SCHOOL OF AGRICULTURE SCIENCES

Programme Structure & Syllabus
B. Sc. (Hons.)Agriculture

(As per ICAR Fifth Deans' Committee Recommendations)

2023-2024

Pro Vice Chancellor
KK University
Berauti, Nepura, Bihar Sharif
Nalanda - 803115 (Bihar)

K. K. UNIVERSITY

NALANDA, BIHAR-803115

Programme Structure- B.Sc. (*Hons.)* Agriculture

Introduction:

Agriculture sector is an integral part of development and economic growth of a nation. Agriculture plays a key role in the economy of developing countries and provides food, income and job opportunities to a significant portion of population. The curriculum of Agriculture studies offers a wide range of learning and paves way to widespread opportunities to learners as professionals or entrepreneurs. Some of the agriculture core and allied areas that are designed in the curriculum are - Plant Sciences, Agronomy, Entomology, Agricultural Economics, Agricultural Extension and Communication, Genetics and Plant Breeding, Plant Pathology, Horticulture, Crop Modeling, Animal Sciences, Soil Science, Crop Physiology, Agricultural Engineering, Agro Forestry, Food Science, Seed Science and Technology, Agro Meteorology, Environmental Sciences, Microbiology, Floriculture, Vegetable Science, Production Techniques and Pest Management etc.

Agriculture study is a fine blend of classroom teaching and hands-on training at the field. Therefore, the teaching pedagogy is an excellent mix of these two aspects of learning. Students are made aware about the pedagogical tools at various stages of the program. Complete plan of teaching discourse is shared with the stakeholders and the faculty follows the teaching plan as per the schedule. The teaching pedagogy involves class room teaching, role plays, home and class assignments, lesson plan, field works at demonstration and regular fields, hands-on training etc. Keeping in view the consciousness and sensitization of students on various issues, the college ensures learning of students through various outreach programs too. National Service Scheme (NSS) unit of college leaves no stone unturned to meet the objectives laid through this program.

B.Sc. (Hons.) Agriculture : Four Year (8-Semester)			
Basic Structure: Distribution of Courses			
S.No.	**Type of Course**	**No. of Courses**	**Credits**
1	Core Course (CC)	91	115
2	Remedial Courses (RC)	01	02
3	Value Added Course (VAC)	03	02
4	Ability Enhancement Course (AEC)	10	20
5	Discipline Specific ElectiveCourse (DSEC)	06	09
6	Open Electives Course (OEC)	02	-
7	Skill Enhancement Courses (SEC)	02	4
8	Student READY Programme(Rural Agricultural Work Experience (RAWE) and Experience Learning Programme)	03	40
	Total	119	192

Following is the course module designed for the B.Sc. *(Hons.)* Agriculture programme:

1. ***Core Course (CC):*** A wide range of core courses are provided in the basic agriculture disciplines like agronomy, entomology, horticulture, plant pathology, agriculture economics, statistics etc. Core courses are offered in semester I, II, III, IV, V, and VII during the B.Sc. *(Hons.)* Agriculture programme.
2. ***Remedial Courses (RC):*** These courses are offered in Ist semester of programme. Students having Biology in intermediate (10+2) register for Elementary Mathematics (BAG1108) whereas the students having Mathematics register for Introductory Biology (BAG1107). Other students choose any of the above two courses.
3. ***Value added course (VAC)*** Value added courses include *Practical Crop Production, Soft Skills,* and *Educational Tour*. These courses are offered in V and VI semesters of degree programme.
4. ***Ability Enhancement Compulsory Course (AEC):*** These courses enhance the ability in students in variousaspects. These courses are offered in I, II, III, IV and V semester of degree programme.
5. ***Discipline Specific Elective Course (DSEC):*** The discipline specific elective course

is offered to inculcate specific knowledge of a domain in learners. The specific areas may include agronomy, horticulture, and entomology. It will be covered in IV,V and VI semester of programme.

6. ***Open Electives Courses (OEC):*** Open elective courses are provided to the students in IVth and VIth semester where students can learn various concepts.
7. ***Skill Enhancement Courses (SEC):*** Here, students are made familiar with the rural agricultural activities. This course is offered in VII semester of degree programme.
8. ***Student READY Programme:*** The term READY refers to "Rural Entrepreneurship Awareness Development Yojana." This component envisages reorienting graduates of agriculture and allied subjects for ensuring and assuring employability and developing entrepreneurs for emerging knowledge intensive agriculture. Two types of courses are offered under READY programme Rural Agricultural Work Experience (RAWE) and Experience Learning Programme (ELP)

9. ***Rural Agricultural Work Experience (RAWE):*** The Rural Agricultural Work Experience (RAWE) helps the students primarily to understand the rural situations, status of agricultural technologies adopted by the farmers to prioritize the farmers' problems and to develop skills & attitude of working with farm families for overall development in rural area. It is offered in VII semester.

10. ***Experience Learning Programme (ELP):*** In this course, learning and development are achieved through personally determined experience and involvement, rather than on received teaching or training, typically in group, by observation, study of theory or hypothesis and bring in innovation or some other transfer of skills or knowledge. This course may be chosen from a pool of courses designed to provide value/skill based knowledge. In VIII semester, the student can choose two skill enhancement course of his/her choice.

Programme Outcomes (POs)

On completion of the four year *B.Sc. (Hons.) Agriculture*, the students will be

PO - 1	Understanding the concepts of agriculture for their practical utility in Indian context
PO -2	Understanding efficient utilization of agri-resources in farming
PO - 3	Improving of communication, learning skills and leadership quality for searching novel solutions of site- specific agriculture.
PO - 4	Analyzing strengths, weaknesses, opportunities and threats of modern technologies
PO - 5	Analyzing site-specific and tactical solutions under ambient and stressful situations.
PO - 6	Developing entrepreneurial skills and business management competence in agricultureand allied sectors.

Programme Specific Outcomes (PSOs)

On completion of four year *B.Sc. (Hons.) Agriculture* the students will be

PSO-1	Understanding the integrated management of sustainable agriculture, horticulture, vegetable science, forestry, agro forestry and livestock production.
PSO-2	Applying the tools and techniques of agronomy, soil science, plant pathology, and entomology and allied sciences for enhancing agriculture productivity.
PSO-3	Analyzing the information related to agricultural economics for finding solution for various problems.
PSO-4	Collaborating with farmers, industries and different types of institutions for devising useful solutions.
PSO-5	Evaluating the efficiency of various technologies for identifying better site-specific solutions for agriculture sector.
PSO-6	Developing competence in agricultural extension and managing different typesof agricultural resources.
PSO-7	Developing entrepreneurial skills and business management competence in agriculture and allied sciences.
PSO-8	Developing entrepreneurial skill with using smart agri- practices in agribusinessmodule through Experience Learning Programmes.

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Pedagogy & Unique practices adopted:

- ***Case Studies exposure*:** *Case studies* provide live examples to the students from around the world demonstrating the best practices for sustainable *agriculture*. They provide evidence on farming practices in various ways. Case studies also demonstrate the dangers of excessive use of chemical fertilizers and pesticides in agriculture. Therefore, they understand sustainable organic agriculture practices too for achieving food security without harming the environment and public health.

- ***Emphasis on practical exposure:*** Emphasis on practical exposure is much better than mere attaining the theoretical knowledge. The primary reason behind emphasizing upon the importance of practical learning is the kind of exposure students receive from such practices which helps them improves their skills. Here students can test their skills and help themselves to identify their weaknesses. This student-centered space enables learner-oriented assessment, where the design of the task is created for active student learning. Therefore, Practical exposure helps students to learn from self-experiences which make them ready for the framework of the industry even before joining them.

- ***Inclusion of IT tools in teaching:*** Various types of IT tools are used to support student learning. In present scenario, technology has taken a front seat and classrooms are well equipped with equipment and gadgets. Computers and mobiles are playing an important role in teaching- learning process. The use of open educational resources and other technologies are helping to increase educational productivity by accelerating the rate of learning, reducing costs associated with instructional materials or program delivery and better utilizing teacher time.

- ***Field/Live Projects*:** Field work is one of the major important part in the field of

Agriculture. A truly hands on training is given to the students in Practical Crop Production (PCP) in which students learn by doing the each and every step of crop production.

- ***Learning visits organized:*** Our institute organizes learning visits of KVK, Industrial units, agriculture markets, Kisan Mela and various Agriculture institutes of repute. These visits are essential to give students hands on exposure and experience of how things work in industries. Such visits play a vital role to enhance students' exposure to practical learning in various domains.

- ***Guest Lectures:*** To cater the present needs of industry we organize guest lectures, as part of lecture-series. Guest lectures are delivered in the college by eminent speakers from industry/ academia. The objective ofthese lectures is to provide extra attention on some topics/concepts as they either may be high in difficulty level or requires experts from specific industry/domain to make things/concepts clear for a better understanding from the perspective of the industry.

- ***Experience Learning Programme (ELP):*** The Experiential Learning Programme aims at promoting professional skills and knowledge through hands on experience and confidence building sessions. Ability to work in project requires management capabilities to build confidence. This programme provides a good platform for students with an approach of "Learning by Doing" and "Seeing by Believing" in various area of agriculture. The experiential learning programme is offered in the final semester.

- ***Special assistance programme:*** A special attention is given on slow learners & fast learners to develop their potential. We identify slow & fast learners through continuous evaluation in class room practices as well sessional exam performance. We develop the mechanism to correcting knowledge gap

according to their needthrough extra classes and personal interaction.

- ***Orientation programme:*** 15 days orientation programme is conducted for first year admitted students. Student's orientation programme is designed to guide students about university and college. The programme includes domains like syllabus, library, examination system, college environment, and physical facilities, which aids to their educational and personal goals. Orientation programme play a vital role in developing positive attitude, minimizing stress and creating self confidence among newly admitted students.

- ***Mentor mentee scheme:*** Faculty members of College of Agriculture Science are actively involved in mentoring of students. Students share their problems with their respective mentors. Teachers maintain the academic progress record on prescribed booklet.

- ***Career & personal counseling*****:** Training and placement department is copiously involved in developing career oriented skill development activities and personality development to help the students in getting job.

- ***Competitive exam preparation***: The College run competitive exam preparation classes for final year students to provide guidance, necessary literature and other information about cracking competitive examinations.

- ***Extracurricular Activities***: Participation in extracurricular activities is set mandatory for the students to develop self-confidence and public speaking.

DISCIPLINE WISE COURSES

Discipline/Course title		Credit Hours
Agronomy		
1.	Fundamentals of Agronomy	4(3+1)
2.	Introductory Agro-meteorology & Climate Change	2(1+1)
3.	Crop Production Technology – I (*Kharif* crops)	2(1+1)
4.	Crop Production Technology – II (*Rabi* crops)	2(1+1)
5.	Farming System & Sustainable Agriculture	1(1+0)
6.	Practical Crop Production - I *(Kharif* crops*)*	2(0+2)
7.	Practical Crop Production - II *(Rabi* crops*)*	2(0+2)
8.	Principles of Organic Farming	2(1+1)
9.	Geo-informatics and Nanotechnology and Precision Farming	2(1+1)
10.	Rainfed Agriculture & Watershed Management	2(1+1)
Genetics & Plant Breeding		
1.	Fundamentals of Genetics	3(2+1)
2.	Principles of Seed Technology	3(1+2)
3.	Fundamentals of Plant Breeding	3(2+1)
4.	Crop Improvement-I (*Kharif* crops)	2(1+1)
5.	Crop Improvement-II (*Rabi* crops)	2(1+1)
Soil Science & Agricultural Chemistry		
1.	Fundamentals of Soil Science	3(2+1)
2.	Manures, Fertilizers and Soil Fertility Management	3(2+1)
3.	Problematic soils and their Management	2(2+0)
Entomology		
1.	Fundamentals of Entomology	4(3+1)
2.	Pests of Crops and Stored Grain and their Management	3(2+1)
3.	Management of Beneficial Insects	2(1+1)
Agricultural Economics		
1.	Fundamentals of Agricultural Economics	2(2+0)
2.	Agricultural Finance and Co-Operation	3(2+1)
3.	Agricultural Marketing Trade & Prices	3(2+1)
4.	Farm Management, Production & Resource Economics	2(1+1)
Agricultural Engineering		
1.	Soil and Water Conservation Engineering	2(1+1)
2.	Farm Machinery and Power	2(1+1)
3.	Renewable Energy and Green Technology	2(1+1)
4.	Protected Cultivation and Secondary Agriculture	2(1+1)
Plant Pathology		
1.	Fundamentals of Plant Pathology	4(3+1)
2.	Diseases of Field and Horticultural Crops and their Management-I	3(2+1)

3.	Diseases of Field and Horticultural Crops and their Management-II	3(2+1)
4.	Principles of Integrated Pest and Disease Management	3(2+1)
Horticulture		
1.	Fundamentals of Horticulture	2(1+1)
2.	Production Technology for Fruit and Plantation Crops	2(1+1)
3.	Production Technology for Vegetables and Spices	2(1+1)
4.	Production Technology for Ornamental Crops, MAP and Landscaping	2(1+1)
5.	Post-harvest Management and Value Addition of Fruits and Vegetables	2(1+1)
Food Science & Technology		
1.	Principles of Food Science & Nutrition	2(2+0)
Agricultural Extension and Communication		
1.	Fundamentals of Agricultural Extension Education	3(2+1)
2.	Rural Sociology & Educational Psychology	2(2+0)
3.	Entrepreneurship Development and Business Communication	2(1+1)
4.	Communication Skills and Personality Development	2(1+1)
Biochemistry / Physiology / Microbiology/ Environmental Sciences		
1.	Fundamentals of Plant Biochemistry and Biotechnology	3(2+1)
2.	Fundamentals of Crop Physiology	2(1+1)
3.	Agricultural Microbiology	2(1+1)
4.	Environmental Studies & Disaster Management	3(2+1)
5.	Introduction to Forestry	2(1+1)
Statistics, Computer Application and I.P.R.		
1.	Statistical Methods	2(1+1)
2.	Agri- Informatics	2(1+1)
3.	Intellectual Property Rights	1(1+0)
Animal Production		
1.	Livestock and poultry Management	4(3+1)
Language		
1.	Comprehension & Communication Skills in English (Gradial course)	2(1+1)
Remedial Courses		
1.	Agricultural Heritage	1(1+0)
2.	Introductory Biology	2(1+1)
3.	Elementary Mathematics	2(2+0)
Non-Gradial Courses		
1.	NSS/NCC/Physical Education & Yoga Practices	2(0+2)
2.	Human Values & Ethics	1(1+0)
3.	Educational Tour	2(0+2)

NEW COURSES

As per ICAR Fifth Deans' Committee Recommendations

Sl. No.	Course Title	Credit Hours
1.	Geoinformatics, Nanotechnology and Precision Farming	2(1+1)
2.	Rainfed Agriculture and Watershed Management	2(1+1)
3.	Problematic Soils and their Management	2(2+0)
4.	Renewable Energy and Green Technology	2(1+1)
5.	Management of Beneficial Insects	2(1+1)
6.	Fundamentals of Horticulture	2(1+1)
7.	Introduction to Forestry	2(1+1)
8.	Agri- Informatics	2(1+1)
9.	Intellectual Property Rights	1(1+0)
10.	Principles of Food Science & Technology	2(2+0)
11.	Communication Skills and Personality Development	2(1+1)
12.	Principles of Integrated Pest & Diseases Management	3(2+1)
13.	Agricultural Heritage	1(1+0)*
14.	Introductory Biology	2(1+1)*
15.	Elementary Mathematics	2(2+0)*
16.	Human Values & Ethics (NG)	1(1+0)**

* Remedial courses ** Non-gradial courses

Elective Courses: A student can select three elective courses out of the following and offer during 4^{th}, 5^{th} and 6^{th} semesters.

S.N.	Courses	Credit Hours
1	Agribusiness Management	3(2+1)
2	Agrochemicals	3(2+1)
3	Commercial Plant Breeding	3(1+2)
4	Landscaping	3(2+1)
5	Food Safety and Standards	3(2+1)
6	Biopesticides & Biofertilizers	3(2+1)
7	Protected Cultivation	3(2+1)
8	Micro propagation Technologies	3(1+2)
9	Hi-tech. Horticulture	3(2+1)
10	Weed Management	3(2+1)
11	System Simulation and Agro-advisory	3(2+1)
12	Agricultural Journalism	3(2+1)

EXAMINATION

External theory (50%)

Internal Theory + Practical (50%)

- Courses with Theory and Practical: Mid-term Exam (30%) + Assignment (5%) in practical oriented courses + Practical (15%)
- Courses with only Theory: Mid-term Exam (40%) + Assignment (10%)
- Courses with only Practical: 100% Internal (Final Evaluation of 50% and Continuous Evaluation of 50%)

❖ Paper to be set by external: HOD shall ensure the coverage of syllabus. If needed moderation can be done.

❖ Evaluation to be done internally by the faculty other than the Course Instructor. Syllabus of the concerned course shall be sent to the external examiner, who shall prepare the question papers. For practical, it is recommended that examination shall be conducted by course instructor(s) and one teacher nominated by Dean.

EVALUATION

❖ As per University norms

Programme Structure

Undergraduate Programme of Bachelor of Science Honours in Agriculture

Semester-wise distribution of courses

I SEMESTER

S. No.	Course Code	Course Title	Credits	L	T	P
1	BSAG-1101	Fundamentals of Horticulture	2 (1+1)	1		1
2	BSAG-1102	Fundamentals of Plant Biochemistry and Biotechnology	3 (2+1)	2		1
3	BSAG-1103	Fundamentals of Soil Science	3 (2+1)	2		1
4	BSAG-1104	Introduction to Forestry	2 (1+1)	1		1
5	BSAG-1105	Comprehension & Communication Skills in English	2 (1+1)	1		1
6	BSAG-1106	Fundamentals of Agronomy	4 (3+1)	3		1
7	BSAG-1107	Introductory Biology*	2 (1+1)*	1		1
8	BSAG-1108	Elementary Mathematics*	2 (2+0)*	2		0
9	BSAG-1109	Agricultural Heritage*	1 (1+0)*	1		0
10	BSAG-1110	Rural Sociology & Educational Psychology	2 (2+0)	2		0
11	BSAG-1111	Human Values & Ethics	1(1+0)**	1		0
12	BSAG-1112	NSS/NCC/Physical Education & Yoga Practices	2 (0+2)**	0		2
TOTAL			18+03*+03**			

*R: Remedial course

CourseCode	Name of the Course	Teaching Scheme (Periods)				Evaluation Scheme				
						Sessional (50Marks)			ESE (50Marks)	Total
		L	T	P	Total	Theory	Assignment	Practical /Oral		
BSAG-1101	Fundamentals of Horticulture	1	-	2	2	30	5	15	50	100
BSAG-1102	Fundamentals of Plant Biochemistry & Biotechnology	2	-	2	3	30	5	15	50	100
BSAG-1103	Fundamentals of Soil Science	2	-	2	3	30	5	15	50	100
BSAG-1104	Introduction to Forestry	1	-	2	2	30	5	15	50	100
BSAG-1105	Comprehension & Communication Skills in English	1	-	2	2	30	5	15	50	100
BSAG-1106	Fundamentals of Agronomy	3	-	2	4	30	5	15	50	100
BSAG-1107	Introductory Biology*	1	-	2	2	30	5	15	50	100
BSAG-1108	Elementary Mathematics*	2	-	0	2	40	10	-	50	100
BSAG-1109	Agricultural Heritage*	1	-	0	1	40	10	-	50	100
BSAG-1110	Rural Sociology & Educational Psychology	2	-	0	2	40	10	-	50	100
BSAG-1111	Human Values & Ethics	1	-	0	1	40	10	-	50	100
BSAG-1112	NSS/NCC/Physical Education & Yoga Practices**	0	-	4	2	-	-	50	50	100
										Total :1200

* *R: Remedial course; **NC: Non-Gradial courses ESE: End Semester Examination

- Students having Biology at intermediate (10+2) will opt Elementary Mathematics (BAG-108) and students having Mathematics will opt Introductory Biology (BAG-1107).
- NSS/NCC/ Physical Education & Yoga Practices: These courses are non-gradial. The College offers Physical Education & Yoga Practices in Ist semesters. Students have to opt either NSS or Physical Education & Yoga Practices.

