3	3	2	3		2		3	3
CO5	3	3		3		3	3		2	3		3

BSAE48000	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1		3	3	2	3	2	3	3	2	2	2	3
CO2	3	3	2	3	3		3	2	3	2		3
CO3	3	3	2		3	2	3	3	3		2	3
CO4	2	2	2	3		3	2		3	2	2	3
CO5	3	2	3	3		3		2	2	3	3	2

BSAE48001	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2		3	3	3	3	2	3	2	3	2
CO2	2	3	2	3	2		2	3	2	3		2
CO3	3	3	3		3	2	3	2		2	2	3
CO4	3	3	2	3	3	3	2	3	2	3		3
CO5	2		3	2	3		3	2	3	2	3	3

BSAE42000	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	2		2	2		2	2	3	3	
CO2	2	3	3	2		3	3		2	2	2	2
CO3	3	2		3	2	2	3		2		3	3
CO4	3	2	2	2	3		2	3	3	3	2	3
CO5	3	3	3	3		2	3	3	3	3		2

BSAE42001	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1		3	2	2	2	3	2	2	3		2	3
CO2	3		3		3		3	3	2	3	3	2
CO3	2	2	2	2	3	2		2		2	2	
CO4	3	2		3		2	2	2	2	3		3
CO5	2	2	3	2	2		2		3		2	3

BSAE48002	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	3		2	3	3	2		2	
CO2	2	3	3	2		2	2		3	3	3	3
CO3	3	2		2	3	2	3	2	2		2	3
CO4	3	3	2	2	2		2		3	2	3	2
CO5		3			3	2	3	3	3	2	3	2

BSAE48003	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	2		2	2			2	2	2	3
CO2	2		2		3	3	2		2	2	2	3
CO3	3	3	3	3	3		3	2	2	3	3	2
CO4	2	3	3	3		2	2	3	3	2		2
CO5	2	3	3	3	3	2	2	2	2	2	2	2

BSAE47002	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	3	2	2	2	3	3	2	2		3
CO2	3	3		2				2	2	2		2
CO3	3	3	2	2		2		2		2	2	
CO4	3	2			2		2	2			2	2
CO5	2	2	3	2	2	2	3	3	2	2		3

BSAE47003	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	3		2		2	2	2	2	2
CO2	3	2	3	2	2			3	3		3	
CO3	2	3	2	3			2	3	3	2		2
CO4	3	2			3	2	3			2	2	3
CO5	2		3	3	3	2		3	3	2	3	3

BSAE47004	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	2	3		2		3	2	3	2	2
CO2				2	2		3	3	3		3	
CO3	3	3	2		3		2	2	3	2		2
CO4	3	2	2	3		2			2	3	2	2
CO5	2		3	3	3	3		3	3	3	3	3

BSAE47005	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	3	3	3		2	2	2		3	2
CO2		2		3	2	3	2	2	2	3	2	2
CO3	3	3	3		3	3	3		3	3	3	
CO4	3		2	2	2	3	3	2		3	3	2
CO5	3	3	3	3	3	3		2	3		3	

BSAE41005	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	3		3	3		2	3	3	3
CO2	3		3		2	2	3	2	2	2	3	2
CO3		3	3	3		3	3	3		3	3	3
CO4	2	2	2	3	3	2	3		2			3
CO5	2	2		3	3	2	3		2		3	3

BSAE41006	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	3			2	2		3	2
CO2			3		2	2	3	3		2	3	2
CO3	3	3	3	3		3	3	3		3	3	3
CO4	2	2		3	3	2	3		2		3	3
CO5	3	3		3		3	3		2	3		3

BSAE48004	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1		3	3	2	3	2	3	3	2	2	2	3
CO2	3	3	2	3	3		3	2	3	2		3
CO3	3	3	2		3	2	3	3	3		2	3
CO4	2	2	2	3		3	2		3	2	2	3
CO5	3	2	3	3		3		2	2	3	3	2

BSAE48005	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2		3	3	3	3	2	3	2	3	2
CO2	2	3	2	3	2		2	3	2	3		2
CO3	3	3	3		3	2	3	2		2	2	3
CO4	3	3	2	3	3	3	2	3	2	3		3
CO5	2		3	2	3		3	2	3	2	3	3

BSAE48006	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	2		2	2		2	2	3	3	
CO2	2	3	3	2		3	3		2	2	2	2
CO3	3	2		3	2	2	3		2		3	3
CO4	3	2	2	2	3		2	3	3	3	2	3
CO5	3	3	3	3		2	3	3	3	3		2

BSAE48007	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1		3	2	2	2	3	2	2	3		2	3
CO2	3		3		3		3	3	2	3	3	2
CO3	2	2	2	2	3	2		2		2	2	
CO4	3	2		3		2	2	2	2	3		3
CO5	2	2	3	2	2		2		3		2	3

BSAE57000	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	3		2	3	3	2		2	
CO2	2	3	3	2		2	2		3	3	3	3
CO3	3	2		2	3	2	3	2	2		2	3
CO4	3	3	2	2	2		2		3	2	3	2
CO5		3			3	2	3	3	3	2	3	2

BSAE57001	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	2		2	2			2	2	2	3
CO2	2		2		3	3	2		2	2	2	3
CO3	3	3	3	3	3		3	2	2	3	3	2
CO4	2	3	3	3		2	2	3	3	2		2
CO5	2	3	3	3	3	2	2	2	2	2	2	2

BSAE58000	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	3	2	2	2	3	3	2	2		3
CO2	3	3		2				2	2	2		2
CO3	3	3	2	2		2		2		2	2	
CO4	3	2			2		2	2			2	2
CO5	2	2	3	2	2	2	3	3	2	2		3

BSAE58001	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	3		2		2	2	2	2	2
CO2	3	2	3	2	2			3	3		3	
CO3	2	3	2	3			2	3	3	2		2
CO4	3	2			3	2	3			2	2	3
CO5	2		3	3	3	2		3	3	2	3	3

BSAE43002	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	2	3		2		3	2	3	2	2
CO2				2	2		3	3	3		3	
CO3	3	3	2		3		2	2	3	2		2
CO4	3	2	2	3		2			2	3	2	2
CO5	2		3	3	3	3		3	3	3	3	3

BSAE43003	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	3	3	3		2	2	2		3	2
CO2		2		3	2	3	2	2	2	3	2	2
CO3	3	3	3		3	3	3		3	3	3	
CO4	3		2	2	2	3	3	2		3	3	2
CO5	3	3	3	3	3	3		2	3		3	

BSAE58002	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	3		3	3		2	3	3	3
CO2	3		3		2	2	3	2	2	2	3	2
CO3		3	3	3		3	3	3		3	3	3
CO4	2	2	2	3	3	2	3		2			3
CO5	2	2		3	3	2	3		2		3	3

BSAE58003	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	3			2	2		3	2
CO2			3		2	2	3	3		2	3	2
CO3	3	3	3	3		3	3	3		3	3	3
CO4	2	2		3	3	2	3		2		3	3
CO5	3	3		3		3	3		2	3		3

BSAE42002	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1		3	3	2	3	2	3	3	2	2	2	3
CO2	3	3	2	3	3		3	2	3	2		3
CO3	3	3	2		3	2	3	3	3		2	3
CO4	2	2	2	3		3	2		3	2	2	3
CO5	3	2	3	3		3		2	2	3	3	2

BSAE42003	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2		3	3	3	3	2	3	2	3	2
CO2	2	3	2	3	2		2	3	2	3		2
CO3	3	3	3		3	2	3	2		2	2	3
CO4	3	3	2	3	3	3	2	3	2	3		3
CO5	2		3	2	3		3	2	3	2	3	3

BSAE41007	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	2		2	2		2	2	3	3	
CO2	2	3	3	2		3	3		2	2	2	2
CO3	3	2		3	2	2	3		2		3	3
CO4	3	2	2	2	3		2	3	3	3	2	3
CO5	3	3	3	3		2	3	3	3	3		2

BSAE41008	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1		3	2	2	2	3	2	2	3		2	3
CO2	3		3		3		3	3	2	3	3	2
CO3	2	2	2	2	3	2		2		2	2	
CO4	3	2		3		2	2	2	2	3		3
CO5	2	2	3	2	2		2		3		2	3

BSAE49000	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	3		2	3	3	2		2	
CO2	2	3	3	2		2	2		3	3	3	3
CO3	3	2		2	3	2	3	2	2		2	3
CO4	3	3	2	2	2		2		3	2	3	2
CO5		3			3	2	3	3	3	2	3	2

BSAE49001	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	2		2	2			2	2	2	3
CO2	2		2		3	3	2		2	2	2	3
CO3	3	3	3	3	3		3	2	2	3	3	2
CO4	2	3	3	3		2	2	3	3	2		2
CO5	2	3	3	3	3	2	2	2	2	2	2	2

BSAE48008	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	3	2	2	2	3	3	2	2		3
CO2	3	3		2				2	2	2		2
CO3	3	3	2	2		2		2		2	2	
CO4	3	2			2		2	2			2	2
CO5	2	2	3	2	2	2	3	3	2	2		3

BSAE48009	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	3		2		2	2	2	2	2
CO2	3	2	3	2	2			3	3		3	
CO3	2	3	2	3			2	3	3	2		2
CO4	3	2			3	2	3			2	2	3
CO5	2		3	3	3	2		3	3	2	3	3

WHNN99000	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1			2	3	3	2	2	2			3	2
CO2	3	3		3	2			2	2	3		2
CO3	2		2			3	2	3		3	2	
CO4	3	3	2	3	2	3	3	3		3		3
CO5	2	3			2	3	3		3		2	3

8. Curriculum

Course Name: Agri-Business Management

Course Code: BSAE45000

Course Outline

Unit-I: 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-II: 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. Components of a business plan, Steps in planning and implementation. Organization staffing, directing and motivation.

Unit-III: 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. 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.

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.

Course Name: Agri-Business Management Lab

Course Code: BSAE45001

Course Outline

Unit-I: 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.

Course Name: Management of natural resources

Course Code: BSAE43000

Course Outline

Unit-I: Introduction to Natural Resource Bases: Concept of resource, classification of natural resources. Factors influencing resource availability, distribution and uses. Interrelationships among different types of natural resources. Concern on Productivity issues. Ecological, social and economic dimension of resource management. Land resources: Land as a resource. Dry land, land use classification, land degradation, man induced landslides, soil erosion and desertification. Landscape impact analysis, wetland ecology and management. Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems.

Unit-II: Water ecology and management. Energy resources: Growing energy needs, renewable and non- renewable energy sources, use of alternate energy sources. Resource Management Paradigms: Resource management the evolution and history of resource management paradigms. Resource conflicts: Resource extraction, access and control system. Approaches in Resource Management: Ecological approach; economic approach; ethnological approach; implications of the approaches; integrated resource management strategies. Introduction to soil and water conservation and causes of soil erosion.,

Unit-III: Definition and agents of soil erosion, water erosion - Forms of water erosion, Gully classification and control measures. Soil loss estimation by universal soil loss equation - Soil loss measurement techniques. Principles of erosion control - Introduction to contouring, strip cropping. Contour bund - Graded bund and bench terracing. Wind erosion - Mechanics of wind erosion, types of soil movement - Principles of wind erosion control and its control measures, Water harvesting techniques - Lining of ponds, tanks and canal systems.

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 Natural Resources: Focus on Land and Water. Ed. Harikesh N. Mishra. PHI, Learning, 496p.
4. Management of Resources for Sustainable Development: Sushma Goel. The Orient Blackswan 284p.
5. Natural Resources: Their Conservation and Management by Arvindrai Upadhyay. Aspiration Academy, 320p.
6. Natural Resource Management for Growth Development and Sustainability by Vasudeva Srishti Pal.Today & Tomorrows Printers and Publishers, 336p.

Course Name: Management of natural resources Lab

Course Code: BSAE43001

Course Outline

Unit-I: 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.

Course Name: Agrochemicals

Course Code: BSAE47000

Course Outline

Unit-I: 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. Fungicides-classification –Inorganic fungicides-characteristics, preparation and use of sulphur and copper. Mode of action- Bordeaux mixture and copper oxychloride.

Unit-II: Organic fungicides –Mode of action –Dithiocarbamates- characteristics, preparation and use of Zineb and maneb. Systemic fungicides- Benomyl, carboxin, oxycarboxin, Metalaxyl, Carbendazim, characteristics and use. 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. 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:

Unit-III: Natural sources of potash, manufacturing of potassium chloride, potassium sulphate and potassium nitrate. Mixed and complex fertilizers: Sources and compatibility- preparation 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.

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.

Course Name: Agrochemicals Lab

Course Code: BSAE47001

Course Outline

Unit-I: 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.

Course Name: Agricultural Journalism

Course Code: BSAE50000

Course Outline

Unit-I: 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. Qualities of journalist, Role of journalist /journalism in agricultural development and development of newspaper and magazines readers.

Unit-II: 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. 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 stories- definition, nature, components, guidelines of writing a success story. Writing a news story difference between news and feature story, the principle of writing a news story, Inverted pyramid structure.

Unit-III: 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. 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.

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.

Course Name: Agricultural Journalism Lab

Course Code: BSAE50001

Course Outline

Unit-I: 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.

Course Name: Landscaping

Course Code: BSAE48000

Course Outline

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

Unit-II: Climber and creepers importance, selection, propagation, planting. Annuals: selection, propagation, planting scheme. Other garden plants: palms, ferns, grasses and cacti succulents. Pot plants: selection, arrangement, management. Bio-aesthetic planning: definition, need, planning. Landscaping of urban and rural areas, Peri-urban landscaping,

Unit-III: 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.

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.

Course Name: Landscaping Lab

Course Code: BSAE48001

Course Outline

Unit-I: 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.

Course Name: Commercial Plant breeding

Course Code: BSAE42000

Course Outline

Unit-I: 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. Advances in hybrid seed production of maize, rice, sorghum, pearl millet, castor, sunflower, cotton pigeon pea, Brassica etc. Speed Breeding, Breeding Management systems,

Unit-II: High-throughput phenotyping and genotyping platforms, 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-III: 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.

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.

Course Name: Commercial Plant breeding Lab

Course Code: BSAE42001

Course Outline

Unit-I: 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.

Course Name: Food safety and standards

Course Code: BSAE48002

Course Outline

Unit-I: Food safety –Definition, Importance, Scope and Factors affecting Food Safety. Hazards and Risks, Type of Hazards - Biological, Chemical Physical hazards. Management of hazards – Need. Control of Parameters. Temperature Control. Food Storage. Production Design. Hygiene and Sanitation in Food Service Establishments-Introduction. Sources of contamination and their control. Waste Disposal. Pest and Rodent Control. Personnel Hygiene. Food safety Measures.

Unit-II: 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. 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-III: 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.

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.

Course Name: Food safety and standards Lab

Course Code: BSAE48003

Course Outline

Unit-I: 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.

Course Name: Bioformulation and Nanoformulation

Course Code: BSAE47002

Course Outline

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

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

Unit-III: 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

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.

Course Name: Bioformulation and Nanoformulation Lab

Course Code: BSAE47003

Course Outline

Unit-I: 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 Para pheromone 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

Course Name: Biopesticides and Biofertilizers

Course Code: BSAE47004

Course Outline

Unit-I: History and concept of bio pesticides. Importance, scope and potential of bio pesticides. Definitions, concepts and classification of bio pesticides viz. Pathogen, botanical pesticides, and bio rationales. Botanicals and their uses. Mass production technology of bio-pesticides. Virulence, pathogenicity and symptoms of entomopathogenic pathogens and nematodes, Methods of application of bio pesticides. Methods of quality control and Techniques of bio pesticides. Impediments and limitation in production and use of bio pesticides.

