Detailed Course Scheme

Bachelor of Science (Hons.)

Agriculture

Semester- VI

(2024- 28)

DOC202410100011

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 (January-June) Even Semester 2027 along with examination pattern is as follows:

Course Scheme

Semester- VI

S. No.	Course Code	Course Category	Course Name	L	T	P	Credits
1.	BSAC58350	DSCBT-1a	Fundamentals of Agricultural Biotechnology	2	0	0	2
2.	BSAC58351	DSCBT-1b	Fundamentals of Agricultural Biotechnology Lab	0	0	2	1
3.	BSAC52350	DSCST-1b	Basic and Applied Agricultural Statistics	2	0	0	2
4.	BSAC52351	DSCST-2b	Basic and Applied Agricultural Statistics Lab	0	0	2	1
5.	BSAC42350	DSCPB-4a	Crop Improvement (Rabi crops)- II	1	0	0	1
6.	BSAC42351	DSCPB-4b	Crop Improvement (Rabi crops)- II Lab	0	0	2	1
7.	BSAC46352	DSCAE-2a	Renewable energy in Agriculture and Allied Sector	1	0	0	1
8.	BSAC46353	DSCAE-2b	Renewable energy in Agriculture and Allied Sector Lab	0	0	2	1
9.	BSAC41353	DSCAG-8a	Dryland agriculture/ Rainfed agriculture and watershed management	1	0	0	1
10.	BSAC41354	DSCAG-8b	Dryland agriculture/ Rainfed agriculture and watershed management Lab	0	0	2	1
11.	BSAC47352	DSCPP-3a	Agricultural Microbiology and Phyto-remediation	1	0	0	1
12.	BSAC47353	DSCPP-3b	Agricultural Microbiology and Phyto-remediation Lab	0	0	2	1
13.	BSAC45350	DSCEC-2a	Agricultural Finance and Cooperation	1	0	0	1
14.	BSAC45351	DSCEC-2b	Agricultural Finance and Cooperation Lab	0	0	2	1
15.	BSCA51350	DSCBi-2a	Essentials of Plant Biochemistry	2	0	0	2
16.	BSCA51351	DSCBi-2b	Essentials of Plant Biochemistry Lab	0	0	2	1
17.	BSAC42352	DSCPB-5a	Fundamentals of Seed Science and Technology	1	0	0	1
18.	BSAC42353	DSCPB-5b	Fundamentals of Seed Science and Technology Lab	0	0	2	1
19.	WHNN99000		Workshop & Seminars / Human Value & Social Service / NSS	-	-	-	1
			Total	**12**	**0**	**18**	**22**

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
BSAC58350 - Fundamentals of Agricultural Biotechnology	**CO1:** Understand the principles and techniques of plant tissue culture, including cellular totipotency, callus culture, somatic embryogenesis, and their applications in hybrid development and crop improvement. **CO2:** Apply in vitro culture techniques such as embryo rescue, ovule culture, and micropropagation to address challenges in hybrid development, production of quality planting material, and disease-free plants. **CO3:** Analyze the molecular mechanisms of DNA replication, transcription, and translation, along with gene regulation concepts like the Lac Operon and the use of PCR for genetic studies in crops. **CO4:** Evaluate the methods of recombinant DNA technology, including physical, chemical, and Agrobacterium-mediated gene transfer methods, and assess their impact on transgenic crop improvement with biosafety considerations. **CO5:** Create strategies for marker-assisted breeding and the application of molecular markers like RFLP, RAPD, SSR, and SNP in designing innovative crop improvement programs.
BSAC58351 - Fundamentals of Agricultural Biotechnology Lab	**CO1:** Understand and demonstrate good laboratory practices, including media preparation, sterilization techniques, and glassware handling, to maintain a contamination-free environment in plant tissue culture labs. **CO2:** Apply practical techniques such as micropropagation, callus induction, anther culture, and apical meristem culture to develop plant tissue culture skills for crop improvement. **CO3:** Analyze the processes of plasmid DNA isolation, quantification, and restriction digestion using agarose gel electrophoresis to study genetic material effectively. **CO4:** Evaluate the outcomes of advanced molecular techniques such as PCR amplification, gel electrophoresis of DNA, and synthetic seed preparation to assess their applicability in agricultural biotechnology. **CO5:** Create insights by visiting tissue culture units and biotech labs to integrate theoretical knowledge with practical applications, fostering innovative approaches in plant tissue culture and biotechnology.

BSAC52350 - Basic and Applied Agricultural Statistics	**CO1:** Analyse the types, scales, and summarization of data, including classification, frequency distribution, and diagrammatic and graphical presentations to describe. **CO2:** Evaluate and apply measures of central tendency and dispersion such as mean, median, mode, standard deviation, and variance for both grouped. **CO3:** Explain fundamental probability concepts and solve problems involving classical, empirical, and axiomatic probabilities, including the use of normal distribution, random variables. **CO4:** Demonstrate the use of correlation and regression analysis, including Karl Pearson's coefficient and regression equations, to assess relationships between variables. **CO5:** Apply statistical methods, including hypothesis testing, ANOVA, and experimental design techniques, to analyze and interpret data, with an emphasis on sampling methods.
BSAC52351 - Basic and Applied Agricultural Statistics Lab	**CO1:** Illustrate data through diagrammatic and graphical representations such as bar diagrams, pie charts, histograms, frequency polygons, and ogives to communicate statistical information effectively. **CO2:** Compute measures of central tendency, including Arithmetic Mean, Median, and Mode, for both grouped and ungrouped data, demonstrating their application in summarizing datasets. **CO3:** Analyze measures of dispersion, including Standard Deviation (S.D.) and Coefficient of Variation (C.V.), for grouped and ungrouped data to assess data variability and consistency. **CO4:** Apply statistical tools, including correlation and regression analysis, to identify and quantify relationships between variables, emphasizing their practical use in data interpretation. **CO5:** Perform hypothesis testing using t-tests for one-sample, two-sample (independent and dependent).
BSAC42350 - Crop Improvement (Rabi crops)- II	**CO1:** Tell about the evolutionary history of important field crops along with their Centre of origin. **CO2:** Explain plant genetic resources, its utilization and conservation. **CO3:** Develop the understanding for germplasm conservation, utilization, and center of origin of various rabi field crops, genetics of qualitative and quantitative characters, and their inheritance. **CO4:** Discuss the major breeding objectives and procedures including conventional and modern innovative approaches for development of hybrids and varieties. **CO5:** Interpret Gene preservation method for further use to improve Rabi varieties.

BSAC42351 - Crop Improvement (Rabi crops)- II Lab	**CO1:** Interpret the floral biology, emasculation and hybridization techniques in different crop species **CO2:** Plan how to use different population improvement approach **CO3:** Plan different experimental design for crop research **CO4:** Utilize Study of field techniques for seed production and hybrid seeds production in Rabi crops; **CO5:** Estimate the heterosis, inbreeding depression and heritability
BSAC46352 - Renewable energy in Agriculture and Allied Sector	**CO1:** Understand the classification of energy sources and their contributions to the agricultural sector, focusing on sustainable energy practices. **CO2:** Gain knowledge of biomass utilization for biofuel production, including biogas, bio alcohol, biodiesel, and biooil, and their applications as bioenergy resources. **CO3:** Learn about the types, construction, and functioning of biogas plants, gasifiers, and other bioenergy systems for efficient energy generation. **CO4:** Familiarize with solar energy collection, its applications, and solar energy devices like solar cookers, water heaters, and photovoltaic systems for agricultural and domestic use. **CO5:** Explore the availability and applications of wind energy and biomass across different regions for energy generation and agricultural utility.
BSAC46353 - Renewable energy in Agriculture and Allied Sector Lab	**CO1:** Develop familiarity with renewable energy gadgets and their applications in sustainable energy generation and agricultural practices. **CO2:** Understand the functioning and production processes of biogas plants, gasifiers, biodiesel, biofuels, and briquetting machines. **CO3:** Gain knowledge of various solar energy gadgets, including solar lights, pumps, fencing systems, cookers, and drying systems, and their practical uses. **CO4:** Study advanced solar energy systems such as solar photovoltaic systems, solar distillation, solar ponds, and their integration with wind energy in hybrid systems **CO5:** Explore the design, operation, and benefits of renewable energy technologies for enhancing energy efficiency in agricultural and domestic sectors.