II SEMESTER

S.No.	Course Code	Course Title	Credits	L	T	P
1	BSAG-1201	Fundamentals of Genetics	3(2+1)	2		1
2	BSAG-1202	Agricultural Microbiology	2(1+1)	1		1
3	BSAG-1203	Soil and Water Conservation Engineering	2(1+1)	1		1
4	BSAG-1204	Fundamentals of Crop Physiology	2(1+1)	1		1
5	BSAG-1205	Fundamentals of Agricultural Economics	2(2+0)	2		0
6	BSAG-1206	Fundamentals of Plant Pathology	4(3+1)	3		1
7	BSAG-1207	Fundamentals of Entomology	4(3+1)	3		1
8	BSAG-1208	Fundamentals of Agricultural Extension Education	3(2+1)	2		1
9	BSAG-1209	Communication Skills and Personality Development	2(1+1)	1		1
Total			24(16+8)			

CourseCode	Name of the Course	Teaching Scheme (Periods)				Evaluation Scheme				
						Sessional (50Marks)			ESE (50Marks)	Total
		L	T	P	Total	Theory	Assignment	Practical /Oral		
BSAG-1201	Fundamentals of Genetics	2	-	2	3	30	5	15	50	100
BSAG-1202	Agricultural Microbiology	1	-	2	2	30	5	15	50	100
BSAG-1203	Soil and Water Conservation Engineering	1	-	2	2	30	5	15	50	100
BSAG-1204	Fundamentals of Crop Physiology	1	-	2	2	30	5	15	50	100
BSAG-1205	Fundamentals of Agricultural Economics	2	-	0	2	40	10	-	50	100
BSAG-1206	Fundamentals of Plant Pathology	3	-	2	4	30	5	15	50	100
BSAG-1207	Fundamentals of Entomology	3	-	2	4	30	5	15	50	100
BSAG-1208	Fundamentals of Agricultural Extension Education	2	-	2	3	30	5	15	50	100
BSAG-1209	Communication Skills and Personality Development	1	-	2	2	30	5	15	50	100
									Total :900	

* *R: Remedial course; **NC: Non-Gradial courses ESE: End Semester Examination

III SEMESTER

S. No.	Course Code	Course Title	Credits	L	T	P
1	BSAG-2301	Crop Production Technology – I *(Kharif Crops)*	2 (1+1)	1		1
2	BSAG-2302	Fundamentals of Plant Breeding	3 (2+1)	2		1
3	BSAG-2303	Agricultural Finance and Cooperation	3 (2+1)	2		1
4	BSAG-2304	Agri- Informatics	2(1+1)	1		1
5	BSAG-2305	Farm Machinery and Power	2 (1+1)	1		1
6	BSAG-2306	Production Technology for Vegetables and Spices	2 (1+1)	1		1
7	BSAG-2307	Environmental Studies and Disaster Management	3(2+1)	2		1
8	BSAG-2308	Statistical Methods	2(1+1)	1		1
9	BSAG-2309	Livestock and Poultry Management	4 (3+1)	3		1
Total			23(14+9)			

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CourseCode	Name of the Course	Teaching Scheme (Periods)				Evaluation Scheme				
						Sessional (50Marks)			ESE (50Marks)	Total
		L	T	P	Total	Theory	Assignment	Practical /Oral		
BSAG-2301	Crop Production Technology – I *(Kharif Crops)*	1	-	2	2	30	5	15	50	100
BSAG-2302	Fundamentals of Plant Breeding	2	-	2	3	30	5	15	50	100
BSAG-2303	Agricultural Finance and Cooperation	2	-	2	3	30	5	15	50	100
BSAG-2304	Agri- Informatics	1	-	2	2	30	5	15	50	100
BSAG-2305	Farm Machinery and Power	1	-	2	2	30	5	15	50	100
BSAG-2306	Production Technology for Vegetables and Spices	1	-	2	2	30	5	15	50	100
BSAG-2307	Environmental Studies and Disaster Management	2	-	2	3	30	5	15	50	100
BSAG-2308	Statistical Methods	1	-	2	2	30	5	15	50	100
BSAG-2309	Livestock and Poultry Management	3	-	2	4	30	5	15	50	100
										Total :900

* *R: Remedial course; **NC: Non-Gradial courses ESE: End Semester Examination

IV SEMESTER

S. No.	Course Code		Course Title	Credits	L	T	P
1	BSAG-2401		Crop Production Technology –II *(Rabi Crops)*	2(1+1)	1		1
2	BSAG-2402		Production Technology for Ornamental Crops, MAP and Landscaping	2(1+1)	1		1
3	BSAG-2403		Renewable Energy and Green Technology	2(1+1)	1		1
4	BSAG-2404		Problematic Soils and their Management	2(2+0)	2		0
5	BSAG-2405		Production Technology for Fruit and Plantation Crops	2(1+1)	1		1
6	BSAG-2406		Principles of Seed Technology	3(1+2)	1		2
7	BSAG-2407		Farming System & Sustainable Agriculture	1(1+0)	1		0
8	BSAG-2408		Agricultural Marketing Trade & Prices	3(2+1)	2		1
9	BSAG-2409		Introductory Agro-meteorology & Climate Change	2(1+1)	1		1
10	Elective Course	BSAG-2410	Agribusiness Management	3(2+1)	2		1
		BSAG-2411	Agrochemicals	3(2+1)	2		1
		BSAG-2412	Commercial Plant Breeding	3(1+2)	1		2
		BSAG-2413	Landscaping	3(2+1)	2		1
		BSAG-2414	Food Safety and Standards	3(2+1)	2		1
		BSAG-2415	Biopesticides & Biofertilizers	3(2+1)	2		1
		BSAG-2416	Protected Cultivation	3(2+1)	2		1
		BSAG-2417	Micro propagation Technologies	3(1+2)	1		2
		BSAG-2418	Hi-tech. Horticulture	3(2+1)	2		1
		BSAG-2419	Weed Management	3(2+1)	2		1
		BSAG-2420	System Simulation and Agro-advisory	3(2+1)	2		1
		BSAG-2421	Agricultural Journalism	3(2+1)	2		1
Total				19(11+8)+3			

CourseCode		Name of the Course	Teaching Scheme (Periods)				Evaluation Scheme				
							Sessional (50Marks)			ESE (50Marks)	Total
			L	T	P	Total	Theory	Assignment	Practical /Oral		
BSAG-2401		Crop Production Technology –II *(Rabi Crops)*	1	-	2	2	30	5	15	50	100
BSAG-2402		Production Technology for Ornamental Crops, MAP and Landscaping	1	-	2	2	30	5	15	50	100
BSAG-2403		Renewable Energy and Green Technology	1	-	2	2	30	5	15	50	100
BSAG-2404		Problematic Soils and their Management	2	-	0	2	40	10	-	50	100
BSAG-2405		Production Technology for Fruit and Plantation Crops	1	-	2	2	30	5	15	50	100
BSAG-2406		Principles of Seed Technology	1	-	4	3	30	5	15	50	100
BSAG-2407		Farming System & Sustainable Agriculture	1	-	0	1	40	10	-	50	100
BSAG-2408		Agricultural Marketing Trade & Prices	2	-	4	3	30	5	15	50	100
BSAG-2409		Introductory Agro-meteorology & Climate Change	1	-	4	2	30	5	15	50	100
Elective Course	BSAG-2410	Agribusiness Management	2	-	2	3	30	5	15	50	100
	BSAG-2411	Agrochemicals	2	-	2	3	30	5	15	50	100
	BSAG-2412	Commercial Plant Breeding	1	-	4	3	30	5	15	50	100
	BSAG-2413	Landscaping	2	-	2	3	30	5	15	50	100
	BSAG-2414	Food Safety and Standards	2	-	2	3	30	5	15	50	100
	BSAG-2415	Biopesticides & Biofertilizers	2	-	2	3	30	5	15	50	100
	BSAG-2416	Protected Cultivation	2	-	2	3	30	5	15	50	100
	BSAG-2417	Micro propagation Technologies	1	-	4	3	30	5	15	50	100
	BSAG-2418	Hi-tech. Horticulture	2	-	2	3	30	5	15	50	100
	BSAG-2419	Weed Management	2	-	2	3	30	5	15	50	100
	BSAG-2420	System Simulation and Agro-advisory	2	-	2	3	30	5	15	50	100
	BSAG-2421	Agricultural Journalism	2	-	2	3	30	5	15	50	100
											Total :1000

A student can select one elective course out of the following and offer during the 4th Semester

*** *R: Remedial course; **NC: Non-Gradial courses ESE: End Semester Examination**

V SEMESTER

S. No.	Course Code	Course Title	Credits	L	T	P
1	BSAG-3501	Principles of Integrated Pest and Disease Management	3(2+1)	2		1
2	BSAG-3502	Manures, Fertilizers and Soil Fertility Management	3 (2+1)	2		1
3	BSAG-3503	Pests of Crops and Stored Grain and their Management	3 (2+1)	2		1
4	BSAG-3504	Diseases of Field and Horticultural Crops and their Management –I	3 (2+1)	2		1
5	BSAG-3505	Crop Improvement-I *(Kharif Crops)*	2 (1+1)	1		1
6	BSAG-3506	Entrepreneurship Development and Business Communication	2 (1+1)	1		1
7	BSAG-3507	Geo-informatics, Nano-technology and Precision Farming	2 (1+1)	1		1
8	BSAG-3508	Practical Crop Production – I (*Kharif* crops)	2 (0+2)	0		2
9	BSAG-3509	Intellectual Property Rights	1(1+0)	1		0
	BSAG-3510	Agribusiness Management	3(2+1)	2		1

10		BSAG-3511	Agrochemicals	3(2+1)	2		1
		BSAG-3512	Commercial Plant Breeding	3(1+2)	1		2
		BSAG-3513	Landscaping	3(2+1)	2		1
		BSAG-3514	Food Safety and Standards	3(2+1)	2		1
		BSAG-3515	Biopesticides & Biofertilizers	3(2+1)	2		1
		BSAG-3516	Protected Cultivation	3(2+1)	2		1
		BSAG-3517	Micro propagation Technologies	3(1+2)	1		2
		BSAG-3518	Hi-tech. Horticulture	3(2+1)	2		1
		BSAG-3519	Weed Management	3(2+1)	2		1
		BSAG-3520	System Simulation and Agro-advisory	3(2+1)	2		1
		BSAG-3521	Agricultural Journalism	3(2+1)	2		1
Total				**21(12+09)+ 3**			

CourseCode		Name of the Course	Teaching Scheme (Periods)				Evaluation Scheme				
							Sessional (50Marks)			ESE (50Marks)	Total
			L	T	P	Total	Theory	Assignment	Practical /Oral		
BSAG-3501		Principles of Integrated Pest and Disease Management	2	-	2	3	30	5	15	50	100
BSAG-3502		Manures, Fertilizers and Soil Fertility Management	2	-	2	3	30	5	15	50	100
BSAG-3503		Pests of Crops and Stored Grain and their Management	2	-	2	3	30	5	15	50	100
BSAG-3504		Diseases of Field and Horticultural Crops and their Management –I	2	-	2	3	30	5	15	50	100
BSAG-3505		Crop Improvement-I *(Kharif Crops)*	1	-	2	2	30	5	15	50	100
BSAG-3506		Entrepreneurship Development and Business Communication	1	-	2	2	30	5	15	50	100
BSAG-3507		Geo-informatics, Nano-technology and Precision Farming	1	-	2	2	30	5	15	50	100
BSAG-3508		Practical Crop Production – I (*Kharif* crops)	0	-	4	2	-	-	50	50	100
BSAG-3509		Intellectual Property Rights	1	-	0	1	40	10	-	50	100
Elective Course	BSAG-3510	Agribusiness Management	2	-	2	3	30	5	15	50	100
	BSAG-3511	Agrochemicals	2	-	2	3	30	5	15	50	100
	BSAG-3512	Commercial Plant Breeding	1	-	4	3	30	5	15	50	100
	BSAG-3513	Landscaping	2	-	2	3	30	5	15	50	100
	BSAG-3514	Food Safety and Standards	2	-	2	3	30	5	15	50	100
	BSAG-3515	Biopesticides & Biofertilizers	2	-	2	3	30	5	15	50	100
	BSAG-3516	Protected Cultivation	2	-	2	3	30	5	15	50	100
	BSAG-3517	Micro propagation Technologies	1	-	4	3	30	5	15	50	100
	BSAG-3518	Hi-tech. Horticulture	2	-	2	3	30	5	15	50	100
	BSAG-3519	Weed Management	2	-	2	3	30	5	15	50	100
	BSAG-3520	System Simulation and Agro-advisory	2	-	2	3	30	5	15	50	100
	BSAG-3521	Agricultural Journalism	2	-	2	3	30	5	15	50	100
											Total :1000

- A student can select one elective course out of the following and offer during the 5th Semester

*** *R: Remedial course; **NC: Non-Gradial courses** **ESE: End Semester Examination**

VI SEMESTER

S. No.	Course Code		Course Title	Credits	L	T	P
1	BSAG-3601		Rainfed Agriculture & Watershed Management	2 (1+1)	1		1
2	BSAG-3602		Protected Cultivation and Secondary Agriculture	2 (1+1)	1		1
3	BSAG-3603		Diseases of Field and Horticultural Crops and their Management-II	3 (2+1)	2		1
4	BSAG-3604		Post-harvest Management and Value Addition of Fruits and Vegetables	2 (1+1)	1		1
5	BSAG-3605		Management of Beneficial Insects	2 (1+1)	1		1
6	BSAG-3606		Crop Improvement-II *(Rabi crops)*	2 (1+1)	1		1
7	BSAG-3607		Practical Crop Production –II (*Rabi* crops)	2 (0+2)	0		2
8	BSAG-3608		Principles of Organic Farming	2 (1+1)	1		1
9	BSAG-3609		Farm Management, Production & Resource Economics	2 (1+1)	1		1
10	BSAG-3610		Principles of Food Science and Nutrition	2(2+0)	2		0
11	Elective Course	BSAG-3611	Agribusiness Management	3(2+1)	2		1
		BSAG-3612	Agrochemicals	3(2+1)	2		1
		BSAG-3613	Commercial Plant Breeding	3(1+2)	1		2
		BSAG-3614	Landscaping	3(2+1)	2		1
		BSAG-3615	Food Safety and Standards	3(2+1)	2		1
		BSAG-3616	Biopesticides & Biofertilizers	3(2+1)	2		1
		BSAG-3617	Protected Cultivation	3(2+1)	2		1
		BSAG-3618	Micro propagation Technologies	3(1+2)	1		2
		BSAG-3619	Hi-tech. Horticulture	3(2+1)	2		1
		BSAG-3620	Weed Management	3(2+1)	2		1
		BSAG-3621	System Simulation and Agro-advisory	3(2+1)	2		1
		BSAG-3622	Agricultural Journalism	3(2+1)	2		1
Total				**21 (11+10)+3**			

CourseCode	Name of the Course	Teaching Scheme (Periods)				Evaluation Scheme				
						Sessional (50Marks)			ESE (50Marks)	Total
		L	T	P	Total	Theory	Assignment	Practical /Oral		
BSAG-3601	Rainfed Agriculture & Watershed Management	1	-	2	2	30	5	15	50	100
BSAG-3602	Protected Cultivation and Secondary Agriculture	1	-	2	2	30	5	15	50	100
BSAG-3603	Diseases of Field and Horticultural Crops and their Management-II	2	-	2	3	30	5	15	50	100
BSAG-3604	Post-harvest Management and Value Addition of Fruits and Vegetables	1	-	2	2	30	5	15	50	100
BSAG-3605	Management of Beneficial Insects	1	-	2	2	30	5	15	50	100
BSAG-3606	Crop Improvement-II *(Rabi crops)*	1	-	2	2	30	5	15	50	100
BSAG-3607	Practical Crop Production –II (*Rabi* crops)	0	-	4	2	-	-	50	50	100
BSAG-3608	Principles of Organic Farming	1	-	2	2	30	5	15	50	100
BSAG-3609	Farm Management, Production & Resource Economics	1	-	2	2	30	5	15	50	100
BSAG-3610	Principles of Food Science and Nutrition	2	-	0	2	40	10	-	50	100

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Elective Course	BSAG-3611	Agribusiness Management	2	-	2	3	30	5	15	50	100
	BSAG-3612	Agrochemicals	2	-	2	3	30	5	15	50	100
	BSAG-3613	Commercial Plant Breeding	1	-	4	3	30	5	15	50	100
	BSAG-3614	Landscaping	2	-	2	3	30	5	15	50	100
	BSAG-3615	Food Safety and Standards	2	-	2	3	30	5	15	50	100
	BSAG-3616	Biopesticides & Biofertilizers	2	-	2	3	30	5	15	50	100
	BSAG-3617	Protected Cultivation	2	-	2	3	30	5	15	50	100
	BSAG-3618	Micro propagation Technologies	1	-	4	3	30	5	15	50	100
	BSAG-3619	Hi-tech. Horticulture	2	-	2	3	30	5	15	50	100
	BSAG-3620	Weed Management	2	-	2	3	30	5	15	50	100
	BSAG-3621	System Simulation and Agro-advisory	2	-	2	3	30	5	15	50	100
	BSAG-3622	Agricultural Journalism	2	-	2	3	30	5	15	50	100
											Total :1100

- A student can select one elective course out of the following and offer during the 5th Semester

*** *R: Remedial course; **NC: Non-Gradial courses** **ESE: End Semester Examination**

VII SEMESTER

S. No.	Course Code	Course Title: Rural Agricultural Work Experience and Agro-industrial Attachment (RAWE &AIA)						
		Activities	No. of weeks	Credit Hours	Marks distribution			
					Presentation and viva	Report	Attendance	Total
1	BSAG-4701	General orientation & On campus training by different faculties	1	14				
2		Village attachment	8					
3		Unit attachment in Univ./College. KVK/ Research Station Attachment	5					
4		Plant clinic	2	02				
5		Agro-Industrial Attachment	3	04				
6		Project Report Preparation, Presentation and Evaluation	1					
Total			**20**	**20**	**60**	**30**	**10**	**100**

- **Agro- Industrial Attachment:** The students would be attached with the agro-industries for a period of 3 weeks to get an experience of the industrial environment and working.

- Educational tour will be conducted in break between IV & V Semester or VI & VII Semester

RAWE Component-I

Village Attachment Training Programme

Sl. No.	Activity	Duration
1	Orientation and Survey of Village	1 week
2	Agronomical Interventions	1 week
3	Plant Protection Interventions	1 week
4	Soil Improvement Interventions (Soil sampling and testing)	1 week
5	Fruit and Vegetable production interventions	1 week
6	Food Processing and Storage interventions	1 week
7	Animal Production Interventions	1 week
8	Extension and Transfer of Technology activities	1 week

RAWE Component –II

Agro Industrial Attachment

- Students shall be placed in Agro-and Cottage industries and Commodities Boards for 03 weeks.
- Industries include Seed/Sapling production, Pesticides-insecticides, Post harvest-processing- value addition, Agri-finance institutions, etc.

Activities and Tasks during Agro-Industrial Attachment Programme

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

VIII SEMESTER

Experiential Learning Programme/ Hands-on Training (HOT)

Modules for Skill Development and Entrepreneurship: A student has to register 20 credits opting for two modules of (0+10) credits each (total 20 credits) from the package of modules in the **VIII semester.**

Sl. No.	Course Code	Title of the module	Credits
1	BSAG-4801	Production Technology for Bio agents and Bio fertilizer	0+10
2	BSAG-4802	Seed Production and Technology	0+10
3	BSAG-4803	Mushroom Cultivation Technology	0+10
4	BSAG-4804	Soil, Plant, Water and Seed Testing	0+10
5	BSAG-4805	Commercial Beekeeping	0+10
6	BSAG-4806	Poultry Production Technology	0+10
7	BSAG-4807	Commercial Horticulture	0+10
8	BSAG-4808	Floriculture and Landscaping	0+10
9	BSAG-4809	Food Processing	0+10
10	BSAG-4810	Agriculture Waste Management	0+10
11	BSAG-4811	Organic Production Technology	0+10
12	BSAG-4812	Commercial Sericulture	0+10

NOTE: In addition to above ELP modules other important modules may be given to the students by K.K.U

Evaluation of Experiential Learning Programme/ HOT

S.No.	Parameters	Max. Marks
1.	Project Planning and Writing	10
2.	Presentation	10
3.	Regularity	10
4.	Monthly Assessment	10
5.	Output delivery	10
6.	Technical Skill Development	10
7.	Entrepreneurship Skills	10
8.	Business networking skills	10
9.	Report Writing Skills	10
10.	Final Presentation	10
	Total	**100**

Discipline-wise summary of credit hours

S.No.	Group	Credits
1	Agronomy	21(10+11)
2	Genetics & Plant Breeding	13(7+6)
3	Soil Science & Agricultural Chemistry	8(6+2)
4	Entomology	9(6+3)
5	Agricultural Economics	10(7+3)
6	Agricultural Engineering	8(4+4)
7	Plant Pathology	13(9+4)
8	Horticulture	10(5+5)
9	Food Science	2(2+0)
10	Agricultural Extension	9(6+3)
11	Biochemistry / Physiology / Microbiology/ Environmental Sciences	12(7+5)
12	Statistics, Computer Application and I.P.R.	5(3+2)
13	Animal Production	4(3+1)
14	English	2 (1+1)
15	Remedial Courses	03 (Bio/ Math); 01 (Agriculture)
16	NSS/NCC/Physical Education & Yoga Practices	2(0+2)
17	Human Values and Ethics	1(1+0)
18	Educational Tour	2(0+2)
Total		126 + 3 (for Bio / Math)/ 01(Agri) + 5 NC 126+3+1+5+ 9 credits elective
RAWE/ELP		**20 +20**
Grand Total		144+20+20=184
New Courses		**24+4 (remedial)+ 1 (NC)**

SEMESTER WISE CURRICULUM

SEMESTER-I

S. No.	Course Code	Course Title	Credits
1	BSAG-1101	Fundamentals of Horticulture	2 (1+1)
2	BSAG-1102	Fundamentals of Plant Biochemistry and Biotechnology	3(2+1)
3	BSAG-1103	Fundamentals of Soil Science	3(2+1)
4	BSAG-1104	Introduction to Forestry	2 (1+1)
5	BSAG-1105	Comprehension & Communication Skills in English	2 (1+1)
6	BSAG-1106	Fundamentals of Agronomy	4(3+1)
7	BSAG-1107	Introductory Biology*	2 (1+1) *
8	BSAG-1108	Elementary Mathematics*	2(2+0)*
9	BSAG-1109	Agricultural Heritage*	1(1+0)*
10	BSAG-1110	Rural Sociology & Educational Psychology	2 (2+0)
11	BSAG-1111	Human Values & Ethics (non gradial)	1(1+0)**
12	BSAG-1112	NSS/NCC/Physical Education & Yoga Practices**	2 (0+2)**
TOTAL ***R: Remedial course; **NC: Non-gradial courses**			**18+03*+03****

BSAG-1101: FUNDAMENTALS OF HORTICULTURE

Course Code	Course Title	Credits	L	T	P
BSAG-1101	**Fundamentals of Horticulture**	**2 (1+1)**	**1**	**-**	**1**

Learning objectives

- To impart knowledge on fundamentals of horticulture
- To learn about the importance, branches, layout of an orchard, special horticulture techniques for horticultural crops.
- To learn about the sexual and asexual Propagation techniques.
- Learn about the different tools and their use in propagation of horticultural crops andidentification of horticultural crops.