Unit-II: Biofertilizers - Introduction, status and scope. Structure and characteristics feature of bacterial biofertilizers – Azospirillum, Azotobacter, Bacillus, Pseudomonas, Rhizobium and Frankia; Cynobacterial bio fertilizers- Anabaena, Nostoc, Hapalosiphon and fungal biofertilizers – AM mycorrhiza and ectomycorhiza. Nitrogen fixation –Free living and symbiotic nitrogen fixation. Mechanism of phosphate solubilisation and phosphate mobilization, K solubilisation. Production Technology:

Unit-III: Strain selection, sterilization, growth and fermentation, mass production of carrier based and liquid biofertilizers. FCO specifications and quality control of biofertilizers. Application technology for seeds, seedlings, tubers, sets etc. Biofertilizers-Storage, shelf life, quality control and marketing. Factors influencing the efficiency of biofertilizers.

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 using Antagonistic Organisms in India. Precision Fototype Services, Bengaluru.

11. Singh, Awani Kr. Handbook of Microbial Biofertilizers. Agrotech Press, Jaipur, India.
12. Singh, A.K. Organic Farming. New India Publishing Agency, New Delhi.
13. Singh, S.P. and Hussanini, S.S. 1998. Biological Suppression of Plant Disease, Phytoparasitic Nematodes and Weeds. Precision Fototype Services, Bengaluru.
14. Trivedi, P.C. Fungal Biopesticides and VAM applications. Pointer Publishers, Jaipur, India.

Course Name: Biopesticides and Biofertilizers Lab

Course Code: BSAE47005

Course Outline

Unit-I: 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.

Course Name: System Simulation and Agroadvisory

Course Code: BSAE41005

Course Outline

Unit-I: 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. Potential and achievable crop production- concept and modelling, techniques for their estimation.

Unit-II: Crop production in moisture and nutrients limited conditions; components of soil water and nutrients balance. Weather forecasting, types methods, tools and techniques, forecast verification; Value added weather forecast, ITK for weather forecast and its validity;

Unit-III: Crop- Weather Calendars; Preparation of agro-advisory bulletin based on weather forecast. Use of crop simulation model for preparation of Agro- advisory and its effective dissemination.

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.

Course Name: System Simulation and Agroadvisory Lab

Course Code: BSAE41006

Course Outline

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.

Course Name: Hi-tech Horticulture

Course Code: BSAE48004

Course Outline

Unit-I: 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-II: Micro irrigation systems and its components; EC, pH based fertilizer scheduling; canopy management; high density orcharding; Components of precision farming: Remote sensing; Geographical Information System (GIS); Differential Geo-positioning

Unit-III: System (DGPS); Variable Rate Applicator (VRA); application of precision farming in horticultural crops (fruits, vegetables and ornamental crops); mechanized harvesting of produce.

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.

Course Name: Hi-tech Horticulture Lab

Course Code: BSAE48005

Course Outline

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.

Course Name: Protected cultivation

Course Code: BSAE48006

Course Outline

Unit-I: 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. 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-II: Greenhouse cultivation of important horticultural crops-rose, carnation, chrysanthemum, gerbera, orchid, anthurium, lilium, tulip, tomato, bell pepper, cucumber, strawberry, pot plants etc. Cultivation of economically important medicinal and aromatic plants. Off- season production of flowers and vegetables. Insect pest and disease management.

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.

Course Name: Protected cultivation Lab

Course Code: BSAE48007

Course Outline

Unit-I: 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.

Course Name: Climate Resilient Agriculture

Course Code: BSAE57000

Course Outline

Unit-I: Climate change and impacts of climate change on agriculture and food security; crop productivity under different climate change scenarios including extreme events such as drought, flood, pest and disease outbreak etc. Basics of adaption and mitigation in the agricultural sectors; analyzing and assessing climate vulnerability to identify vulnerable sectors and possible adaptation options in agriculture; assessing biophysical and socio-economic impacts on agricultural sector; risk assessment strategies, preparedness for weather and climate risks in agriculture; application of geospatial tools and techniques for sustainable agriculture. Climate resilient agriculture (CRA) –concept, scope and importance with special reference to India, climate resilient technologies for enhancing crop productivity and sustainability – role of weather and climatic information, agro- advisories, ICTs and simulation models; climate resilient agronomic practices – crop/cultivar selection, crop diversification/ crop mixtures; water management practices – rain water harvesting, micro-irrigation, deficit irrigation and drainage management, organic/natural farming, integrated farming systems (IFS);

Unit-II: site specific nutrient management (SSNM), conservation agriculture technologies to build soil organic carbon, harnessing microbial biodiversity, biomass recycling; use of renewable sources of energy; climate resilient pest-disease management strategies. Breeding strategies for development of climate change resilient crops and varieties, development of biotic and abiotic stress tolerant/resistant cultivars under changed climatic scenarios including extreme weather events.

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.

Course Name: Climate Resilient Agriculture Lab

Course Code: BSAE57001

Course Outline

Unit-I: 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.

Course Name: Biotechnology of Crop Improvement

Course Code: BSAE58000

Course Outline

Unit-I: 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. 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. 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;

Unit-II: Gene silencing techniques; introduction to siRNA; siRNA technology; Micro RNA; construction of siRNA vectors; 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; 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 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.

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: The Genetic Manipulation of Plants. Oxford, 400p.

Course Name: Biotechnology of Crop Improvement Lab

Course Code: BSAE58001

Course Outline

Unit-I: 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.

Course Name: Geoinformatics and remote sensing, precision farming

Course Code: BSAE43002

Course Outline

Unit-I: 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; Advantages and disadvantages of remote sensing; Remote sensing institutes in India; Basic Concepts about geoinformatics.

Unit-II: 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; Probability and Statistics: Bayes Theorem, correlation and Covariance, Continuous Random variables and probability distribution function, various forms of distributions, central limit theorem; Basics of Machine Learning:

Unit-III: 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.

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 edh (WSE) Paperback – 1 January 2011, Willey Student Edition.
9. Remote Sensing and Geographic Information by A.M. Chandra and S.K. Ghosh. Narosa.

Course Name: Geoinformatics and remote sensing, precision farming Lab

Course Code: BSAE43003

Course Outline

Unit-I: 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.

Course Name: Micro-propagation Technologies

Course Code: BSAE58002

Course Outline

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

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.

Course Name: Micro-propagation Technologies Lab

Course Code: BSAE58003

Course Outline

Unit-I: 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.

Course Name: Commercial Seed Production

Course Code: BSAE42002

Course Outline

Unit-I: 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. 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.

Unit-II: General Principles of Seed Testing: Seed testing-Introduction, Procedure of Seed testing, components of seed quality testing genetic, physical, physiological and seed health testing, Seed sampling, Types of seed sampling, Requirements of sampling, Concept of seed viability and vigour; dormancy, types and principles of seed dormancy, Physiological quality of seed, Principles of seed Germination, types of germination, biochemical and genetic basis. Seed Certification: History, concept and objectives of seed certification; seed certification agency/organization and staff requirement Indian Minimum Seed Certification Standards (I.M.S.C.S.) - general and specific crop standards including GM varieties, field and seed standards.

Unit-III: Seed Industry and Seed Marketing: Introduction, Evolution of the seed industry, Development of the vegetable and Flower seed industry, Seed marketing – concept, definition and purpose, importance and promotion of quality seed, formal and informal seed supply systems, Seed marketing intelligence and product mix, sales promotion, distribution channels, marketing costs and margins; packaging and labelling, Seed Associations, Factors influencing seed marketing, Seed marketing programs, Seed industry organizations, Marketing of public versus private players, Demand and supply of seed; role of seed replacement rate (SRR), seed multiplication ratio (SMR), economics of seed production; determining seed needs, Seed pricing and price policy, seed processing and / packaging, demand forecasting and factors affecting demand for seeds, effect of price and farm income on seed demand, Role of WTO in seed marketing. 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.

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.

Course Name: Commercial Seed Production Lab

Course Code: BSAE42003

Course Outline

Unit-I: 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.

Unit-II: 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 seed- borne diseases, seed treatment methods.,

Unit-III: 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.

Course Name: Principles and Practices of Organic Farming and Conservation Agriculture

Course Code: BSAE41007

Course Outline

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

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.

Course Name: Principles and Practices of Organic Farming and Conservation Agriculture Lab

Course Code: BSAE41008

Course Outline

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

Course Name: Food Science and Nutrition

Course Code: BSAE49000

Course Outline

Unit-I: 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; 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;

Unit-II: Digestion, absorption, transport and metabolism of nutrients in human system; Protein quality evaluation. Biochemical and nutritional aspects of vitamins, minerals, nutraceuticals, antioxidant, antinational factors and biochemistry of post-harvest storage, losses during processing.

Unit-III: Effect of cooking, processing and preservation on nutrients of different food products, biochemical aspects of food spoilage; Food fads, food safety and quality standards. Enzymes in food industry, food additives, nutritional quality of plant, animal, dairy, marine and fermented products.

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.

Course Name: Food Science and Nutrition Lab

Course Code: BSAE49001

Course Outline

Unit-I: 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.

Course Name: Post Harvest Technology and Value Addition

Course Code: BSAE48008

Course Outline

Unit-I: 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; 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; Intermediate moisture food (jam, jelly, marmalade, preserve, candy) - concepts and standards; Fermented and non-fermented beverages. Tomato products - concepts and standards; Drying /Dehydration of fruits and vegetables –concept and methods, osmotic drying. Canning – concepts and standards, packaging of products.

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.

Course Name: Post Harvest Technology and Value Addition Lab

Course Code: BSAE48009

Course Outline

Unit-I: 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.

Note: The review of Syllabus happens on periodic basis for the benefit of the students. In case there are changes in curriculum due to review, students would be intimated in writing.

……. End of Document…….

9. Lesson Plan

BSAE45000-Agri-Business Management

Unit	Particulars	Class No.	Pedagogy of Class
Unit-I	Transformation of agriculture into agribusiness, various stakeholders and components of agribusiness systems.	C-1	Lecture
Unit-I	Transformation of agriculture into agribusiness, various stakeholders and components of agribusiness systems.	C-2	Lecture
Unit-I	Quiz	C-3	Quiz
Unit-I	Importance of agribusiness in the Indian economy and New Agricultural Policy.	C-4	Lecture
Unit-I	Importance of agribusiness in the Indian economy and New Agricultural Policy.	C-5	Lecture
Unit-I	Distinctive features of Agribusiness Management: Importance and needs of agro-based industries.	C-6	Lecture
Unit-I	Presentation	C-7	Presentation
Unit-I	Distinctive features of Agribusiness Management: Importance and needs of agro-based industries.	C-8	Lecture
Unit-I	Classification of industries and types of agro based industries.	C-9	Lecture
Unit-I	Classification of industries and types of agro based industries.	C-10	Lecture
Unit-I	Classroom Assignment	C-11	Classroom Assignment
Unit-II	Institutional arrangement, procedures to set up agro based industries. Constraints in establishing agro-based industries.	C-12	Lecture
Unit-II	Institutional arrangement, procedures to set up agro based industries. Constraints in establishing agro-based industries.	C-13	Lecture
Unit-II	Agri-value chain: Understanding primary and support activities and their linkages.	C-14	Lecture
Unit-II	Clarification class	C-15	Clarification class
Unit-II	Agri-value chain: Understanding primary and support activities and their linkages.	C-16	Lecture
Unit-II	Business environment: PEST and SWOT analysis.	C-17	Lecture
Unit-II	Business environment: PEST and SWOT analysis.	C-18	Lecture
Unit-II	Home Assignment		Home Assignment
Unit-II	Management functions: Roles and activities, Organization culture.	C-19	Lecture
Unit-II	Management functions: Roles and activities, Organization culture.	C-20	Lecture
Unit-II	Planning, meaning, definition, types of plans.	C-21	Lecture
Unit-II	Quiz	C-22	Quiz

Unit-II	Planning, meaning, definition, types of plans.	C-23	Lecture
Unit-II	Purpose or mission, goals or objectives, Strategies, polices procedures, rules, programs and budget.	C-24	Lecture
Unit-II	Purpose or mission, goals or objectives, Strategies, polices procedures, rules, programs and budget.	C-25	Lecture
Unit-II	Presentation	C-26	Presentation
Unit-II	Components of a business plan, Steps in planning and implementation. Organization staffing, directing and motivation.	C-27	Lecture
Unit-II	Components of a business plan, Steps in planning and implementation. Organization staffing, directing and motivation.	C-28	Lecture
Unit-III	Ordering, leading, supervision, communications, control.	C-29	Lecture
Unit-III	Classroom Assignment	C-30	Classroom Assignment
Unit-III	Ordering, leading, supervision, communications, control.	C-31	Lecture
Unit-III	Capital management and Financial management of Agribusiness.	C-32	Lecture
Unit-III	Clarification class	C-33	Clarification class
Unit-III	Capital management and Financial management of Agribusiness.	C-34	Lecture
Unit-III	Financial statements and their importance. Marketing Management: Segmentation, targeting and positioning.	C-35	Lecture
Unit-III	Home Assignment		Home Assignment
Unit-III	Financial statements and their importance. Marketing Management: Segmentation, targeting and positioning.	C-36	Lecture
Unit-III	Marketing mix and marketing strategies.	C-37	Lecture
Unit-III	Presentation	C-38	Presentation
Unit-III	Consumer behaviour analysis, Product Life Cycle (PLC). Sales and Distribution Management.	C-39	Lecture
Unit-III	Pricing policy, various pricing methods.	C-40	Lecture
Unit-III	Classroom Assignment	C-41	Classroom Assignment
Unit-III	Pricing policy, various pricing methods.	C-42	Lecture
Unit-III	Project Management definition, project cycle, identification, formulation, appraisal, implementation, monitoring and evaluation.	C-43	Lecture
Unit-III		C-44	Clarification class
Unit-III	Project Management definition, project cycle, identification, formulation, appraisal, implementation, monitoring and evaluation. Project Appraisal and evaluation techniques.	C-45	Lecture
Unit-III	Home Assignment		Home Assignment

BSAE45001-Agri-Business Management Lab

Unit	Particulars	Class No.	Pedagogy of Class
Unit-I	Study of agri –input markets: Seed, fertilizers pesticides.	P-1	Practical
Unit-I	Study of output markets: grains, fruits, vegetables, flowers.	P-2	Practical
Unit-I	Study of product market, retails trade commodity trading, and value-added products.	P-3	Practical
Unit-I	Study of product market, retails trade commodity trading, and value-added products.	P-4	Practical
Unit-I	Study of financing institutions- Cooperative, Commercial Bank, RRBs, Agribusiness Finance Limited, NABARD. Preparations of projects and Feasibility reports for agribusiness entrepreneur.	P-5	Practical
Unit-I	Study of financing institutions- Cooperative, Commercial Bank, RRBs, Agribusiness Finance Limited, NABARD. Preparations of projects and Feasibility reports for agribusiness entrepreneur.	P-6	Practical
Unit-I	Appraisal /evaluation techniques of identifying viable project- Non discounting techniques.	P-7	Practical
Unit-I	Case study of agro- based industries.	P-8	Practical
Unit-I	Case study of agro- based industries.	P-9	Practical
Unit-I	Trend and growth rate of price of agricultural commodities.	P-10	Practical
Unit-I	Trend and growth rate of price of agricultural commodities.	P-11	Practical
Unit-I	Net present worth technique for selection of viable project.	P-12	Practical
Unit-I	Net present worth technique for selection of viable project.	P-13	Practical
Unit-I	Internal rate of return.	P-14	Practical
Unit-I	Internal rate of return.	P-15	Practical