BSAC41353 - Dryland agriculture/ Rainfed agriculture and watershed management	**CO1:** Understand dryland agriculture's characteristics, challenges, and historical significance in India. **CO2:** Analyze soil, climatic conditions, LGP, and SMA for rainfed cropping systems. **CO3:** Apply conservation techniques and water harvesting for improved crop management. **CO4:** Evaluate cropping plans and land-use systems for sustainability under weather stress. **CO5:** Create sustainable practices using watershed management and dryland farming principles
BSAC41354 - Dryland agriculture/ Rainfed agriculture and watershed management Lab	**CO1:** Understand the principles of climate classification and rainfall patterns in rainfed areas to assess monsoon dynamics. **CO2:** Analyse meteorological data to calculate Length of Growing Period (LGP), Soil Moisture Availability (SMA), and effective rainfall for crop planning. **CO3:** Apply agronomic and mechanical measures for soil moisture conservation and mitigate drought impacts. **CO4:** Evaluate cropping patterns, meteorological drought, and watershed characterization to optimize rainfed agricultural practices. **CO5:** Create and demonstrate water harvesting structures and soil conservation measures in model rainfed areas and research stations.
BSAC47352 - Agricultural Microbiology and Phyto-Remediation	**CO1:** Define key concepts of microbiology, such as microorganisms, their roles in different environments. **CO2:** Explain the structural and functional diversity of bacteria. **CO3:** Apply microbial techniques in food microbiology. **CO4:** Analyze the role of microbial biopesticides and plant growth-promoting rhizobacteria (PGPR) in sustainable agriculture. **CO5:** Design biotechnological solutions using genetic engineering.
BSAC47353 - Agricultural Microbiology and Phyto-Remediation Lab	**CO1:** Recall the principles of microscopic techniques. **CO2:** Apply appropriate staining techniques. **CO3:** Analyze microbial diversity in the phyllosphere and rhizosphere. **CO4:** Evaluate the efficiency of culture media preparation and microbial isolation techniques. **CO5:** Develop and construct optimized protocols for the cultivation, purification, and application of microbial in laboratory and field conditions.

BSAC45350 - Agricultural Finance and Cooperation	**CO1:** Explain the fundamental concepts, scope, and significance of agricultural finance and credit, including its role in Indian agriculture. (Understand) **CO2:** Classify agricultural credit into various types and analyze the need, principles, and sources of institutional and non-institutional finance in the agricultural sector. (Analyze) **CO3:** Apply the 4 R's, 3 C's, 5 C's, and 7 P's of credit analysis to evaluate the creditworthiness of farmers and agricultural enterprises. (Apply) **CO4:** Evaluate the financial performance of agricultural projects through the preparation and analysis of financial statements, including balance sheets and income statements, and the application of SWOT analysis. (Evaluate) **CO5:** Design project reports and develop strategies for effective cooperative systems and agricultural credit models by incorporating case studies like AMUL and Pradhan Mantri Fasal Bima Yojana.
BSAC45351 - Agricultural Finance and Cooperation Lab	**CO1:** Explain the principles of capital allocation and the methodologies for assessing the progress and performance of cooperatives, commercial banks, and RRBs using published data. **CO2:** Demonstrate the ability to estimate credit requirements for farm businesses and evaluate loan proposals through real-world case studies. **CO3:** Analyze balance sheets, income statements, and techno-economic parameters to assess the financial viability of agricultural enterprises. **CO4:** Evaluate various repayment plans and prepare bankable project reports for agricultural products and value-added products. **CO5:** Design effective financial strategies and management plans by synthesizing insights from visits to financial institutions and cooperatives, and present findings through seminars on selected topics.
BSCA51350 - Essentials of Plant Biochemistry	**CO1:** Identify and describe the structure and function of key biomolecules, including carbohydrates, proteins, lipids, and nucleic acids. **CO2:** Analyze and explain the biochemical pathways of metabolism, including glycolysis, citric acid cycle, and oxidative phosphorylation. **CO3:** Apply concepts of enzyme action, regulation, and their role in metabolic processes and industrial applications. **CO4:** Evaluate the mechanisms of photosynthesis, gluconeogenesis, and nitrogen fixation in plants. **CO5:** Assess the biosynthesis and applications of secondary metabolites like terpenoids, alkaloids, and phenolics in various industries.

BSCA51351 - Essentials of Plant Biochemistry Lab	**CO1:** Identify and describe the principles and procedures for preparing standard solutions and reagents. **CO2:** Perform qualitative and quantitative tests for carbohydrates, proteins, amino acids, and secondary metabolites. **CO3:** Apply methods for estimating fat, protein, and ascorbic acid content in various samples. **CO4:** Analyze the results of biochemical estimations and calculate values such as acid value, saponification, and iodine number. **CO5:** Evaluate and interpret experimental data related to the estimation of biochemical components in plant and food samples.
BSAC42352 - Fundamentals of Seed Science and Technology	**CO1:** Define seed technology and articulate its importance in agriculture, demonstrating an understanding of how seed quality impacts crop yield and sustainability **CO2:** Assess seed quality by identifying the characteristics of good quality seeds, understanding the causes of varietal purity deterioration, and applying methods for genetic purity assessment. **CO3:** Implement the production procedures for foundation and certified seeds of important cereals, pulses, and oilseeds, including conducting field inspections and ensuring compliance with quality standards. **CO4:** Apply post-harvest seed quality management techniques, including processing, drying, treatment, and proper packing, to enhance seed longevity and viability. **CO5:** Explain the regulatory framework surrounding seed certification and legislation, including the Seed Act and the New Seed Bill 2019, and describe the roles and responsibilities of seed inspectors and quality testing methods.
BSAC42353 - Fundamentals of Seed Science and Technology Lab	**CO1:** Describe the structure of seeds and explain the significance of each component in relation to seed function and quality. **CO2:** Conduct seed sampling and perform assessments of physical purity, moisture determination, and germination tests to evaluate seed quality. **CO3:** Perform seed and seedling vigor tests and assess seed viability using established methodologies, ensuring robust seed health and performance. **CO4:** Conduct genetic purity tests through grow-out tests and execute field inspections to ensure varietal integrity and compliance with quality standards. **CO5:** Conduct seed health testing using blotter and agar plate methods, evaluating seed health and identifying potential pathogens.

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

BSAC58350	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	2	3	2	2	2	2		2	2	3
CO2	3			3	2	2	3	2	3	3	2	3
CO3	3	3	2	3		2	2		3	2	2	3
CO4	3	3	2	3	3	2	2		3	2	2	3
CO5	3	2	3		2	3	3	2	2	2		3

BSAC58351	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	3	2	2	3	2	3	2	3	2		3
CO2	3	2	2	2	3	3	3	2	3		2	3
CO3	3	3	3	3	2	2		3	3	3	2	2
CO4	2	2	3		3	3	2	3	2	2	3	3
CO5	2	3	2	2	3	2	3	2	2		3	2

BSAC52350	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3		3	2	3		3	3			2	2
CO2	3	2	2	2		3	3		2	3	2	3
CO3	3	3	3	3	2	3		3		3	3	
CO4	3	3		2	2			2	2		2	3
CO5	2		3		3	3	3	3	3	3		3

BSAC52351	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	3	2		2	2		2	3	2	2
CO2	3	2	3	2			3	3		2	3	2
CO3	2	3	3	3	2	3	2	2	2		2	2
CO4	2	3		2	3	2	3		2	2	3	
CO5	2	2	3	2	3	3			2			2

BSAC42350	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3		3	3	3		2			3	2	3
CO2	3	3	3	2	2	3	3		2	3	2	2
CO3	3	3	3	2	3	2		2	3		3	
CO4	3	3	2	3	2	2	3			2	2	3
CO5	2	3		2	2	3	2	2	3	3	3	3

BSAC42351	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	2		3	2	3	2	3	2		2
CO2	3		3		2		3	2	2	2	2	2
CO3	3	2		2		3	3	3	3		3	2
CO4	2		2		2	2	3	3	2	2	3	2
CO5		2	3	2	3	3	3	2		2	3	3

BSAC46352	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	3	2	2			2	2		3	2
CO2	2	2	2	2	2	2	3			2	2	
CO3	3	3	3	3		2		2	3		3	2
CO4	3	3		2	2	2	2		2	3		3
CO5	3	2	3	3	3	3	2	2	2	2	3	2

BSAC46353	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	3	3	2	3	3		2	2	2	3	2
CO2	3	3	3		3	2	2	2	3	2	3	3
CO3	2		2	2		3	2	3	3	2		3
CO4	2	3	3	2	3			3	2	3	2	3
CO5	2	2		2	2	3	2	2		2	3	

BSAC41353	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1		2	2		2	2	2		3	2	2	2
CO2	3	3		2		3		3		3		3
CO3	3	3	2	2	3	2	3	3		3	2	
CO4	3	2		3			2		3		3	2
CO5	3	2	3		3	3	3	3		3	2	3