Theory

Unit I:

Basic concepts of Horticulture: Horticulture - Its definition and branches, importanceand scope. Horticultural and botanical classification. Climate and soil for horticultural crops. Horticulture zones of India and Bihar.

Unit II:

Propagation Methods and Structures: Plant propagation-methods and propagating structures. Seed dormancy, Seed germination, principles of orchard establishment.

Unit III:

Training and Pruning: Principles and methods of training and pruning, juvenility and flower bud differentiation, unfruitfulness.

Unit IV:

Pollination: Pollination, Pollinizers and Pollinators. Fertilization and Parthenocarpy.

Unit V:

Growth regulators: Importance of plant bio-regulators in horticulture. Irrigation – methods, Fertilizer application in horticultural crops.

Practical

Identification of garden tools, Identification of horticultural crops, Preparation of seed bed/ nursery bed. Practice of sexual and asexual methods of propagation including micro-propagation. Layout and planting of orchard, Training and pruning of fruit trees, Preparation of potting mixture, Fertilizer application in different crops, Visits to commercial nurseries/orchard

COURSE OUTCOMES (COs)

CO-1: The student will gain knowledge on branches of horticulture and the climaticrequirements of horticulture Crops

CO-2: The student will acquire skill on different propagation methods of horticulture crops

CO-3: The student will acquire knowledge on establishment and management of orchardcrops

CO-4: The students will gain skills on training, pruning and crop regulations of horticulturecrops

CO-5: The students will acquire knowledge on bearing habits and factors influencing onfruitfulness

CO-PO Mapping matrix

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6
CO 1	3	1	0	1	2	0
CO 2	3	2	0	0	1	0
CO 3	2	1	0	3	1	0
CO 4	2	2	1	2	1	0
CO 5	3	2	0	2	2	0

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1. Adams C.R., K.H.Bradford, M.P. Early. 1996. Principles of Horticulture. CBS Publishersand Distributors, New Delhi.
2. Christopher, E.P. 2001. Introductory Horticulture. Biotech Books, New Delhi.
3. Edmond J.B., A.M. Musser and F.S. Andrews. 1975. Fundamentals of Horticulture. TataMcGraw Hill Publishing Co., New Delhi.
4. Hartman. H.T. and D.E. Kester. 1976. Plant Propagation – Principles and

Practices.Prentice Hall of India Ltd., New Delhi.

5. Janic, J.W.H., 1988. Horticultural Science. Freeman and Co., San Francisco.

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1. http://aggie-horticulture,tamu.edu/propagation/propagation.html
2. http://www/britannica.com/
3. http://www.horticulture.com.au/export/hmac.asp
4. http://www.horticultureworld.net/hort-india.htm
5. http://www.fao.org/

BSAG-1102: FUNDAMENTALS OF PLANT BIOCHEMISTRY AND BIOTECHNOLOGY

Course Code	Course Title	Credits	L	T	P
BSAG-1102	Fundamentals of Plant Biochemistry and Biotechnology	3(2+1)	2	-	1

Learning objectives

- To understand the concepts of biochemistry and biotechnology
- To understand the biochemical reactions occurring in living cells
- To differentiate between qualitative identification and quantitative estimations
- To understand the separation of biomolecules using various biochemical techniques
- To understand the basic techniques of biotechnology

Theory

Unit I: Importance of Biochemistry, Carbohydrates, lipids and proteins

Importance of Biochemistry, Properties of Water, pH and Buffer Buffer – Phosphate and carbonate-bicarbonate buffer, Carbohydrate: Importance and classification. Structures of Monosaccharides, Structure of Disaccharides and Polysaccharides, Lipid: classification, Proteins: – amino acids – classification essential and non-essential amino acids, classification based on their hydrophobicity of R (side chain) groups.

Unit II: Nucleic acids

Nucleic acids – structure of nitrogen bases – nucleosides and nucleotides – Adenosine triphosphate (ATP),Guanosine triphosphate (GTP), Cytidine triphosphate (CTP), Thymidine triphosphate (TTP) and Uridine triphosphate (UTP), Types of DNA -A, B & Z DNA. Types of RNA

Unit III: Enzymes and metabolism

Enzymes: General properties; Classification; Mechanism of action; Michaelis & Menten and Line Weaver Burk equation & plots; Introduction to allosteric enzymes. Glycolysis and Tricarboxylic Acid (TCA) cycle- metabolic energy generation in the above cycles. Oxidative phosphorylation and substrate level phosphorylation – electron transport chain in

mitochondria

Unit IV: Plant Biotechnology-I

Concepts and applications of plant biotechnology: Organ culture, embryo culture, cell suspension culture, callus culture, anther culture and pollen culture and their applications, Micro-propagation methods; organogenesis and embryogenesis, Synthetic seeds and their significance, cryo-preservation.

Unit V: Plant Biotechnology-II

Introduction to recombinant DNA methods: physical (Gene gun method), chemical (PEG mediated) and *Agrobacterium* mediated gene transfer methods, Transgenics and its importance in crop improvement; PCR techniques and its applications; RFLP, RAPD, SSR; Marker Assisted Breeding in crop improvement; Biotechnology regulations.

Practical

Preparation of solution, pH & buffers, Qualitative tests of carbohydrates and amino acids. Quantitative estimation of glucose/ proteins. Titration methods for estimation of amino acids/lipids, Effect of pH, temperature and substrate concentration on enzyme action, Paper chromatography/ TLC demonstration for separation of amino acids/ Monosaccharides. Sterilization techniques. Composition of various tissue culture media and preparation of stock solutions for MS nutrient medium. Callus induction from various explants. Micro-propagation, hardening and acclimatization. Demonstration on isolation of DNA. Demonstration of gel electrophoresis techniques and DNA finger printing.

COURSE OUTCOMES (COs)

CO-1: Understanding the structure, functions and chemical nature of living systems

CO-2: Understanding the application of the modern approaches of biotechnology in micro-propagation and crop improvement

CO-3: Analyzing the qualitative and quantitative properties of various biomolecules.

CO-4: Understand the basic techniques of biotechnology.

CO-5: the separation of biomolecules using various biochemical techniques.

CO-PO Mapping matrix

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6
CO 1	3	1	0	1	2	0
CO 2	3	2	0	0	1	0
CO 3	2	1	0	3	1	0
CO 4	2	2	1	2	1	0
CO 5	3	2	0	2	2	0

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1. Buchanan, B.B., Gruissem, W. and Jones, R.L. 2002.Biochemistry and Molecular Biology of Plants. John Wiley and Sons, UK.
2. Conn, E.E., Stumpf, P.K., Bruening, G. and Doi, R.H. 1995. Outlines of Biochemistry. John Wiley and Sons Inc., Singapore.
3. Lehninger, A.L., Nelson, D.A. and Cox,M.M.2005.PrinciplesofBiochemistry. CBS Publishers and Distributors, New Delhi.
4. H.S.Chawla (2003), Introduction to plant biotechnology Oxford & IBH Publishing Co. NewDelhi
5. B.D. Singh, (2006), Plant Biotechnology. Kalyani Publishers.
6. K.S. Bilgrami and A.K. Pandey (1992) Introduction to Biotechnology CBS Pub. New Delhi
7. P.K. Gupta (1994) Elements of Biotechnology Rastogi and Co., Educational Publishers,
8. Meerut Stryer, L. 2005. Biochemistry. W.H. Freeman and Company, New York.

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1. https://www.agrimly.in/2020/08/fundamentals-of-plant-biochemistry-and.html
2. https://www.ncbi.nlm.nih.gov/books/NBK115568/

BSAG-1103: FUNDAMENTALS OF SOIL SCIENCE

Course Code	Course Title	Credits	L	T	P
BSAG-1103	Fundamentals of Soil Science	3(2+1)	2	-	1

Learning objectives

- To demonstrate basic knowledge of terms and concepts in soil science, apply this knowledge to new problems and situations.
- To learn the key physical, chemical, and biological aspects of soils and form a basic understanding of formative processes for different soil types and recognition of soil as a natural body.
- To learn the significance of soil microorganisms on its role in organic matter decomposition and nutrient transformation in soil
- To gain knowledge on sources of pollutants and its impact on soil pollution
- To learn the concept of soil organic matter and its role in crop growth and soil fertility

Theory

Unit I: Earth origin and rocks

Origin of earth – theories – planetesimal and nebular hypothesis – Composition of Earth's crust. Soil forming rocks and minerals – origin – classification. Weathering of rocks and minerals – physical, chemical and biological weathering.

Unit II: Soil formation and Soil taxonomy

Soil formation – soil forming factors – active and passive. Soil forming processes – fundamental and specific soil forming processes. Soil profile – master horizons, subordinate horizons – Definition of soil – Soil composition Pedalogical and Edaphological concepts. Elementary knowledge of soil taxonomy and classification-Soils of India and Bihar.

Unit III –Soil physical properties I

Soil physical properties and their significance – Soil texture – classification of soil separates, properties of soil separates, Particle size analysis textural classes. Soil structure – classification, soil aggregates, evaluation of soil structure, significance. Pore space types, factors affecting porosity, manipulation. Bulk density and particle density – relationships, factors, significance and manipulation. Soil colour – factors, attributes and significance. Soil consistency – forms, factors, limits and significance.

Unit IV Soil physical properties –II

Soil water classification, potentials, Soil moisture constants, movement of soil water – saturated and unsaturated flow – Infiltration, hydraulic conductivity, percolation, permeability. Soil air – composition, gaseous exchange, influence of soil air on plant growth. Soil temperature – thermal properties of soils, flow of heat, soil temperature regimes, influence of soil temperature on plant growth.

Unit V Soil colloids and Soil pollution

Soil Chemical properties – Soil colloids – Properties, types and significance – Layer silicate clays – their genesis and sources of charges – Ion exchange – CEC, AEC and Base saturation – Factors influencing Ion exchange – significance. Soil reaction, Buffering capacity and EC. Soil organic matter – sources – chemical composition – decomposition – humus formation – role and functions of organic matter in soil. Soil organisms – Beneficial and harmful effects. Soil pollution - behavior of pesticides and inorganic contaminants, prevention and mitigation of soil pollution. Current stream of thoughts

Practical

Study of soil profile in field. Study of soil sampling tools, collection of representative soil sample, its processing and storage. Study of soil forming rocks and minerals. Determination of soil density, moisture content and porosity. Determination of soil texture by feel and Bouyoucos Methods. Studies of capillary rise phenomenon of water in soil column and water movement in soil. Determination of soil pH and electrical conductivity. Determination of cation exchange capacity of soil. Study of soil map. Determination of soil colour. Demonstration of heat transfer in soil. Estimation of organic matter content of soil.

COURSE OUTCOMES (COS) (COs)

CO 1: Students gain the knowledge origin of earth, weathering of rocks and minerals

CO 2: Students learn to explain soil formation and different soil forming processes.

CO 3: Students develop individual skills and ability to analysis the soil for Physical andChemical properties.

CO 4: Students learn to understand the role of microorganisms in promoting better soil health.

CO 5: Students gain knowledge on impact of various pollutants causing soil pollution

CO-PO Mapping matrix

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	1	2	-	-	1	-
CO2	-	2	-	-	1	-
CO3	2	3	3	1	1	1
CO4	1	1	-	2	2	-
CO5	-	2	-	-	2	-

References

1. Biswas, T.D. Mukherjee, S. K. 1995. Text Book of Soil Science 2nd Ed. Tata McGraw Hill,New Delhi
2. Brady, N. C. 2016. The Nature and Properties of Soils. 15th edition Publisher: PearsonEducation, New Delhi
3. Das, D.K. 2015. Introductory Soil Science, 4th edition, Kalyani Publishers, New Delhi.
4. Indian Society of Soil Science. 2012. Fundamentals of Soil Science, IARI, New Delhi.
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BSAG-1104: INTRODUCTION TO FORESTRY

Course Code	Course Title	Credits	L	T	P

BSAG-1104	**Introduction to Forestry**	**2 (1+1)**	**1**	**-**	**1**

Learning objectives

- To acquire knowledge on the basic aspect of Forestry.
- To conceptualize the importance of forests and Agro forestry system.
- To impart knowledge on Agroforestry systems as an essential eco-friendly mechanism inproductivity of agro-ecosystems.
- To learn about artificial regeneration and manmade forestry
- To learn about techniques of tree planting and its management.

Theory

Unit I: Forest and its importance

Forest- definitions of basic terms. Role and functions of forests. Forest classification- Social forestry, farm forestry, agro forestry, community forestry, industrial forestry and urban forestry, forest Influences. Scope of forestry- types of forest in World, India and Bihar. Salient features of national forest policies.

Unit II: Forest regeneration

Forest regeneration- objectives- natural regeneration from seed and vegetative parts, coppicing, pollarding, root suckers. Artificial regeneration-Man made plantations. Factors determining regeneration. Nursery technique. Forest plantation. Tending operations – weeding, cleaning, thinning – mechanical, ordinary, crown and advance thinning.

Unit III: Forest mensuration

Forest mensuration- objectives, diameter measurement, instruments used in diameter measurement. Non instrumental methods of height measurement - shadow and single pole method. Instrumental methods of height measurement - geometric and trigonometric principles. Instruments used in height measurement. Measurement of tree diameter, tree height, age and growth rate and tree stand.

Unit IV: Agroforestry

Agroforestry- concept, definitions, importance, benefits, limitations. Criteria of selection of trees in Agroforestry. Classification of different agro forestry systems prevalent in the country-Shifting cultivation, taungya, alley cropping, wind breaks, shelter belts and home gardens. Criteria for selection of AF Trees.

Unit V: Silviculture

Silviculture- definition, objectives. Plant classification – Crown, stem, roots locality, Plantsuccession- Cultivation practices for importance trees. Silviculture practices for important fast growing tree species of the region. TBO's, MPTS and NFTS- Ailanthus, Neem, Pungam, Prosopis, Casuarina, Silk cotton, Bamboo and Acacias and Current stream of thoughts.

Practical

Identification of tree-species. Diameter measurements using calipers and tape, diameter measurements of forked, buttressed, fluted and leaning trees. Height measurement of standing trees by shadow method, single pole method and hypsometer. Volume measurement of logs using various formulae. Nursery lay out, seed sowing, vegetative propagation techniques. Forest plantations and their management. Visits of nearby forest based industries.

COURSE OUTCOMES(COs)

CO 1: Students can learn about the basic aspects of Forestry.

CO 2: Students can understand the importance of forests and Agro forestry system.

CO 3: Students acquire knowledge about the minor forest products.

CO 4: Students can learn about the aging of tree species.

CO 5: Students learn about techniques of tree planting and its management.

CO-PO Mapping matrix

CO/PO	PO 1	PO2	PO3	PO4	PO5	PO6
CO1	3	2	-	3	2	1
CO2	2	2	3	-	3	-
CO3	2	3	3	-	2	2
CO4	2	1	3	-	1	2
CO5	3	3	2	3	2	2

References

1. Chauhan SK .2020. Agroforestry , Agrotech Publishing Academy, Udaipur .
2. Indian Society of Agronomy. 1989. Agroforestry System in India. Research and Development, New Delhi. Rex Immanuel R, M. Thiruppathi and A. Balasubramanian. 2018.
3. Social Forestry and Agroforestry: Past Triumphs and Future Horizons. Empyreal Publishing House, Guwahati, Assam.
4. Singh, SP. 2021. Handbook of Agroforestry 3rd ed, Agrotech Publishing Academy, Udaipur .
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BSAG-1105: COMPREHENSION & COMMUNICATION SKILLS IN ENGLISH

Course Code	Course Title	Credits	L	T	P
BSAG-1105	Comprehension & Communication Skills in English	2 (1+1)	1		1

Learning Objectives

- To improve the knowledge level of the students on various communication skills
- To improve listening skills and develop presentation skills
- To gain knowledge on personality development and team building
- To enhance skill on various group techniques
- To facilitate the student on effective management of time and stress.

Theory

Unit I: Comprehension

Reading Comprehension –Synonyms—Antonyms--Verbal Ability, A list of Words often confused and misused

Unit II: Vocabulary

Vocabulary --Homonyms --Homophones

Unit III: Grammar

Functional Grammar--Tenses --Active voice and Passive voice--Degrees of Comparison -- Types of Sentences--Direct and Indirect Speech --Agreement of Verb with Subject—Articles—Prepositions--Parts of Speech

Unit IV: Composition

Business Correspondence--Principles of Letter Writing--Structure and Layout of Letters -- Quotations and Orders --Tenders--Job Application Letters --Social Correspondence—CV-- Professional Writing--Precis Writing

Unit V: Interview

The Screening Interview--The informational Interview --The Stress Interview—The Behavioural Interview--The Audition --Body Language and Interview.

Practical

Listening Comprehension: Listening to short talks lectures, speeches (scientific, commercial and general in nature). Oral Communication: Phonetics, stress and

intonation, Conversation practice. Conversation: rate of speech, clarity of voice, speaking and Listening, politeness &Reading skills: reading dialogues, rapid reading, intensive reading, improving reading skills. Mock Interviews: testing initiative, team spirit, leadership, intellectual ability. Group Discussions.

COURSE OUTCOMES (COs)

At the end of the course students will be able to

CO 1: Organize and conduct of various group techniques

CO 2: Students will be able to acquire various personality traits

CO 3: Develop hard and soft skills

CO 4: Gain knowledge on conflict management

CO 5: Acquire skill on public speaking

CO-PO Mapping matrix

CO/PO	PO 1	PO2	PO3	PO4	PO5	PO6
CO1	1	0	3	0	0	3
CO2	0	1	3	1	1	3
CO3	1	1	3	1	0	3
CO4	0	0	3	0	1	3
CO 5	1	1	3	0	0	3

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2. Ray G L, 1991. Extension Communication and Management, Naya Prakasham, Kolkata.
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BSAG-1106: FUNDAMENTALS OF AGRONOMY

Course Code	Course Title	Credits	L	T	P

BSAG-1106	**Fundamentals of Agronomy**	**4(3+1)**	**3**		**1**

Learning objectives

- To know about the basic principles and practices of crop production
- To gain knowledge on various agricultural development from ancient to modern age
- To understand about various factors affecting crop production
- To acquire knowledge on basic agricultural operations viz., seeds and sowing, aftercultivation practices, irrigation and nutrient management
- To obtain awareness on harvesting, cleaning and storage of agricultural products.

Theory

Unit I: Introduction to agriculture and Agronomy

Agriculture- definition, importance and scope-Branches of Agriculture-National and International Agricultural Institutes -Evolution of man and Agriculture. History of Agricultural development in the World, India and Bihar. Agronomy- definition, importance, meaning and scope.

Unit II: Crop distribution and production

Crop adaptation and distribution of crops – classification of crops - economic and agronomic. Major crops of India and Bihar. Major soils of Bihar. Factors affecting crop production; climatic, edaphic, biotic, physiographic and socio economic.

Unit III: Concepts of agricultural operations, planting methods and geometry

Tillage- definition, types, objectives, modern concepts of tillage. Nursery and main field preparation. Seeds-seed rate, sowing methods, crop establishment methods. Planting geometry and its effect on growth and yield. After cultivation, thinning, gap filling.

Unit IV: Weed and irrigation management

Weed-classification of weeds. Weed control methods, integrated weed management. Irrigation source-irrigation methods- macro and micro irrigation. Drainage and its importance inagriculture.

Unit V: Nutrient management and farming systems

Manures and fertilizers (organic, in-organic, green manure) time and method of application- Nutrient Use Efficiency (NUE) – Agronomic interventions for enhancing NUE. Cropping patterns and cropping systems- Sustainable Agriculture. Integrated Farming System. Organic Agriculture-principles and concepts. Dry farming- principles and concepts. Harvesting and Post-Harvest Technology. Current stream of thoughts.

Practical

Identification of crops, seeds, fertilizers, pesticides and tillage implements, study of

agro- climatic zones of India, Identification of weeds in crops, Methods of herbicide and fertilizer application, Study of yield contributing characters and yield estimation, Seed germination and viability test, Numerical exercises on fertilizer requirement, plant population, herbicides and water requirement, Use of tillage implements-reversible plough, one way plough, harrow, leveler, seed drill, Study of soil moisture measuring devices, Measurement of field capacity, bulk density and infiltration rate, Measurement of irrigation water.

COURSE OUTCOMES(COs)

CO 1: To understand the basic principles and practices of crop production

CO 2: To gain knowledge on various agricultural developments from ancient to modern age

CO 3: To critically assess the inter relationship between crop production and different factors affecting the production of crops

CO 4: To construct skills on basic agricultural operations viz., seeds and sowing, after cultivation practices, irrigation and nutrient management

CO 5: To understand about harvesting, cleaning and storage of agricultural products.