BSAE43000-Management of natural resources

Unit	Particulars	Class No.	Pedagogy of Class
Unit-I	Introduction to Natural Resource Bases: Concept of resource, classification of natural resources.	C-1	Lecture
Unit-I	Introduction to Natural Resource Bases: Concept of resource, classification of natural resources.	C-2	Lecture
Unit-I	Quiz	C-3	Quiz
Unit-I	Factors influencing resource availability, distribution and uses. Interrelationships among different types of natural resources.	C-4	Lecture
Unit-I	Concern on Productivity issues.	C-5	Lecture
Unit-I	Concern on Productivity issues.	C-6	Lecture
Unit-I	Presentation	C-7	Presentation
Unit-I	Ecological, social and economic dimension of resource management.	C-8	Lecture
Unit-I	Ecological, social and economic dimension of resource management.	C-9	Lecture
Unit-I	Land resources: Land as a resource.	C-10	Lecture
Unit-I	Classroom Assignment	C-11	Classroom Assignment
Unit-I	Land resources: Land as a resource.	C-12	Lecture
Unit-I	Dry land, land use classification, land degradation, man induced landslides, soil erosion and desertification.	C-13	Lecture
Unit-I	Dry land, land use classification, land degradation, man induced landslides, soil erosion and desertification.	C-14	Lecture
Unit-I	Clarification class	C-15	Clarification class
Unit-I	Landscape impact analysis, wetland ecology and management.	C-16	Lecture
Unit-I	Landscape impact analysis, wetland ecology and management.	C-17	Lecture
Unit-II	Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems.	C-18	Lecture
Unit-II	Home Assignment		Home Assignment
Unit-II	Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems.	C-19	Lecture
Unit-II	Water ecology and management. Energy resources: Growing energy needs, renewable and non- renewable energy sources, use of alternate energy sources. Resource Management Paradigms: Resource management the evolution and history of resource management paradigms.	C-20	Lecture

Unit-II	Water ecology and management. Energy resources: Growing energy needs, renewable and non- renewable energy sources, use of alternate energy sources. Resource Management Paradigms: Resource management the evolution and history of resource management paradigms.	C-21	Lecture
Unit-II	Quiz	C-22	Quiz
Unit-II	Resource conflicts: Resource extraction, access and control system.	C-23	Lecture
Unit-II	Resource conflicts: Resource extraction, access and control system.	C-24	Lecture
Unit-II	Approaches in Resource Management: Ecological approach; economic approach; ethnological approach; implications of the approaches; integrated resource management strategies.	C-25	Lecture
Unit-II	Presentation	C-26	Presentation
Unit-II	Approaches in Resource Management: Ecological approach; economic approach; ethnological approach; implications of the approaches; integrated resource management strategies.	C-27	Lecture
Unit-II	Approaches in Resource Management: Ecological approach; economic approach; ethnological approach; implications of the approaches; integrated resource management strategies.	C-28,29	Lecture
Unit-II	Classroom Assignment	C-30	Classroom Assignment
Unit-III	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.	C-31	Lecture
Unit-III	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.	C-32	Lecture
Unit-III	Clarification class	C-33	Clarification class
Unit-III	Soil loss estimation by universal soil loss equation - Soil loss measurement techniques. Principles of erosion control - Introduction to contouring, strip cropping.	C-34	Lecture
Unit-III	Soil loss estimation by universal soil loss equation - Soil loss measurement techniques. Principles of erosion control - Introduction to contouring, strip cropping.	C-35	Lecture

Unit-III	Home Assignment		Home Assignment
Unit-III	Contour bund - Graded bund and bench terracing.	C-36	Lecture
Unit-III	Contour bund - Graded bund and bench terracing.	C-37	Lecture
Unit-III	Presentation	C-38	Presentation
Unit-III	Contour bund - Graded bund and bench terracing.	C-39	Lecture
Unit-III	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.	C-40	Lecture
Unit-III	Classroom Assignment	C-41	Classroom Assignment
Unit-III	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.	C-42	Lecture
Unit-III	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.	C-43	Lecture
Unit-III	Clarification class	C-44	Clarification class
Unit-III	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.	C-45	Lecture
Unit-III	Home Assignment		Home Assignment

BSAE43001-Management of natural resources Lab

Unit	Particulars	Class No.	Pedagogy of Class
Unit-I	Identifying natural resources and their utility.	P-1	Practical
Unit-I	Practicing survey - Principles and educating to use pacing technique for measurement.	P-2	Practical
Unit-I	Area calculations through chain survey - GPS demo for tracking and area measurement.	P-3	Practical
Unit-I	Estimation of soil loss and calculation of erosion index.	P-4	Practical
Unit-I	Leveling concepts and practical utility in agriculture.	P-5	Practical
Unit-I	Preparation of contour maps.	P-6	Practical
Unit-I	Concept of vegetative water ways and design of grassed water ways.	P-7	Practical
Unit-I	Wind erosion and estimation process.	P-8	Practical
Unit-I	Different irrigation pumps and their constructional differences.	P-9	Practical
Unit-I	Farm pond construction and its design aspects. Visit to nearby farm pond.	P-10	Practical
Unit-I	Farm pond construction and its design aspects. Visit to nearby farm pond.	P-11	Practical
Unit-I	Visit to an erosion site.	P-12	Practical
Unit-I	Exposure to strip cropping/contour bunding.	P-13	Practical
Unit-I	Exposure to strip cropping/contour bunding.	P-14	Practical
Unit-I	Exposure to strip cropping/contour bunding.	P-15	Practical

BSAE47000-Agrochemicals

Unit	Particulars	Class No.	Pedagogy of Class
Unit-I	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.	C-1	Lecture
Unit-I	Herbicides -Major classes, properties and important herbicides.	C-2	Lecture
Unit-I	Quiz	C-3	Quiz
Unit-I	Fate of herbicides.	C-4	Lecture
Unit-I	Fungicides- classification –Inorganic fungicides- characteristics, preparation and use of sulphur and copper.	C-5	Lecture
Unit-I	Mode of action- Bordeaux mixture and copper oxychloride.	C-6	Lecture
Unit-I	Presentation	C-7	Presentation
Unit-II	Organic fungicides –Mode of action – Dithiocarbamates- characteristics, preparation and use of Zineb and maneb.	C-8	Lecture
Unit-II	Systemic fungicides- Benomyl, carboxin, oxycarboxin, Metalaxyl, Carbendazim, characteristics and use.	C-9	Lecture
Unit-II	Systemic fungicides- Benomyl, carboxin, oxycarboxin, Metalaxyl, Carbendazim, characteristics and use.	C-10	Lecture
Unit-II	Classroom Assignment	C-11	Classroom Assignment
Unit-II	Introduction and classification and insecticides: inorganic and organic insecticides organochorine, Ogranophosphates, Carbamates, Synthetic pyrethriods Neonicotinoids, Biorationals.	C-12	Lecture
Unit-II	Introduction and classification and insecticides: inorganic and organic insecticides organochorine, Ogranophosphates, Carbamates, Synthetic pyrethriods Neonicotinoids, Biorationals.	C-13	Lecture
Unit-II	Insecticide Act and rules, Insecticides banned, withdrawn and restricted use.	C-14	Lecture
Unit-II	Clarification class	C-15	Clarification class
Unit-II	Insecticide Act and rules, Insecticides banned, withdrawn and restricted use.	C-16	Lecture
Unit-II	Fate of insecticides in soil and plant.	C-17	Lecture
Unit-II	Fate of insecticides in soil and plant.	C-18	Lecture
Unit-II	Home Assignment		Home Assignment

Unit-II	IGR Biopesticides, Reduced risk insecticides, Botanical, Plant and animal systemic insecticides their characteristics and uses.	C-19	Lecture
Unit-II	IGR Biopesticides, Reduced risk insecticides, Botanical, Plant and animal systemic insecticides their characteristics and uses.	C-20	Lecture
Unit-II	Fertilizers and their importance.	C-21	Lecture
Unit-II	Quiz	C-22	Quiz
Unit-II	Nitrogenous fertilizers: Feedstocks and Manufacturing of ammonium sulphate, ammonium nitrate, ammonium chloride, urea.	C-23	Lecture
Unit-II	Nitrogenous fertilizers: Feedstocks and Manufacturing of ammonium sulphate, ammonium nitrate, ammonium chloride, urea.	C-24	Lecture
Unit-II	Slow release N-fertilizers.	C-25	Lecture
Unit-II	Presentation	C-26	Presentation
Unit-II	Phosphatic fertilizers: feedstock and manufacturing of single superphosphate.	C-27	Lecture
Unit-II	Phosphatic fertilizers: feedstock and manufacturing of single superphosphate.	C-28	Lecture
Unit-II	Preparation of bone meal and basic slag.	C-29	Lecture
Unit-II	Classroom Assignment	C-30	Classroom Assignment
Unit-III	Potassic fertilizers: Natural sources of potash, manufacturing of potassium chloride, potassium sulphate and potassium nitrate.	C-31	Lecture
Unit-III	Potassic fertilizers: Natural sources of potash, manufacturing of potassium chloride, potassium sulphate and potassium nitrate.	C-32	Lecture
Unit-III	Clarification class	C-33	Clarification class
Unit-III	Mixed and complex fertilizers: Sources and compatibility- preparation of major, secondary and micronutrient mixtures.	C-34	Lecture
Unit-III	Mixed and complex fertilizers: Sources and compatibility- preparation of major, secondary and micronutrient mixtures.	C-35	Lecture
Unit-III	Home Assignment		Home Assignment
Unit-III	Complex fertilizers: Manufacturing of ammonium phosphates, nitrophosphates and NPK complexes.	C-36	Lecture
Unit-III	Complex fertilizers: Manufacturing of ammonium phosphates, nitrophosphates and NPK complexes.	C-37	Lecture
Unit-III	Presentation	C-38	Presentation
Unit-III	Fertilizer control order.	C-39	Lecture
Unit-III	Fertilizer logistic and marketing.	C-40	Lecture

Unit-III	Classroom Assignment	C-41	Classroom Assignment
Unit-III	Plant bio-pesticides for ecological agriculture, Bio-insect repellent.	C-42	Lecture
Unit-III	Plant bio-pesticides for ecological agriculture, Bio-insect repellent.	C-43	Lecture
Unit-III	Clarification class	C-44	Clarification class
Unit-III	Plant bio-pesticides for ecological agriculture, Bio-insect repellent.	C-45	Lecture
Unit-III	Home Assignment		Home Assignment

BSAE47001-Agrochemicals Lab

Unit	Particulars	Class No.	Pedagogy of Class
Unit-I	Sampling of fertilizers and pesticides.	P-1	Practical
Unit-I	Pesticides application technology to study about various pesticides appliances.	P-2	Practical
Unit-I	Quick tests for identification of common fertilizers.	P-3	Practical
Unit-I	Identification of anion and cation in fertilizer.	P-4	Practical
Unit-I	Calculation of doses of insecticides to be used.	P-5	Practical
Unit-I	To study and identify various formulations of insecticide available kin market. Estimation of nitrogen in Urea.	P-6	Practical
Unit-I	To study and identify various formulations of insecticide available kin market. Estimation of nitrogen in Urea.	P-7	Practical
Unit-I	Estimation of water soluble P2 O5 and citrate soluble P2 O5 in single super phosphate.	P-8	Practical
Unit-I	Estimation of water soluble P2 O5 and citrate soluble P2 O5 in single super phosphate.	P-9	Practical
Unit-I	Estimation of potassium in Muraite of Potash/ Sulphate of Potash by flame photometer.	P-10	Practical
Unit-I	Estimation of potassium in Muraite of Potash/ Sulphate of Potash by flame photometer.	P-11	Practical
Unit-I	Determination of copper content in copper oxychloride.	P-12	Practical
Unit-I	Determination of copper content in copper oxychloride.	P-13	Practical
Unit-I	Determination of sulphur content in sulphur fungicide.	P-14	Practical
Unit-I	Determination of sulphur content in sulphur fungicide.	P-15	Practical

BSAE50000-Agricultural Journalism

Unit	Particulars	Class No.	Pedagogy of Class
Unit-I	Journalism – Meaning, nature, importance, and types of journalism.	C-1	Lecture
Unit-I	Agricultural Journalism – Meaning, definition, principle, objectives, types, and scope.	C-2	Lecture
Unit-I	Quiz	C-3	Quiz
Unit-I	Agricultural Journalism – Meaning, definition, principle, objectives, types, and scope.	C-4	Lecture
Unit-I	Similarities and difference between agricultural journalism and other types of journalism.	C-5	Lecture
Unit-I	Similarities and difference between agricultural journalism and other types of journalism.	C-6	Lecture
Unit-I	Presentation	C-7	Presentation
Unit-I	Role of agricultural journalist, Training of agricultural journalist.	C-8	Lecture
Unit-I	Qualities of journalist, Role of journalist /journalism in agricultural development and development of newspaper and magazines readers.	C-9	Lecture
Unit-I	Qualities of journalist, Role of journalist /journalism in agricultural development and development of newspaper and magazines readers.	C-10	Lecture
Unit-I	Classroom Assignment	C-11	Classroom Assignment
Unit-II	Newspaper and magazines as communication media: Characteristics, kinds and functions of newspaper and magazines, Characteristics of newspaper and magazines readers.	C-12	Lecture
Unit-II	Newspaper and magazines as communication media: Characteristics, kinds and functions of newspaper and magazines, Characteristics of newspaper and magazines readers.	C-13	Lecture
Unit-II	Form, content, style and language of newspaper and magazines, Standard part of newspaper and magazines.	C-14	Lecture
Unit-II	Clarification class	C-15	Clarification class
Unit-II	Form, content, style and language of newspaper and magazines, Standard part of newspaper and magazines.	C-16	Lecture
Unit-II	The agricultural story: Types of Agriculture stories, subject matter of the agricultural story, structure of the agricultural story.	C-17	Lecture
Unit-II	The agricultural story: Types of Agriculture stories, subject matter of the agricultural story, structure of the agricultural story.	C-18	Lecture

Unit-II	Home Assignment		Home Assignment
Unit-II	Gathering farm information -Sources of farm information: abstracting from research and scientific materials, interviews, coverage of events.	C-19	Lecture
Unit-II	Gathering farm information -Sources of farm information: abstracting from research and scientific materials, interviews, coverage of events.	C-20	Lecture
Unit-II	Other sources: electronic media, field study.	C-21	Lecture
Unit-II	Quiz	C-22	Quiz
Unit-II	Success stories- definition, nature, components, guidelines of writing a success story.	C-23	Lecture
Unit-II	Success stories- definition, nature, components, guidelines of writing a success story.	C-24	Lecture
Unit-II	Writing a news story difference between news and feature story, the principle of writing a news story, Inverted pyramid structure.	C-25	Lecture
Unit-II	Presentation	C-26	Presentation
Unit-II	Writing a news story difference between news and feature story, the principle of writing a news story, Inverted pyramid structure.	C-27	Lecture
Unit-III	Organizing the material, treatment of the story, writing the news lead and the body.	C-28	Lecture
Unit-III	Organizing the material, treatment of the story, writing the news lead and the body.	C-29	Lecture
Unit-III	Classroom Assignment	C-30	Classroom Assignment
Unit-III	Readability measure-readability ease score, automated readability index, gunning fog index, How to improve readability of articles and stories.	C-31	Lecture
Unit-III	Use of photograph in agricultural journalism- Basic principles of photography – composition, exposure, lens, light.	C-32	Lecture
Unit-III	Clarification class	C-33	Clarification class
Unit-III	Use of photograph in agricultural journalism- Basic principles of photography – composition, exposure, lens, light.	C-34	Lecture
Unit-III	Use of artwork (Graphs, charts maps, etc.). Writing the captions.	C-35	Lecture
Unit-III	Home Assignment		Home Assignment
Unit-III	Use of artwork (Graphs, charts maps, etc.). Writing the captions.	C-36	Lecture
Unit-III	Editorial mechanism: Copy reading, headline and title writing.	C-37	Lecture
Unit-III	Presentation	C-38	Presentation

Unit-III	Editorial mechanism: Copy reading, headline and title writing.	C-39	Lecture
Unit-III	Proofreading: definition, signs and symbols of proofreading, level of proofreading, duties of a proof-reader.	C-40	Lecture
Unit-III	Classroom Assignment	C-41	Classroom Assignment
Unit-III	Proofreading: definition, signs and symbols of proofreading, level of proofreading, duties of a proof-reader.	C-42	Lecture
Unit-III	Layout –meaning, principles of layout and design.	C-43	Lecture
Unit-III	Clarification class	C-44	Clarification class
Unit-III	Layout –meaning, principles of layout and design.	C-45	Lecture
Unit-III	Home Assignment		Home Assignment