BSAC41354	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	2	3	2	2	2	2		3	2	3
CO2	3			3	2	2	3	2	3	3	2	3
CO3	3	3	2	3		2	2		3	2	2	3
CO4		3	2	3	3	2	2		3	2	2	3
CO5	3	2	3		2	3	3	2	2	2		3

BSAC47352	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	3	2	2	3	2	3	2	3	2		3
CO2		2	2	2	3		3	2	3		2	3
CO3	3	3		3	2	2		3	3	3	2	2
CO4	2	2	3		3	3	2	3	2	2	3	3
CO5	2	3	2	2	3	2	3	2	2		3	2

BSAC47353	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3		2	2	3		3	3			2	2
CO2	3	2	2	2		3	3		2	3	2	3
CO3	3	3	3	3	2	3		2		3	3	
CO4	3	3		2	2			2	2		2	3
CO5	2		3		3	3	3	3	3	3		3

BSAC45350	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1		2	3	2		2	2		2	3	2	2
CO2	3		3	2			3	3		2	3	2
CO3	2	3	3	3	2	3	2	2	2		2	2
CO4	2	3		2	3	2	3		2	2	3	
CO5	2	2	3		3	3		3	2		3	2

BSAC45351	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3		3	3	3		2	3		3	2	3
CO2	3	3	3	2	2	3	3		2	3	2	2
CO3	3	3	3	3	3	2		2	3		3	
CO4	3	3	2	3	2	2	3			2	2	3
CO5	2	3		2	2	3	2	2	3	3	3	3

BSCA51350	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	2		3	2	3	2	3	2		2
CO2	3		3	3	2		3		2	2	2	2
CO3	3	2		2		3	3	3	3		3	2
CO4	2		2		2	2	3	3	2	2	3	2
CO5		2	3	2	3	3	3	2		2	3	3

BSCA51351	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1		2	3	2	2			2	2		3	2
CO2	2	2	2	2	3	2	3			2	2	
CO3	3	3	3	3		2		2	3		3	2
CO4	3	3		2	2	2	2		2	3		3
CO5	3	2	3	3	3	3	2	2	2	2	3	2

BSAC42352	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	3	3	3	3	3		2	2	2	3	2
CO2	3	3	3		3	2	2	2	2	2	3	3
CO3			2	3		3	2	3	2	2		3
CO4	2	3	3	2	3			3	2	3	2	3
CO5	2	2		2	2	3	2	2		2	3	

BSAC42353	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1		2	3		2	2	2		3	2	3	2
CO2	2	3		2	3	3		3	3	2		3
CO3	3	3	2	2	3	2	3	3		3	2	
CO4	3	2		3			2		3		3	2
CO5	3	2	3		3	2	3	3		3	2	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: Fundamentals of Agricultural Biotechnology

Course Code: BSAC58350

Course Outline

Unit I: Introduction to Plant Tissue Culture and Genetic Engineering: History; Cellular tot potency and cytodifferentiation; Callus culture, Single-cell/suspension culture and their applications; Organogenesis and somatic embryogenesis; Soma clonal variation and its use in crop improvement; Embryo rescue technique and its significance in hybrid development; In vitro fertilization, ovule culture and its significance in hybrid development; Protoplast isolation, culture and regeneration; Somatic hybridization (somatic hybrids and cybrids) and its application in crop improvement; Anther and pollen culture for haploid production; Development of disease-free (virus free) plants through apical meristem culture; Micropropagation technique for the generation of quality planting material; Synthetic seeds and its applications; National certification and Quality management of TC plants-secondary metabolite production- in vitro germplasm conservation.

Unit II: Introduction to Molecular Biology: DNA structure, structure and function; DNA replication, transcription and translation, RNA, types and function; Structure of prokaryotic and eukaryotic gene; Central dogma of life - DNA replication, transcription, genetic codes- translation and protein synthesis; Lac Operon concept - Nucleic acid hybridization; Polymerase chain reaction- DNA sequencing – Sanger method; PCR and its applications.

Unit III: Introduction to recombinant DNA technology: DNA modifying enzymes and vectors; plant genetic transformation – physical (Gene gun method), chemical (PEG mediated) and Agrobacterium-mediated gene transfer methods; Transgenic and its importance in crop improvement with successful stories; biosafety. Introduction to various molecular markers: RFLP, RAPD, SSR, SNP etc.; Marker-assisted breeding in crop improvement

Suggested readings

1. Bhojwani SS. 1983. Plant Tissue Culture: Theory and Practice. Elsevier.
2. Singh BD. 2007. Biotechnology: Expanding Horiozon. Kalyani
3. Christou P and Klee H. 2004. Handbook of Plant Biotechnology. John Wiley & Sons.
4. Lewin B. 2008. Gene IX. Peterson Publications/ Panima. W.H. Freeman & Co.
5. Primrose SB. 2001. Molecular Biotechnology. Panima.

Course Name: Fundamentals of Agricultural Biotechnology Lab

Course Code: BSAC58351

Course Outline

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

Course Name: Basic and Applied Agricultural Statistics

Course Code: BSAC52350

Course Outline

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

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

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

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

and Skewed Distribution. Probability Theory and Normal Distribution. Introduction to Probability. Basic Terminologies. Classical Probability-Definition and Limitations. Empirical Probability- Definition and Limitations. Axiomatic Probability.

Unit V: Addition and Multiplication Theorem (without proof). Conditional Probability. Independent Events. Simple Problems based on Probability. Definition of Random Variable. Discrete and Continuous Random Variable. Normal Distribution-Definition, Prob. Distribution, Mean and Variance. Assumptions of Normal Distribution. Normal Probability Curve. Correlation and Regression. Definition of Correlation. Scatter Diagram. Karl Pearson's Coefficient of Correlation. Types of Correlation Coefficient. Properties of Correlation Coefficient. Definition of Linear Regression. Regression Equations. Regression Coefficients. Properties of Regression Coefficients. Tests of Significance. Definition. Null and Alternative Hypothesis. Type I and Type II Error. Critical Region and Level of Significance. One Tailed and Two Tailed Tests. Test Statistic. One Sample, Two Sample and Paired t-test with Examples. F-test for Variance. ANOVA and Experimental Designs. Definition of ANOVA. Assignable and Non assignable Factors. Analysis of One-way Classified Data. Basic Examples of Experimental Designs. Terminologies. Completely Randomized Design (CRD). Sampling Theory. Introduction. Definition of Population, Sample, Parameter and Statistic. Sampling Vs Complete Enumeration. Sampling Methods. Simple Random Sampling with Replacement and without Replacement. Use of Random Number Table.

Suggested readings

1. Fundamentals of Statistics by D. N. Elhance, Kitab Mahal Publishers.
2. Fundamentals of Applied Statistics by S.C. Gupta and V. K. Kapoor, Sultan Chand and Sons.
3. Basic Statistics by B. L. Agarwal, New Age International Publishers.
4. Agricultural Statistics by S.P. Singh and R.P.S. Verma, Rama Publishing House.
5. Agriculture and Applied Statistics-I by P.K. Sahu, Kalyani Publishers.
6. Agriculture and Applied Statistics-II by P. K. Sahu and A. K. Das, Kalyani Publishers.

Course Name: Basic and Applied Agricultural Statistics Lab

Course Code: BSAC52351

Course Outline

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

Course Name: Crop Improvement (Rabi crops)- II

Course Code: BSAC42350

Course Outline

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

Suggested readings

1. Breeding Field Crops -I by V.L. Chopra
2. Genetic Improvement of Field Crops by C.B. Singh and D. Khare
3. Genetics and Breeding of Pulse crops by D.P. Singh
4. Vegetable Breeding – Principles and Practices by Hari Har Ram
5. Breeding Field Crops by D.A. Sleper and J.M. Poehlman

Course Name: Crop Improvement (Rabi crops)- II Lab

Course Code: BSAC42351

Course Outline

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

Course Name: Renewable energy in Agriculture and Allied Sector

Course Code: BSAC46352

Course Outline

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

application; Familiarization with types of biogas plants and gasifiers, biogas, bio alcohol, biodiesel and biooil production and their utilization as bioenergy resource; introduction of solar energy, collection and their application; Familiarization with solar energy gadgets: solar cooker, solar water heater, application of solar energy: solar drying, solar pond, solar distillation, solar photovoltaic system and their application; Introduction of wind energy and their application. Availability of bio mass and their application in different places.