CO-PO Mapping matrix

	PO 1	PO2	PO3	PO4	PO5	PO6
CO1	**3**	**-**	**2**	**-**	**1**	**-**
CO2	**3**	**-**	**2**	**-**	**-**	**-**
CO3	**3**	**2**	**1**	**1**	**2**	**-**
CO4	**3**	**1**	**-**	**-**	**-**	**-**
CO5	**1**	**-**	**-**	**-**	**2**	**-**

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2. Chandrasekharan, B., K. Annadurai and E. Somasundaram, 2014, Text Book ofAgronomy, Newage international (P) Limited Publishers, New Delhi.
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BSAG-1107: INTRODUCTORY BIOLOGY

Course Code	Course Title	Credits	L	T	P
BSAG-1107	Introductory Biology*	2 (1+1) *	1		1

Learning objectives

- To induce the basics botany among the beginners of Agricultural Programme
- To impart students on classification, Morphology of flowering plants and characteristic features
- Students will gain knowledge on basic botany and its role in agriculture

Theory

Unit I: Systems of classification and general morphological description

Introduction to the living world, diversity and Characteristics of life, Origin of life, Evolution and Eugenics. Bentham and Hooker's classification of plant kingdom - Nomenclature and it guidelines - Agricultural classification of crops; General morphology: Life span, habit, root, stem, leaf - petiole, leaf margin, leaf apex, leaf shape, venation and phyllotaxy; Modification of roots and leaf; Floral morphology: Kinds of bracts, inflorescence; Structure of flower, androecium, gynoecium, placentation, types of fruits.

Unit II: Botanical description and economic uses of Poaceae

List of cultivated crops, economic parts, chromosome number and family description ofPoaceae: Key botanical features of Rice, Wheat, sorghum, Maize, Pearl millet, Finger millet, list of small millets, Guinea grass, Napier grass, Cenchrus and Sugarcane.

Unit III: Botanical description and economic uses of Papilionaceae

List of cultivated crops, economic parts, chromosome number and family description of Papilionaceae: Key botanical features of Red gram, Bengal gram, Soybean, Black gram, Green gram, Cowpea, Lablab, Horse gram, Groundnut, Lucerne, *Stylosanthes*, Clitoria, Agathiand Sunhemp.

Unit IV: Botanical description and economic uses of Pedaliaceae, Brassicaceae

and Malvaceae

List of cultivated crops, economic parts, chromosome number and family description of the following families and Key botanical features of the crops given against them: Brassicaceae - Rapeseed, Mustard and Cabbage, Cauliflower; Malvaceae: Cotton, Mesta and Bhendi.

Unit V: Botanical description and economic uses of following Horticultural crops

List of cultivated crops, economic parts, chromosome number and key botanical features of the crops and family description of the following families, Tiliaceae, Piperaceae, Chenopodiaceae, Solanaceae, Mimosae, Moraceae, Cucurbitaceae, Alliaceae, Musaceae,Rubiaceae, Theaceae, Medicinal Plants them.

Practical

Morphology of flowering plants – root, stem and leaf and their modifications. Inflorence, flower and fruits. Cell, tissues & cell division. Internal structure of root, stem and leaf. Study of specimens and slides. Description of plants - Brassicaceae, Fabaceae and Poaceae.

COURSE OUTCOMES (COs)

CO 1: Understanding the diversity and morphology of living world.
CO 2: Explaining different levels of biological organizations
CO 3: Identifying the specifications of important families of angiosperms
CO 4: Evaluating the germination capacities of seeds of important crops

CO-PO Mapping matrix

CO/PO	PO 1	PO2	PO3	PO4	PO5	PO6
CO1	3	-	2	-	1	-
CO2	3	-	2	-	-	-
CO3	3	2	1	1	2	-
CO4	3	1	-	-	-	-

References

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2. Principles of Genetics-Phundan Singh, Kalyani Publishers
3. Klug. W.S. and Cummings, M.R. 1983. Concepts of Genetics. Charles E. Merill Publishing Co., London.

BSAG-1108: ELEMENTARY MATHEMATICS

Course Code	Course Title	Credits	L	T	P
BSAG-1108	Elementary Mathematics*	2(2+0)*	2	-	0

Learning Objectives

- To impart knowledge to the students on elementary mathematics topics required and useful inthe study of agricultural courses. By the end of the course, the students will be able to
- Understand concepts of geometry of straight lines, circles.
- Understand concepts on calculus and matrices and their applications.

Theory

Unit I: Straight Lines

Distance formula, section formula – Equation of co- ordinate axes, Equation of lines parallel to axes - Problems on distance between the lines, Change of axes - Slope-intercept form of equation of line, Slope-point form of equation of line, Two point form of equation of line - Intercept form of equation of line, Normal form of equation of line, General form of equation of line, Point of intersection of two st. lines- Angles between two st. lines, Parallel lines, Perpendicular lines. **Circles** - Introduction to Circle, Equation of circle with centre and radius, General equation of a circle, Equation of circle passing through three given points and tangent of the circle - Simple problems.

Unit II: Differential Calculus

Definition of function, limit and continuity **-** Differentiation of x^n , e^x , sin x & cos x from first principle - Derivatives of sum, difference, product and quotient of two functions, Differentiation of functions of functions - Logarithmic differentiation (Simple problem based on it), Differentiation by substitution method - Differentiation of Inverse Trigonometric functions .

Unit III: Partial Differentiation

Partial differentiation, homogeneous functions -Examples and problems on partialdifferentiation- Euler's theorem and its application.

Unit IV: Integral Calculus

Integration of simple functions - Integration of Product of two functions, Integration bysubstitution method - Simple problems.

Unit V: Matrices and Determinants

Definition of Matrices, Addition, Subtraction and Determinants of Matrices - Multiplication, Transpose of matrices - Properties of determinants up to 3rd order and their Evaluation - Simple problems.

COURSE OUTCOMES (COs)

CO 1: Understanding the basic concepts of mathematics applied in agriculture
CO 2: Applying the mathematical equations in various fields of agriculture science
CO 3: Understand concepts of geometry of straight lines, circles.
CO 4: Understand concepts on calculus and matrices and their applications
CO 5: Understanding students on elementary mathematics formulas required and useful inthe study of agricultural courses.

CO-PO Mapping matrix

CO/PO	PO 1	PO2	PO3	PO4	PO5	PO6
CO1	3	2	1	1	2	-
CO2	3	1	-	-	-	-
CO3	3	2	1	1	2	-
CO4	3	1	-	-	-	-
CO5	1	-	-	-	2	-

Reference books:

1. Mathematics, class XII Vol-I and Vol-II, R.D. Sharma, Dhanpat Rai Publications.
2. Linear Algebra A Geometric Approach, S. Kumaresan, Prentice Hall India Learning Private Limited.
3. Elementary Mathematics, G. Dorofeev, M.Potapov, N. Rozov, CBS Publisher.

BSAG-1109: AGRICULTURAL HERITAGE*

Course Code	Course Title	Credits	L	T	P
BSAG-1109	Agricultural Heritage*	1(1+0)*	1	-	0

Learning objectives

To enable the student to

- Understand the importance of Agricultural heritage.
- Know about the value of Indigenous knowledge in agriculture.
- Familiarize the students about current scenario of Indian Agriculture.
- The students have gained the basic knowledge about agricultural history of India.
- They have been familiarized with the indigenous knowledge and present scenario of Indianagriculture.

Theory

Unit I:

Agricultural heritage - Introduction, definition of agricultural heritage- Need and importance of Agricultural heritage- Historical facts- Relevance of heritage to present day Agriculture

Unit II:

Development of human culture – stone age, bronze age and iron age periods; Ancientagricultural practices - Indus civilization, Vedic civilization- Agriculture and Kaudilya's Artha sasthra- Agriculture in Sangam literature, Agriculture in Bihar dynasties Chera, Chola, Pandyaans Pallavas

Unit III:

Journey of Indian agriculture and its development from past to modern era- Development of agriculture in World and India- Green revolution in India - Role of International/NationalInstitutions for Agricultural research

Unit IV:

Indigenous Traditional Knowledge (ITK): Plant production and Plant protection through Indigenous traditional knowledge- Crop voyage in India - Branches of Agriculture- Agricultural resources available in India.

Unit V:

Classifications of crops- Major crops of India and Bihar- National Agriculture setup in India- Current scenario of Indian agriculture- Indian Agricultural concerns and future prospects

COURSE OUTCOMES (COs)

CO 1: Understanding the basic concepts and importance of Agricultural heritage

CO 2: Understanding current scenario of Indian Agriculture and various fields of agriculture science

CO 3: Understanding the value of Indigenous knowledge in agriculture.

CO 4: Understand basic knowledge about agricultural history of India

CO 5: Understanding the indigenous knowledge and present scenario of Indian agriculture.

CO-PO Mapping matrix

CO/PO	PO 1	PO2	PO3	PO4	PO5	PO6
CO1	3	2	1	1	2	-
CO2	3	1	-	-	-	-
CO3	3	2	1	1	2	-
CO4	3	1	-	-	-	-
CO5	1	-	-	-	2	-

References

1. A text book on Agricultural heritage of India by D. Kumari M. Veeral

2. Ancient Indian heritage by Varahamihira'S 2nd volume.
3. History of Agriculture in India up to C 1200 a.d
4. Principles of Agronomy and Agricultural Heritage by ICAR
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BSAG-1110: RURAL SOCIOLOGY & EDUCATIONAL PSYCHOLOGY

Course Code	Course Title	Credits	L	T	P
BSAG-1110	Rural Sociology & Educational Psychology	2 (2+0)	2	-	0

Learning Objectives

- To acquire knowledge on basic concepts of rural sociology and educational Psychology
- To understand the social structure and social stratification and social groups: their typesand characteristics
- To gain knowledge on the concepts of migration and its impact on society
- To understand the concepts of social control and social change
- To gain knowledge on teaching–learning process and basic principles of human behavior and personality

Theory

Unit I: Introduction to Sociology, Social groups, Culture and Social Values

Sociology and rural sociology – definitions; society – rural and urban, characteristics, differences and relationships, important characteristics of Indian rural society; social groups – definition, classification, role of social groups in extension; culture – concept, cultural traits, characteristics, functions; ethnocentrism, acculturation, cultural lag, cultural diffusion, marginalman, ethos; social values – definition, values and norms, characteristics of values and its functions

Unit II: Social Structure, Social Stratification and Migration

Structure of rural society – patterns of rural settlement, social institutions, social organizations,ecological entities (region, community, neighbourhood, family); social stratification – concept, functions, types, differences between class and caste system; migration – concept, factors influencing migration.

Unit III: Social Control, Social Customs

Social control – definition; customs – conventions, folkways, mores, rituals, taboos; social interaction process – definition, basic social processes; social change – concept, factors influencing social change, indicators of social change; leader and leadership, definitions,types, functions, characteristics of a good leader, methods of selecting leaders

Unit IV: Introduction to Educational Psychology, Intelligence, Teaching-LearningProcess

Education – psychology – educational psychology – social psychology – definitions, importance in extension; basic principles of human behaviour – sensation, attention, perception – meaning, characteristics; cognitive, affective, psychomotor domains; intelligence – concept, types, measurement, factors affecting intelligence; personality – concept, types, measurement, factors influencing personality; teaching–learning process – teaching – definition, meaning, principles of teaching, steps in extension teaching; learning – definition, meaning, principles, types of learning, learning situation.

Unit V: Motivation, Attitude

Motivation – concept, Maslow's hierarchy of needs, intrinsic and extrinsic motivation, techniques of motivation, importance in extension; attitude – concept, factors influencing the development of attitudes and current stream of thoughts.

COURSE OUTCOMES (COs)

At the end of the course students will be able to

CO 1: Understand basics concepts related to rural sociology and educational psychology.

CO 2: Gain expertise on practical applications of sociological and psychological concepts.

CO 3: Gain expertise on application of various psychological tests.

CO 4: Develop leadership skills

CO 5: Know the hierarchy of needs and techniques of motivation

Co-Po Mapping Matrix

CO/PO	PO 1	PO2	PO3	PO4	PO5	PO6
CO1	2	2	1	0	0	3
CO2	0	2	0	0	3	0
CO3	0	0	2	0	0	0
CO4	0	1	0	3	0	0
CO5	1	0	0	0	0	3

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3. Chitambar, J.B.1997. Introductory Rural Sociology, New Age International (P) Ltd.,Publishers, New Delhi.
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BSAG-1111: HUMAN VALUES & ETHICS (NON GRADIAL)

Course Code	Course Title	Credits	L	T	P
BSAG-1111	Human Values & Ethics (non-gradial)	1(1+0)**	1	0	0

Learning objectives

- To understand the concepts of human values and ethics
- To gain knowledge about virtues and goals in life
- To develop interpersonal skills and ethical decision making
- To know the professional ethics in agricultural research
- To enhance gender sensitivity and emotional intelligence

Theory

Unit I: Human Values

Human values – definition – concepts – culture and values – socialization – evaluation of human values – types of values. Ethics – introduction – origin of ethics – meaning – types of ethics – ethical issues – ethical conflict – national differences in ethics – ethical behaviours, ethics vs. morals and values.

Unit II: Virtues & Goals (

Virtues – civic virtues – civic knowledge – self-restraint – self-assertion – self-reliance – respect for others – living peacefully – caring, sharing, honesty, courage, valuing time,cooperation, commitment, empathy, self-confidence. Goals in life – steps in goal

setting – SMART Goals, mission for life – linking mission to goal setting – vision of life – driving oneself to success – self-esteem and self-confidence. Art of self-improvement – self exploration – self-awareness – putting capabilities to use – SWOT analysis.

Unit III: Personality Development

Personality development – definition – elements and stages of personality development. Attitudes of attachment and detachment. Interpersonal skills – delegation, humour, trust, expectations, values, status, compatibility and their role in building team work – resolving conflicts. Ethical decision making – role of moral philosophies in decision making – difficulties in decision making – ethical reasoning – levels of decision making. Ethics in media and technology – impact on youth, cyber ethics and etiquette, mobile phones, social networking – correct and judicious use.

Unit IV: Spirituality and Positive Thinking

Positive spirit – anatomy of the self – the mind – the intellect – the sub conscious mind –consciousness - the cyclic process within the self – states of awareness – innate and acquired qualities of the self – power to act. Spirituality – concepts, nature and identity of god – form or image – attributes – relationship – purpose and benefits – power and acts – meditation – transmitter and receiver – morality and religion. Positive thinking – assertiveness – coping with life stresses – peer pressure – suicidal tendencies – addiction – substance abuse.

Unit V: Professional ethics

Professional ethics – code of professional ethics in agricultural research – organizational ethics – violation of code of ethics – causes and consequences – whistle blowing. Gender issues and gender sensitivity at work place – legal provisions. Managing emotions – anger, frustration, helplessness etc, emotional intelligence – meaning and role in leading a balanced life. Case study on ethics & values and current stream of thoughts. Self- Exploration. Self- Awareness. Self-Satisfaction. Decision Making. Motivation. Sensitivity. Success. Selfless Service. Case Study of Ethical Lives. Positive Spirit. Body, Mind and Soul. Attachment and Detachment. Spirituality Quotient. Examination.

COURSE OUTCOMES (COs)

At the end of the course students will be able to

CO 1: Understand the concepts of human values and ethics.

CO 2: Gain knowledge about virtues and goals in life.

CO 3: Develop interpersonal skills and ethical decision making.

CO 4: Know the professional ethics in agricultural research.

CO 5: Enhance gender sensitivity and emotional intelligence

Co-Po Mapping Matrix

CO/PO	PO 1	PO2	PO3	PO4	PO5	PO6
CO1	2	0	3	1	0	2
CO2	0	1	3	2	1	3
CO3	0	2	2	0	1	3
CO4	0	1	3	0	1	2
CO 5	1	1	3	1	1	3

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3. Jagannadham Challa, 2018 . Scientific Values and Professional Ethics in Agricultural Research –Principal Scientist, HRD, NAARM, Rajendranagar, Hyderabad – 500 030.
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BSAG-1112: NSS/ PHYSICAL EDUCATION & YOGA PRACTICES**

Course Code	Course Title	Credits	L	T	P
BSAG-1112	NSS/NCC/Physical Education & Yoga Practices**	2 (0+2)**	0	-	2

COURSE TITLE: NATIONAL SERVICE SCHEME I

Introduction and basic components of NSS: Orientation: history, objectives, principles, symbol, badge; regular programmes under NSS, organizational structure of NSS, code of conduct for NSS volunteers, points to be considered by NSS volunteers awareness about health

NSS programmes and activities: Concept of regular activities, special camping, day camps, basis of adoption of village/slums, conducting survey, analysing guiding financial patterns of scheme, youth programme/ schemes of GOI, coordination with different agencies and maintenance of diary

Understanding youth: Definition, profile, categories, issues and challenges of youth; and opportunities for youth who is agent of the social change

Community mobilisation: Mapping of community stakeholders, designing the message as per problems and their culture; identifying methods of mobilisation involving youth-adult partnership **Social harmony and national integration:** Indian history and culture, role of youth in nation building, conflict resolution and peace- building

Volunteerism and shramdan: Indian tradition of volunteerism, its need, importance, motivation and constraints; shramdan as part of volunteerism

Citizenship, constitution and human rights: Basic features of constitution of India, fundamental rights and duties, human rights, consumer awareness and rights and rights to information

Family and society: Concept of family, community (PRIs and other community based organisations) and society

PHYSICAL EDUCATION AND YOGA PRACTICES

1. Teaching of skills of Football – demonstration, practice of the skills, correction, involvement in game situation (For girls teaching of Tennikoit)
2. Teaching of different skills of Football – demonstration, practice of the skills, correction, involvement in game situation (For girls teaching of Tennikoit)
3. Teaching of advance skills of Football – involvement of all the skills in game situation with teaching of rules of the game
4. Teaching of skills of Basketball – demonstration, practice of the skills, correction of skills, involvement in game situation
5. Teaching of skills of Basketball – demonstration, practice of the skills, involvement in game situation
6. Teaching of skills of Basketball – involvement of all the skills in game situation with teaching of rule of the game
7. Teaching of skills of Kabaddi – demonstration, practice of the skills, correction of skills, involvement in game situation
8. Teaching of skills of Kabaddi – demonstration, practice of the skills, correction of skills, involvement in game situation

9. Teaching of advance skills of Kabaddi – involvement of all the skills in game situation with teaching of rule of the game
10. Teaching of skills of Ball Badminton – demonstration, practice of the skills, correction of skills, involvement in game situation
11. Teaching of skills of Ball Badminton – involvement of all the skills in game situation with teaching of rule of the game
12. Teaching of some of Asanas – demonstration, practice, correction and practice
13. Teaching of some more of Asanas – demonstration, practice, correction and practice
14. Teaching of skills of Table Tennis – demonstration, practice of skills, correction and practice and involvement in game situation
15. Teaching of skills of Table Tennis – demonstration, practice of skills, correction and practice and involvement in game situation
16. Teaching of skills of Table Tennis – involvement of all the skills in game situation with teaching of rule of the game
17. Teaching – Meaning, Scope and importance of Physical Education
18. Teaching – Definition, Type of Tournaments
19. Teaching – Physical Fitness and Health Education
20. Construction and laying out of the track and field (*The girls will have Throw Ball).

SEMESTER-II

S. No.	Course Code	Course Title	Credits
1	BSAG-1201	Fundamentals of Genetics	3(2+1)
2	BSAG-1202	Agricultural Microbiology	2(1+1)
3	BSAG-1203	Soil and Water Conservation Engineering	2(1+1)
4	BSAG-1204	Fundamentals of Crop Physiology	2(1+1)
5	BSAG-1205	Fundamentals of Agricultural Economics	2(2+0)
6	BSAG-1206	Fundamentals of Plant Pathology	4(3+1)
7	BSAG-1207	Fundamentals of Entomology	4(3+1)
8	BSAG-1208	Fundamentals of Agricultural Extension Education	3(2+1)
9	BSAG-1209	Communication Skills and Personality Development	2(1+1)
Total			**24(16+8)**

BSAG-1201: FUNDAMENTALS OF GENETICS

Course Code	Course Title	Credits	L	T	P
BSAG-1201	**Fundamentals of Genetics**	**3(2+1)**	**2**	**-**	**1**

Learning objectives

- To inculcate knowledge on the fundamental concepts of inheritance and variation

- To make the students to understand the Structure of chromosomes and their functions
- To explore linkage and crossing over techniques for drawing gene maps
- To understand the sex determination process and inheritance of quantitative traits.
- To decipher the genetic code for the determination of protein product.

Theory

Unit I: Mendal's work and Non-Mendalian inheritance

Pre-Mendelian ideas about heredity – Vapor and fluid theory, Magnetic power theory, Preformation theory, Lamarck's theory, Darwin's theory, Germplasm theory and Mutationtheory. Post mendalian concepts- Probability and Chi-square- Mendel's experiments and laws of inheritance. Allelic interactions – Dominance vs. recessive, complete dominance, codominance, incomplete dominance, over dominance. Deviation from Mendelian inheritance – Non allelic interaction without modification in Mendelian ratio – Bateson and Punnetts experiment on fowl comb shape. Non allelic interaction with modification in Mendelian ratio – i.) Dominant epistasis (12:3:1) ii.) Recessive epistasis (9:3:4) iii.) Duplicate and additive epistasis (9:6:1) iv.) Duplicate dominant epistasis (15:1) v) Duplicate recessive epistasis (9:7) vi.) Dominant and recessive epistasis (13:3); Lethal genes, Pleiotropy, penetrance and expressivity, phenocopy: Multiple alleles, blood group in humans, coat colour in rabbits, self-incompatibility in plants; pseudo alleles, isoalleles.