BSAE50001-Agricultural Journalism Lab

Unit	Particulars	Class No.	Pedagogy of Class
Unit-I	Practice in writing an agricultural news story.	P-1	Practical
Unit-I	Practice in writing an agricultural feature story.	P-2	Practical
Unit-I	Covering agricultural events for the information collection.	P-3	Practical
Unit-I	Practice in interviewing for the information collection.	P-4	Practical
Unit-I	Abstracting stories from research and scientific materials and wire services.	P-5	Practical
Unit-I	Selecting pictures and artwork for the agricultural story.	P-6	Practical
Unit-I	Selecting pictures and artwork for the agricultural story.	P-7	Practical
Unit-I	Practice in editing, copy reading.	P-8	Practical
Unit-I	Practice in editing, copy reading.	P-9	Practical
Unit-I	Practice in headline and title writing.	P-10	Practical
Unit-I	Practice in headline and title writing.	P-11	Practical
Unit-I	Practising proof reading.	P-12	Practical
Unit-I	Practising proof reading.	P-13	Practical
Unit-I	Practice in lay outing of newspaper.	P-14	Practical
Unit-I	Practice in lay outing of newspaper.	P-15	Practical

BSAE48000-Landscaping

Unit	Particulars	Class No.	Pedagogy of Class
Unit-I	Importance and scope of landscaping.	C-1	Lecture
Unit-I	Importance and scope of landscaping.	C-2	Lecture
Unit-I	Quiz	C-3	Quiz
Unit-I	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.	C-4	Lecture
Unit-I	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.	C-5	Lecture
Unit-I	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.	C-6	Lecture
Unit-I	Presentation	C-7	Presentation
Unit-I	Gardens for special purposes.	C-8	Lecture
Unit-I	Gardens for special purposes.	C-9	Lecture
Unit-I	Trees: selection, propagation, planting schemes, canopy management.	C-10	Lecture
Unit-I	Classroom Assignment	C-11	Classroom Assignment
Unit-I	Trees: selection, propagation, planting schemes, canopy management.	C-12	Lecture
Unit-I	Shrubs and herbaceous perennials: selection, propagation, planting schemes, architecture.	C-13	Lecture
Unit-I	Shrubs and herbaceous perennials: selection, propagation, planting schemes, architecture.	C-14	Lecture
Unit-I	Clarification class	C-15	Clarification class
Unit-II	Climber and creepers importance, selection, propagation, planting.	C-16	Lecture
Unit-II	Climber and creepers importance, selection, propagation, planting.	C-17	Lecture
Unit-II	Climber and creepers importance, selection, propagation, planting.	C-18	Lecture
Unit-II	Home Assignment		Home Assignment
Unit-II	Annuals: selection, propagation, planting scheme. Other garden plants: palms, ferns, grasses and cacti succulents.	C-19	Lecture

Unit-II	Annuals: selection, propagation, planting scheme. Other garden plants: palms, ferns, grasses and cacti succulents.	C-20	Lecture
Unit-II	Annuals: selection, propagation, planting scheme. Other garden plants: palms, ferns, grasses and cacti succulents.	C-21	Lecture
Unit-II	Quiz	C-22	Quiz
Unit-II	Annuals: selection, propagation, planting scheme. Other garden plants: palms, ferns, grasses and cacti succulents.	C-23	Lecture
Unit-II	Pot plants: selection, arrangement, management.	C-24	Lecture
Unit-II	Pot plants: selection, arrangement, management.	C-25	Lecture
Unit-II	Presentation	C-26	Presentation
Unit-II	Pot plants: selection, arrangement, management.	C-27	Lecture
Unit-II	Bio- aesthetic planning: definition, need, planning.	C-28	Lecture
Unit-II	Bio- aesthetic planning: definition, need, planning.	C-29	Lecture
Unit-II	Classroom Assignment	C-30	Classroom Assignment
Unit-II	Bio- aesthetic planning: definition, need, planning.	C-31	Lecture
Unit-III	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.	C-32	Lecture
Unit-III	Clarification class	C-33	Clarification class
Unit-III	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.	C-34	Lecture
Unit-III	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.	C-35	Lecture
Unit-III	Home Assignment		Home Assignment
Unit-III	Lawn: establishment and maintenance. CAD application.	C-36	Lecture
Unit-III	Lawn: establishment and maintenance. CAD application.	C-37	Lecture
Unit-III	Presentation	C-38	Presentation
Unit-III	Lawn: establishment and maintenance. CAD application.	C-39	Lecture
Unit-III	Lawn: establishment and maintenance. CAD application.	C-40	Lecture

Unit-III	Classroom Assignment	C-41	Classroom Assignment
Unit-III	Lawn: establishment and maintenance. CAD application.	C-42	Lecture
Unit-III	Lawn: establishment and maintenance. CAD application.	C-43	Lecture
Unit-III	Clarification class	C-44	Clarification class
Unit-III	Lawn: establishment and maintenance. CAD application.	C-45	Lecture
Unit-III	Home Assignment		Home Assignment

BSAE48001-Landscaping Lab

Unit	Particulars	Class No.	Pedagogy of Class
Unit-I	Identification of trees, shrubs, annuals, pot plants;	P-1	Practical
Unit-I	Identification of trees, shrubs, annuals, pot plants;	P-2	Practical
Unit-I	Propagation of trees, shrubs and annuals;	P-3	Practical
Unit-I	Propagation of trees, shrubs and annuals;	P-4	Practical
Unit-I	Care and maintenance of plants, potting and repotting;	P-5	Practical
Unit-I	Care and maintenance of plants, potting and repotting;	P-6	Practical
Unit-I	Identification of tools and implements used in landscape design.	P-7	Practical
Unit-I	Identification of tools and implements used in landscape design.	P-8	Practical
Unit-I	Training and pruning of plants for special effects.	P-9	Practical
Unit-I	Training and pruning of plants for special effects.	P-10	Practical
Unit-I	Lawn establishment and maintenance.	P-11	Practical
Unit-I	Lawn establishment and maintenance.	P-12	Practical
Unit-I	Layout of formal gardens, informal gardens, special type of gardens (sunken garden, terrace garden, rock garden) and designing of conservatory and lathe house.	P-13	Practical
Unit-I	Layout of formal gardens, informal gardens, special type of gardens (sunken garden, terrace garden, rock garden) and designing of conservatory and lathe house.	P-14	Practical
Unit-I	Use of computer software. Visit to important gardens /parks /institutes.	P-15	Practical

BSAE42000-Commercial Plant breeding

Unit	Particulars	Class No.	Pedagogy of Class
Unit-I	Types of crops and modes of plant reproduction.	C-1	Lecture
Unit-I	Types of crops and modes of plant reproduction.	C-2	Lecture
Unit-I	Quiz	C-3	Quiz
Unit-I	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.	C-4	Lecture
Unit-I	Genetic test of commercial hybrids.	C-5	Lecture
Unit-I	Genetic test of commercial hybrids.	C-6	Lecture
Unit-I	Presentation	C-7	Presentation
Unit-I	Advances in hybrid seed production of maize, rice, sorghum, pearl millet, castor, sunflower, cotton pigeon pea, Brassica etc.	C-8	Lecture
Unit-II	Speed Breeding, Breeding Management systems, High-throughput phenotyping and genotyping platforms,	C-9	Lecture
Unit-II	Speed Breeding, Breeding Management systems, High-throughput phenotyping and genotyping platforms,	C-10	Lecture
Unit-II	Classroom Assignment	C-11	Classroom Assignment
Unit-II	Speed Breeding, Breeding Management systems, High-throughput phenotyping and genotyping platforms,	C-12	Lecture
Unit-II	Quality seed production of vegetable crops under open and protected environment.	C-13	Lecture
Unit-II	Quality seed production of vegetable crops under open and protected environment.	C-14	Lecture
Unit-II	Clarification class	C-15	Clarification class
Unit-II	Quality seed production of vegetable crops under open and protected environment.	C-16	Lecture
Unit-II	Alternative strategies for the development of the line cultivators:	C-17	Lecture
Unit-II	haploid inducer, tissue culture techniques and biotechnological tools.	C-18	Lecture
Unit-II	Home Assignment		Home Assignment
Unit-II	haploid inducer, tissue culture techniques and biotechnological tools.	C-19	Lecture
Unit-II	haploid inducer, tissue culture techniques and biotechnological tools.	C-20	Lecture
Unit-III	IPR issues in commercial plant breeding:	C-21	Lecture
Unit-III	Quiz	C-22	Quiz
Unit-III	IPR issues in commercial plant breeding:	C-23	Lecture
Unit-III	IPR issues in commercial plant breeding:	C-24	Lecture

Unit-III	DUS testing and registration of verities under PPV and FR Act.	C-25	Lecture
Unit-III	Presentation	C-26	Presentation
Unit-III	DUS testing and registration of verities under PPV and FR Act.	C-27	Lecture
Unit-III	DUS testing and registration of verities under PPV and FR Act.	C-28	Lecture
Unit-III	Variety testing, release and notification systems in India.	C-29	Lecture
Unit-III	Classroom Assignment	C-30	Classroom Assignment
Unit-III	Variety testing, release and notification systems in India.	C-31	Lecture
Unit-III	Variety testing, release and notification systems in India.	C-32	Lecture
Unit-III	Clarification class	C-33	Clarification class
Unit-III	Principles and techniques of seed production,	C-34	Lecture
Unit-III	Principles and techniques of seed production,	C-35	Lecture
Unit-III	Home Assignment		Home Assignment
Unit-III	Types of seeds, quality testing in self- and cross-pollinated crops.	C-36	Lecture
Unit-III	Types of seeds, quality testing in self- and cross-pollinated crops.	C-37	Lecture
Unit-III	Presentation	C-38	Presentation
Unit-III	Types of seeds, quality testing in self- and cross-pollinated crops.	C-39	Lecture
Unit-III	Types of seeds, quality testing in self- and cross-pollinated crops.	C-40	Lecture
Unit-III	Classroom Assignment	C-41	Classroom Assignment
Unit-III	Types of seeds, quality testing in self- and cross-pollinated crops.	C-42	Lecture
Unit-III	Types of seeds, quality testing in self- and cross-pollinated crops.	C-43	Lecture
Unit-III	Clarification class	C-44	Clarification class
Unit-III	Types of seeds, quality testing in self- and cross-pollinated crops.	C-45	Lecture
Unit-III	Home Assignment		Home Assignment

BSAE42001-Commercial Plant breeding Lab

Unit	Particulars	Class No.	Pedagogy of Class
Unit-I	Floral biology in self- and cross- pollinated species, selfing and crossing techniques.	P-1	Practical
Unit-I	Floral biology in self- and cross- pollinated species, selfing and crossing techniques.	P-2	Practical
Unit-I	Techniques of seed production in self- and cross-pollinated crops using A/B/R and two-line system.	P-3	Practical
Unit-I	Techniques of seed production in self- and cross-pollinated crops using A/B/R and two-line system.	P-4	Practical
Unit-I	Learning techniques in hybrid seed production using male- sterility in field crops.	P-5	Practical
Unit-I	Understanding the difficulties in hybrid seed production.	P-6	Practical
Unit-I	Tools and techniques for optimizing hybrid seed production.	P-7	Practical
Unit-I	Concept of rouging in seed production plot.	P-8	Practical
Unit-I	Concept of line its multiplication and purification in hybrid seed production.	P-9	Practical
Unit-I	Role of pollinators in hybrid seed production.	P-10	Practical
Unit-I	Hybrid seed production techniques in sorghum, pearl millet, maize, rice, rapeseed-mustard, sunflower, castor, pigeon pea, cotton and vegetable crops.	P-11	Practical
Unit-I	Sampling and analytical procedures for purity testing and detection of spurious seed.	P-12	Practical
Unit-I	Seed drying and storage structure in quality seed management.	P-13	Practical
Unit-I	Screening techniques during seed processing, viz. grading and packaging.	P-14	Practical
Unit-I	Visit to public private seed production and processing plants.	P-15	Practical

BSAE48002-Food safety and standards

Unit	Particulars	Class No.	Pedagogy of Class
Unit-I	Food safety –Definition, Importance, Scope and Factors affecting Food Safety.	C-1	Lecture
Unit-I	Hazards and Risks, Type of Hazards - Biological, Chemical Physical hazards.	C-2	Lecture
Unit-I	Quiz	C-3	Quiz
Unit-I	Management of hazards – Need.	C-4	Lecture
Unit-I	Control of Parameters.	C-5	Lecture
Unit-I	Temperature Control.	C-6	Lecture
Unit-I	Presentation	C-7	Presentation
Unit-I	Food Storage.	C-8	Lecture
Unit-I	Production Design.	C-9	Lecture
Unit-I	Hygiene and Sanitation in Food Service Establishments- Introduction. Sources of contamination and their control.	C-10	Lecture
Unit-I	Classroom Assignment	C-11	Classroom Assignment
Unit-I	Waste Disposal.	C-12	Lecture
Unit-I	Waste Disposal.	C-13	Lecture
Unit-I	Pest and Rodent Control.	C-14	Lecture
Unit-I	Clarification class	C-15	Clarification class
Unit-I	Pest and Rodent Control.	C-16	Lecture
Unit-I	Personnel Hygiene.	C-17	Lecture
Unit-I	Personnel Hygiene.	C-18	Lecture
Unit-I	Home Assignment		Home Assignment
Unit-II	Food safety Measures.	C-19	Lecture
Unit-II	Food Safety Management Tool- Basic concepts.	C-20	Lecture
Unit-II	PRPs, GHPs, GMPs, SSOPs etc. HACCP.ISO series.	C-21	Lecture
Unit-II	Quiz	C-22	Quiz
Unit-II	PRPs, GHPs, GMPs, SSOPs etc. HACCP.ISO series.	C-23	Lecture
Unit-II	TQM- concept and need for quality, components of TQM, Kaizen.	C-24	Lecture
Unit-II	TQM- concept and need for quality, components of TQM, Kaizen.	C-25	Lecture
Unit-II	Presentation	C-26	Presentation
Unit-II	Risk Analysis. Accreditation and Auditing, Water Analysis, Surface Sanitation and Personal Hygine.	C-27	Lecture
Unit-II	Food laws and Standards Indian Food Regulatory Regime, FSSA.	C-28	Lecture
Unit-II	Food laws and Standards Indian Food Regulatory Regime, FSSA.	C-29	Lecture

Unit-II	Classroom Assignment	C-30	Classroom Assignment
Unit-II	Global Scenario CAC. Other laws and standards related to food.	C-31	Lecture
Unit-II	Global Scenario CAC. Other laws and standards related to food.	C-32	Lecture
Unit-II	Clarification class	C-33	Clarification class
Unit-II	Recent concerns -New and Emerging Pathogens.	C-34	Lecture
Unit-II	Packaging, Product labelling and Nutritional labelling.	C-35	Lecture
Unit-II	Home Assignment		Home Assignment
Unit-III	Packaging, Product labelling and Nutritional labelling.	C-36	Lecture
Unit-III	Packaging, Product labelling and Nutritional labelling.	C-37	Lecture
Unit-III	Presentation	C-38	Presentation
Unit-III	Genetically modified food/transgenic.	C-39	Lecture
Unit-III	Genetically modified food/transgenic.	C-40	Lecture
Unit-III	Classroom Assignment	C-41	Classroom Assignment
Unit-III	Organic foods.	C-42	Lecture
Unit-III	Newer approaches to food safety.	C-43	Lecture
Unit-III	Clarification class	C-44	Clarification class
Unit-III	Recent Outbreaks. Indian and International Standards for food products.	C-45	Lecture
Unit-III	Home Assignment		Home Assignment