Suggested readings

1. C.S. Solanki. 2011. Solar Photovoltaic – Fundamentals, Technologies and Applications. PHI Learning Pvt. Ltd.
2. S. Sukhatme and J. Nayak. 2008. Solar Energy: Principles of Thermal Collection and Storage. Third Edition (Tata McGraw-Hill).
3. V.V.N. Kishore. 2008. Renewable Energy Engineering and Technology: Principles and Practice, Teri, India.

Course Name: Renewable energy in Agriculture and Allied Sector Lab

Course Code: BSAC46353

Course Outline

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

Course Name: Dryland agriculture/ Rainfed agriculture and watershed management

Course Code: BSAC41353

Course Outline

Unit I: Dryland/Rainfed agriculture: Introduction, types and characteristics; History of dry land/ rainfed agriculture in India; Problems and prospects of dry land/rainfed agriculture in India; Soil and climatic conditions prevalent in dry land/rainfed areas; Length of Growing Period (LGP) and Soil Moisture Availability (SMA) and its impact on crop and cropping system; Soil and water conservation techniques; Drought: types, effect of water deficit on physio- morphological characteristics of the plants; Crop adaptation and mitigation to drought; Water

harvesting: importance, its techniques, Efficient utilization of water through soil and crop management practices; Crops and cropping systems in dry land/rainfed areas;

Unit II: Management of crops in dry land/rainfed areas; Contingent crop planning for aberrant weather conditions; Concept, history, objective, principles and components of watershed management, factors affecting watershed management. Log term rainfall analysis in relation to simple mathematical models and forecasting the weather abnormalities; Alternate land use system location; regional and crop specific dryland principles and practices for profitable and sustainable dryland farming and allied enterprises.

Suggested readings

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

Course Name: Dryland agriculture/ Rainfed agriculture and watershed management Lab

Course Code: BSAC41354

Course Outline

Unit I: Studies on climate classification, studies on rainfall pattern in rainfed areas of the country and pattern of onset and withdrawal of monsoons. Calculation of Length of Growing Period (LGP) and Soil Moisture Availability (SMA) Studies on cropping pattern of different rainfed areas in the country and demarcation of rainfed area on map of India. Interpretation of meteorological data and scheduling of supplemental irrigation on the basis of evapo-transpiration demand of crops. Critical analysis of rainfall and possible drought period in the country. Effective rainfall and its calculation.

Unit II: Studies on cultural practices for mitigating moisture stress including mechanical and agronomic measure. Soil moisture determination under different land situations, Importance of seed priming to mitigate drought. Assessment of meteorological drought. Characterization and delineation of model watershed. Seed treatment, viz., seed hardening and seed priming techniques for all the agricultural crops Field demonstration on soil and moisture conservation measures. Field demonstration on construction of water harvesting structures. Visit to rainfed research station/watershed.

Course Name: Agricultural Microbiology and Phyto-remediation

Course Code: BSAC47352

Course Outline

Unit I: Introduction to Microbiology: Definition, applied areas of Microbiology and Importance of Microbiology. History of Microbiology: Discovery of microorganisms, spontaneous generation theory, Germ theory of diseases, Immunization, fermentation, and origin of life. Bacteria: cell structure, chemoautotrophy, photo autotrophy, growth. Bacterial genetics: Genetic recombination- transformation, conjugation and transduction, genetic engineering.

Unit II: Soil Microbiology: Nutrient mineralization and transformation, Air Microbiology: Phyllosphere microflora, Phylloplane microflora, microflora of floral parts etc. Food Microbiology: Microbial spoilage and principles of food preservations, Food poisoning. Water Microbiology: Types of water, water microorganisms, and microbial analysis of water e.g. coliform test, Purification of water. Industrial Microbiology: Microbial products, Biodegradation, Biogas production, Biodegradable plastics etc.

Unit III: Biological control: Microbial biopesticides for plant disease management Concepts of rhizosphere microbiology- Rhizodeposits -biochemical nature, release mechanism in rhizosphere, function, Carbon flow in rhizosphere, Rhizosphere microbiome- residents and their roles. Potential of plant growth promoting rhizobacteria (PGPR) and endophytes on soil health and sustainability. Bioremediation of polluted soils using microbial mediators. Phytoremediation of polluted soils.

Suggested readings

1. Pelczar, M.J., Chan, E.C.S. and Kreig, N.R. 2002. Microbiology. 5th Edition, Tata McGraw-Hill, New Delhi.
2. Rangaswami, G. and Bagyaraj, D. J. 2005. Agricultural Microbiology. Prentice-Hall of India Pvt. Ltd., New Delhi.
3. Mukherjee, N. and Ghosh, T. 2004. Agricultural Microbiology. Kalyani Publishers, Calcutta
4. Dubey, H.C. 2007. A Textbook of Fungi, Bacteria and Viruses. Vikas Publishing House Ltd., New Delhi – 10014
5. Salyers, A. A. and Whitt, D. D. 2001. Microbiology: diversity, disease, and the environment. Fitzgerald Science Press, Inc.
6. Prescott, L. M. 2002. Microbiology 5th Edition. McGraw-Hill Inc, US

Course Name: Agricultural Microbiology and Phyto-remediation Lab

Course Code: BSAC47353

Course Outline

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

Course Name: Agricultural Finance and Cooperation

Course Code: BSAC45350

Course Outline

Unit I: Agricultural Finance- meaning, scope and significance, credit needs and its role in Indian agriculture. Agricultural credit: meaning, definition, need, classification. Credit analysis: 4 R's, and 3C's of credits. Sources of agricultural finance: institutional and non- institutional sources, commercial banks, social control and nationalization of commercial banks. Micro financing including KCC. Lead bank scheme, RRBs, Scale of finance and unit cost. An introduction to higher financing institutions – RBI, NABARD, ADB, IMF, world bank, Insurance and Credit Guarantee Corporation of India.

Unit II: Cost of credit. Recent development in agricultural credit. Preparation and analysis of financial statements – Balance Sheet and Income Statement. Basic guidelines for preparation of project reports. Bank norms – SWOT analysis. Agricultural

Cooperation – Meaning, brief history of cooperative development in India, objectives, principles of cooperation, significance of cooperatives in Indian agriculture.

Unit III: Agricultural Cooperation in India- credit, marketing, consumer and multi-purpose cooperatives, farmers' service cooperative societies, processing cooperatives, farming cooperatives, cooperative warehousing; role of ICA, NCUI, NCDC, NAFED. 3 R's, 5 C's and 7 P's of credit. Crop insurance: its scope, significance and limitations and the potential of the newly launched 'Pradhan Mantri Fasal Bima Yojana' (Prime Minister's Crop Insurance Scheme). Successful cooperative systems in Gujarat (AMUL), Tamil Nadu (Aavin), Karnataka (Nandini), Maharashtra and Punjab.

Suggested readings

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

Course Name: Agricultural Finance and Cooperation Lab

Course Code: BSAC45351

Course Outline

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

Course Name: Essentials of Plant Biochemistry

Course Code: BSCA51350

Course Outline

Unit I: Biochemistry – Introduction and importance, Properties of water, pH and buffer, plant cell and its components. Bio-molecules – Structure, classification, properties and function of carbohydrates, amino acids, proteins, lipids and nucleic acids. Vitamins – physiological and metabolic role. Enzymes: General properties; Classification; Mechanism of action; Michaelis and Menten and Line Weaver Burk equation and plots; Introduction to allosteric enzymes, use of enzymes.

Unit II: Metabolic energy and its generation – Metabolism – Basic concepts, Glycolysis, Citric acid Cycle, Pentose phosphate pathway, oxidative phosphorylation, Fatty acid oxidation. Biosynthetic Pathways – Photosynthesis, Gluconeogenesis, nitrogen fixation, fatty acid and starch formation. Regulation of metabolic pathways. Secondary metabolites, Terpenoids, Alkaloids, Phenolic and their applications in food and pharmaceutical industries.

Suggested readings

1. Nelson and Cox. 2008. Lehninger Principles of Biochemistry. Fourth/Fifth edition. Freeman (Can be downloaded)
2. Conn, Stumpf, Bruening and Doi. 2006. Outlines of Biochemistry. Fifth Edition. Wiley
3. Horton, Moran, Rawn, Scrimgeour, Perry. 2011. Principles of Biochemistry. Fifth Edition. Pearson/Prentice Hall (Can be downloaded)
4. Heldt. 2005. Plant Biochemistry. Elsevier (Can be downloaded)
5. Goodwin and Mercer. 2005. Introduction to Plant Biochemistry. 2nd edition. CBS.