Unit II: Study of chromosomes and chromosomal theory of inheritance

Structure and function of cell and cell organelles - Chromosome structure, chemical composition, nucleosome, centromere, telomere, euchromatin, heterochromatin, NOR, satellite chromosome, karyotype, ideogram –Types of chromosomes based on position of centromere, based on structure and function: based on the role in sex determination, normal and special chromosomes - polytene, lamp brush, other types of chromosomes - B, ring and isochromosomes. Cell division – mitosis, meiosis and their significance, cell cycle-Chromosomal theory of inheritance.

Unit III: Recombination genetics and chromosomal aberrations

Linkage - coupling and repulsion; Experiment on Bateson and Punnet Chromosomal theory of linkage of Morgan – Complete and incomplete linkage, Linkage group. Crossing over – significance of crossing over; cytological proof for crossing over - Stern's experiment; Factors controlling crossing over. Strength of linkage and recombination; Two point and three-point test cross. Double cross over, interference and coincidence; genetic map. Chromosomal aberration: Variation in chromosome structure – deletion, duplication, inversion and translocation – genetic

and cytological implications; Chromosomal aberration: Variation in chromosome number – euploid, aneuploid, types of aneuploids and their origin; Uses of Di haploids and Doubled haploids in Genetics-Nondisjunction - Klinefelter syndrome and Turner syndrome; Polyploid - auto and allopolyploids, their characters; evolution of wheat, Triticale, cotton, tobacco, Brassicas.

Unit IV: Sex chromosomes and extra chromosomal inheritance

Sexual reproduction- Sporogenesis and Gametogenesis- Sex determination: Autosomes and sex chromosomes - chromosomal theory of sex determination - different types –Genic balance theory of Bridges, Sex linked inheritance – criss cross inheritance – reciprocal difference; holandric genes; sex influenced and sex-limited inheritance. Cytoplasmic inheritance and maternal effects – features of cytoplasmic inheritance, chloroplast, mitochondrial - plastid colour in *Mirabilis jalapa* - iojap gene of maize, cytoplasmic male sterility in rice, kappaparticles of paramecium - plasmid and episomic inheritance. Quantitative inheritance – Multiple factor hypothesis – Nilsson Ehle experiment on wheat kernel colour. Polygenes – transgressive segregation, comparison of quantitatively and qualitatively inherited characters; modifiers; Types of gene action controlling quantitative traits. Mutation – characteristics of mutation – Classification of Mutation- micro and macro mutation – ClB technique - molecular basis of mutation- Transition and transversion; major physical and chemical mutagens.

Unit V: DNA-Models, Replication, Genetic code and Protein Synthesis

Nature of Genetic material- DNA as genetic material – Griffith's experiment, experiment of Avery, McCleod and McCarthy – confirmation by Hershey and Chase; RNA as genetic material – Frankel, Conrat and Singer experiment. Structure of DNA – Watson and Crick model – Central dogma of life. Proof for semi conservative method of DNA replication; Models of DNA replication; RNA types - mRNA, tRNA, rRNA; Genetic code, protein synthesis; Gene function-Regulation of gene expression – operon model of Jacob and Monad; Gene concept- Cistron,muton and recon; Complementation test; exons, introns – split genes –Functional genomics, Metagenomics, Transcriptomics, Proteomics, Metabolomics and Phenomics.

Practical

Study of microscope. Study of cell structure. Mitosis and Meiosis cell division. Experiments on monohybrid, dihybrid, trihybrid, test cross and back cross, Experiments on epistatic interactions including test cross and back cross, Practice on mitotic and meiotic cell division, Experiments on probability and Chi-square test.

Determination of linkage and cross-over analysis (through two point test cross and three point test cross data). Study on sex linked inheritance in Drosophila. Study of models on DNA and RNA structures.

COURSE OUTCOMES (COs)

CO 1: Students will understand the molecular structure of DNA and the central dogma oflife.

CO 2: Importance of studying Linkage and recombination mapping will be well understood bythe students.

CO 3: Students will able to figure out the Fine structure of gene and gene mapping techniques.

CO 4: The necessity of studying Gene regulation and function will be well elucidated

CO 5: To explore the students in understanding various Genetic disorders and have a betteridea on consanguineous mating

CO-PO Mapping Matrix

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	0	0	0	3	0
CO2	0	1	2	1	0	0
CO3	1	0	0	2	1	0
CO4	0	0	0	0	0	4
CO5	0	1	0	2	0	0

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4. https://www.nature.com/scitable/ebooks/essentials-of-cell-biology-14749010
5. https://www.nature.com/scitable/ebooks/essentials-of-genetics

BSAG-1202: AGRICULTURAL MICROBIOLOGY

Course Code	Course Title	Credits	L	T	P
BSAG-1202	Agricultural Microbiology	2(1+1)	1	-	1

Learning Objectives:

- To enable better understanding of students about the microscopic world around them
- To acquaint students with the basic laboratory techniques and tools ofmicrobiology
- To highlighten the role of soil microorganisms in soil fertility and plant growth promotion
- To develop experimental skills in soil microbiology which includes isolation of beneficial microorganisms from soil and plant and their mass production
- To understand biogeochemical cycles through the microbial transformation of nutrients in soil

Theory

Unit - I: History and concept of Microbiology.

History and development in Agricultural Microbiology-Contributions of Beijerinck, Winogradsky and Waksman; Position of microorganisms in living world; Prokaryotes Vs Eukaryotes-Biogenesis and abiogenesis- Groups of microorganisms;Morphology -Bacterialsize, shape and arrangement -Morphology of fungi and Algae.

Unit-II: Microbiological Techniques.

Microscopy – principles of light microscopy -magnification, resolving power and numerical aperture. -Different types of light and electron microscope; Staining techniques – principle and types of stain- simple, negative and differential staining. Sterilization and disinfection techniques; Principles and methods of sterilization – Physical methods – heat, filters and radiation; Chemical methods; Isolation and pure culture techniques – Enrichment culture, Preservation of microbial cultures.

Unit-III: Microbial growth and Genetics

Bacterial growth - measurement of growth and factors influencing bacterial growth – Growth curve; Nutritional types; Genetic Recombination – Transformation, Conjugation and Transduction.

Unit-IV: Soil Microbiology

Distribution and importance of soil microorganisms in soil fertility – factors

affecting the activities of soil microorganisms; Rhizosphere microorganisms and their importance, R:S Ratio; Phyllosphere microorganisms; Soil microorganisms Agriculturally beneficial microorganisms and their interaction -Positive and negative interaction. Plant growth promoting Rhizobacteria.

Unit-V: Microbial transformation and bio inoculants

Microbial transformation of nutrients in soil – Nitrogen Cycle-Carbon andPhosphorous cycle; Bioinoculants-importance and types-carrier based, liquid based, -Mass production, method of applications and quality control of biofertilizers

Practical

Introduction to microbiology laboratory and its equipments; Microscope- parts, principles of microscopy, resolving power and numerical aperture. Methods of sterilization. Nutritional media and their preparations. Enumeration of microbial population in soil- bacteria, fungi, actinomycetes. Methods of isolation and purification of microbial cultures. Isolation of *Rhizobium* from legume root nodule. Isolation of *Azotobacter* from soil. Isolation of *Azospirillum* from roots. Isolation of BGA. Staining and microscopic examination of microbes.

COURSE OUTCOMES (COs)

CO1: The students would thoroughly understand about the role of microorganisms in soil and their influence on the plant growth production and historical perspectives.

CO 2: Further, they would enrich on the various basic microbiological techniques.

CO 3: The students exposed to soil microbial diversity and microbial genetics.

CO 4: Thestudents would expose to the beneficial and harmful relationshipsbetween soil microorganism and different parts of plants.

CO 5: The students will gain hands on experience of production and quality control aspects of different microbial inoculants and to have self-confidence to become successful entrepreneurship.

CO –PO Mapping Matrix

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	2	-	-	-	-
CO2	3	2	-	-	-	-
CO3	-	-	-	-	2	-
CO4	2	2	-	-	1	-
CO5	-	-	2	1	-	-

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2. Rangaswami G Bhagyaraj D J (2nd ed) 2001, **Agricultural Microbiology:** PrenticeHallof India Pvt Ltd., New Delhi
3. Prabhakaram. G. 2004, **Introduction to Soil & Agricultural Microbiology:** Himalayapublication house, Mumbai
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BSAG-1203: SOIL AND WATER CONSERVATION ENGINEERING

Course Code	Course Title	Credits	L	T	P
BSAG-1203	Soil and Water Conservation Engineering	2(1+1)	1	-	1

Learning objectives

- To impart the basics of soil and water conservation engineering to the undergraduate students.
- To understand the different types of erosion and its control measures
- To learn Suitable soil conservation measures under different land slopes
- To identify suitable vegetative species to control soil erosion as well as wind erosion

Theory

Unit I: Surveying and Levelling

Surveying and levelling – Chain, compass and plane table survey – levelling – land measurement and computation of area – Simpson's rule and Trapezoidal rule. Height of instrument, Bench mark, Contour survey-definition, characteristics

Unit II: Irrigation and drainage

Irrigation – measurement of flow in open channels – velocity area method – rectangular weir- Cippoletti weir – V notch – orifices – Parshall flume – duty of water – irrigation efficiencies – conveyance of irrigation water – canal lining – underground pipeline system – surface irrigation methods – borders, furrows and check basins – drip and sprinkler irrigation – agricultural drainage – surface irrigation systems – sub-surface drainage systems – drainage coefficient - design of

open ditches.

Unit III: Wells and Pumps

Groundwater occurrence – aquifers – types of wells and sizes – pump types – reciprocating pumps – centrifugal pumps – turbine pumps – submersible pumps – jet pumps – airlift pumps -selection of pumps – operation and their maintenance. Current Streams of thought.

Unit IV: Soil conservation and watershed management

Erosion control measures for agricultural lands – biological measures – contour cultivation – Strip cropping - cropping systems – vegetative barriers – wind breaks and shelterbelts – shifting cultivation – mechanical measures – contour bund – graded bund – broad beds and furrows – basin listing – random tie ridging – mechanical measures for hill slopes – contour trench – bench terrace – contour stone wall – Rain water harvesting – insitu soil moisture conservation – Runoff Computation – runoff water harvesting – Farm ponds and percolation ponds – storage and its use for domestic and ground water recharge. Gully control structures -Check dams – Temporary and permanent. Watershed concept–Integrated approach and management.

Unit V: Soil erosion

Soil Erosion – causes and evil effects of soil erosion – geologic and accelerated erosion – water erosion – causes – erosivity and erodibility – mechanics of water erosion – splash, sheet, rill and gully erosion – ravines – land slides – wind erosion – factors influencing wind erosion – mechanics of wind erosion – suspension, saltation, surface creep. Water harvesting techniques.

Practical

General status of soil conservation in India. Calculation of erosion index. Estimation of soil loss. Measurement of soil loss. Preparation of contour maps. Design of grassed water ways. Design of contour bunds. Design of graded bunds. Design of bench terracing system. Problem on wind erosion.

COURSE OUTCOMES (COs)

CO1: Understanding the classification, cause and type of soil erosion

CO 2: Applying and analyzing the control measures for soil erosion

CO 3: Understanding and analyzing soil loss by USLE (universal soil loss equation)

CO 4: The students would expose to the beneficial and harmful relationships between soil erosion and different parts of plants.

CO 5: The students will gain hands on experience of production and quality control aspects of different soil erosion and to have self-confidence to become successful entrepreneurship

CO –PO Mapping Matrix

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6

CO1	**3**	**2**	**-**	**-**	**-**	**-**
CO2	**3**	**2**	**-**	**-**	**-**	**-**
CO3	**-**	**-**	**-**	**-**	**2**	**-**
CO4	**2**	**2**	**-**	**-**	**1**	**-**
CO5	**-**	**-**	**2**	**1**	**-**	**-**

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2. Land and water Management Engineering by Murthy V V N 1982, Kalyani publishers, NewDelhi.
3. Irrigation Theory and practice by Michael A M 1989. Vikas Publishing House Pvt. Ltd, NewDelhi.
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BSAG-1204: FUNDAMENTALS OF CROP PHYSIOLOGY

Course Code	Course Title	Credits	L	T	P
BSAG-1204	**Fundamentals of Crop Physiology**	**2(1+1)**	**1**	**-**	**1**

Learning objectives

- To impart basic knowledge on various functions and processes related to crop production,mineral nutrition, plant growth regulators and environmental stresses.
- To understand the mechanism of absorption and translocation of water and nutrients fromthe soil.
- To study the different pathways in photosynthesis and respiration
- To study the topics on plant growth regulators and stress physiology
- To impart knowledge about selection of ideal plant type for higher crop productivity.

Theory

Unit I: Plant water relations

Importance of crop physiology in agriculture – Cell organelle- Plasma membrane, chloroplast, mitochondria, peroxisome and vacuole - Structure and role of water – Water potential and its components – diffusion – osmosis – imbibition - plasmolysis – Field Capacity and permanent wilting point- Mechanisms of water absorption – Pathways of water movement – Apoplast and Symplast -

Translocation of water – ascent of sap – mechanisms - Transpiration – significance – structure of stomatal pore- mechanisms of stomatal opening and closing – guttation – anti transpirants.

Unit II: plant mineral nutrition

Criteria of essentiality - Classification of nutrients – macro, micro, mobile, beneficial elements and immobile – mechanism of nutrient uptake- Physiological functions, deficiencies and disorders of macro and micro nutrients – Hidden hunger- Foliar nutrition- root feeding and fertigation – Sand culture, hydroponics and aeroponics

Unit III: Photosynthesis and respiration

Light reaction – Photosystems- Red drop and Emerson enhancement effect- Photolysis of water and photophosphorylation - Photosynthetic pathways – C3 and C4, CAM – difference between three pathways - Factors affecting photosynthesis- Photorespiration – pathway and its significance - Phloem transport – Munch hypothesis - Phloem loading and unloading - Source and sink strength and their manipulations - Glycolysis – TCA cycle - Oxidative phosphorylation – difference between photo and oxidative phosphorylation – energy budgeting - respiratory quotient.

Unit IV: Growth and development

Growth – phases of growth - factors affecting growth – Hormones- classifications - Biosynthetic pathway and role of auxins - Biosynthetic pathway and role of gibberellins and cytokinins- Biosynthetic pathway and role of ethylene and ABA- Novel and new generation PGR's – Brassinosteroids and salicylic acid - Growth retardants – Commercial uses of PGR's- Photoperiodism - short, long and day neutral plants – Chailakhyan's theory of flowering-Forms of phytochrome - Pr and Pfr - regulation of flowering – Vernalisation - Theories of vernalisation - Seed germination - physiological and biochemical changes - seed dormancy and breaking methods - Senescence and abscission – physiological and biochemical changes-Physiology of fruit ripening- climacteric and non-climacteric fruits - factors affecting ripening- Manipulations

Unit V: Stress physiology

Classification of stresses - Physiological changes and adaptations to drought, flooding, high and low temperature, salinity and UV radiation – compatible osmolytes – membrane properties — compartmentalization – stress alleviation - Global warming – green house gases– physiological effects on crops - Carbon Sequestration.

Practical

Study of plant cells, structure and distribution of stomata, imbibitions, osmosis, plasmolysis, measurement of root pressure, rate of transpiration, Separation of photosynthetic pigments through paper chromatography, Rate of transpiration, photosynthesis, respiration, tissue test for mineral nutrients, estimation of relative water content, Measurement of photosynthetic CO2 assimilation by Infra Red Gas Analyser (IRGA).

COURSE OUTCOMES (COs)

CO 1: Students will acquire basic knowledge on various functions and processes related tocrop productivity

CO 2: Will be able to identify the mineral nutrient deficiencies and their symptoms

CO 3: Know about the various plant growth regulators and environmental stresses.

CO 4: In addition, hands on exposure to preparation of solutions, analysis of pigmentcomposition, estimation of growth analytical parameters,

CO 5: Will be able to diagnose nutrient deficiencies in crops and ameliorate them and will becompetent in enzyme assays and applications of plant growth regulators

CO-PO Mapping Matrix

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5
CO 1	3	-	-	-	-
CO 2	-	3	-	-	-
CO 3	-	2	-	-	2
CO 4	2	-	-	-	-
CO 5	-	-	-	-	-

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BSAG-1205: FUNDAMENTALS OF AGRICULTURAL ECONOMICS

Course Code	Course Title	Credits	L	T	P
BSAG-1205	Fundamentals of Agricultural Economics	2(2+0)	2		0

Learning objectives

- To provide knowledge to students about basic concepts of economics
- To explain its relevance and importance in agricultural science
- To understand the theory of production
- To know the theory of exchange and distribution
- To provide knowledge to national income and inflation

Theory

Unit I: Nature and Scope of Economics

Economics: Meaning, scope and subject matter, definitions, activities, approaches to economic analysis; micro and macroeconomics, positive and normative analysis. Nature of economic theory; rationality assumption, concept of equilibrium, economic laws as generalization of human behavior. Economic systems: Concepts of economy and its functions, Important features of capitalistic, socialistic and mixed economies. Agricultural economics: meaning, definition, characteristics of agriculture.

Unit II: Theory of Consumption

Utility theory; law of diminishing marginal utility, equi-marginal utility principle. Indifference curve analysis and properties, budget line – Consumer's equilibrium and derivation of demand curve, concept of consumer surplus. Demand: meaning, law of demand, schedule and demand curve, determinants, Elasticity of demand: concept and measurement of price elasticity, incomeelasticity and cross elasticity.

Unit III: Theory of Production

Production: process, creation of utility, factors of production, input output relationship- Production function- Supply: Stock v/s supply, law of supply, schedule, supply curve, determinants of supply, elasticity of supply. Producer's surplus.

Unit IV: Exchange and Theory of Distribution

Market structure: meaning and types of market, basic features of perfectly competitive and imperfect markets. Price determination under perfect competition; Distribution theory: meaning, factor market and pricing of factors of production. Concepts of rent, wage, interest and profit.

Unit V: Macroeconomic concepts

Public finance -National income: Meaning and importance, circular flow, concepts of national income accounting and approaches to measurement, difficulties in measurement. Population: Importance, Malthusian and Optimum population theories, natural and socio-economic determinants, current policies and programmes on population control. Money: Barter system of exchange and its problems, evolution, meaning and functions of money, classification ofmoney, supply, general price index, inflation and deflation. Budget-public revenue and public expenditure. Tax: meaning, direct and indirect taxes, agricultural taxation, VAT/GST Economic Planning-its importance, elements of Agricultural Economics- importance and its role in economic development. Agricultural planning and development in the country. Current stream of thought.

COURSE OUTCOMES (COs)

CO 1: To understand the important concepts on micro and macro economics.

CO 2: To know the principles of economics and its application

CO 3: To acquire the practical exposure on application of economic principles related to agriculture.

CO 4: To work out the measurement of Human Development Index, welfare indicators.

CO 5: To understand the concepts like GDP, GNP and Inflation.

CO-PO Mapping Matrix

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	-	-	-	-	-
CO2	2	-	-	2	-	2
CO3	-	-	2	2	-	1
CO4	1	-	1	-	-	-
CO5	-	2	-	-	2	-

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BSAG-1206: FUNDAMENTALS OF PLANT PATHOLOGY

Course Code	Course Title	Credits	L	T	P
BSAG-1206	Fundamentals of Plant Pathology	4(3+1)	3		1

Learning objectives

- To acquaint with the basic concepts of Plant Pathology and causes of plant diseases
- To know about pathogenesis and plant defense mechanisms
- To acquire knowledge of the general characters and classification of fungal kingdomProtozoa, Chromista, Phylum Zygomycota, Ascomycota and Basidiomycota
- To acquire knowledge of the general characters of Bacteria, Virus, Virusoids, Algae,Phanerogamic parasites, nematodes and abiotic diseases.
- To learn about the growth and reproduction of plant pathogens

Theory

Unit I: Plant pathogenic organisms

Introduction – Definition- Scope and objectives of Plant Pathology – History of Plant Pathology – Koch's Postulates – Causes of plant diseases – Biotic and abiotic factors

–Significance of plant diseases – Plant pathogenic organisms – protozoa, chromista,fungi, bacteria, *Candidatus* phytoplasma, spiroplasma, fastidious vascular bacteria, viruses, viroids, virusoids, algae, phanerogamic parasites and nematodes with examplesof diseases caused by them – Abiotic disorders.

Unit II: General characters and molecular phylogeny of fungi

General characters of fungi – Fungal somatic structures, types of fungal mycelia-Modification of fungal mycelia – Reproduction in fungi (vegetative, asexual and sexual) – Disease cycle – Symptoms of fungal diseases – Classification based on molecular phylogeny. I Kingdom: Protozoa II. Kingdom: Chromista, III. Kingdom: Fungi, Phylum: Chytridiomycota, Phylum: Blastocladiomycota, Phylum:

Zygomycota, Phylum:Ascomycota, Phylum: Basidiomycota.