BSAE48003-Food safety and standards Lab

Unit	Particulars	Class No.	Pedagogy of Class
Unit-I	Water quality analysis physico – chemical and microbiological.	P-1	Practical
Unit-I	Water quality analysis physico – chemical and microbiological.	P-2	Practical
Unit-I	Preparation of different types of media.	P-3	Practical
Unit-I	Preparation of different types of media.	P-4	Practical
Unit-I	Microbiological examination of different food samples.	P-5	Practical
Unit-I	Microbiological examination of different food samples.	P-6	Practical
Unit-I	Assessment of surface sanitation by swab/rinse method.	P-7	Practical
Unit-I	Assessment of surface sanitation by swab/rinse method.	P-8	Practical
Unit-I	Assessment of personal hygiene.	P-9	Practical
Unit-I	Assessment of personal hygiene.	P-10	Practical
Unit-I	Biochemical tests for identification of bacteria.	P-11	Practical
Unit-I	Biochemical tests for identification of bacteria.	P-12	Practical
Unit-I	Scheme for the detection of food borne pathogens.	P-13	Practical
Unit-I	Scheme for the detection of food borne pathogens.	P-14	Practical
Unit-I	Preparation of plants for Implementation of FSMS-HACCP, ISO:22000.	P-15	Practical

BSAE47002-Bioformulation and Nano formulation

Unit	Particulars	Class No.	Pedagogy of Class
Unit-I	Introduction and history of biological control of pests and diseases;	C-1	Lecture
Unit-I	Introduction and history of biological control of pests and diseases;	C-2	Lecture
Unit-I	Quiz	C-3	Quiz
Unit-I	Microbial biopesticides: the global and Indian market scenario;	C-4	Lecture
Unit-I	biopesticides for organic agriculture;	C-5	Lecture
Unit-I	biopesticides for organic agriculture;	C-6	Lecture
Unit-I	Presentation	C-7	Presentation
Unit-I	Different phytopathogenic biocontrol agents: Mode of action;	C-8	Lecture
Unit-I	Different entomopathogenic biocontrol agents: Mode of action;	C-9	Lecture
Unit-I	Different entomopathogenic biocontrol agents: Mode of action;	C-10	Lecture
Unit-I	Classroom Assignment	C-11	Classroom Assignment
Unit-I	Microbial inoculants as biofertilizer candidates, Production, quality assessment and methods of application of biopesticides and biofertilizers;	C-12	Lecture
Unit-I	Microbial inoculants as biofertilizer candidates, Production, quality assessment and methods of application of biopesticides and biofertilizers;	C-13	Lecture
Unit-II	Regulatory system of biopesticides in India;	C-14	Lecture
Unit-II	Clarification class	C-15	Clarification class
Unit-II	Regulatory system of biopesticides in India;	C-16	Lecture
Unit-II	Formulations of plant essential oils, botanicals, pheromone, and parapheromone and their application in insect pest management;	C-17	Lecture
Unit-II	Use of predators and parasitoids for insect pest management;	C-18	Lecture
Unit-II	Home Assignment		Home Assignment
Unit-II	Use of predators and parasitoids for insect pest management;	C-19	Lecture
Unit-II	Nanotechnology: its applications in pest and disease diagnosis and management;	C-20	Lecture
Unit-II	Nanotechnology: its applications in pest and disease diagnosis and management;	C-21	Lecture
Unit-II	Quiz	C-22	Quiz
Unit-II	Nano biopesticides: Concept and importance, different techniques of producing nano biopesticides;	C-23	Lecture

Unit-II	Nano biopesticides: Concept and importance, different techniques of producing nano biopesticides;	C-24	Lecture
Unit-II	Nano biopesticides: Concept and importance, different techniques of producing nano biopesticides;	C-25	Lecture
Unit-II	Presentation	C-26	Presentation
Unit-III	Nano Fertilizers: Concept and importance, Types of nano fertilizers;	C-27	Lecture
Unit-III	Nano Fertilizers: Concept and importance, Types of nano fertilizers;	C-28	Lecture
Unit-III	Nano Fertilizers: Concept and importance, Types of nano fertilizers;	C-29	Lecture
Unit-III	Classroom Assignment	C-30	Classroom Assignment
Unit-III	Different techniques of producing nano fertilizers;	C-31	Lecture
Unit-III	Different techniques of producing nano fertilizers;	C-32	Lecture
Unit-III	Clarification class	C-33	Clarification class
Unit-III	Green synthesis of nano fertilizers;	C-34	Lecture
Unit-III	Green synthesis of nano fertilizers;	C-35	Lecture
Unit-III	Home Assignment		Home Assignment
Unit-III	Green synthesis of nano fertilizers;	C-36	Lecture
Unit-III	Green synthesis of nano fertilizers;	C-37	Lecture
Unit-III	Presentation	C-38	Presentation
Unit-III	Green slow-release fertilizer composition based on urea-modified hydroxyapatite nanoparticles	C-39	Lecture
Unit-III	Green slow-release fertilizer composition based on urea-modified hydroxyapatite nanoparticles	C-40	Lecture
Unit-III	Classroom Assignment	C-41	Classroom Assignment
Unit-III	Green slow-release fertilizer composition based on urea-modified hydroxyapatite nanoparticles	C-42	Lecture
Unit-III	Green slow-release fertilizer composition based on urea-modified hydroxyapatite nanoparticles	C-43	Lecture
Unit-III	Clarification class	C-44	Clarification class
Unit-III	Green slow-release fertilizer composition based on urea-modified hydroxyapatite nanoparticles	C-45	Lecture
Unit-III	Home Assignment		Home Assignment

BSAE47003-Bioformulation and Nanoformulation Lab

Unit	Particulars	Class No.	Pedagogy of Class
Unit-I	Introduction and acquaintance with biopesticide laboratory;	P-1	Practical
Unit-I	Preparation of culture media;	P-2	Practical
Unit-I	Isolation and purification of bioagent from soil and infected insects;	P-3	Practical
Unit-I	Microscopic study of different microbial bioagents;	P-4	Practical
Unit-I	In vitro assay of microbial bioagents against plant pathogens.	P-5	Practical
Unit-I	In vitro compatibility study among different microbial bioagents;	P-6	Practical
Unit-I	Mass multiplication of biopesticides;	P-7	Practical
Unit-I	Population enumeration of biocontrol agents in different biopesticides;	P-8	Practical
Unit-I	Preparation of plant extracts and their efficacy test against insect pests;	P-9	Practical
Unit-I	Use of pheromone parapheromone for monitoring and management of insect pests;	P-10	Practical
Unit-I	Bioassay of Entomopathogenic biocontrol agents on insect pests;	P-11	Practical
Unit-I	Preparation of microbial inoculants of biofertilizer microbes;	P-12	Practical
Unit-I	Compatibility of biofertilizer microbes;	P-13	Practical
Unit-I	Preparation of solid and liquid consortia of biofertilizer microbes	P-14	Practical
Unit-I	Preparation of solid and liquid consortia of biofertilizer microbes	P-15	Practical

BSAE47004-Biopesticides and Biofertilizers

Unit	Particulars	Class No.	Pedagogy of Class
Unit-I	History and concept of bio pesticides.	C-1	Lecture
Unit-I	History and concept of bio pesticides.	C-2	Lecture
Unit-I	Quiz	C-3	Quiz
Unit-I	Importance, scope and potential of bio pesticides.	C-4	Lecture
Unit-I	Definitions, concepts and classification of bio pesticides viz. Pathogen, botanical pesticides, and bio rationales. Botanicals and their uses.	C-5	Lecture
Unit-I	Definitions, concepts and classification of bio pesticides viz. Pathogen, botanical pesticides, and bio rationales. Botanicals and their uses.	C-6	Lecture
Unit-I	Presentation	C-7	Presentation
Unit-I	Mass production technology of bio-pesticides.	C-8	Lecture
Unit-I	Virulence, pathogenicity and symptoms of entomopathogenic pathogens and nematodes,	C-9	Lecture
Unit-I	Virulence, pathogenicity and symptoms of entomopathogenic pathogens and nematodes,	C-10	Lecture
Unit-I	Classroom Assignment	C-11	Classroom Assignment
Unit-I	Methods of application of bio pesticides.	C-12	Lecture
Unit-I	Methods of application of bio pesticides.	C-13	Lecture
Unit-I	Methods of quality control and Techniques of bio pesticides.	C-14	Lecture
Unit-I	Clarification class	C-15	Clarification class
Unit-I	Methods of quality control and Techniques of bio pesticides.	C-16	Lecture
Unit-I	Impediments and limitation in production and use of bio pesticides.	C-17	Lecture
Unit-I	Biofertilizers - Introduction, status and scope.	C-18	Lecture
Unit-I	Home Assignment		Home Assignment
Unit-II	Biofertilizers - Introduction, status and scope.	C-19	Lecture
Unit-II	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.	C-20,21	Lecture
Unit-II	Quiz	C-22	Quiz
Unit-II	Nitrogen fixation –Free living and symbiotic nitrogen fixation.	C-23	Lecture
Unit-II	Nitrogen fixation –Free living and symbiotic nitrogen fixation.	C-24	Lecture

Unit-II	Mechanism of phosphate solubilisation and phosphate mobilization, K solubilisation.	C-25	Lecture
Unit-II	Presentation	C-26	Presentation
Unit-II	Mechanism of phosphate solubilisation and phosphate mobilization, K solubilisation.	C-27	Lecture
Unit-III	Production Technology: Strain selection, sterilization, growth and fermentation, mass production of carrier based and liquid biofertilizers.	C-28	Lecture
Unit-III	Production Technology: Strain selection, sterilization, growth and fermentation, mass production of carrier based and liquid biofertilizers.	C-29	Lecture
Unit-III	Classroom Assignment	C-30	Classroom Assignment
Unit-III	FCO specifications and quality control of biofertilizers.	C-31	Lecture
Unit-III	FCO specifications and quality control of biofertilizers.	C-32	Lecture
Unit-III	Clarification class	C-33	Clarification class
Unit-III	Application technology for seeds, seedlings, tubers, sets etc.	C-34	Lecture
Unit-III	Application technology for seeds, seedlings, tubers, sets etc.	C-35	Lecture
Unit-III	Home Assignment		Home Assignment
Unit-III	Application technology for seeds, seedlings, tubers, sets etc.	C-36	Lecture
Unit-III	Biofertilizers-Storage, shelf life, quality control and marketing.	C-37	Lecture
Unit-III	Presentation	C-38	Presentation
Unit-III	Biofertilizers-Storage, shelf life, quality control and marketing.	C-39	Lecture
Unit-III	Factors influencing the efficiency of biofertilizers.	C-40	Lecture
Unit-III	Classroom Assignment	C-41	Classroom Assignment
Unit-III	Factors influencing the efficiency of biofertilizers.	C-42	Lecture
Unit-III	Factors influencing the efficiency of biofertilizers.	C-43	Lecture
Unit-III	Clarification class	C-44	Clarification class
Unit-III	Factors influencing the efficiency of biofertilizers.	C-45	Lecture
Unit-III	Home Assignment		Home Assignment

BSAE47005-Biopesticides and Biofertilizers Lab

Unit	Particulars	Class No.	Pedagogy of Class
Unit-I	Isolation and purification of important biopestisides: trichoderma Pseudomonas, Bacillus, Metarhyziumetc. and its production.	P-1	Practical
Unit-I	Identification of important botanicals.	P-2	Practical
Unit-I	Visit to biopesticide laboratory in nearby area.	P-3	Practical
Unit-I	Field visit to explore naturally infected cadavers.	P-4	Practical
Unit-I	Identification of entomopathogenic entities in field condition.	P-5	Practical
Unit-I	Identification of entomopathogenic entities in field condition.	P-6	Practical
Unit-I	Quality control of biopesticides. Isolation and purification of Azospirillum, Azotobactor, Rhizobium, P-solubilizers and cyanobacteria.	P-7	Practical
Unit-I	Quality control of biopesticides. Isolation and purification of Azospirillum, Azotobactor, Rhizobium, P-solubilizers and cyanobacteria.	P-8	Practical
Unit-I	Mass multiplication and inoculums production of biofertilizers.	P-9	Practical
Unit-I	Mass multiplication and inoculums production of biofertilizers.	P-10	Practical
Unit-I	Isolation of AM fungi- Wet sieving method and sucrose gradient method.	P-11	Practical
Unit-I	Isolation of AM fungi- Wet sieving method and sucrose gradient method.	P-12	Practical
Unit-I	Mass production of AM inoculants.	P-13	Practical
Unit-I	Mass production of AM inoculants.	P-14	Practical
Unit-I	Mass production of AM inoculants.	P-15	Practical

BSAE41005-System Simulation and Agro-advisory

Unit	Particulars	Class No.	Pedagogy of Class
Unit-I	System approach for representing soil-plant-atmospheric continuum, system boundaries.	C-1	Lecture
Unit-I	System approach for representing soil-plant-atmospheric continuum, system boundaries.	C-2	Lecture
Unit-I	Quiz	C-3	Quiz
Unit-I	Crop models, concepts and techniques, types of crop models, data requirements, relational diagrams.	C-4	Lecture
Unit-I	Crop models, concepts and techniques, types of crop models, data requirements, relational diagrams.	C-5	Lecture
Unit-I	Crop models, concepts and techniques, types of crop models, data requirements, relational diagrams.	C-6	Lecture
Unit-I	Presentation	C-7	Presentation
Unit-I	Evaluation of crop responses to weather elements;	C-8	Lecture
Unit-I	Evaluation of crop responses to weather elements;	C-9	Lecture
Unit-I	Elementary crop growth models;	C-10	Lecture
Unit-I	Classroom Assignment	C-11	Classroom Assignment
Unit-I	Elementary crop growth models;	C-12	Lecture
Unit-I	Elementary crop growth models;	C-13	Lecture
Unit-I	calibration, validation, verification and sensitivity analysis.	C-14	Lecture
Unit-I	Clarification class	C-15	Clarification class
Unit-I	calibration, validation, verification and sensitivity analysis.	C-16	Lecture
Unit-I	calibration, validation, verification and sensitivity analysis.	C-17	Lecture
Unit-I	Potential and achievable crop production- concept and modelling, techniques for their estimation.	C-18	Lecture
Unit-I	Home Assignment		Home Assignment
Unit-I	Potential and achievable crop production- concept and modelling, techniques for their estimation.	C-19	Lecture
Unit-I	Potential and achievable crop production- concept and modelling, techniques for their estimation.	C-20	Lecture
Unit-II	Crop production in moisture and nutrients limited conditions; components of soil water and nutrients balance.	C-21	Lecture
Unit-II	Quiz	C-22	Quiz
Unit-II	Crop production in moisture and nutrients limited conditions; components of soil water and nutrients balance.	C-23	Lecture

Unit-II	Crop production in moisture and nutrients limited conditions; components of soil water and nutrients balance.	C-24	Lecture
Unit-II	Weather forecasting, types methods, tools and techniques, forecast verification;	C-25	Lecture
Unit-II	Presentation	C-26	Presentation
Unit-II	Weather forecasting, types methods, tools and techniques, forecast verification;	C-27	Lecture
Unit-II	Weather forecasting, types methods, tools and techniques, forecast verification;	C-28	Lecture
Unit-II	Value added weather forecast, ITK for weather forecast and its validity;	C-29	Lecture
Unit-II	Classroom Assignment	C-30	Classroom Assignment
Unit-II	Value added weather forecast, ITK for weather forecast and its validity;	C-31	Lecture
Unit-II	Value added weather forecast, ITK for weather forecast and its validity;	C-32	Lecture
Unit-II	Clarification class	C-33	Clarification class
Unit-III	Crop- Weather Calendars;	C-34	Lecture
Unit-III	Crop- Weather Calendars;	C-35	Lecture
Unit-III	Home Assignment		Home Assignment
Unit-III	Crop- Weather Calendars;	C-36	Lecture
Unit-III	Preparation of agro-advisory bulletin based on weather forecast.	C-37	Lecture
Unit-III	Presentation	C-38	Presentation
Unit-III	Preparation of agro-advisory bulletin based on weather forecast.	C-39	Lecture
Unit-III	Preparation of agro-advisory bulletin based on weather forecast.	C-40	Lecture
Unit-III	Classroom Assignment	C-41	Classroom Assignment
Unit-III	Use of crop simulation model for preparation of Agro- advisory and its effective dissemination.	C-42	Lecture
Unit-III	Use of crop simulation model for preparation of Agro- advisory and its effective dissemination.	C-43	Lecture
Unit-III	Clarification class	C-44	Clarification class
Unit-III	Use of crop simulation model for preparation of Agro- advisory and its effective dissemination.	C-45	Lecture
Unit-III	Home Assignment		Home Assignment