Course Name: Essentials of Plant Biochemistry Lab

Course Code: BSCA51351

Course Outline

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

Course Name: Fundamentals of Seed Science and Technology

Course Code: BSAC42352

Course Outline

Unit I: Introduction to seed technology, definition and importance; Seed quality - definition, characters of good quality seed; Causes of deterioration of varietal purity and assessment of genetic purity, different classes of seed. Foundation and certified seed production of important cereals, pulses and oilseed, field inspection, importance and procedures; post-harvest seed quality management; seed processing procedures, seed drying; Seed treatment, its importance, method of application and seed packing;

Unit II: Seed storage - general principles, stages and factors affecting seed longevity during storage; Seed health management during storage. Seed Certification and legislation; Seed Act and Seed Act enforcement, duty and powers of seed inspector, offences and penalties. Seeds Control Order 1983, basics of seed quality testing; New Seed Bill 2019; Seed quality enhancement techniques.

Suggested Readings

1. Agarwal, R.L. 1995. Seed Technology (2nd edition). Oxford & IBH Publishing Co. Pvt. Ltd. New Delhi, India.
2. Khare, D. and Bhale, M.S. 2019. Seed Technology (2nd revised & enlarged edn), Scientific Publishers, ISBN: 978-81-72338-84-8, New Pali Road, P.O. Box 91, Jodhpur, India
3. Vanangamudi, K. 2014. Seed Technology (An illustrated book), New India Publishing Agency, New Delhi, India.
4. Bhojwani, S.S. and Bhatnagar, S.P. 1999. The Embryology of Angiosperm. Vikas Publ
5. McDonald, M.B. Jr and Copeland, L.O. 1997. Seed Production: Principles and Practices. Chapman & Hall.
6. Tunwar, N.S. and Singh, S.N. 1988. Indian Minimum Seed Certification Standards. CSCB, Ministry of Agriculture, New Delhi.

Course Name: Fundamentals of Seed Science and Technology Lab

Course Code: BSAC42353

Course Outline

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

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.

9. Lesson Plan

BSAC58350 - Fundamentals of Agricultural Biotechnology

Unit	Particulars	Class No.	Pedagogy of Class
Unit-I	Introduction to Plant Tissue Culture and Genetic Engineering: History; Cellular tot potency and cytodifferentiation;	C-1	Lecture
Unit-I	Callus culture, Single-cell/suspension culture and their applications; Organogenesis and somatic embryogenesis;	C-2	Lecture
Unit-I	Quiz	C-3	Quiz
Unit-I	Soma clonal variation and its use in crop improvement; Embryo rescue technique and its significance in hybrid development;	C-4	Lecture
Unit-I	In vitro fertilization, ovule culture and its significance in hybrid development;	C-5	Lecture
Unit-I	Protoplast isolation, culture and regeneration;	C-6	Lecture
Unit-I	Presentation	C-7	Presentation
Unit-I	Somatic hybridization (somatic hybrids and cybrids) and its application in crop improvement;	C-8	Lecture
Unit-I	Anther and pollen culture for haploid production;	C-9	Lecture
	Development of disease-free (virus free) plants through apical meristem culture;	C-10	Lecture
Unit-I	Home Assignment		Home Assignment
Unit-I	Clarification class I	C-11	Clarification Class
Unit-I	Micropropagation technique for the generation of quality planting material;	C-12	Lecture
Unit-I	Synthetic seeds and its applications;	C-13	Lecture
Unit-I	National certification and Quality management of TC plants-secondary metabolite production- in vitro germplasm conservation.	C-14	Lecture
Unit-I	Classroom assignment I	C-15	Classroom Assignment
Unit-II	Introduction to Molecular Biology: DNA structure, structure and function;	C-16	Lecture
Unit-II	DNA replication, transcription and translation, RNA, types and function;	C-17	Lecture
Unit-II	Structure of prokaryotic and eukaryotic gene;	C-18	Lecture
Unit-II	Presentation	C-19	Presentation
Unit-II	Central dogma of life - DNA replication, transcription, genetic codes- translation and protein	C-20	Lecture

	synthesis;		
Unit-II	Lac Operon concept - Nucleic acid hybridization;	C-21	Lecture
Unit-II	Polymerase chain reaction- DNA sequencing – Sanger method;	C-22	Lecture
Unit-II	Classroom Assignment	C-23	Classroom Assignment
Unit-II	PCR and its applications, Introduction to recombinant DNA technology: DNA modifying enzymes and vectors;	C-24	Lecture
Unit-III	plant genetic transformation – physical (Gene gun method), chemical (PEG mediated) and Agrobacterium-mediated gene transfer methods;	C-25	Lecture
Unit-III	Transgenic and its importance in crop improvement with successful stories;	C-26	Lecture
Unit-III	Home Assignment		Home Assignment
Unit-III	Clarification Class	C-27	Clarification Class
Unit-III	biosafety. Introduction to various molecular markers: RFLP, RAPD, SSR, SNP etc.;	C-28	Lecture
Unit-III	Marker-assisted breeding in crop improvement	C-29	Lecture
Unit-III	Quiz	C-30	Quiz

BSAC58351 - Fundamentals of Agricultural Biotechnology Lab

Unit	Particulars	Class No.	Pedagogy of Class
Unit-I	Introduction to Plant Tissue Culture Laboratory;	P-1	Practical
Unit-I	Good Laboratory Practices;	P-2	Practical
Unit-I	Media Preparation and sterilization;	P-3	Practical
Unit-I	Glassware sterilization;	P-4	Practical
Unit-I	Micropropagation;	P-5	Practical
Unit-I	Callus induction and culture; Anther culture; Apical meristem culture;	P-6	Practical
Unit-I	Preparation of synthetic seeds;	P-7	Practical
Unit-I	Isolation of plasmid DNA;	P-8	Practical
Unit-I	Quantification of DNA;	P-9	Practical
Unit-I	Agarose Gel Electrophoresis and visualization of plasmid DNA;	P-10	Practical
Unit-I	Restriction digestion of plasmid DNA and agarose gel electrophoresis;	P-11	Practical
Unit-I	Isolation of Plant genomic DNA;	P-12	Practical
Unit-I	PCR amplification of DNA;	P-13	Practical
Unit-I	Gel electrophoresis of amplified DNA;	P-14	Practical
Unit-I	Visit to tissue culture units /biotech labs.	P-15	Practical

BSAC52350 - Basic and Applied Agricultural Statistics

Unit	Particulars	Class No.	Pedagogy of Class
Unit-I	Introduction to Statistics and its Applications in Agriculture. Types of Data. Scales of measurements of Data. Summarization of Data. Classification of Data.	C-1	Lecture
Unit-I	Frequency Distribution. Methods of Classification. Definition of Grouped and Ungrouped Data, Definition of Class Interval (formula for determining the no. of class interval), Width of CI, Class Limits (Boundaries),	C-2	Lecture
Unit-I	Quiz	C-3	Quiz
Unit-I	Mid Points. Types of Frequency Distribution. Diagrammatic Presentation of Data., Bar Diagrams – Simple, Multiple, Sub-divided and Percentage Bar Diagrams. Pie-diagram. Graphical Presentation of Data – Histogram, Frequency Polygon and Ogives.	C-4	Lecture
Unit-II	Measures of Central Tendency. Requisites for an Ideal Measure of Central Tendency. Different Types of Measure. Arithmetic Mean– Definition, Properties, Merits, Demerits and Uses. A.M. (examples) for Grouped and Ungrouped Data.	C-5	Lecture
Unit-II	Step-deviation Method. Weighted Mean. Definition of Geometric Mean and Harmonic Mean. Relationship between A.M., G.M. and H.M. Median- Definition, Merits,	C-6	Lecture
Unit-II	Presentation	C-7	Presentation
Unit-II	Demerits and Uses. Graphical Location of Median. Mode- Definition, Merits, Demerits and Uses. Graphical Location of Mode. Relationship between Mean, Median and Mode.	C-8	Lecture
Unit-III	Measures of Dispersion. Characteristics for an Ideal Measure of Dispersion. Different Types of Measures of Dispersions.	C-9	Lecture
Unit-III	Definition of Range, Interquartile Range, Quartile Deviation and Mean Deviation. Standard Deviation- Definition, Properties. S.D. and Variance for Grouped and Ungrouped Data. Variance of Combined Series. Coefficients of Dispersions. Co-efficient of Variation.	C-10	Lecture
Unit-III	Home Assignment		Home Assignment
Unit-III	Clarification Class	C-11	Clarification Class
Unit-IV	Measures of Skewness and Kurtosis. Definition of Symmetrical Distribution. Definition of Skewness, Measures of Skewness. Definition of Kurtosis., Measure of Kurtosis. Relationship between Mean, Median and Mode for Symmetrical and Skewed Distribution. Probability Theory and Normal	C-12	Lecture