Unit III: Bacteria, Phytoplasma Virus, Viroid, Virusoid, Algae, Phanerogamic Plant Parasites and Abiotic disorders

Classification of bacteria - general characters and symptoms of phytopathogenic bacteria- growth and reproduction - mode of entry and spread- general characters and symptoms of*Candidatus* phytoplasma, spiroplasma, fastidious vascular bacteria, viruses - virus vector relationship-symptoms and transmission of viral diseases - viroids, virusoid, algae- flowering plant parasites - Abiotic disorders.

Unit IV: Nematodes

General morphology and reproduction, classification, symptoms and nature of damage caused by plant nematodes (*Heterodera*, *Meloidogyne*, *Anguina*, *Radopholus* etc.).

Unit V: Growth and reproduction of plant pathogens

Pathogenesis –Pre-penetration, Penetration and Post penetration – Mode of infection, survival and Spread - Effect of pathogen on physiological functions of the plants – Role of enzymes and toxins on disease development – Epidemiological factors affecting disease development - Plant defence mechanisms. Principles and methods of plant disease management. Nature, chemical combinations, classification, mode of action andformulations of fungicides and antibiotics.

Practical

Acquaintance with various laboratory equipments and microscopy. Collection and preservation of disease specimen. Preparation of media, isolation and Koch's postulates. General study of different structures of fungi. Study of symptoms of various plant diseases. Study of representative fungal genera. Staining and identification of plant pathogenic bacteria. Transmission of plant viruses. Study of phanerogamic plant parasites.

Study of morphological features and identification of plant parasitic nematodes. Sampling and extraction of nematodes from soil and plant material, preparation of nematode mounting. Study of fungicides and their formulations. Methods of pesticide application and their safe use. Calculation of fungicide sprays concentrations**.**

COURSE OUTCOMES (COs)

CO 1: Acquainted with the basic concepts of plant pathology, Host parasite relationship ofpathogens

CO 2: Having in depth knowledge of pathogenesis and plant defense mechanisms

CO 3: Having in depth knowledge of fungal kingdom Protozoa and Chromista,

PhylumZygomycota, Ascomycota and Basidiomycota

CO 4: Having in depth knowledge of the general characters and pathogenicity of bacteria, virus, virusoids, algae, phanerogamic parasites, nematodes and abiotic diseases.

CO 5: Acquainted with the growth and reproduction of plant pathogens

CO – PO Mapping matrix

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6
CO 1	1	2	-	1	-	-
CO 2	1	2	-	-	-	-
CO 3	2	3	-	-	-	-
CO 4	2	2	-	2	-	-
CO 5	2	2	-	-	-	-

References

1. Agrios, G.N. 2005. Plant Pathology –5th Edition. Academic Press, New York.
2. Singh R.S. 2017. 5th Edition, Introduction to Principles of Plant Pathology. MedtechPublishers.
3. Alice, D, and Jeyalakshmi, C. 2014. Plant Pathology. A.E Publications, Coimbatore
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BSAG-1207: FUNDAMENTALS OF ENTOMOLOGY

Course Code	Course Title	Credits	L	T	P
BSAG-1207	Fundamentals of Entomology	4(3+1)	3	-	1

Learning Objectives:

- To study about the relative position of insects in animal kingdom
- To explore the external morphology of insects
- To observe the anatomy, physiology and behaviour of insects
- To understand the classification of insects and to identify different groups of insects

- To study different methods of collection and preservation of insects

Theory

Unit I: **History of Entomology in India**.

Major points related to dominance of Insecta in Animal kingdom. Classification of phylum Arthropodauptoclasses.Relationship of class Insecta with other classes of Arthropoda. Morphology: Structure and functions of insect cuticle and molting. Body segmentation.Structure of Head, thorax and abdomen. Structure and modifications of insect antennae, mouth parts, legs, Wing venation, modifications and wing coupling apparatus. Structure of male and female genital organ. Metamorphosis and diapause in insects.Types of larvae and pupae. Structure and functions of digestive, circulatory, excretory, respiratory, nervous,secretary (Endocrine) and reproductive system, in insects. Types of reproduction in insects. Major sensory organslike simple and compound eyes, chemoreceptor.

Unit II: **Insect Ecology**:

Introduction, Environment and its components. Effect of abiotic factors– temperature, moisture, humidity, rainfall, light, atmospheric pressure and air currents. Effect of biotic factors – food competition, natural and environmental resistance.

Unit III: **Categories of pests.**

Concept of IPM, Practices, scope and limitations of IPM. Classification of insecticides, toxicity of insecticides and formulations of insecticides. Chemical control importance, hazards and limitations. Recent methods of pest control, repellents, antifeedants, hormones, attractants, gamma radiation. Insecticides Act 1968- Important provisions. Application techniques of spray fluids.Symptoms of poisoning, first aid and antidotes.

Unit IV : **Systematics:**

Taxonomy –importance, history and development and binomial nomenclature. Definitions of Biotype, Sub-species, Species, Genus, Family and Order. Classification of class Insecta upto Orders, basic groups of present day insects with special emphasis to orders and families of Agricultural importance like Orthoptera: Acrididae,Tettigonidae, Gryllidae, Gryllotalpidae; Dictyoptera: Mantidae, Blattidae; Odonata; Isoptera: Termitidae; Thysanoptera: Thripidae; Hemiptera: Pentatomidae, Coreidae, Cimicidae, Pyrrhocoridae, Lygaeidae, Cicadellidae, Delphacidae, Aphididae, Coccidae, Lophophidae, Aleurodidae, Pseudococcidae;

Unit V: **Neuroptera**:

Chrysopidae; Lepidoptera: Pieridae, Papiloinidae, Noctuidae, Sphingidae, Pyralidae, Gelechiidae, Arctiidae, Saturnidae, Bombycidae;

Coleoptera: Coccinellidae, Chrysomelidae, Cerambycidae, Curculionidae, Bruchidae, Scarabaeidae; Hymenoptera: Tenthridinidae, Apidae, Trichogrammatidae, lchneumonidae, Braconidae, Chalcididae; Diptera: Cecidomyiidae,Tachinidae, Agromyziidae, Culicidae, Muscidae, Tephritidae.

Practical

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

COURSE OUTCOMES (COs)

CO1: Describe characters of Arthropoda and Insecta, and their relationship and reasons forinsect dominance

CO2: Explain morphology of insects, their appendages, their modifications, growth anddevelopment (metamorphosis) and behavior

CO3: Describe anatomy and physiology of various systems of insects

CO4: Identify different orders of insects based on their diagnostic characters up to familylevel

CO5: Demonstrate different collection and preservation techniques of insects

CO-PO Mapping Matrix:

	PO 1	PO2	PO3	PO4	PO5	PO6
CO1	**1**	**2**	**0**	**0**	**1**	**0**
CO2	**1**	**2**	**0**	**0**	**1**	**0**
CO3	**3**	**3**	**0**	**0**	**1**	**0**
CO4	**2**	**3**	**0**	**0**	**1**	**0**
CO5	**3**	**3**	**0**	**0**	**1**	**0**

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2. Norman F. Johnson, Charles A. Triple Horn. 2004. *Borror and Delong'sIntroduction*

to theStudy of Insects (VII Edition). Thomson Publication, New York. 888p.
3. Richards O.W. and R.G. Davies. 1977. *Imm's GeneralText Book of Entomology*, Vol. Iand II. Chapman and Hall Publication, London. 692p.
4. Gullen, P.J. and P.S. Cranston. 2011. *The Insects – An Outline of Entomology* (IVEdition).Wiley- Blackwell. UK. 565p.
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BSAG-1208: FUNDAMENTALS OF AGRICULTURAL EXTENSION EDUCATION

Course Code	Course Title	Credits	L	T	P
BSAG-1208	Fundamentals of Agricultural Extension Education	3(2+1)	2	-	1

Learning objectives

- To improve the knowledge level of the students on concepts, Principles of Extension Education, various extension teaching methods and information sources.
- To acquaint the students with Agricultural journalism, Innovation Decision Process andcapacity building of various stake holders.
- To identify and understand various information sources for effective transfer oftechnology.
- To understand the scope and importance of agricultural journalism and state the sourcesof news and types.
- To gain knowledge on capacity building among the target groups.

Theory

Unit I: Extension Education, Programme planning and Administration

Extension Education - Meaning, definition, scope & process, Objectives & principles of extension education, Extension programme planning: meaning & principles, Steps

in programme planning, Extension administration: Meaning, concept, functions & principles. Monitoring & Evaluation – concept, definition & types, Differences between monitoring & evaluation & importance of evaluation in agricultural extension.

Unit II: Communication Methods and Techniques

Communication - Meaning, definition, elements & characteristics. Models: Aristotle, Shannon& weaver, Schramm, Paul Leagans, Westley, Macclean & Litterer, Concepts to related to Communication- Empathy, redundancy, fidelity, frame of reference, entropy. Barriers to communication, Extension teaching methods - Definition, functions & classification, Media mix, selection & combination of extension teaching methods, Agricultural journalism: Meaning,Scope, importance & characteristics.

Unit III: Diffusion and adoption of innovation

Factors determining news value, types and sources of news, Diffusion and adoption - Meaning & Definition steps in adoption process: 5 stage & 7 stage models. Concepts of Innovation, attributes of innovation, over adoption & rate of adoption. Adopter categories- characteristics & classification, Innovation decision process: Meaning, definition & stages, Factors influencingrate of adoption.

Unit IV: Transfer of technology, Reforms & New trends in agricultural extension

Transfer of technology: Concept & models with examples, Reforms in Agricultural Extension - ATMA, SREP, Gap Analysis, **New trends in agricultural extension -** Privatization of extension, meaning, factors influencing privatization, Privatization - merits & demerits and strategies with examples. Cyber extension meaning, features, successful models, Kisan call centers, farmers call centers: Meaning. Objectives, operational mechanism, Market led extension: Meaning, enhanced roles of agriculture extension personnel in light of market led extension, Difference between TOT & market led extension. Indigenous Technical Knowledge - Meaning, Definition, Methods of Documentation, Farmers led extension- Meaning, Examples. Expert system in agriculture - Meaning, components, examples

Unit V: Capacity building of extension personnel and farmers

Training meaning, concept & types of training - pre service, in-service, orientation, induction, refresher training, Training to farmers & farm women: time, duration & venue, short term, midterm & long term. FTC, KVK , DAATC: mandate & objectives PRA: Meaning, techniques andimportance in Agricultural Extension and current stream of thoughts

Practical

To get acquainted with university extension system. Group discussion- exercise;

handling and use of audio visual equipments and digital camera and LCD projector; preparation and use of AV aids,preparation of extension literature – leaflet, booklet, folder, pamphlet news stories and success stories; Presentation skills exercise; micro teaching exercise; A visit to village to understand the problems being encountered by the villagers/ farmers; to study organization and functioning of DRDA and other development departments at district level; visit to NGO and learning from their experience in rural development; understanding PRA techniques and their application in village development planning; exposure to mass media: visit to community radio and television studio forunderstanding the process of programme production; script writing, writing for print and electronic media, developing script for radio and television.

COURSE OUTCOMES (COs)

At the end of the course students will be able to

CO 1: Understand fundamentals of extension education.

CO 2: know the concepts related to communication

CO 3: Gain expertise to conduct PRA exercise

CO 4: Expose on Extension activities of different organizations.

CO 5: Gain knowledge about to TOT and capacity building

CO-PO Mapping Matrix

CO/PO	PO 1	PO2	PO3	PO4	PO5	PO6
CO1	2	0	2	0	3	3
CO2	1	1	0	3	0	3
CO3	0	2	2	0	3	0
CO4	2	0	1	0	0	3
CO 5	0	0	-	0	0	3

References

1. Ray, G. L.1991, Extension Communication and management. Naya Prakashan, Kolkata.
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3. Rogers, E. M. 1995. Diffusion of innovations.. Free Press, New York.
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BSAG-1209: COMMUNICATION SKILLS AND PERSONALITY DEVELOPMENT

Course Code	Course Title	Credits	L	T	P
BSAG-1209	Communication Skills and Personality Development	2(1+1)	1		1

Learning Objectives

- To improve the knowledge level of the students on various communication skills
- To improve listening skills and develop presentation skills
- To gain knowledge on personality development and team building
- To enhance skill on various group techniques
- To facilitate the student on effective management of time and stress.

Theory

Unit I: Communication skills

Communication: Meaning & process of communication. Forms of communication: verbal & non-verbal -meaning. Communication skills: Meaning, hard & soft skills – over view, Verbal & non- verbal communication: Verbal: oral &written skills Non-verbal communication skills: Concept, meaning, forms & functions, importance of non- verbal communication incommunication.

Unit II: Listening & Presentation skills

Listening skill- meaning, concept, types of listening, barriers in listening & Note Taking, Oral presentation skills: impromptu presentation & extempore presentation, Effective Public Speaking.

Unit III: Group discussion & Techniques

Group discussion: Procedure, principles, purpose, advantages & disadvantages, Small group discussion techniques: Panel. Symposium, buzz session, syndicate, conference, seminars, workshop, debate and lecture. Writing of technical articles, field diary & lab record, indexing, footnote &bibliographic procedures

Unit IV: Personality development & Team Building

Personality development: Meaning, definition & overview of personality traits,

Questioning skills Attitude: Meaning, functions of attitude, developing positive attitude, Team building: working in team

Unit V: Time & Stress Management

Time management: Importance & role in personality development & time management Techniques, Conflict management: Meaning. Concept, causes of conflict & managing conflicts, Stress management: Meaning, definition, management of stress and current stream of thoughts.

Practical

Listening and note taking, writing skills, oral presentation skills; field diary and lab record; indexing, footnote and bibliographic procedures. Reading and comprehension of general and technical articles, precise writing, summarizing, abstracting; individual and group presentations.

COURSE OUTCOMES (COs)

At the end of the course students will be able to

CO 1: Organize and conduct of various group techniques

CO 2: Students will be able to acquire various personality traits

CO 3: Develop hard and soft skills

CO 4: Gain knowledge on conflict management

CO 5: Acquire skill on public speaking

CO-PO Mapping Matrix

CO/PO	PO 1	PO2	PO3	PO4	PO5	PO6
CO1	1	0	3	0	0	3
CO2	0	1	3	1	1	3
CO3	1	1	3	1	0	3
CO4	0	0	3	0	1	3
CO 5	1	1	3	0	0	3

References

1. Sanjay Kumar, 2011. Communication Skills. Oxford Publication.
2. Ray G L, 1991. Extension Communication and Management, Naya Prakasham, Kolkata.
3. Barun K. Mitra, 2011. Personality Development and Soft skills. Oxford Publication.
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III SEMESTER

S. No.	Course Code	Course Title	Credits
1	BSAG-2301	Crop Production Technology – I *(Kharif Crops)*	2 (1+1)
2	BSAG-2302	Fundamentals of Plant Breeding	3 (2+1)
3	BSAG-2303	Agricultural Finance and Cooperation	3 (2+1)
4	BSAG-2304	Agri- Informatics	2(1+1)
5	BSAG-2305	Farm Machinery and Power	2 (1+1)
6	BSAG-2306	Production Technology for Vegetables and Spices	2 (1+1)
7	BSAG-2307	Environmental Studies and Disaster Management	3(2+1)
8	BSAG-2308	Statistical Methods	2(1+1)
9	BSAG-2309	Livestock and Poultry Management	4 (3+1)
Total			**23(14+9)**

BSAG-2301: CROP PRODUCTION TECHNOLOGY – I (*KHARIF CROPS*)

Course Code	Course Title	Credits	L	T	P
BSAG-2301	**Crop Production Technology – I *(Kharif Crops)***	**2 (1+1)**	**1**		**1**

Learning objectives:

1. To impart updated technology and skills in performing different operations in rising of the crops.
2. To understand crop statistics and study the constraints for low productivity in India.
3. The students will gain knowledge about the *Kharif crops* and their cultivation techniques.
4. To know cropping systems in India and post-harvest operations for different crops.
5. To learn about seed production, Farm Mechanization and resource conservation technology.

Theory

Unit I: Cereals and Millets

Cereals – Rice, Maize, Millets – Sorghum, Pearl millet, Finger millet. Minor millets – Foxtail millet, Kodo millet, Common millet, little millet and barnyard millet.

Unit II: Pulses and oil seeds

Pulses – Pigeon pea, Black gram, Green gram, Horse gram and cluster bean.Oil seeds – Sesame, Soybean, Castor and Jatropha.

Unit III: Fiber crops.

Cotton, jute and mesta

Unit IV: Fodder and Forage crops

Fodder sorghum, fodder maize, cowpea, horse gram, and cluster bean. Forage crops –Stylosanthus, elephant grass and Napier hybrid grass.

Unit V : Green manures and green leaf manures

Green manures – Daincha, Sunnhemp, sesbania, kolingi. Green leaf manures – Glyricida, subabul, pungam, poovarasu, and neem. Insitu incorporation ofgreen manures and green leaf manures. Current stream of thoughts.

Practical

Rice nursery preparation, transplanting of rice, sowing of soybean, pigeonpea and mungbean. maize, groundnut and cotton, effect of seed size on germination and seedling vigour of *kharif* season crops, effect of sowing depth on germination of *kharif* crops, identification of weeds in *kharif* season crops, top dressing and foliar feeding of nutrients, study of yield contributing characters and yield calculation of *kharif* season crops, study of crop varieties and important agronomic experiments at experimental farm. study of forage experiments, morphological description of *kharif* season crops, visit to research centres of related crops.

COURSE OUTCOMES (COS):

CO1: To understand the importance of food grain requirement and cultivation of major cereal crops

CO 2: To gain knowledge about importance of minor millets and its cultivation practices

CO3: To formulate legume based cropping system and production technologies for various pulse crops

CO4: To construct idea regarding knowledge on growing of legume and perennial fodders and its preservation

CO5: To create awareness about role of green manures in soil fertility

CO-PO Mapping Matrix

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6
CO 1	2	-	-	-	-	2
CO 2	2	-	-	-	-	2
CO 3	2	2	2	-	-	2
CO 4	2	2	2	-	2	2
CO 5	2	-	-	-	2	-

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1. Ahlawat, I.P.S., Om Prakash and G.S.Saini.2010. Scientific Crop Production in India. Rama Publishing House, Meerut.
2. Rajendra Prasad 2006. Text Book of Field Crops Production. ICAR, New Delhi.
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BSAG-2302: FUNDAMENTALS OF PLANT BREEDING

Course Code	Course Title	Credits	L	T	P
BSAG-2302	Fundamentals of Plant Breeding	3 (2+1)	2		1

Learning objectives:

1. To expose the students to basic and applied principles of plant breeding.
2. To impart knowledge on emasculation and pollination techniques of various crops.
3. To impart knowledge on breeding methods of self, cross and clonally propagated crops.
4. To impart knowledge on application of various genetic principles in crop improvement.
5. To familiarize recent strides in molecular markers.

Theory

Unit I: Reproductive systems in plant breeding

Plant Breeding – definition, concept, Nature, Aims & Objectives and Role. Major Achievements and future Prospects of Plant Breeding. History and Development of Plant Breeding – Genetics in relation to Plant Breeding – Modes of reproduction – Asexual reproduction (Vegetative reproduction and apomixes) and sexual reproduction – their classification and significance in plant breeding – Modes of

pollination – classification of crop species on the basis of mode of pollination – self-pollination – Mechanisms promoting self andcross pollination. Self-incompatibility – classification – utilization in crop improvement. Male sterility – different types – genetic, cytoplasmic and cytoplasmic genetic male sterility – inheritance and maintenance – Utilization of male sterile lines in hybrid seed production – their limitations, advantages and disadvantages.

Unit II: Breeding methods of self-pollinated crops

Genetic consequences of self-pollination, cross pollination and often cross-pollinated crops - Plant introduction – Types, history, purpose, procedure, merits and demerits – plant introduction agencies in India – NBPGR and its activities – germplasm collections, genetic erosion, gene sanctuaries – centers of origin / diversity. Biometrical genetics – definition, qualitative and quantitative characters, role of environment on quantitative characters – biometrical techniques used in plant breeding – Selection – natural and artificial selection – basic principles of selection – selection intensity – selection differential – heritability – genetic advance. Johannsen's pure line theory and its concepts and significance – progeny test. Genetic basis and breeding methods in self-pollinated crops – Mass selection – procedure by mass selection – merits, demerits and achievements. Genetic basis of pure line selection – general procedure for evolving a variety by pure line selection – merits, demerits and achievements – comparison between mass and pure line selection – Hybridization – types of hybridization – pre-requisites of hybridization – procedure / steps involved in hybridization. – Pedigree, bulk method – procedure – merits, demerits and achievements – comparisonbetween pedigree and bulk method – single seed descent method. Back cross method – applications, procedure for transfer of single dominant gene, recessive gene – merits, demerits and achievements, comparison between pedigree and back cross methods – Multiline variety – definition, characteristics, development of multiline varieties and achievements.

Unit III: Breeding methods of cross pollinated crops and clonally propagated crops

Population genetics – concepts, Hardy Weinberg law, factors affecting equilibrium frequenciesin random mating populations. Heterosis breeding and Inbreeding depression

–Composites and Synthetics – steps in development of synthetics and composites Population improvement – selection without progeny testing – selection with progeny testing – progeny selection – merits and demerits of progeny selection – line breeding – achievements –Recurrent selection – different types – detailed procedure

of simple recurrent selection and brief description of other recurrent selection methods – conclusion of the efficiency of different selection schemes. Methods of breeding for vegetatively propagated crops – clone – characteristics of asexually propagated crops – characteristics of clones – importance of a clone – sources of clonal selection – procedure – advantages and disadvantages – problems in breeding asexually propagated crops - genetic variation within a clone – clonal degeneration – achievements – comparison among clones, purelines and inbreds.