BSAE41006-System Simulation and Agro-advisory Lab

Unit	Particulars	Class No.	Pedagogy of Class
Unit-I	Preparation of crop weather calendars.	P-1	Practical
Unit-I	Preparation of agro-advisories based on weather forecast using various approaches and synoptic charts.	P-2	Practical
Unit-I	Working with statistical and simulation models for crop growth.	P-3	Practical
Unit-I	Potential and achievable production;	P-4	Practical
Unit-I	Potential and achievable production;	P-5	Practical
Unit-I	yield forecasting, insect and disease forecasting models.	P-6	Practical
Unit-I	yield forecasting, insect and disease forecasting models.	P-7	Practical
Unit-I	Simulation with limitations of water and nutrient management options.	P-8	Practical
Unit-I	Simulation with limitations of water and nutrient management options.	P-9	Practical
Unit-I	Sensitivity analysis of varying weather and crop management practices.	P-10	Practical
Unit-I	Sensitivity analysis of varying weather and crop management practices.	P-11	Practical
Unit-I	Use of statistical approaches in data analysis and preparation of historical, past and present meteorological data for medium range weather forecast.	P-12	Practical
Unit-I	Use of statistical approaches in data analysis and preparation of historical, past and present meteorological data for medium range weather forecast.	P-13	Practical
Unit-I	Feedback from farmers about the agro- advisory.	P-14	Practical
Unit-I	Feedback from farmers about the agro- advisory.	P-15	Practical

BSAE48004-Hi-tech Horticulture

Unit	Particulars	Class No.	Pedagogy of Class
Unit-I	Introduction and importance;	C-1	Lecture
Unit-I	Introduction and importance;	C-2	Lecture
Unit-I	Quiz	C-3	Quiz
Unit-I	Nursery management and mechanization;	C-4	Lecture
Unit-I	micro propagation of horticultural crops;	C-5	Lecture
Unit-I	micro propagation of horticultural crops;	C-6	Lecture
Unit-I	Presentation	C-7	Presentation
Unit-I	Modern field preparation and planting methods;	C-8	Lecture
Unit-I	Protected cultivation: advantages, controlled conditions, method and techniques;	C-9	Lecture
Unit-I	Protected cultivation: advantages, controlled conditions, method and techniques;	C-10	Lecture
Unit-I	Classroom Assignment	C-11	Classroom Assignment
Unit-II	Micro irrigation systems and its components;	C-12	Lecture
Unit-II	Micro irrigation systems and its components;	C-13	Lecture
Unit-II	EC, pH-based fertilizer scheduling;	C-14	Lecture
Unit-II	Clarification class	C-15	Clarification class
Unit-II	EC, pH-based fertilizer scheduling;	C-16	Lecture
Unit-II	EC, pH-based fertilizer scheduling;	C-17	Lecture
Unit-II	canopy management;	C-18	Lecture
Unit-II	Home Assignment		Home Assignment
Unit-II	canopy management;	C-19	Lecture
Unit-II	canopy management;	C-20	Lecture
Unit-II	high density orcharding;	C-21	Lecture
Unit-II	Quiz	C-22	Quiz
Unit-II	high density orcharding;	C-23	Lecture
Unit-II	high density orcharding;	C-24	Lecture
Unit-II	Components of precision farming: Remote sensing;	C-25	Lecture
Unit-II	Presentation	C-26	Presentation
Unit-II	Components of precision farming: Remote sensing;	C-27	Lecture
Unit-II	Components of precision farming: Remote sensing;	C-28	Lecture
Unit-II	Geographical Information System (GIS); Differential Geo-positioning System (DGPS);	C-29	Lecture
Unit-II	Classroom Assignment	C-30	Classroom Assignment
Unit-II	Geographical Information System (GIS); Differential Geo-positioning System (DGPS);	C-31	Lecture
Unit-II	Geographical Information System (GIS); Differential Geo-positioning System (DGPS);	C-32	Lecture

Unit-II	Clarification class	C-33	Clarification class
Unit-III	Variable Rate Applicator (VRA);	C-34	Lecture
Unit-III	Variable Rate Applicator (VRA);	C-35	Lecture
Unit-III	Home Assignment		Home Assignment
Unit-III	Variable Rate Applicator (VRA);	C-36	Lecture
Unit-III	Application of precision farming in horticultural crops (fruits, vegetables and ornamental crops);	C-37	Lecture
Unit-III	Presentation	C-38	Presentation
Unit-III	Application of precision farming in horticultural crops (fruits, vegetables and ornamental crops);	C-39	Lecture
Unit-III	Application of precision farming in horticultural crops (fruits, vegetables and ornamental crops);	C-40	Lecture
Unit-III	Classroom Assignment	C-41	Classroom Assignment
Unit-III	Mechanized harvesting of produce.	C-42	Lecture
Unit-III	Mechanized harvesting of produce.	C-43	Lecture
Unit-III	Clarification class	C-44	Clarification class
Unit-III	Mechanized harvesting of produce.	C-45	Lecture
Unit-III	Home Assignment		Home Assignment

BSAE48005-Hi-tech Horticulture Lab

Unit	Particulars	Class No.	Pedagogy of Class
Unit-I	Types of polyhouses and shade net houses,	P-1	Practical
Unit-I	Types of polyhouses and shade net houses,	P-2	Practical
Unit-I	Intercultural operations,	P-3	Practical
Unit-I	Intercultural operations,	P-4	Practical
Unit-I	tools and equipment identification and application,	P-5	Practical
Unit-I	tools and equipment identification and application,	P-6	Practical
Unit-I	Micro propagation,	P-7	Practical
Unit-I	Micro propagation,	P-8	Practical
Unit-I	Nursery- portrays,	P-9	Practical
Unit-I	Nursery- portrays,	P-10	Practical
Unit-I	micro-irrigation,	P-11	Practical
Unit-I	micro-irrigation,	P-12	Practical
Unit-I	EC, pH-based fertilizer scheduling,	P-13	Practical
Unit-I	canopy management,	P-14	Practical
Unit-I	visit to hi-tech orchard/nursery.	P-15	Practical

BSAE48006-Protected cultivation

Unit	Particulars	Class No.	Pedagogy of Class
Unit-I	Protected cultivation- importance and scope, status of protected cultivation in India and World, types of protected structure based on site and climate.	C-1	Lecture
Unit-I	Protected cultivation- importance and scope, status of protected cultivation in India and World, types of protected structure based on site and climate.	C-2	Lecture
Unit-I	Cladding material involved in greenhouse/ poly house.	C-3	Lecture
Unit-I	Class room assignment	C-4	Class room assignment
Unit-I	Cladding material involved in greenhouse/ poly house.	C-5	Lecture
Unit-I	Home Assignment		Home Assignment
Unit-I	Greenhouse design, environment control, artificial lights, Automation.	C-6	Lecture
Unit-I	Quiz	C-7	Quiz
Unit-I	Soil preparation and management, Substrate management.	C-8	Lecture
Unit-I	Soil preparation and management, Substrate management.	C-9	Lecture
Unit-I	Soil preparation and management, Substrate management.	C-10	Lecture
Unit-I	Clarification class	C-11	Clarification class
Unit-I	Types of benches and containers, Irrigation and fertigation management.	C-12	Lecture
Unit-I	Types of benches and containers, Irrigation and fertigation management.	C-13	Lecture
Unit-I	Types of benches and containers, Irrigation and fertigation management.	C-14	Lecture
Unit-I	Class room assignment-II	C-15	Class room assignment
Unit-I	Propagation and production of quality planting material of horticultural crops.	C-16	Lecture
Unit-I	Propagation and production of quality planting material of horticultural crops.	C-17	Lecture
Unit-I	Propagation and production of quality planting material of horticultural crops.	C-18	Lecture
Unit-I	Home Assignment		Home Assignment

Unit-II	Greenhouse cultivation of important horticultural crops-rose, carnation, chrysanthemum, gerbera, orchid, anthurium, lilium, tulip, tomato, bell pepper, cucumber, strawberry, pot plants etc.	C-19	Lecture
Unit-II	Greenhouse cultivation of important horticultural crops-rose, carnation, chrysanthemum, gerbera, orchid, anthurium, lilium, tulip, tomato, bell pepper, cucumber, strawberry, pot plants etc.	C-20	Lecture
Unit-II	Clarification class	C-21	Clarification class
Unit-II	Greenhouse cultivation of important horticultural crops-rose, carnation, chrysanthemum, gerbera, orchid, anthurium, lilium, tulip, tomato, bell pepper, cucumber, strawberry, pot plants etc.	C-22	Lecture
Unit-II	Cultivation of economically important medicinal and aromatic plants. Off- season production of flowers and vegetables.	C-23	Lecture
Unit-II	Presentation	C-24	Presentation
Unit-II	Cultivation of economically important medicinal and aromatic plants. Off- season production of flowers and vegetables.	C-25	Lecture
Unit-II	Cultivation of economically important medicinal and aromatic plants. Off- season production of flowers and vegetables.	C-26	Lecture
Unit-II	Insect pest and disease management.	C-27	Lecture
Unit-II	Insect pest and disease management.	C-28	Lecture
Unit-II	Insect pest and disease management.	C-29	Lecture
Unit-II	Clarification class	C-30	Clarification class

BSAE48007-Protected cultivation Lab

Unit	Particulars	Class No.	Pedagogy of Class
Unit-I	Raising of seedlings and saplings under protected conditions,	P-1	Practical
Unit-I	Raising of seedlings and saplings under protected conditions,	P-2	Practical
Unit-I	Raising of seedlings and saplings under protected conditions,	P-3	Practical
Unit-I	Use of portrays in quality planting material production,	P-4	Practical
Unit-I	Use of portrays in quality planting material production,	P-5	Practical
Unit-I	Use of portrays in quality planting material production,	P-6	Practical
Unit-I	Bed preparation and planting of crop for production.	P-7	Practical
Unit-I	Bed preparation and planting of crop for production.	P-8	Practical
Unit-I	Bed preparation and planting of crop for production.	P-9	Practical
Unit-I	Inter cultural operations, Soil EC and pH measurement.	P-10	Practical
Unit-I	Inter cultural operations, Soil EC and pH measurement.	P-11	Practical
Unit-I	Inter cultural operations, Soil EC and pH measurement.	P-12	Practical
Unit-I	Regulation of irrigation and fertilizers through drip, fogging and misting.	P-13	Practical
Unit-I	Regulation of irrigation and fertilizers through drip, fogging and misting.	P-14	Practical
Unit-I	Regulation of irrigation and fertilizers through drip, fogging and misting.	P-15	Practical

BSAE57000-Climate Resilient Agriculture

Unit	Particulars	Class No.	Pedagogy of Class
Unit-I	Climate change and impacts of climate change on agriculture and food security;	C-1	Lecture
Unit-I	Climate change and impacts of climate change on agriculture and food security;	C-2	Lecture
Unit-I	Home Assignment		Home Assignment
Unit-I	crop productivity under different climate change scenarios including extreme events such as drought, flood, pest and disease outbreak etc.	C-3	Lecture
Unit-I	crop productivity under different climate change scenarios including extreme events such as drought, flood, pest and disease outbreak etc.	C-4	Lecture
Unit-I	Quiz	C-5	Quiz
Unit-I	Basics of adaption and mitigation in the agricultural sectors;	C-6	Lecture
Unit-I	Basics of adaption and mitigation in the agricultural sectors;	C-7	Lecture
Unit-I	Class room assignment-I	C-8	Class room assignment
Unit-I	analyzing and assessing climate vulnerability to identify vulnerable sectors and possible adaptation options in agriculture;	C-9	Lecture
Unit-I	analyzing and assessing climate vulnerability to identify vulnerable sectors and possible adaptation options in agriculture;	C-10	Lecture
Unit-I	Clarification class	C-11	Clarification class
Unit-I	assessing biophysical and socio-economic impacts on agricultural sector;	C-12	Lecture
Unit-I	assessing biophysical and socio-economic impacts on agricultural sector;	C-13	Lecture
Unit-I	risk assessment strategies, preparedness for weather and climate risks in agriculture;	C-14	Lecture
Unit-I	Presentation	C-15	Presentation
Unit-I	risk assessment strategies, preparedness for weather and climate risks in agriculture;	C-16	Lecture
Unit-I	application of geospatial tools and techniques for sustainable agriculture.	C-17	Lecture
Unit-I	application of geospatial tools and techniques for sustainable agriculture.	C-18	Lecture
Unit-I	Class room assignment-II	C-19	Class room assignment
Unit-I	Climate resilient agriculture (CRA) –concept, scope and importance with special reference to India,	C-20	Lecture

Unit-I	Climate resilient agriculture (CRA) –concept, scope and importance with special reference to India,	C-21	Lecture
Unit-I	Clarification class	C-22	Clarification class
Unit-I	climate resilient technologies for enhancing crop productivity and sustainability – role of weather and climatic information, agro- advisories, ICTs and simulation models;	C-23	Lecture
Unit-I	climate resilient agronomic practices – crop/cultivar selection, crop diversification/ crop mixtures;	C-24	Lecture
Unit-I	water management practices – rain water harvesting, micro-irrigation, deficit irrigation and drainage management, organic/natural farming, integrated farming systems (IFS);	C-25	Lecture
Unit-II	Home Assignment		Home Assignment
Unit-II	site specific nutrient management (SSNM), conservation agriculture technologies to build soil organic carbon, harnessing microbial biodiversity, biomass recycling;	C-26	Lecture
Unit-II	use of renewable sources of energy; climate resilient pest-disease management strategies.	C-27	Lecture
Unit-II	Breeding strategies for development of climate change resilient crops and varieties,	C-28	Lecture
Unit-II	development of biotic and abiotic stress tolerant/resistant cultivars under changed climatic scenarios including extreme weather events.	C-29	Lecture
Unit-II	Clarification class	C-30	Clarification class

BSAE57001-Climate Resilient Agriculture Lab

Unit	Particulars	Class No.	Pedagogy of Class
Unit-I	Acquaintance with meteorological instruments including AWS,	P-1	Practical
Unit-I	Statistical techniques to study trend of climatic parameters,	P-2	Practical
Unit-I	Analysis of extreme weather events using non-parametric tests,	P-3	Practical
Unit-I	Building climate change scenarios under different futuristic emission of GHGs,	P-4	Practical
Unit-I	Designing strategies to mitigate the effect of climate change using climate resilient crops/cultivars,	P-5	Practical
Unit-I	Climate resilient technologies and manipulation of cropping patterns,	P-6	Practical
Unit-I	Climate resilient technologies and manipulation of cropping patterns,	P-7	Practical
Unit-I	Acquaintance with ICTs for effective dissemination of local weather information and agro-advisories,	P-8	Practical
Unit-I	Acquaintance with ICTs for effective dissemination of local weather information and agro-advisories,	P-9	Practical
Unit-I	Analysing carbon sequestration potential of different agro-ecosystems;	P-10	Practical
Unit-I	Analysing carbon sequestration potential of different agro-ecosystems;	P-11	Practical
Unit-I	Designing climate smart village model considering the availability of resources.	P-12	Practical
Unit-I	Designing climate smart village model considering the availability of resources.	P-13	Practical
Unit-I	Awareness programme on climate change and climate resilient agriculture among farming community.	P-14	Practical
Unit-I	Awareness programme on climate change and climate resilient agriculture among farming community.	P-15	Practical