	Distribution. Introduction to Probability.		
Unit-IV	Class-room- Assignment	C-13	Lecture
Unit-IV	Basic Terminologies. Classical Probability-Definition and Limitations. Empirical Probability- Definition and Limitations. Axiomatic Probability.	C-14	Lecture
Unit-V	Classroom Assignment	C-15	Classroom Assignment
Unit-V	Addition and Multiplication Theorem (without proof). Conditional Probability. Independent Events. Simple Problems based on Probability.	C-16	Lecture
Unit-V	Definition of Random Variable. Discrete and Continuous Random Variable., Normal Distribution-Definition, Prob. Distribution, Mean and Variance. Assumptions of Normal Distribution. Normal Probability Curve.	C-17	Lecture
Unit-V	Correlation and Regression. Definition of Correlation. Scatter Diagram.	C-18	Lecture
Unit-V	Presentation	C-19	Presentation
Unit-V	Karl Pearson's Coefficient of Correlation. Types of Correlation Coefficient. Properties of Correlation Coefficient.	C-20	Lecture
Unit-V	Definition of Linear Regression. Regression Equations. Regression Coefficients. Properties of Regression Coefficients.	C-21	Lecture
Unit-V	Tests of Significance. Definition. Null and Alternative Hypothesis. Type I and Type II Error. Critical Region and Level of Significance. One Tailed and Two Tailed Tests.	C-22	Lecture
Unit-V	Classroom Assignment	C-23	Classroom Assignment
Unit-V	Test Statistic. One Sample, Two Sample and Paired t-test with Examples. F-test for Variance.	C-24	Lecture
Unit-V	ANOVA and Experimental Designs. Definition of ANOVA. Assignable and Non-assignable Factors.	C-25	Lecture
Unit-V	Analysis of One-way Classified Data. Basic Examples of Experimental Designs. Terminologies.	C-26	Lecture
Unit-V	Home Assignment		Home Assignment
Unit-V	Clarification Class	C-27	Clarification Class
Unit-V	Completely Randomized Design (CRD). Sampling Theory. Introduction. Definition of Population, Sample, Parameter and Statistic.	C-28	Lecture
Unit-V	Sampling Vs Complete Enumeration. Sampling Methods. Simple Random Sampling with Replacement and without Replacement. Use of Random Number Table.	C-29	Lecture
Unit-V	Quiz	C-30	Quiz

BSAC52351 - Basic and Applied Agricultural Statistics- Lab

Unit	Particulars	Class No.	Pedagogy of Class
Unit-I	Diagrammatic and Graphical representation of data.	P-1,2	Practical
Unit-I	Calculation of A.M., Median and Mode (Ungrouped and Grouped data).	P-3, 4	Practical
Unit-I	Calculation of S.D. and C.V. (Ungrouped and Grouped data).	P-5,6	Practical
Unit-I	Correlation and Regression analysis.	P-7, 8	Practical
Unit-I	Application of t-test (one sample, two sample independent and dependent).	P-9, 10	Practical
Unit-I	Analysis of variance one-way classification. CRD.	P-11, 13	Practical
Unit-I	Selection of random sample using simple random sampling.	P-14,15	Practical

BSAC42350 - Crop Improvement-II (Rabi crops)

Unit	Particulars	Class No.	Pedagogy of Class
Unit-I	Introduction Aim and objective of crop Improvement	C-1	Lecture
Unit-I	Centers of Origin and Distribution of different crops	C-2	Lecture
Unit-I	Presentation	C-3	Presentation
Unit-I	Plant Genetic Resources: Utilization and Conservation, Genetics of Qualitative Characters	C-4	Lecture
Unit-I	Quiz	C-5	Quiz
Unit-I	Genetics of Quantitative Characters	C-6	Lecture
Unit-I	Major breeding objectives, conventional breeding methods (selection, hybridization, mutation breeding, etc.),	C-7	Lecture
Unit-I	Clarification class	C-8	Clarification class
Unit-I	Home Assignment	C-9	Home Assignment
Unit-I	Modern breeding techniques (biotechnology, marker-assisted selection, genomic selection), their applications and examples.	C-10	Lecture
Unit-I	Presentation	C-11	Presentation
Unit-I	Development of Hybrids and Varieties: Stability and Stress Tolerance, Breeding for Quality Traits	C-12	Lecture
Unit-I	Hybrid Seed Production Technology of Rabi Crops	C-13	Lecture
Unit-I	Classroom Assignment	C-14	Classroom Assignment
Unit-I	Ideotype Concept and Climate Resilient Crop Varieties	C-15	Lecture
Unit-I	Home Assignment		Home Assignment

BSAC42351 - Crop Improvement-II (Rabi crops) Lab

Unit	Particulars	Class No.	Pedagogy of Class
Unit-I	Introduction to Floral Biology	P-1	Practical
Unit-I	Emasculation Techniques in Wheat, Oat, Barley	P-2	Practical
Unit-I	Practical hybridization methods in Chickpea, Lentil, Field Pea	P-3	Practical
Unit-I	Practical on hybrid seed production techniques in Safflower, Potato	P-4	Practical
Unit-I	Study of Heritability	P-5	Practical
Unit-I	Estimation of Heterosis	P-6	Practical
Unit-I	Inbreeding Depression	P-7	Practical
Unit-I	Germplasm Handling	P-8	Practical
Unit-I	Field techniques for seed production in Rabi crops	P-9	Practical
Unit-I	Methods for producing hybrid seeds in selected Rabi crops	P-10	Practical
Unit-I	Practical exercises on estimating heterosis, inbreeding depression, and heritability	P-11	Practical
Unit-I	Field Experiment Layout	P-12	Practical
Unit-I	Evaluation of quality characters and identification of donor parents for different traits in Rabi crops	P-13	Practical
Unit-I	Seed Production Plot Visit	P-14	Practical
Unit-I	All India Coordinated Research Project (AICRP) Plot Visit	P-15	Practical

BSAC46352 - Renewable energy in Agriculture and Allied Sector

Unit	Particulars	Class No.	Pedagogy of Class
Unit-I	Introduction to Energy Sources, Biomass Utilization for Biofuel Production	C-1	Lecture
Unit-I	Presentation	C-2	Presentation
Unit-I	Introduction to Biogas Plants and Gasifiers	C-3	Lecture
Unit-I	Bioenergy Resources: Biogas, Bioalcohol, Biodiesel, and Biooil	C-4	Lecture
Unit-I	Quiz	C-5	Quiz
Unit-I	Introduction to Solar Energy	C-6	Lecture
Unit-I	Solar Energy Gadgets	C-7	Lecture
Unit-I	Class Assignment	C-8	Class Assignment
Unit-I	Applications of Solar Energy	C-9	Lecture
Unit-I	Clarification Class	C-10	Clarification Class
Unit-I	Solar Photovoltaic Systems, Introduction to Wind Energy	C-11	Lecture
Unit-I		C-12	Lecture
Unit-I	Presentation	C-13	Presentation
Unit-I	Availability and Application of Biomass	C-14	Lecture
Unit-I	Clarification Class	C-15	Lecture
Unit-I	Home Assignment		Home Assignment

BSAC46353 - Renewable energy in Agriculture and Allied Sector Lab

Unit	Particulars	Class No.	Pedagogy of Class
Unit-I	Introduction to Renewable Energy Gadgets	P-1	Practical
Unit-I	Familiarization with Biogas Plants	P-2	Practical
Unit-I	Gasifiers	P-3	Practical
Unit-I	Production Process of Biodiesel	P-4	Practical
Unit-I	Briquetting Machine	P-5	Practical
Unit-I	Production Process of Biofuels	P-6	Practical
Unit-I	Solar Energy Gadgets - Overview	P-7	Practical
Unit-I	Solar Photovoltaic System	P-8	Practical
Unit-I	Solar Pumping System	P-9	Practical
Unit-I	Solar Fencing	P-10	Practical
Unit-I	Solar Cooking and Drying Systems	P-11	Practical
Unit-I	Solar Distillation and Solar Pond	P-12	Practical
Unit-I	Solar-Wind Hybrid System	P-13	Practical
Unit-I	Solar-Wind Hybrid System	P-14	Practical
Unit-I	Field Visit to Solar-Wind Farm	P-15	Practical