Unit IV: Special breeding methods

Wide hybridization – history – objectives – barriers to the production of distant hybrids – techniques for production of distant hybrids – applications of wide hybridization in crop improvement – sterility in distant hybrids – Polyploidy breeding – classification - applications in crop improvement and limitations. Mutation breeding – spontaneous and induced mutations – characteristic features of mutations – procedure of mutation breeding – applications – advantages, limitations and achievements. Breeding for resistance to biotic stresses – disease resistance – mechanisms of disease resistance in plants – Insect resistance – mechanism of insect resistance in plants – nature of insect resistance – genetics of insect resistance – horizontal and vertical – genetics of resistance – sources of insect resistance – breeding methods for insect resistance – problems in breeding for insect resistance – achievements. Breeding for resistance to abiotic stresses – drought resistance – mechanisms of drought resistance – features associated with drought resistance – sources – breeding methods – limitations – achievements ; breeding for resistance to water logging – effects of water logging mechanism of toleance – ideotype for flooded areas – breeding methods – breeding for salt tolerance – response of plants to salinity – symptoms – mechanisms – breading methods – problems – achievements; cold tolerance – chilling resistance – effects of chilling stress of plants – mechanism – sources – selection criteria – freezing resistance – effects of freezing – mechanism if freezing resistance – genetic resources freezing tolerance – selection criteria – problems in breeding for freezing tolerance.

Unit V: Molecular markers and plant breeders rights

Molecular markers – Definition – Brief description of different types of molecular markers, RFLP, AFLP, RAPD and SSR markers – Importance, procedure and applications.DNA finger printing – procedure, application – QTL mapping and MAS and its applications in crop improvement. Pre breeding – Definition, Concept, need, methods and factors affecting pre breeding. Participatory Plant Breeding – Concept Relevance, activities and goals of PPB, kinds of PPB, perspectives and prospects, advantages, disadvantages and limitations. Intellectual Property Rights

(IRP) and Patents – Types, protection of IPR, trade secret, copy rights, Plant Variety Protection and Geographical Indications, Plant Breeders' Rights – Benefits and disadvantages. Protection of Plant Varieties and Farmers' Rights Act – Introduction, types f varieties, NDUS, salient features, National Gene Fund, Award and Recognitions.

Practical:

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

COURSE OUTCOMES (COs)

CO 1: The student will have the gist of the various self and cross pollinated crops.
CO 2: Will be able to develop expertise in the various crossing and emasculation techniquesin various crops
CO 3: Students will develop the capacity to carry out independent plant breeding experiments
CO 4: The students will be able to multiply and modify the vegetatively propagated crops.
CO 5: The students will be able to develop in the various biotic and abiotic resistance sourcein various crops.

CO-PO Mapping Matrix

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	0	0	3	3	0
CO2	3	0	0	0	3	3
CO3	0	0	0	0	0	3
CO4	0	0	0	0	0	3
CO5	0	3	0	0	0	2

References

1. Singh, B.D. 2006. Plant breeding - Principles and methods. Kalyani Publishers, NewDelhi.
2. Allard, R. 1960. Principles of Plant breeding. John Wiley and Sons, New York.
3. Chopra, V.L., 1994. Plant Breeding Theory and Practice. Oxford and IBH PublishingCo.Pvt. Ltd.

4. Phundan Singh, 2006. Essentials of Plant Breeding. Kalyani Publishers, New Delhi.
5. Sharma, J.R. 1994. Principles and Practice of Plant Breeding. Tata McGraw Hill Publishing Company Ltd., New Delhi.

E- resources

1. http://eagri.org/eagri50/GBPR211/index.html
2. https://www.rvskvv.net/images/II-Year-II-Sem_Principles_Plant-Breeding_ANGRAU_20.04.2020.pdf
3. https://www.rvskvv.net/images/II-Year-II-Sem_Principles_Plant-Breeding_YNAU_20.04.2020.pdf
4. http://ecoursesonline.iasri.res.in/course/view.php?id=134
5. https://ecourses.icar.gov.in/e-Leaarningdownload3_new.aspx?Degree_Id=01

BSAG-2303: AGRICULTURAL FINANCE AND COOPERATION

Course Code	Course Title	Credits	L	T	P
BSAG-2303	Agricultural Finance and Cooperation	3 (2+1)	2		1

Learning objectives:

1. To inculcate the knowledge on principles of finance and banking
2. To understand the micro financial institutions
3. To study the functions of various institutions involved farm financial analysis
4. To provide the knowledge on co-operative credit structure
5. To know the benefits of insurance schemes and different crop insurance productsimplemented in India.

Theory

Unit I: Agricultural Finance – Nature and Scope:

Agricultural Finance- meaning, scope and significance,credit needs and its role in Indian agriculture. Agricultural credit: meaning, definition, need, classification. Sources of credit - advantages and disadvantages - Rural indebtedness- History and Development of rural credit inIndia.

Unit II: Financial Institutions:

Sources of agricultural finance: institutional and non-institutional sourcesand their roles,commercial banks - social control and nationalization of commercial banks – AD branches – Area approach – Priority sector lending. Micro financing including KCC, Micro finance – SHG Models, Lead Bank Scheme, RRBs, Scale of finance and unit cost. Cost of credit. An introduction to higher financing institutions – RBI, NABARD, ADB, IMF, World Bank, Insurance and Credit Guarantee Corporation of India. Recent development in agricultural credit: Rural credit policies of Government – Subsidized farm credit - Differential Interest Rate (DIR) Scheme – Loan relief measures

Unit III: Farm Financial Analysis:

Credit analysis: 3 R's,7 P'sand 5 C's of credit. Preparation of bankable projects / Farm credit proposals – Feasibility; Appraisal - Time value of money: Compounding and Discounting - Undiscounted and Discounted measures. Preparation and analysis of financial statements Balance Sheet, Income Statement and Cash Flow Statement. Basic guidelines for preparation of project reports - Bank norms – SWOT analysis.

Unit IV: Co-operation:

Agricultural Cooperation in India–Meaning, brief history of cooperative development in India - Pre and Post - Independence periods and Co-operation in different plan periods, objectives, principles of cooperation, significance of cooperatives in Indian agriculture. Cooperative credit structure: short term and long term. Agricultural Cooperation - credit, marketing, consumer and multi-purpose cooperatives, farmers' service cooperative societies, processing cooperatives, farming cooperatives, cooperative warehousing; role of ICA, NCUI, NCDC, NAFED. Strength and weakness of co-operative credit system, Policies for revitalizing cooperative credit.

Unit V: Banking and Insurance:

Negotiable Instruments: Meaning, Importance and Types - Central bank: RBI – functions- Credit control – Objectives and Methods: CRR, SLR and Repo rate - Credit rationing – Dear money and cheap money. monetary policies. Credit gap: Factors influencing credit gap. Non -Banking Financial Institutions (NBFI). NPA – Causes, consequences and mitigation. CropInsurance: Schemes, Coverage, Advantages and Limitations in Implementation. Weather based crop insurance, features, determinants of compensation. Livestock Insurance Schemes -Agricultural Insurance Company of India Ltd (AIC): Objectivesand functions.

Practicals

Determination of most profitable level of capital use. 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 firsthand 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.

COURSE OUTCOMES (COs)

CO1: Tounderstandthefunctionsofvariousinstitutionsinvolvedinfarmfinancing.
CO2: To know the principles of credit,5c's,3R's and time value of money.
CO3: To gain knowledge on micro finance, role of SHG's,NGO.
CO4: To understand risk mitigating measures like agricultural insurances chemes available for the benefits of famers.
CO5: To know the different crop insurance schemes in India

CO-PO Mapping Matrix

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	2	-	-	-	-	2
CO2	3	-	-	-	-	-
CO3	2	-	-	-	-	-
CO4	2	-	-	-	-	2
CO5	2	-	-	1	2	-

References

1. Muniraj, R.1987. Farm Finance for Development, Oxford and IBH, New Delhi.
2. SubbaReddy, S and P.Raghu Ram, 2011. Agricultural Finance and Management, Oxford and IBH, New Delhi.
3. Lee,W.F.,M.D.Boehlje, A.G.Nelson and W.G. Murray, 1998. Agricultural Finance,Kalyani Publishers, New Delhi.
4. Mammoria, C.B. and R.D.Saxen, 1973. Cooperation in India, KitabMahal, Allahabad.
5. Patnaik, V.E. and A.K.Roy.1988. Cooperation and Cooperative Management, Kalyani Publishers, Ludhiana.

E-resources

1. https://www.iaritoppers.com/2019/06/angrau-notes-download-angrau-study-material.html
2. https://www.academia.edu/31604110/LECTURE_NOTES_Course_No_AECO_142_Agricultural_Finance_and_Co_operation
3. http://hillagric.ac.in/edu/coa/agriecoextedursocio/Study%20Materials/AgEcon233.pdf
4. https://agrimoon.com/wp-content/uploads/Agricultural-Finance Cooperation.pdf
5. https://www.agristudyinfo.com/agricultural-finance-cooperation-notes-pdf-download/

BSAG-2304: AGRI- INFORMATICS

Course Code	Course Title	Credits	L	T	P
BSAG-2304	Agri- Informatics	2(1+1)	1		1

Learning objectives:

1. Give students an in-depth understanding of why computers are essential components in business, education and society.
2. Introduce the fundamentals of computing devices and reinforce computer vocabulary, particularly with respect to personal use of computer hardware and software, the Internet, networking and mobile computing.
3. Provide hands-on use of Microsoft Office applications Word, Excel, Access and PowerPoint. Completion of the assignments will result in MS Office applications knowledge and skills.
4. To get familiar with basics of the Internet Programming.

Theory

Unit I: Introduction to Computers:

Introduction to Computers, Definition, Advantages & Limitations Anatomy of Computers – Components of Computers and its functions - Overview of Input devices of Computer Memory concepts, Units of memory - Operating System Definition and Types of operating systems.

Unit II: Microsoft Office:

MSWORD: Creating, Editing, Formatting a document and saving a document – Features ofFile, Edit and Format menus.

MSEXCEL: Data Presentation, Data presentation, interpretation and graph creation -Statistical analysis, mathematical expressions with MSEXCEL

MSACCESS: Database, concepts and types - Uses of DBMS in Agriculture; creating database.

Unit III: Internet& Programming Languages:

Internet - World Wide Web (WWW): Concepts and components - Programming Languages: Introduction to different computer programming languages - Programming Languages: Concepts and standard input/output operations.

Unit IV: E-Agriculture:

E-Agriculture, concepts and applications, Use of ICT in Agriculture - IT application: Computer-controlled devices (automated systems) for Agri-input management - Smartphone Apps in Agriculture for farm advises, market price, postharvest management etc;

Unit V: Applications in Agriculture:

Decision support systems, concepts, components and applications in Agriculture, Agriculture Expert System, Soil Information Systems etc for supporting Farm decisions.

Practical

Study of Computer Components, accessories, practice of important DOS Commands. Introduction of different operating

systems such as windows, Unix/ Linux, Creating, Files & Folders, File Management. Use of MS-WORD and MS Power-point for creating, editing and presenting a scientific Document. MS-EXCEL - Creating a spreadsheet, use of statistical tools, writing expressions, creating graphs, analysis of scientific data. MS-ACCESS: Creating Database, preparing queries and reports, demonstration of Agri-information system. Introduction to World Wide Web (WWW). Introduction of programming languages. Hands on Crop Simulation Models (CSM) such as DSSAT/Crop-Info/CropSyst/ Wofost; Computation of water and nutrient requirements of crop using CSM and IT tools. Introduction of Geospatial Technology for generating valuable information for Agriculture. Hands on Decision Support System. Preparation of contingent crop planning.

COURSE OUTCOMES (COs)

At the end of the course students will be able to

CO 1: Describe the usage of computers and why computers in society.

CO2: Analyse common business problems using appropriate

CO 3: Learn categories of programs.

CO 4: system software and applications.

CO 5: Information Technology applications and systems.

CO - PO Mapping Matrix

CO/PO	PO 1	PO2	PO3	PO4	PO5	PO6
CO1	1	0	3	0	0	3
CO2	0	1	3	1	1	3
CO3	1	1	3	1	0	3
CO4	0	0	3	0	1	3
CO5	1	1	3	0	0	3

References

1. Satish Jain, M Geetha, Kratika, (2012) Computer Course Windows 7 With Ms Office 2010,Bpb Publications.
2. Anupama Jain and Avneet Mehra (2012), Computer Fundamental MS Office: IncludingInternet & Web Technology 2010.
3. Meera SN 2008 ICTs in agricultural extension: Tactical to practical.
4. Willem Zip 1994 Improving the transfer and use of agricultural information: A guide toinformation technology.
5. Programming in Ansi C Paperback – 8 May 2012, by E Balagurusamy (Author).

E-resources

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2. https://vikaspedia.in/education/digital-litercy/it-literacy-courses-in-associating-with-msup/computer-fundamentals.
3. https://www.shobhituniversity.ac.in/caigers/caigers-course.php.
4. https://ecourses.icar.gov.in/.
5. https://www.kisangates.com/agro-informatics.html.

Course Code	Course Title	Credits	L	T	P
BSAG-2305	Farm Machinery and Power	2 (1+1)	1		1

Learning objectives:

1. To impart knowledge to the students on the significance, use and maintenance of farm power and improved farm equipment through various media including demonstrations.
2. To gain knowledge on the various types of IC engines, types and selection of tractors.
3. To understand the construction and working of various farm implements like tillageimplements, seed drills, plant protection and harvesting equipments.
4. To gain knowledge on the various renewable energy sources like solar, wind, biogas andbiomass energy.
5. To understand the construction and working of various solar energy gadgets, windmill, bio gas plants and production of bio diesel and ethanol from agricultural produce.

Theory

Unit I : Status of Farm power in India

Status of Farm Power in India, Sources of Farm Power , I.C. engines, working principles of I C engines, comparison of two stroke and four stroke cycle engines ,

Unit II: Comparison of Two stroke and Four stroke cycle engines

Study of different components of I.C. engine, I.C. engine terminology and solved problems, Familiarization with different systems of I.C. engines: Air cleaning, cooling, lubrication, fuel supply and hydraulic control system of a tractor,

Unit III: Tractor types

Familiarization with Power transmission system : clutch, gear box, differential and final drive of a tractor , Tractor types, Cost analysis of tractor power and attached implement,

Unit IV: Tillage

Familiarization with Primary and Secondary Tillage implement, Implement for hill agriculture, implement for intercultural operations, Familiarization with sowing and planting equipment,

Unit V:Sprayers

Calibration of a seed drill and solved examples, Familiarization with Plant Protection equipment, Familiarizationwith harvesting and threshing equipment.

Practicals

Study of different components of I.C. engine. To study air cleaning and cooling

system of engine, Familiarization with clutch, transmission, differential and final drive of a tractor, Familiarization with lubrication and fuel supply system of engine, Familiarization with brake, steering, hydraulic control system of engine, Learning of tractor driving, Familiarization with operation of power tiller, Implements for hill agriculture, Familiarization with different types of primary and secondary tillage implements: mould plough, disc plough and disc harrow . Familiarization with seed- cum-fertilizer drills their seed metering mechanism and calibration, planters and transplanter Familiarization with different types of sprayers and dusters Familiarization with different inter- cultivation equipment, Familiarization with harvesting and threshing machinery.

COURSE OUTCOMES (COs)

At the end of the course students will be able to

CO 1: Understanding the working, operation and uses of different farm machines

CO2: Understanding the various scientific principles for the efficient operation of farming activities

CO 3: Applying the different farming machine-operational methods

CO 4: system IC engines and applications.

CO 5: Creating an appropriate method of farm machining that can give maximum crop productivity withminimum cost and human efforts.

CO-PO Mapping Matrix

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	2	-	-	-	-	2
CO2	3	-	-	-	-	-
CO3	2	-	-	-	-	-
CO4	2	-	-	-	-	2
CO5	2	-	-	1	2	-

References:

1. Ojha, T.P and A.M.Michael 2005. Principles of Agricultural Engineering Vol-I. Jain Brothers, New Delhi. ISBN: 978-8186321638
2. Nakra C.P 1970. Farm Machinery and Equipment: Dhanpat Rai Publishing Company Ltd,New Delhi ISBN: 978-8187433231
3. Srivastava, A.C., 1991. Elements of Farm Machinery. Oxford and IBH Publishing Co PvtLtd, New Delhi. ISBN: 978-8120405134
4. Senthilkumar, T., R. Kavitha and V. M. Duraisamy. 2015. A Text Book of Farm Machinery,Thannambikkai Publications, Coimbatore. ISBN: 978-9381102305
5. Renewable Energy, Godfrey Boyle (Editor) ISBN: 0199261784 / ISBN-13:

E-resources:

1. www.agricoop.nic.in/dacdivision/Machinery1/directory.htm
2. www.farmmachineryshow.org
3. www.freesolaronline.com

BSAG-2306: PRODUCTION TECHNOLOGY FOR VEGETABLES AND SPICES

Course Code	Course Title	Credits	L	T	P
BSAG-2306	Production Technology for Vegetables and Spices	2 (1+1)	1		1

Learning objectives

- To learn about the nursery practices, planting methods of vegetable crops.
- To learn about the cultivation techniques, maturity indices, harvesting techniques ofvegetable crops.
- To learn about the nursery practices, propagation methods of spice crops.
- To learn about the cultivation techniques, harvesting techniques of spice crops.
- To provide knowledge on protected cultivation of vegetable crops.

Theory

Unit I

Importance of vegetables & spices in human nutrition and national economy, kitchen gardening,

Unit II

Brief about origin, area, climate, soil, improved varieties and cultivation practices such as time of sowing, sowing, transplanting techniques, planting distance, fertilizer requirements, irrigation, weed management, harvesting and yield, physiological disorders, of important vegetable and spices (Tomato, Brinjal, Chilli, Capsicum,

Unit III

Brief about origin, area, climate, soil, improved varieties and cultivation practices such as time of sowing, sowing, transplanting techniques, planting distance, fertilizer requirements, irrigation, weed management, harvesting and yield, physiological disorders, of important vegetable and spicesCucumber, Melons, Gourds, Pumpkin,

Unit IV

Brief about origin, area, climate, soil, improved varieties and cultivation practices such as time of sowing, sowing, transplanting techniques, planting distance, fertilizer requirements, irrigation, weed management, harvesting and yield, physiological disorders, of important vegetable and spices French bean, Peas; Cole crops such as Cabbage, Cauliflower, Knol-khol; Bulb crops such as Onion, Garlic;

Unit V

Brief about origin, area, climate, soil, improved varieties and cultivation practices such as time of sowing, sowing, transplanting techniques, planting distance, fertilizer requirements, irrigation, weed management, harvesting and yield, physiological disorders, of important vegetable and spices French bean, Root crops such as Carrot, Raddish, Beetroot; Tuber crops such as Potato; Leafy vegetables such as Amaranth, Palak. Perennial vegetables).

Practical

Identification of vegetables & spice crops and their seeds. Nursery rising. Direct seed sowing and transplanting. Study of morphological characters of different vegetables & spices. Fertilizers applications. Harvesting & preparation for market. Economics of vegetables and spices cultivation.

COURSE OUTCOMES (COs)

CO1: The students will be able to practice the nursery techniques and planting methods ofvegetable crops.

CO2: The students will be able to understand the cultivation techniques of vegetable crops.

CO3: The students will be to diagnose problems in cultivation of vegetable crops.

CO4: The students will be able to practice the protected cultivation of vegetable crops.

CO5: The students will be able to practice production techniques of spice crops.

CO-PO Mapping matrix

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6
CO 1	3	3	1	3	2	0
CO 2	3	3	2	3	3	0
CO 3	3	3	1	3	3	0
CO 4	3	3	3	3	1	0
CO 5	3	3	2	3	3	0

References

1. Shanmugavelu, K.G. 1989. Production Technology of Vegetable Crops. Oxford IndiaPublication, New Delhi.
2. Singh, S.P. 1989. Production Technology of Vegetable Crops. Universal Publicationcentre, Karnal.
3. Veera raghavathatham, D., M. Jawaharlal and SeemanthiniRamadas. 1996. A Guideon Vegetable Culture. A.E. Publications, Coimbatore
4. Thamburaj. S. and N.Singh 2004. Vegetables, Tuber Crops and Spices. ICAR. VishnuSwarup, 2006. Vegetable science and technology in India. Kalyani publishers, New Delhi.
5. Balraj Singh. 2005. Protected cultivation of vegetable crops. Kalyani Publishers, Ludhiana.

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2. http://www.ces.ncsu.edu/depts/hort/hil/hil-32-a.html
3. http://attra.ncat.org/attra-pub/manures.html
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5. http://www.sus-veg-thai.de/

BSAG-2307: ENVIRONMENTAL STUDIES AND DISASTER MANAGEMENT

Course Code	Course Title	Credits	L	T	P
BSAG-2307	Environmental Studies and Disaster Management	3(2+1)	2		1

Learning objectives:

- To learn the basics of environmental studies, environmental pollution and itseffects.
- To learn about disasters and management.
- To learn about ecosystems, pollution and other problems related to environment To learn about disasters and its management

Theory

Unit I

Definition and Scope of environmental studies, multidisciplinary nature of environmental studies, concept of sustainability & sustainable development.