BSAE58000-Biotechnology of Crop Improvement

Unit	Particulars	Class No.	Pedagogy of Class
Unit-I	Impact of Biotechnology on crop improvement and the perspective of society;	C-1	Lecture
Unit-I	Various biotechnological techniques available for crop improvement – Plant Tissue Culture, Genetic Engineering, Genome editing, Marker Assisted breeding and Genomic Selection.	C-2	Lecture
Unit-I	Biosafety regulations and their application in Agricultural Biotechnology.	C-3	Lecture
Unit-I	Quiz	C-4	Quiz
Unit-I	Somaclonal variation and its use in crop improvement; embryo culture;	C-5	Lecture
Unit-I	Home Assignment		Home Assignment
Unit-I	anther/pollen culture; somatic embryogenesis; artificial seeds;	C-6	Lecture
Unit-I	techniques of protoplast culture, regeneration and somatic cell hybridization, achievements and limitations, utility in the improvement of crop plants.	C-7	Lecture
Unit-I	Direct and Indirect methods of gene transfer in plants - Agrobacterium-mediated gene transfer in dicots and monocots;	C-8	Lecture
Unit-I	Class room assignment	C-9	Class room assignment
Unit-I	Direct DNA delivery methods (microinjection, particle gun method, electroporation);	C-10	Lecture
Unit-II	gene targeting; Gene silencing techniques; introduction to siRNA; siRNA technology;	C-11	Lecture
Unit-II	Micro RNA; construction of siRNA vectors;	C-12	Lecture
Unit-II	Clarification class	C-13	Clarification class
Unit-II	principle and application of gene silencing;	C-14	Lecture
Unit-II	creation of transgenic plants;	C-15	Lecture
Unit-II	debate over GM crops; introduction to methods of genetic manipulation in different model systems.	C-16	Lecture
Unit-II	Class room assignment	C-17	Class room assignment
Unit-II	Introduction to genome editing – Various tools of genome editing; CRISPR-Cas9 with specific emphasis on Indian regulations;	C-18	Lecture
Unit-II	Cloning genomic targets into CRISPR/Cas9 plasmids;	C-19	Lecture
Unit-II	electroporation of Cas9 plasmids into cells;	C-20	Lecture
Unit-II	Clarification class	C-21	Clarification class

Unit-II	purification of DNA from Cas9 treated cells and evaluation of Cas9 gene editing;	C-22	Lecture
Unit-II	in vitro synthesis of single guide RNA (sgRNA);	C-23	Lecture
Unit-II	Home Assignment		Home Assignment
Unit-II	using Cas9/sgRNA complexes to test for activity on DNA substrates;	C-24	Lecture
Unit-II	Presentation	C-25	Presentation
Unit-II	evaluate Cas9 activity by T7E1 assays and DNA sequence analysis;	C-26	Lecture
Unit-II	Applications of CRISPR/cas9 technology in crop plants.	C-27	Lecture
Unit-II	Marker Assisted Breeding and Genomic Selection: Introduction to various DNA-based markers and their use in marker-assisted breeding;	C-28	Lecture
Unit-II	Foreground Selection, Recombinant Selection and background Selection; Marker-assisted backcross breeding, marker-assisted selection – success stories; Introduction to Genomic Selection.	C-29	Lecture
Unit-II	Clarification class	C-30	Clarification class

BSAE58001-Biotechnology of Crop Improvement Lab

Unit	Particulars	Class No.	Pedagogy of Class
Unit-I	Agrobacterium-mediated transformation in Tobacco –	P-1	Practical
Unit-I	Agrobacterium-mediated transformation in Tobacco –	P-2	Practical
Unit-I	Preparation of construct,	P-3	Practical
Unit-I	Preparation of construct,	P-4	Practical
Unit-I	Transfer to binary vector,	P-5	Practical
Unit-I	Transfer to binary vector,	P-6	Practical
Unit-I	Transform Agrobacterium, prepare explant, Inoculation and Co-cultivation,	P-7	Practical
Unit-I	Transform Agrobacterium, prepare explant, Inoculation and Co-cultivation,	P-8	Practical
Unit-I	Antibiotic based selection of putative transformants,	P-9	Practical
Unit-I	Antibiotic based selection of putative transformants,	P-10	Practical
Unit-I	Validation using PCR;	P-11	Practical
Unit-I	Validation using PCR;	P-12	Practical
Unit-I	Genome editing- preparation of CRISPR/CAS construct, direct transfer to plant, analysis of the targets;	P-13	Practical
Unit-I	Genome editing- preparation of CRISPR/CAS construct, direct transfer to plant, analysis of the targets;	P-14	Practical
Unit-I	Planning of a MABB programme – selection of parents, crossing strategies, marker analysis.	P-15	Practical

BSAE43002-Geoinformatics and remote sensing, precision farming

Unit	Particulars	Class No.	Pedagogy of Class
Unit-I	Introduction and history of remote sensing;	C-1	Lecture
Unit-I	Introduction and history of remote sensing;	C-2	Lecture
Unit-I	Quiz	C-3	Quiz
Unit-I	Sources, Principles of remote sensing, propagation of radiations in atmosphere;	C-4	Lecture
Unit-I	Interaction with matter;	C-5	Lecture
Unit-I	Interaction with matter;	C-6	Lecture
Unit-I	Presentation	C-7	Presentation
Unit-I	Application of remote sensing techniques land use soil surveys;	C-8	Lecture
Unit-I	crop stress and yield forecasting;	C-9	Lecture
Unit-I	crop stress and yield forecasting;	C-10	Lecture
Unit-I	Classroom Assignment	C-11	Classroom Assignment
Unit-I	Advantages and disadvantages of remote sensing;	C-12	Lecture
Unit-I	Advantages and disadvantages of remote sensing;	C-13	Lecture
Unit-I	Remote sensing institutes in India;	C-14	Lecture
Unit-I	Clarification class	C-15	Clarification class
Unit-I	Remote sensing institutes in India;	C-16	Lecture
Unit-I	Basic Concepts about geoinformatics.	C-17	Lecture
Unit-I	Class room assignment I	C-18	Lecture
Unit-I	Home Assignment		Home Assignment
Unit-II	Data sharing;	C-19	Lecture
Unit-II	Data sharing;	C-20	Lecture
Unit-II	Expert System: Introduction to expert system,	C-21	Lecture
Unit-II	Quiz	C-22	Quiz
Unit-II	Expert System: Introduction to expert system,	C-23	Lecture
Unit-II	Characteristics and features of expert system,	C-24	Lecture
Unit-II	Characteristics and features of expert system,	C-25	Lecture
Unit-II	Presentation	C-26	Presentation
Unit-II	Applications of Expert System,	C-27	Lecture
Unit-II	Applications of Expert System,	C-28	Lecture
Unit-II	Importance of Expert system, Rule based system architecture;	C-29	Lecture
Unit-II	Classroom Assignment	C-30	Classroom Assignment
Unit-II	Importance of Expert system, Rule based system architecture;	C-31	Lecture
Unit-II	Software Agents; Impact of Block chain and it's concepts;	C-32	Lecture

Unit-II	Clarification class	C-33	Clarification class
Unit-II	Software Agents; Impact of Block chain and it's concepts;	C-34	Lecture
Unit-II	Probability and Statistics: Bayes Theorem, correlation and Covariance,	C-35	Lecture
Unit-II	Home Assignment		Home Assignment
Unit-II	Probability and Statistics: Bayes Theorem, correlation and Covariance,	C-36	Lecture
Unit-III	Continuous Random variables and probability distribution function,	C-37	Lecture
Unit-III	Presentation	C-38	Presentation
Unit-III	various forms of distributions, central limit theorem;	C-39	Lecture
Unit-III	Basics of Machine Learning: Random Forest, SVM, ensemble methods;	C-40	Lecture
Unit-III	Classroom Assignment	C-41	Classroom Assignment
Unit-III	Basics of Deep learning: various model architectures and it's training aspects;	C-42	Lecture
Unit-III	Hyperspectral and Thermal Remote Sensing; Proximal Soil and Crop Sensors.	C-43	Lecture
Unit-III	Clarification class	C-44	Clarification class
Unit-III	Hyperspectral and Thermal Remote Sensing; Proximal Soil and Crop Sensors.	C-45	Lecture
Unit-III	Home Assignment		Home Assignment

BSAE43003-Geoinformatics and remote sensing, precision farming Lab

Unit	Particulars	Class No.	Pedagogy of Class
Unit-I	Familiarization with different remote sensing equipments and data products,	P-1	Practical
Unit-I	Familiarization with different remote sensing equipments and data products,	P-2	Practical
Unit-I	Interpretation of aerial photographs and satellite data for mapping of land resources,	P-3	Practical
Unit-I	Interpretation of aerial photographs and satellite data for mapping of land resources,	P-4	Practical
Unit-I	Global positioning system (GPS),	P-5	Practical
Unit-I	Global positioning system (GPS),	P-6	Practical
Unit-I	Basics of Geographic Information System (GIS),	P-7	Practical
Unit-I	Basics of Geographic Information System (GIS),	P-8	Practical
Unit-I	Georeferencing of toposheets,	P-9	Practical
Unit-I	Georeferencing of toposheets,	P-10	Practical
Unit-I	Digital soil mapping with different variables,	P-11	Practical
Unit-I	Digital soil mapping with different variables,	P-12	Practical
Unit-I	Basics of multivariate data analytics,	P-13	Practical
Unit-I	Principal component analysis and regression applications,	P-14	Practical
Unit-I	clustering methods and geostatistics are essential in agricultural studies.	P-15	Practical

BSAE58002-Micro-propagation Technologies

Unit	Particulars	Class No.	Pedagogy of Class
Unit-I	Introduction, History, Advantages and limitations.	C-1	Lecture
Unit-I	Introduction, History, Advantages and limitations.	C-2	Lecture
Unit-I	Quiz	C-3	Quiz
Unit-I	Types of cultures (seed, embryo, organ, callus, cell);	C-4	Lecture
Unit-I	Types of cultures (seed, embryo, organ, callus, cell);	C-5	Lecture
Unit-I	Types of cultures (seed, embryo, organ, callus, cell);	C-6	Lecture
Unit-I	Presentation	C-7	Presentation
Unit-I	Stages of micro propagation;	C-8	Lecture
Unit-I	Stages of micro propagation;	C-9	Lecture
Unit-I	Stages of micro propagation;	C-10	Lecture
Unit-I	Classroom Assignment	C-11	Classroom Assignment
Unit-I	Stages of micro propagation;	C-12	Lecture
Unit-I	Axillary bud proliferation (Shoot tip and meristem culture, bud culture);	C-13	Lecture
Unit-I	Axillary bud proliferation (Shoot tip and meristem culture, bud culture);	C-14	Lecture
Unit-I	Clarification class	C-15	Clarification class
Unit-I	Axillary bud proliferation (Shoot tip and meristem culture, bud culture);	C-16	Lecture
Unit-I	Organogenesis (calluys and direct organ formation);	C-17	Lecture
Unit-I	Organogenesis (calluys and direct organ formation);	C-18	Lecture
Unit-I	Home Assignment		Home Assignment
Unit-I	Organogenesis (calluys and direct organ formation);	C-19	Lecture
Unit-I	Organogenesis (calluys and direct organ formation);	C-20	Lecture
Unit-I	Somatic embryogenesis;	C-21	Lecture
Unit-I	Quiz	C-22	Quiz
Unit-I	Somatic embryogenesis;	C-23	Lecture
Unit-I	Somatic embryogenesis;	C-24	Lecture
Unit-I	Somatic embryogenesis;	C-25	Lecture
Unit-I	Presentation	C-26	Presentation
Unit-I	Cell suspension cultures; production of secondary metabolites;	C-27	Lecture
Unit-I	Cell suspension cultures; production of secondary metabolites;	C-28	Lecture
Unit-I	Cell suspension cultures; production of secondary metabolites;	C-29	Lecture

Unit-I	Classroom Assignment	C-30	Classroom Assignment
Unit-I	Cell suspension cultures; production of secondary metabolites;	C-31	Lecture
Unit-I	Somaclonal variation;	C-32	Lecture
Unit-I	Clarification class	C-33	Clarification class
Unit-I	Somaclonal variation;	C-34	Lecture
Unit-I	Somaclonal variation;	C-35	Lecture
Unit-I	Home Assignment		Home Assignment
Unit-I	Somaclonal variation;	C-36	Lecture
Unit-I	Cryopreservation.	C-37	Lecture
Unit-I	Presentation	C-38	Presentation
Unit-I	Cryopreservation.	C-39	Lecture
Unit-I	Cryopreservation.	C-40	Lecture
Unit-I	Classroom Assignment	C-41	Classroom Assignment
Unit-I	Cryopreservation.	C-42	Lecture
Unit-I	Cryopreservation.	C-43	Lecture
Unit-I	Clarification class	C-44	Clarification class
Unit-I	Cryopreservation.	C-45	Lecture
Unit-I	Home Assignment		Home Assignment

BSAE58003-Micro-propagation Technologies Lab

Unit	Particulars	Class No.	Pedagogy of Class
Unit-I	Identification and use of equipment in tissue culture Laboratory;	P-1	Practical
Unit-I	Nutrition media composition;	P-2	Practical
Unit-I	Sterilization techniques for media, containers and small instruments;	P-3	Practical
Unit-I	Sterilization techniques for explants;	P-4	Practical
Unit-I	Preparation of stocks and working solution;	P-5	Practical
Unit-I	Preparation of working medium;	P-6	Practical
Unit-I	Preparation of working medium;	P-7	Practical
Unit-I	Culturing of explants: Seeds, shoot tip and single node;	P-8	Practical
Unit-I	Culturing of explants: Seeds, shoot tip and single node;	P-9	Practical
Unit-I	Callus induction;	P-10	Practical
Unit-I	Callus induction;	P-11	Practical
Unit-I	Induction of somatic embryos regeneration of whole plants from different explants;	P-12	Practical
Unit-I	Induction of somatic embryos regeneration of whole plants from different explants;	P-13	Practical
Unit-I	Hardening procedures.	P-14	Practical
Unit-I	Hardening procedures.	P-15	Practical

BSAE42002-Commercial Seed Production

Unit	Particulars	Class No.	Pedagogy of Class
Unit-I	General Principles of Seed Production: Raising the seed crop,	C-1	Lecture
Unit-I	Introduction, Procurement of a class of Improved seeds, Reporting to Monitoring or certification Agency,	C-2	Lecture
Unit-I	Quiz	C-3	Quiz
Unit-I	Principles and practices of selection of area and agronomic requirement of seed production of field crops,	C-4	Lecture
Unit-I	Importance of isolation distance and Rouging, Principles of hybrid seed production in field crops,	C-5	Lecture
Unit-I	Principles and practices of selection of area and agronomic requirement of seed production of horticultural crops,	C-6	Lecture
Unit-I	Presentation	C-7	Presentation
Unit-I	Concept of apomixes, male sterility and self-incompatibility and its application in hybrid seed production of horticultural crops,	C-8	Lecture
Unit-I	Farmers participatory seed production. General Principles of Seed Processing: Introduction,	C-9	Lecture
Unit-I	Objectives of Seed Processing, Seed Drying, Principles of Drying,	C-10	Lecture
Unit-I	Classroom Assignment	C-11	Classroom Assignment
Unit-I	Water vapour equilibrium, Methods of drying seeds,	C-12	Lecture
Unit-I	Cleaning and grading, Air and screen machines, Dimensional separators,	C-13	Lecture
Unit-I	Density separators, Surface texture separators,	C-14	Lecture
Unit-I	Clarification class	C-15	Clarification class
Unit-I	Colour separators, Spiral separators, Electric separators, Vibrator separators,	C-16	Lecture
Unit-I	Separation based on Affinity to liquids, Seed treatment,	C-17	Lecture
Unit-I	Temperature treatment, Chemical treatment, Bagging and Labelling.	C-18	Lecture
Unit-I	Home Assignment		Home Assignment
Unit-II	General Principles of Seed Testing: Seed Testing-Introduction, Procedure of Seed testing,	C-19	Lecture
Unit-II	components of seed quality testing genetic, physical, physiological and seed health testing,	C-20	Lecture
Unit-II	Seed sampling, Types of seed sampling, Requirements of sampling, Concept of seed viability and vigour;	C-21	Lecture
Unit-II	Quiz	C-22	Quiz
Unit-II	dormancy, types and principles of seed dormancy, Physiological quality of seed, Principles of seed	C-23	Lecture