BSAC41353 - Dryland agriculture/ Rainfed agriculture and watershed management

Unit	Particulars	Class No.	Pedagogy of Class
Unit-I	Dryland/Rainfed agriculture: Introduction, types and characteristics	C-1	Lecture
Unit-I	History of dry land/ rainfed agriculture in India; Problems and prospects of dry land/rainfed agriculture in India	C-2	Lecture
Unit-I	Quiz	C-3	Quiz
Unit-I	Soil and climatic conditions prevalent in dry land/rainfed areas; Length of Growing Period (LGP) and Soil Moisture Availability (SMA) and its impact on crop and cropping system	C-4	Lecture
Unit-I	Soil and water conservation techniques; Drought: types, effect of water deficit on physio- morphological characteristics of the plants; Crop adaptation and mitigation to drought;	C-5	Lecture
Unit-I	Class Room Assignment	C-6	Class Room Assignment
Unit-I	Soil and water conservation techniques; Drought: types, effect of water deficit on physio- morphological characteristics of the plants; Crop adaptation and mitigation to drought;	C-7	Lecture
Unit-I	Water harvesting: importance, its techniques, Efficient utilization of water through soil and crop management practices	C-8	Lecture
Unit-I	Presentation	C-9	Presentation
Unit-I	Crops and cropping systems in dry land/rainfed areas; Management of crops in dry land/rainfed areas; Contingent crop planning for aberrant weather conditions; Crops and cropping systems in dry land/rainfed areas;	C-10	Lecture
Unit-I	Home Assignment		Home Assignment
Unit-II	Management of crops in dry land/rainfed areas; Contingent crop planning for aberrant weather conditions;	C-11	Lecture
Unit-I	Clarification Class	C-12	Clarification Class
Unit-II	Concept, history, objective, principles and components of watershed management, factors affecting watershed management.	C-13	Lecture
Unit-II	Log term rainfall analysis in relation to simple mathematical models and forecasting the weather abnormalities, Alternate land use system location; regional and crop specific dryland principles and practices for profitable and sustainable dryland farming and allied enterprises.	C-14	Lecture
Unit-II	Presentation	C-15	Presentation

BSAC41354 - Dryland agriculture/ Rainfed agriculture and watershed management Lab

Unit	Particulars	Class No.	Pedagogy of Class
Unit-I	Studies on climate classification, studies on rainfall pattern in rainfed areas of the country and pattern of onset and withdrawal of monsoons.	P-1	Practical
Unit-I	Calculation of Length of Growing Period (LGP) and Soil Moisture Availability (SMA) Studies on cropping pattern of different rainfed areas in the country and demarcation of rainfed area on map of India	P-2	Practical
Unit-I	Calculation of Length of Growing Period (LGP) and Soil Moisture Availability (SMA) Studies on cropping pattern of different rainfed areas in the country and demarcation of rainfed area on map of India	P-3	Practical
Unit-I	Interpretation of meteorological data and scheduling of supplemental irrigation on the basis of evapo-transpiration demand of crops.	P-4	Practical
Unit-I	Critical analysis of rainfall and possible drought period in the country. Effective rainfall and its calculation.	P-5	Practical
Unit-I	Critical analysis of rainfall and possible drought period in the country. Effective rainfall and its calculation.	P-6	Practical
Unit-I	Studies on cultural practices for mitigating moisture stress including mechanical and agronomic measure	P-7	Practical
Unit-I	Studies on cultural practices for mitigating moisture stress including mechanical and agronomic measure	P-8	Practical
Unit-I	Soil moisture determination under different land situations, Importance of seed priming to mitigate drought.	P-9	Practical
Unit-I	Assessment of meteorological drought. Characterization and delineation of model watershed.	P-10	Practical
Unit-I	Seed treatment, viz., seed hardening and seed priming techniques for all the agricultural crops Field demonstration on soil and moisture conservation measures.	P-11	Practical
Unit-I	Seed treatment, viz., seed hardening and seed priming techniques for all the agricultural crops Field demonstration on soil and moisture conservation measures.	P-12	Practical
Unit-I	Field demonstration on construction of water harvesting structures.	P-13	Practical
Unit-I	Field demonstration on construction of water harvesting structures.	P-14	Practical
Unit-I	Visit to rainfed research station/watershed.	P-15	Practical

BSAC47352 - Agricultural Microbiology and Phyto-Remediation

Unit	Particulars	Class No.	Pedagogy of Class
Unit-I	Introduction to Microbiology: Definition, applied areas of Microbiology and Importance of Microbiology.	C-1	Lecture
Unit-I	History of Microbiology: Discovery of microorganisms, spontaneous generation theory, Germ theory of diseases, Immunization, fermentation, and origin of life.	C-2	Lecture
Unit-I	Quiz	C-3	Quiz
Unit-I	Bacteria: cell structure, chemoautotrophy, photo autotrophy, growth.	C-4	Lecture
Unit-I	Bacterial genetics: Genetic recombination-transformation, conjugation and transduction, genetic engineering.	C-5	Lecture
Unit-I	Home Assignment		Home Assignment
Unit-II	Soil Microbiology: Nutrient mineralization and transformation.	C-6	Lecture
Unit-I	Classroom Assignment I	C-7	Classroom Assignment
Unit-II	Air Microbiology: Phyllosphere microflora, Phylloplane microflora, microflora of floral parts etc. Food Microbiology: Microbial spoilage and principles of food preservations, Food poisoning.	C-8	Lecture
Unit-II	Presentation	C-9	Presentation
Unit-II	Water Microbiology: Types of water, water microorganisms, and microbial analysis of water e.g. coliform test, Purification of water.	C-10	Lecture
Unit-II	Industrial Microbiology: Microbial products, Biodegradation, Biogas production, Biodegradable plastics etc.	C-11	Lecture
Unit-III	Presentation	C-12	Presentation
Unit-III	Biological control: Microbial biopesticides for plant disease management. Concepts of rhizosphere microbiology- Rhizodeposits -biochemical nature, release mechanism in rhizosphere, function, Carbon flow in rhizosphere, Rhizosphere microbiome-residents and their roles.	C-13	Lecture
Unit-III	Potential of plant growth promoting rhizobacteria (PGPR) and endophytes on soil health and sustainability. Bioremediation of polluted soils using microbial mediators. Phytoremediation of polluted soils	C-14	Lecture
Unit-III	Clarification Class	C-15	Clarification Class

BSAC47353 - Agricultural Microbiology and Phyto-Remediation Lab

Unit	Particulars	Class No.	Pedagogy of Class
Unit-I	Study of the microscope; Acquaintance with laboratory material and equipment	P-1	Practical
Unit-I	Microscopic observation of different groups of microorganisms.	P-2	Practical
Unit-I	Direct staining of bacteria by crystal violet	P-3	Practical
Unit-I	Negative or indirect staining of bacteria by nigrosine	P-4	Practical
Unit-I	Gram staining of bacteria.	P-5	Practical
Unit-I	Study of phyllo sphere and rhizosphere microflora.	P-6, 7	Practical
Unit-I	Measurement of microorganisms	P-8	Practical
Unit-I	Preparation of culture media.	P-9	Practical
Unit-I	Isolation and purification of rhizospheric microbes.	P-10, 11	Practical
Unit-I	Isolation and purification of N-fixers.	P-12	Practical
Unit-I	Isolation and purification of Nutrient solubilizers.	P-13	Practical
Unit-I	Isolation and purification of Endophytes.	P-14, 15	Practical

BSAC45350 - Agricultural Finance and Cooperation

Unit	Particulars	Class No.	Pedagogy of Class
Unit-I	Agricultural Finance- meaning, scope and significance, credit needs and its role in Indian agriculture.	C-1	Lecture
Unit-I	Agricultural credit: meaning, definition, need, classification. Credit analysis: 4 R's, and 3C's of credits.	C-2	Lecture
Unit-I	Presentation	C-3	Presentation
Unit-I	Sources of agricultural finance: institutional and non-institutional sources, commercial banks, social control and nationalization of commercial banks. Micro financing including KCC.	C-4	Lecture
Unit-I	Lead bank scheme, RRBs, Scale of finance and unit cost. An introduction to higher financing institutions – RBI, NABARD, ADB, IMF, world bank, Insurance and Credit Guarantee Corporation of India.	C-5	Lecture
Unit-I	Quiz	C-6	Quiz
Unit-II	Cost of credit. Recent development in agricultural credit. Preparation and analysis of financial statements – Balance Sheet and Income Statement.	C-7	Lecture
Unit-II	Basic guidelines for preparation of project reports.	C-8	Lecture
Unit-II	Home Assignment		Home Assignment
Unit-II	Bank norms – SWOT analysis. Agricultural Cooperation – Meaning, brief history of cooperative development in India, objectives, principles of cooperation, significance of cooperatives in Indian agriculture.	C-9	Lecture
	Presentation	C-10	Presentation
Unit-III	Agricultural Cooperation in India- credit, marketing, consumer and multi-purpose cooperatives, farmers' service cooperative societies, processing cooperatives, farming cooperatives, cooperative warehousing;	C-11	Lecture
Unit-III	Role of ICA, NCUI, NCDC, NAFED. 3 R's, 5 C's and 7 P's of credit.	C-12	Lecture
Unit-III	Crop insurance: its scope, significance and limitations and the potential of the newly launched 'Pradhan Mantri Fasal Bima Yojana' (Prime Minister's Crop Insurance Scheme).	C-13	Lecture
Unit-III	Successful cooperative systems in Gujarat (AMUL), Tamil Nadu (Aavin), Karnataka (Nandini), Maharashtra and Punjab.	C-14	Lecture
Unit-III	Clarification class II	C-15	Clarification class
Unit-III	Home Assignment		Home Assignment