	Germination,		
Unit-II	types of germination, biochemical and genetic basis. Seed Certification: History, concept and objectives of seed certification;	C-24	Lecture
Unit-II	seed certification agency/organization and staff requirement	C-25	Lecture
Unit-II	Presentation	C-26	Presentation
Unit-II	Indian Minimum Seed Certification Standards (I.M.S.C.S.) - general and specific crop standards including GM varieties,	C-27	Lecture
Unit-II	field and seed standards.	C-28	Lecture
Unit-III	Seed Industry and Seed Marketing: Introduction, Evolution of the seed industry,	C-29	Lecture
Unit-III	Classroom Assignment	C-30	Classroom Assignment
Unit-III	Development of the vegetable and Flower seed industry,	C-31	Lecture
Unit-III	Seed marketing – concept, definition and purpose, importance and promotion of quality seed, formal and informal seed supply systems,	C-32	Lecture
Unit-III	Clarification class	C-33	Clarification class
Unit-III	Seed marketing intelligence and product mix, sales promotion, distribution channels,	C-34	Lecture
Unit-III	marketing costs and margins; packaging and labelling,	C-35	Lecture
Unit-III	Home Assignment		Home Assignment
Unit-III	Seed Associations, Factors influencing seed marketing, Seed marketing programs, Seed industry organizations, Marketing of public versus private players, Demand and supply of seed;	C-36	Lecture
Unit-III	role of seed replacement rate (SRR), seed multiplication ratio (SMR), economics of seed production; determining seed needs, Seed pricing and price policy,	C-37	Lecture
Unit-III	Presentation	C-38	Presentation
Unit-III	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.	C-39	Lecture
Unit-III	Biotechnology in Seed Technology: History of plant tissue culture, Laboratory organization, Composition of nutrient medium,	C-40	Lecture
Unit-III	Classroom Assignment	C-41	Classroom Assignment
Unit-III	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,	C-42	Lecture

Unit-III	Types of synthetic seeds, methods of development of synthetic seeds, Components of nutrient media for synthetic seed development,	C-43	Lecture
Unit-III	Clarification class	C-44	Clarification class
Unit-III	Storage of synthetic seeds, Advantages and limitations of synthetic seed production.	C-45	Lecture
Unit-III	Home Assignment		Home Assignment

BSAE42003-Commercial Seed Production Lab

Unit	Particulars	Class No.	Pedagogy of Class
Unit-I	Planning of Seed Production, requirements for different classes of seeds in field crops - unit area and rate	P-1	Practical
Unit-I	Operation and handling of mechanical drying equipment; effect of drying temperature and duration on seed germination and storability seed processing equipment; seed treating equipment.	P-2	Practical
Unit-II	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;	P-3	Practical
Unit-II	supplementary pollination, pollen storage, hand emasculation and pollination in tomato,	P-4	Practical
Unit-II	Hybrid seed production in Maize, detasseling in maize, identification of rogues and pollen shedders, Pollen collection, storage, viability and stigma receptivity;	P-5	Practical
Unit-II	gametocide application and visits to seed production plots etc.,	P-6	Practical
Unit-II	Visit to seed processing plant and commercial controlled and uncontrolled Seed Stores, Seed industries and local entrepreneurships visit to nearby areas,	P-7	Practical
Unit-II	Different methods of examination of seeds to assess seed-borne microorganisms and to quantify infection percentage,	P-8	Practical
Unit-II	detection of seed-borne fungi, bacteria and viruses, identification of storage fungi, control of seed- borne diseases, seed treatment methods.,	P-9	Practical
Unit-III	Maintenance of aseptic conditions and sterilization techniques, Preparation of nutrient stocks for synthetic media, Selection of explants for callus induction,	P-10,11	Practical
Unit-III	Preparation of MS medium for micro-propagation and Callus induction, Selection of explants for callus induction,	P-12	Practical
Unit-III	Preparation of MS medium for micro-propagation and Callus induction, Selection of explants for callus induction,	P-13	Practical
Unit-III	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.	P-14,15	Practical

BSAE41007-Principles and Practices of Organic Farming and Conservation Agriculture

Unit	Particulars	Class No.	Pedagogy of Class
Unit-I	Concept of organic farming, principles and its scope in India;	C-1	Lecture
Unit-I	Choice of crops and varieties in organic farming;	C-2	Lecture
Unit-I	Nutrient management in organic farming and their sources;	C-3	Lecture
Unit-I	Class room assignment	C-4	Class room assignment
Unit-I	Fundamentals of insect, pest, disease and weed management under organic mode of production;	C-5	Lecture
Unit-I	Operational structure of NPOP;	C-6	Lecture
Unit-I	Certification process and crop standards of organic farming;	C-7	Lecture
Unit-I	Clarification class	C-8	Clarification class
Unit-I	Processing, labelling, economic considerations and viability, marketing and export potential of organic products.	C-9	Lecture
Unit-I	Initiatives taken by Government (central/state), NGOs and other organizations for promotion of organic agriculture.	C-10	Lecture
Unit-I	Conservation agriculture: definition, origin, principles, advantages, challenges;	C-11	Lecture
Unit-I	Home Assignment		Home Assignment
Unit-I	Primary practices in conservation agriculture: minimum soil disturbance, crop residue retention, and crop diversification,	C-12	Lecture
Unit-I	complementary practices, conservation agriculture vis a vis Climate Smart Agriculture;	C-13	Lecture
Unit-I	Organic manures- recommended doses and application in comparison to inorganic fertilizers for major crops.	C-14	Lecture
Unit-I	Clarification class	C-15	Clarification class

BSAE41008-Principles and Practices of Organic Farming and Conservation Agriculture Lab

Unit	Particulars	Class No.	Pedagogy of Class
Unit-I	Visit of organic farms to study the various components and their utilization;	P-1	Practical
Unit-I	Preparation of enrich compost, vermicompost and their quality analysis;	P-2	Practical
Unit-I	Preparation of enrich compost, vermicompost and their quality analysis;	P-3	Practical
Unit-I	Method of application of bio-fertilizers;	P-4	Practical
Unit-I	Method of application of bio-fertilizers;	P-5	Practical
Unit-I	Indigenous technology knowledge (ITK) for nutrient, insect-pest and disease management;	P-6	Practical
Unit-I	Indigenous technology knowledge (ITK) for nutrient, insect-pest and disease management;	P-7	Practical
Unit-I	Studies in green manuring in-situ and green leaf manuring,	P-8	Practical
Unit-I	Studies in green manuring in-situ and green leaf manuring,	P-9	Practical
Unit-I	Studies on different type of botanicals for insect- pest management;	P-10	Practical
Unit-I	Studies on different type of botanicals for insect- pest management;	P-11	Practical
Unit-I	Weed management in organic farming;	P-12	Practical
Unit-I	Weed management in organic farming;	P-13	Practical
Unit-I	Cost of organic production system;	P-14	Practical
Unit-I	Practices of conservation agriculture.	P-15	Practical

BSAE49000-Food Science and Nutrition

Unit	Particulars	Class No.	Pedagogy of Class
Unit-I	Introduction on fundamentals of foods and human nutrition;	C-1,2	Lecture
Unit-I	Quiz	C-3	Quiz
Unit-I	Basic food groups; Concept of balanced diets;	C-4	Lecture
Unit-I	Basic food groups; Concept of balanced diets;	C-5	Lecture
Unit-I	Basic food groups; Concept of balanced diets;	C-6	Lecture
Unit-I	Presentation	C-7	Presentation
Unit-I	Recommended Daily Allowances (RDA) for various age groups;	C-8	Lecture
Unit-I	Recommended Daily Allowances (RDA) for various age groups;	C-9	Lecture
Unit-I	Biochemical composition, energy and food value of various food grains, fruits and vegetables;	C-10	Lecture
Unit-I	Classroom Assignment	C-11	Classroom Assignment
Unit-I	Biochemical composition, energy and food value of various food grains, fruits and vegetables;	C-12	Lecture
Unit-I	Biochemical composition, energy and food value of various food grains, fruits and vegetables;	C-13	Lecture
Unit-I	Carbohydrates, proteins, fats as nutrients and their interactions;	C-14	Lecture
Unit-I	Clarification class	C-15	Clarification class
Unit-I	Carbohydrates, proteins, fats as nutrients and their interactions;	C-16	Lecture
Unit-I	Carbohydrates, proteins, fats as nutrients and their interactions;	C-17	Lecture
Unit-I	Physio-chemical, functional and nutritional characteristics of essential nutrients- sources and functions,	C-18	Lecture
Unit-I	Home Assignment		Home Assignment
Unit-I	Physio-chemical, functional and nutritional characteristics of essential nutrients- sources and functions,	C-19,20	Lecture
Unit-I	Nutritional requirements, malnutrition, inborn errors of metabolism, deficiency diseases; Digestion, absorption, transport and metabolism of nutrients in human system;	C-21	Lecture
Unit-I	Quiz	C-22	Quiz
Unit-II	Nutritional requirements, malnutrition, inborn errors of metabolism, deficiency diseases; Digestion, absorption, transport and metabolism of nutrients in human system;	C-23	Lecture

Unit-II	Nutritional requirements, malnutrition, inborn errors of metabolism, deficiency diseases; Digestion, absorption, transport and metabolism of nutrients in human system;	C-24	Lecture
Unit-II	Protein quality evaluation.	C-25	Lecture
Unit-II	Presentation	C-26	Presentation
Unit-II	Protein quality evaluation.	C-27	Lecture
Unit-II	Protein quality evaluation.	C-28	Lecture
Unit-II	Biochemical and nutritional aspects of vitamins, minerals, nutraceuticals, antioxidant, antinational factors and biochemistry of post- harvest storage, losses during processing.	C-29	Lecture
Unit-II	Classroom Assignment	C-30	Classroom Assignment
Unit-II	Biochemical and nutritional aspects of vitamins, minerals, nutraceuticals, antioxidant, antinational factors and biochemistry of post- harvest storage, losses during processing.	C-31,32	Lecture
Unit-II	Clarification class	C-33	Clarification class
Unit-III	Effect of cooking, processing and preservation on nutrients of different food products, biochemical aspects of food spoilage;	C-34,35	Lecture
Unit-III	Home Assignment		Home Assignment
Unit-III	Effect of cooking, processing and preservation on nutrients of different food products, biochemical aspects of food spoilage;	C-36	Lecture
Unit-III	Food fads, food safety and quality standards.	C-37	Lecture
Unit-III	Presentation	C-38	Presentation
Unit-III	Food fads, food safety and quality standards.	C-39	Lecture
Unit-III	Food fads, food safety and quality standards.	C-40	Lecture
Unit-III	Classroom Assignment	C-41	Classroom Assignment
Unit-III	Enzymes in food industry, food additives, nutritional quality of plant, animal, dairy, marine and fermented products.	C-42	Lecture
Unit-III	Enzymes in food industry, food additives, nutritional quality of plant, animal, dairy, marine and fermented products.	C-43	Lecture
Unit-III	Lecture	C-44	Clarification class
Unit-III	Clarification class	C-45	Lecture
Unit-III	Home Assignment		Home Assignment

BSAE49001- Food Science and Nutrition Lab

Unit	Particulars	Class No.	Pedagogy of Class
Unit-I	Proximate analysis of foods;	P-1	Practical
Unit-I	Proximate analysis of foods;	P-2	Practical
Unit-I	Proximate analysis of foods;	P-3	Practical
Unit-I	calorific value of foods;	P-4	Practical
Unit-I	calorific value of foods;	P-5	Practical
Unit-I	calorific value of foods;	P-6	Practical
Unit-I	Estimation of vitamins, phenols and flavonoids, carotenoids, antinutrients like Phytate/ Oxalate,	P-7	Practical
Unit-I	Estimation of vitamins, phenols and flavonoids, carotenoids, antinutrients like Phytate/ Oxalate,	P-8	Practical
Unit-I	Estimation of vitamins, phenols and flavonoids, carotenoids, antinutrients like Phytate/ Oxalate,	P-9	Practical
Unit-I	Trypsin and Chymotrypsin inhibitor activities,	P-10	Practical
Unit-I	Trypsin and Chymotrypsin inhibitor activities,	P-11	Practical
Unit-I	Trypsin and Chymotrypsin inhibitor activities,	P-12	Practical
Unit-I	limiting amino acids in food stuff.	P-13	Practical
Unit-I	limiting amino acids in food stuff.	P-14	Practical
Unit-I	limiting amino acids in food stuff.	P-15	Practical

BSAE48008-Post Harvest Technology and Value Addition

Unit	Particulars	Class No.	Pedagogy of Class
Unit-I	Importance of post –harvest processing of fruits and vegetables,	C-1	Lecture
Unit-I	extent and possible causes of post-harvest losses	C-2	Lecture
Unit-I	Pre-harvest factors affecting post-harvest quality, maturity, ripening and changes occurring during ripening;	C-3	Lecture
Unit-I	Class room assignment	C-4	Class room assignment
Unit-I	Respiration and factors affecting respiration rate; Harvesting and field handling;	C-5	Lecture
Unit-I	Storage (ZECC, cold storage, CA, MA and hypobaric);	C-6	Lecture
Unit-I	Value addition concept;	C-7	Lecture
Unit-I	Quiz	C-8	Quiz
Unit-I	Principles and methods of preservation;	C-9	Lecture
Unit-I	Intermediate moisture food (jam, jelly, marmalade, preserve, candy) - concepts and standards;	C-10	Lecture
Unit-I	Home Assignment		Home Assignment
Unit-I	Fermented and non-fermented beverages.	C-11	Lecture
Unit-I	Tomato products -concepts and standards;	C-12	Lecture
Unit-I	Drying /Dehydration of fruits and vegetables –concept and methods, osmotic drying.	C-13	Lecture
Unit-I	Canning – concepts and standards, packaging of products.	C-14	Lecture
Unit-I	Clarification class	C-15	Clarification class

BSAE48009-Post Harvest Technology and Value Addition

Unit	Particulars	Class No.	Pedagogy of Class
Unit-I	Applications of different types of packing, containers for shelf-life extension.	P-1	Practical
Unit-I	Applications of different types of packing, containers for shelf-life extension.	P-2	Practical
Unit-I	Effect of temperature on shelf life and quality of produce.	P-3	Practical
Unit-I	Effect of temperature on shelf life and quality of produce.	P-4	Practical
Unit-I	Demonstration of chilling and freezing injury in vegetables and fruits.	P-5	Practical
Unit-I	Demonstration of chilling and freezing injury in vegetables and fruits.	P-6	Practical
Unit-I	Extraction and preservation of pulps and juices.	P-7	Practical
Unit-I	Extraction and preservation of pulps and juices.	P-8	Practical
Unit-I	Extraction and preservation of pulps and juices.	P-9	Practical
Unit-I	Preparation of jam, jelly, RTS, nectar, squash, osmotically dried products, fruit bar candy and tomato products, canned products.	P-10	Practical
Unit-I	Preparation of jam, jelly, RTS, nectar, squash, osmotically dried products, fruit bar candy and tomato products, canned products.	P-11	Practical
Unit-I	Preparation of jam, jelly, RTS, nectar, squash, osmotically dried products, fruit bar candy and tomato products, canned products.	P-12	Practical
Unit-I	Quality evaluation of products- Physico-chemical and sensory.	P-13	Practical
Unit-I	Quality evaluation of products- Physico-chemical and sensory.	P-14	Practical
Unit-I	Visit to processing unit/industry.	P-15	Practical

Note:

This is a tentative lesson plan. The same may change from faculty to faculty as per the teaching pedagogy adopted by the faculty.

The students will register for online courses of 10 credit hours (as per UGC guidelines for online courses) as a partial requirement for the comprising one or more courses at the approved portals during the third and fourth years with prior approval from the Head of the institution.

---------- End of document----------

RNB Global University

Digitally signed by RNB Global University
DN: cn=RNB Global University, o=RNB Global University, ou=Academic Administrative and Academic Audit Cell
Reason: I am the author of this document
Location:
Date: 2024-02-07 16:19+05:30