BSAC45351 - Agricultural Finance and Cooperation Lab

Unit	Particulars	Class No.	Pedagogy of Class
Unit-I	Optimum allocation of limited amount of capital among different enterprise.	P-1	Practical
Unit-I	Optimum allocation of limited amount of capital among different enterprise.	P-2	Practical
Unit-I	Analysis of progress and performance of cooperatives using published data.	P-3	Practical
Unit-I	Analysis of progress and performance of commercial banks and RRBs using published data.	P-4	Practical
Unit-I	Visit to a commercial bank, cooperative bank and cooperative society to acquire first-hand knowledge of their management, schemes and procedures.	P-5	Practical
Unit-I	Estimation of credit requirement of farm business – A case study. Preparation and analysis of balance sheet – A case study.	P-6	Practical
Unit-I	Estimation of credit requirement of farm business – A case study. Preparation and analysis of balance sheet – A case study.	P-7	Practical
Unit-I	Preparation and analysis of income statement – A case study. Appraisal of a loan proposal – A case study.	P-8	Practical
Unit-I	Preparation and analysis of income statement – A case study. Appraisal of a loan proposal – A case study.	P-9	Practical
Unit-I	Techno-economic parameters for preparation of projects.	P-10	Practical
Unit-I	Preparation of Bankable projects for various agricultural products and its value-added products.	P-11	Practical
Unit-I	Preparation of Bankable projects for various agricultural products and its value-added products.	P-12	Practical
Unit-I	Seminar on selected topics.	P-13	Practical
Unit-I	Different types of repayment plans.	P-14	Practical
Unit-I	Different types of repayment plans.	P-15	Practical

BSCA51350 - Essentials of Plant Biochemistry

Unit	Particulars	Class No.	Pedagogy of Class
Unit-I	Introduction to Biochemistry	C-1	Lecture
Unit-I	Properties of Water and its Importance in Biological Systems	C-2	Lecture
Unit-I	Quiz	C-3	Quiz
Unit-I	pH and Buffers in Biological Systems	C-4	Lecture
Unit-I	Plant Cell and its Components	C-5	Lecture
Unit-I	Bio-molecules: Carbohydrates, Amino Acids, and Proteins	C-6	Lecture
Unit-I	Presentation	C-7	Presentation
Unit-I	Bio-molecules: Lipids and Nucleic Acids	C-8	Lecture
Unit-I	Vitamins: Physiological and Metabolic Roles	C-9	Lecture
Unit-I	Enzymes: General Properties and Classification	C-10	Lecture
Unit-I	Enzymes: Mechanism of Action and Michaelis-Menten Theory	C-11	Lecture
Unit-I	Enzymes: Allosteric Enzymes and Their Regulation	C-12	Lecture
Unit-I	Clarification Class	C-13	Clarification Class
Unit-I	Use of Enzymes in Biotechnology and Industry	C-14	Lecture
Unit-I	Home Assignment		Home Assignment
Unit-II	Metabolic Energy and Its Generation	C-15	Lecture
Unit-II	Class Room Assignment	C-16	Class Room Assignment
Unit-II	Metabolism: Basic Concepts and Introduction to Pathways	C-17	Lecture
Unit-II	Glycolysis: Overview and Detailed Pathway	C-18	Lecture
Unit-II	Home Assignment		Home Assignment
Unit-II	Citric Acid Cycle (Krebs Cycle)	C-19	Lecture
Unit-II	Pentose Phosphate Pathway and its Role in Metabolism	C-20	Lecture
Unit-II	Oxidative Phosphorylation and ATP Synthesis	C-21	Lecture
Unit-II	Presentation	C-22	Presentation
Unit-II	Fatty Acid Oxidation and its Role in Energy Production	C-23	Lecture
Unit-II	Photosynthesis: Mechanisms and Light vs. Dark Reactions	C-24	Lecture
Unit-II	Gluconeogenesis: Overview and Mechanism	C-25	Lecture
Unit-II	Class Room Assignment	C-26	Class Room Assignment
Unit-II	Nitrogen Fixation: Mechanism and Significance, Fatty Acid and Starch Formation: Biosynthetic Pathways	C-27	Lecture
	Quiz	C-28	Quiz
Unit-II	Regulation of Metabolic Pathways, Secondary Metabolites: Terpenoids, Alkaloids, Phenolics and their Applications	C-29	Lecture
Unit-II	Clarification Class	C-30	Clarification Class

BSCA51351 - Essentials of Plant Biochemistry Lab

Unit	Particulars	Class No.	Pedagogy of Class
Unit-I	Preparation of Standard Solutions and Reagents	P-1	Practical
Unit-I	Determination of pH	P-2	Practical
Unit-I	Qualitative Tests of Carbohydrates	P-3	Practical
Unit-I	Qualitative Tests of Amino Acids	P-4	Practical
Unit-I	Quantitative Estimation of Soluble Sugars and Starch	P-5	Practical
Unit-I	Estimation of Protein by Kjeldahl Method	P-6	Practical
Unit-I	Estimation of Protein by Lowry's Method	P-7	Practical
Unit-I	Preparation of Mineral Solution from Ash	P-8	Practical
Unit-I	Estimation of Fat by Soxhlet Method	P-9	Practical
Unit-I	Determination of Acid Value	P-10	Practical
Unit-I	Determination of Saponification Value and Iodine Number	P-11	Practical
Unit-I	Estimation of Ascorbic Acid	P-12	Practical
Unit-I	Qualitative/Quantitative Tests of Secondary Metabolites	P-13	Practical
Unit-I	Data Analysis and Calculation of Results	P-14	Practical
Unit-I	Review and Discussion of Practical Techniques and Results	P-15	Practical

BSAC42352 - Fundamentals of Seed Science and Technology

Unit	Particulars	Class No.	Pedagogy of Class
Unit-I	Introduction to seed technology, definition and importance.	C-1	Lecture
Unit-I	Seed quality -definition, characters of good quality seed.	C-2	Lecture
Unit-I	Quiz	C-3	Quiz
Unit-I	Causes of deterioration of varietal purity and assessment of genetic purity	C-4	Lecture
Unit-I	Different classes of seed	C-5	Lecture
Unit-I	Presentation	C-6	Presentation
Unit-I	Foundation and certified seed production of important cereals, pulses and oilseed, field inspection, importance and procedures	C-7	Lecture
Unit-I	Classroom Assignment	C-8	Classroom Assignment
Unit-I	Post-harvest seed quality management seed processing procedures, seed drying, Seed treatment, its importance, method of application and seed packing.	C-9	Lecture
Unit-II	Seed storage - general principles, stages and factors affecting seed longevity during storage.	C-10	Lecture
Unit-II	Home Assignment		Home Assignment
Unit-II	Seed health management during storage. Seed Certification and legislation.	C-11	Lecture
Unit-II	Presentation	C-12	Presentation
Unit-II	Seed Act and Seed Act enforcement, duty and powers of seed inspector, offences and penalties	C-13	Lecture
Unit-II	Seeds Control Order 1983, basics of seed quality testing; New Seed Bill 2019; Seed quality enhancement techniques.	C-14	Lecture
Unit-II	Clarification Class	C-15	Clarification Class

BSAC42353 - Fundamentals of Seed Science and Technology Lab

Unit	Particulars	Class No.	Pedagogy of Class
Unit-I	Seed structure.	P-1, 2	Practical
Unit-I	Seed sampling.	P-3, 4	Practical
Unit-I	Physical purity.	P-5	Practical
Unit-I	Moisture determination, germination test.	P-6, 7	Practical
Unit-I	Seed and seedling vigour test.	P-8	Practical
Unit-I	Seed Viability.	P-9	Practical
Unit-I	Genetic purity test, grow out test.	P-10, 11	Practical
Unit-I	Field inspection, seed health testing using blotter and agar plate method.	P-12, 13	Practical
Unit-I	Visit to seed production farms, seed testing laboratories and seed processing plant.	P-14, 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.

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