Ecology and Environment: Concept of an Ecosystem- its structure and functions, Energy Flow in an Ecosystem, Food Chain, Food Web, Ecological Pyramid & Ecological succession, Study of following ecosystems: Forest Ecosystem, Grass land Ecosystem & Aquatic Ecosystem & Desert Ecosystem.

Unit II

Natural Resources: Renewable & Non-Renewable resources; Land resources and landuse change; Land degradation, Soil erosion & desertification. Deforestation: Causes & impacts due to mining, Dam building on forest biodiversity & tribal population. Energy Resources: Renewable & Non-Renewable resources, Energy scenario & use of alternate energy sources, Case studies. Biodiversity: Hot Spots of Biodiversity in India and World, Conservation, Importance and Factors Responsible for Loss of Biodiversity, Biogeographical Classification of India

Unit III

Environmental Pollutions: Types, Causes, Effects & control; Air, Water, soil & noise pollution, Nuclear hazards & human health risks, Solid waste Management; Control measures of urban & industrial wastes,pollution case studies.

Unit IV

Environmental policies & practices: Climate change & Global Warming (Greenhouse Effect), Ozone Layer - Its Depletion and Control Measures, Photochemical Smog, Acid Rain Environmental laws:

Environment protection Act; air prevention & control of pollution act, Water Prevention & Control of Pollution Act, Wild Life Protection Act, Forest Conservation Acts, International Acts; Montreal &Kyoto Protocols & Convention on biological diversity, Nature reserves, tribal population & Rights & human wild life conflicts in Indian context

Unit V

Human Communities & Environment: Human population growth; impacts on environment, human health & welfare, Resettlement & rehabilitation of projects affected person: A case study, Disaster Management; Earthquake, Floods & Droughts, Cyclones & Landslides, Environmental Movements; Chipko, Silent Valley, Vishnoi's of Rajasthan, Environmental Ethics; Role of Indian & other regions & culture in environmental conservation, Environmental communication & public awareness; Case study

Practical

Pollution case studies. Case Studies- Field work: Visit to a local area to document environmental assets river/ forest/ grassland/ hill/ mountain, visit to a local polluted site-Urban/Rural/Industrial/ Agricultural, study of common plants, insects, birds and study of simple ecosystems-pond, river, hill slopes, etc.

COURSE OUTCOMES (COs)

CO1: Understanding of various environmental aspects, biodiversity conservation and role of individual, NGOs and Government for environmental protection activities

CO2: Recognizing the importance of sustainable development and appropriate use of natural resourcesand maintaining the balanced ecosystem.

CO3: Discussing new techniques of development through Environmental Impact Assessment (EIA) toreduce the rate of consumption of natural resources

CO4: Analyzing various controlling measures of environmental pollution, ozone layer depletion,global warming and acid rain

CO5: Evaluating the importance of eco-friendly activities to maintain the quality of environment and humanlife.

CO-PO Mapping matrix

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6
CO 1	3	3	1	3	2	0
CO 2	3	3	2	3	3	0
CO 3	3	3	1	3	3	0
CO 4	3	3	3	3	1	0
CO 5	3	3	2	3	3	0

References

1. "Biodiversity and Conservation", Bryant, P. J., Hypertext Book
2. "Textbook of Environment Studies", Tewari, Khulbe & Tewari, I.K. Publication
3. "Environmental Chemistry", De, A. K., New Age Publishers Pvt. Ltd.

BSAG-2308: STATISTICAL METHODS

Course Code	Course Title	Credits	L	T	P
BSAG-2308	Statistical Methods	2(1+1)	1		1

Learning objectives:

- To understand and apply fundamental concept of statistical applications in biology
- To acquire about theoretical concept of descriptive statistics, testing of hypothesis, correlation, regression and basic design of experiments.

Theory

Unit I: Diagrams and graphs

Introduction to Statistics, Definition, Advantages & Limitations and its Applications in Agriculture, Quantitative and Qualitative data- Discrete and Continuous Variables. Diagrammatic representations Bar Graphs- Pie Graphs - Graphical Representation – Frequency histogram, Frequency polygon, frequency curve and ogives.

Unit II: Measures of Central Tendency and Dispersion

Measures of Central Tendency: Definition, Different Measures, Characteristics of a Satisfactory Average. Definition and Calculation of Arithmetic Mean, Median and Mode - Merits and Demerits. Measures of Dispersion: Standard Deviation, Variance and Coefficient ofVariation

Unit III: Probability Distribution and Bivariate Analysis

Introduction to Probability—Events, Sample Space, Definition of Probability, Addition and Multiplication Theorem (without proof). Binomial Distribution, Poisson Distribution. NormalDistribution (Concepts only).

Introduction to Correlation: Definition, Scatter Diagram, Types of correlation, Properties - Karl Pearson's correlation coefficient. Regression – definition – fitting of two simple linear regression equation – properties of regression coefficient. Chi-square test

Unit IV: Tests of Significance

Definitions of Statistical Population, Sample, Random Sampling, Parameter, Statistic. Sampling distribution, Standard error - Test of Significance, Null Hypotheses, Types of Errors, Level of Significance and Degrees of freedom, Steps involved in Testing of a Hypotheses. Large sample tests: Test of single and difference of proportions - Test of single and difference of means. Small sample tests: student's-t test for one and two samples. Paired T test and test for correlation coefficient. Chi-square test for attributes, F test for equality of variances.

Unit V: Design of Experiments

Analysis of Variance (ANOVA) – assumptions – one way and two way

classifications. Basic principles of experimental designs – Completely Randomized Design (CRD) – Randomized Block Design (RBD) – Latin Square Design (LSD). Current Streams of thought.

Practical

Graphical Representation of Data. Measures of Central Tendency (Ungrouped data) with Calculation of Quartiles, Deciles & Percentiles. Measures of Central Tendency (Grouped data) with Calculation of Quartiles, Deciles & Percentiles. Measures of Dispersion (Ungrouped Data). Measures of Dispersion (Grouped Data). Moments, Measures of Skewness & Kurtosis (Ungrouped Data). Moments, Measures of Skewness & Kurtosis (Grouped Data). Correlation & Regression Analysis. Application of One Sample t-test. Application of Two Sample Fisher's t-test. Chi-Square test of Goodness of Fit. Chi-Square test of Independence of Attributes for 2 ×2 contingency table. Analysis of Variance One Way Classification. Analysis of Variance Two Way Classification. Selection of random sample using Simple Random Sampling.

COURSE OUTCOMES (COs)

CO1: Understand fundamental concept of statistical applications in biology
CO2: Application of statistical concepts
CO3: Acquire theoretical concept of descriptive statistics, testing of hypothesis, correlation, regression and basic design of experiments.
CO4: Practical exposure to concept of descriptive statistics, testing of hypothesis, correlationand regression
CO5: Practical exposure to basic design of experiments.

CO - PO Mapping Matrix

CO/PO	PO 1	PO2	PO3	PO4	PO5	PO6
CO1	2	-	-	-	-	2
CO2	3	-	-	-	-	-
CO3	2	-	-	-	-	-
CO4	2	-	-	-	-	2
CO5	2	-	-	1	2	-

References:

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BSAG-2309: LIVESTOCK AND POULTRY MANAGEMENT

Course Code	Course Title	Credits	L	T	P
BSAG-2309	Livestock and Poultry Management	4 (3+1)	3		1

Learning Objectives

- The course aims to impart knowledge and adequate understanding of the importance ofthe Dairy Industry in the National economy and in different career Opportunities
- To familiarize with different livestock breeds in relation to various agro climatic zones,enabling to choose appropriate breeds for their utility
- To provide hands-on and field oriented training in dairy cattle management techniquesthat will assist students to develop entrepreneurial skills.
- To disseminate information on scientific feeding using locally available feed componentsin order to save the farming expenditure
- To signify the importance of clean milk production and different milking methods

Theory

Unit I:

Dairy Cattle: Introduction - Meaning of commonly used terms - Origin and domestication of livestock - Livestock census – Role of livestock in Indian economy - Milk production and availability. Cattle breeds – Indigenous breeds – Red Sindhi, Sahiwal, Gir, Kangayam – Exotic breeds-Holstein Friesian, Jersey, Brown Swiss. Breeds of buffalo – Murrah – Surti – Nili - Ravi – Selection of dairy cattle. Male and Female reproductive system – Oestrous cycle - Signs of heat. Care of calf at birth - Heifer management - Management of pregnant animals. Housing - Selection of site for the farm buildings - Types of animal housing – Conventional barn – Loose housing - construction details of cattle shed. Classification of feeds – Nutrients and their function. Digestive system of ruminants – Digestion of feed - Common ailments – Bloat – Carbohydrate engorgement – Diarrhoea – Indigestion. Common diseases – Mastitis - Foot and Mouth disease – Anthrax – Black quarter – Endoparasites – Ectoparasites.

Unit II:

Sheep: Introduction – Zoological classification – Advantages of sheep farming – breeds classification – Indigenous breeds – Hissardale, chokla, Nali, Nellore, Mandya – Breeds of Bihar – Mecheri, Madras red, Ramnad White, Trichy black, Kilakarsal, Vembur – Exotic breeds – Merino, Rambouillet, Dorest- Suffolk – South Down – Breeding – Selection of breeding stocks - Reproduction in sheep – Breeding system – Breeding policy for improving mutton and wool production — Feeding – Nutrient requirements – Feed resources – Pasture management – Flushing-Feeding of pregnant and lactating ewes – Housing of sheep – Common diseases – Sheep pox – Blue tongue – PPR – Anthrax – Hemorrhagic septicemia – Foot root – Pregnancy toxemia.

Unit III:

Goat: Introduction – Meaning of commonly used terms – Advantages of goat farming – Breeds – Indigenous breeds – Jamunapari – Tellicherry – Barbari – Exotic breeds – Saanen –Toggenberg – Nubian – Breeding – Selection of breeding animal – Reproduction - Mating systems – Feeding-Feeding habits of goat – Nutrient requirement – Stall fed system of goat rearing – Control of ecto and endo parasites – Common complaints – Carbohydrate engorgement – HCN poisoning – Tetanus.

Unit IV:

Swine: Advantages and disadvantages of pig farming – Utility – Breeds – Large White Yorkshire – Middle White Yorkshire – Landrace – Berkshire-Breeding – Selection of breeding stocks – Reproduction - symptoms of heat – Care of pregnant sows – Management at the time of furrowing – Weaning – Feeding – Creep feeding – Starter ration – Grower ration – Finisher ration – quantity to be feed – Housing of pigs - Common diseases– Swine fever – Swine pox – Foot and mouth disease – Swine erysipelas – Brucellosis.

Unit V:

Poultry: Advantages of poultry farming – Role of egg and chicken meat in human nutrition – Parts of a fowl – Classification of poultry – American – English – Asiatic – Mediterranean classes – Management – Chick – Grower – Layer – Broiler – Housing – Location – Housing requirements – Construction details – Deep litter system – Cage system – Feeding –Nutrient requirement for different classes of chicken – Feed formulation – Common diseases – Ranikhet disease – Infectious bursal disease – Coccidiosis – Vaccination – Dressing of bird for table purpose.

Practical

External body parts of cattle, buffalo, sheep, goat, swine and poultry. Handling and restraining of livestock. Identification methods of farm

animals and poultry. Visit to IDF and IPF to study breeds of livestock and poultry and daily routine farm operations and farm records. Judging of cattle, buffalo and poultry. Culling of livestock and poultry. Planning and layout of housing for different types of livestock. Computation of rations for livestock. Formulation of concentrate mixtures. Clean milk production, milking methods. Hatchery operations, incubation and hatching equipments. Management of chicks, growers and layers. Debeaking, dusting and vaccination. Economics of cattle, buffalo, sheep, goat, swine and poultry production.

COURSE OUTCOMES (COs)

CO 1: The students gain knowledge in basic concepts of scientific rearing of cattle.

CO 2: Further, they would enrich on cattle management practices including feeding,breeding and housing.

CO 3: Students would be able to analyse and solve different problems arising in cattle andgoat rearing.

CO 4: This course encompasses all relevant information and serve as source of knowledge to understand the modern techniques used in animal husbandry sector.

CO 5: It enlightens the importance of livestock products and clean milk production.

CO-PO Mapping Matrix

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6
CO 1	3	-	2	1	3	-
CO 2	3	-	2	-	3	1
CO 3	3	-	3	1	1	1
CO 4	3	-	3	-	2	2
CO 5	2	-	1	2	2	1

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3. Gopalakrishnan C.A and Lal, DMM., 1992. Livestock and Poultry Enterprises for RuralDevelopment,Vikas Publishing House Private Limited , New Delhi-44.
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IV SEMESTER

S. No.	Course Code	Course Title	Credits
1	BSAG-2401	Crop Production Technology –II *(Rabi Crops)*	2(1+1)
2	BSAG-2402	Production Technology for Ornamental Crops, MAP and Landscaping	2(1+1)
3	BSAG-2403	Renewable Energy and Green Technology	2(1+1)
4	BSAG-2404	Problematic Soils and their Management	2(2+0)
5	BSAG-2405	Production Technology for Fruit and Plantation Crops	2(1+1)
6	BSAG-2406	Principles of Seed Technology	3(1+2)
7	BSAG-2407	Farming System & Sustainable Agriculture	1(1+0)
8	BSAG-2408	Agricultural Marketing Trade & Prices	3(2+1)
9	BSAG-2409	Introductory Agro-meteorology & Climate Change	2(1+1)
10	BSAG-2410/ BSAG-2411/ BSAG-2412/ BSAG-2413/ BSAG-2414/ BSAG-2415/ BSAG-2416/ BSAG-2417/ BSAG-2418/ BSAG-2419/ BSAG-2420/ BSAG-2421	Elective Course	**3 credit**
Total			**19(11+8) + 3**

BSAG-2401: CROP PRODUCTION TECHNOLOGY –II (RABI CROPS)

Course Code	Course Title	Credits	L	T	P
BSAG-2401	**Crop Production Technology –II *(Rabi Crops)***	**2(1+1)**	**1**		**1**

Learning objectives

- To impart updated technology and skills in performing different operations in raising the crop.
- To understand the effect of climate, soil, varieties, affordable and clean energy.
- To understand the concepts of integrated weed control, integrated nutrient management and conjunctive use of water.
- To know cropping systems in India and Bihar, post-harvest operations in different crops.
- To learn about farm mechanization and resource conservation technology for sustainable development for the communities.

Theory

Unit I: Cereals

Wheat, Barley and Rye – Origin, geographical distribution, economic importance, soil and climatic requirements, varieties, cultural practices land preparation to harvest and Yield.

Unit II: Pulses

Bengal gram (Chick pea), Lentil and Peas: Origin, geographical distribution, economic importance, soil and climatic requirements, varieties, cultural practices land preparation to harvest and Yield.

Unit III: Oilseeds

Rape seed and Mustard**,** Sesame (Gingelly) and Sunflower - Origin, geographical distribution, economic importance, soil and climatic requirements, varieties, cultural practices land preparation to harvest and Yield.

Unit IV: Sugar, Medicinal and Aromatic Crops:

Sugarcane and Sugar beet- Medicinal and Aromatic crops- Mentha, Lemon grass and Citronella - Origin, geographical distribution, economic importance , soil and climatic requirements, varieties, cultural practices land preparation to harvest and Yield.

Unit V: Forage crops and Fodder preservation

Fodder legumes- Berseem, Lucerne and Oats- Tree fodder crops- Agathi, Subabul and Acacia -Origin, geographical distribution, economic importance , soil and climatic requirements, varieties, cultural practices land preparation to harvest and Yield- Classification of feed- Green fodder, hay and silage (Preserved fodder)- hay and silage making methods

Practical

Sowing methods of wheat and sugarcane, identification of weeds in *rabi* season crops, study of morphological characteristics of *rabi* crops, study of yield contributing characters of *rabi* season crops, yield and juice quality analysis of sugarcane, study of important agronomic experiments of *rabi* crops at experimental farms. Study of *rabi* forage experiments, oil extraction of medicinal crops, visit to research stations of related crops.

COURSE OUTCOMES (COs)

CO1: To understand the importance of oil seed production and cultivation of major oilseed crops

CO2: To gain knowledge about importance of sugar crops and its Cultivation practices

CO3: To formulate different cropping system and production technologies for various fibre crops

CO4: To construct idea regarding knowledge on growing of tuber crops

CO5: To create awareness about narcoticscrops and its production Technologies

CO-PO Mapping matrix

CO/PO	PO 1	PO2	PO3	PO4	PO5	PO6

CO1	**3**	**1**	**-**	**-**	**1**	**-**
CO2	**3**	**3**	**-**	**-**	**1**	**-**
CO3	**3**	**2**	**3**	**-**	**3**	**2**
CO4	**3**	**2**	**-**	**-**	**3**	**-**
CO5	**3**	**2**	**-**	**-**	**1**	**-**

References

1. Mukund joshi, 2019. Text Book of Field Crops. PHL Learning Publishers, NewDelhi.
2. B.Gururajan, R. Balasubramanian and V.Swaminathan.2014.
3. Recent Strategies on Crop Production. Kalyani Publishers , New Delhi
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5. Reddy, S.R. 2004. Agronomy of Feld Crops. Kalyani Publishers, New Delhi.
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BSAG-2402: PRODUCTION TECHNOLOGY FOR ORNAMENTAL CROPS, MAP AND LANDSCAPING

Course Code	Course Title	Credits	L	T	P
BSAG-2402	**Production Technology for Ornamental Crops, MAP and Landscaping**	**2(1+1)**	**1**		**1**

Learning objectives

- To impart knowledge on basic principles, components and practices of landscape gardening.
- To highlight the different styles of gardens and special features in a garden.
- To enable them in designing gardens using various tools and techniques
- To impart knowledge on the production technology of Cut and Loose flower crops.
- To impart comprehensive knowledge about the production technology of Medicinal andAromatic crops

Theory

Unit I: Introductory Floriculture:

Importance, Scope, Potential of Floriculture, Flower Trading, Flowers and foliage's, Productionand constraints, Famous gardens of India.

Unit II: Protected cultivation – Cut flowers:

Production technology of important cut flowers like Rose, Gerbera, Carnation, Lilium, Orchids and Anthurium under protected conditions.

Unit III: Production technology of Cut flowers and Loose flowers:

Production technology of Gladiolus, tuberose, chrysanthemum under open conditions. Package of practices for loose flowers like Rose, Jasmine, Marigold, Crossandra and Nerium under open conditions.

Unit IV: Production technology of Medicinal plants Aromatic plants:

Ashwagandha, Asparagus, Aloe, Costus, Cinnamomum, Periwinkle, Isabgol, Mint, Lemongrass, Citronella, Palmarosa, Ocimum, Rose, geranium, Vetiver. Processing and value addition in ornamental crops and MAPs produce.

Unit V: Landscaping:

History, Styles, Soft and Hardscape Components, Principles of landscaping, Landscape designing-drawing-manual and CAD, Practising Garden designing for Residential, Community living, Institutional, Industrial gardens and Theme parks, Horticultural crafts and current streamof thoughts.

Practical

Identification of Ornamental plants. Identification of Medicinal and Aromatic Plants. Nursery bed preparation and seed sowing. Training and pruning of Ornamental plants. Planning and layout of garden. Bed preparation and planting of MAP. Protected structures – care and maintenance. Intercultural operations in flowers and MAP. Harvesting and post harvest handling of cut and loose flowers. Processing of MAP. Visit to commercial flower/MAP unit.

COURSE OUTCOMES (COs)

CO 1: The students will be able to practice the nursery techniques and planting methods ofcut and loose flower crops

CO 2: The students will beable to understand the cultivation techniques of medicinal andaromatic plants.

CO3: The students will be to diagnose problems in cultivation of flower crops under protectedcultivation.

CO4: The students will be able to practice the landscape designing for various places

CO5: The students will be able to practice horticultural crafts

CO-PO Mapping matrix

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6

CO 1	**3**	**3**	**1**	**3**	**2**	**0**
CO 2	**3**	**3**	**2**	**3**	**3**	**0**
CO 3	**3**	**3**	**1**	**3**	**3**	**0**
CO 4	**1**	**0**	**3**	**3**	**2**	**0**
CO 5	**1**	**0**	**2**	**3**	**1**	**0**

References

1. Bose, T.K. and P. Yadav. 1989. Commercial flowers. Naya Prakash Publications, Calcutta.
2. Kumar, N, Md. Abdul Khader, P. Rangasamy, and I. Irulappan, 1994. Spices, Plantation Crops, Medicinal and Aromatic plants, Rajalakshmi Publications, Nagercoil.
3. Randhawa, G.S. and A. Mukhopadhyay. 1986. Floriculture in India. Allied Publishers (P) Ltd., New Delhi.
4. Prajapati, Purohit, Sharma and Kumar. 2006. A Handbook of Medicinal plants-A complete source book. Agrobios, India
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BSAG-2403: RENEWABLE ENERGY AND GREEN TECHNOLOGY

Course Code	Course Title	Credits	L	T	P
BSAG-2403	Renewable Energy and Green Technology	2(1+1)	1		1

Learning objectives

- To gain knowledge on the various renewable energy sources like solar, wind, biogas andbiomass energy.
- To understand the construction and working of various solar energy gadgets, windmill, bio gas plants and production of bio diesel and ethanol from agricultural produce.

Theory

Unit I

Classification of energy sources, contribution of these of sources in agricultural sector,

Unit II

Familiarization with biomass utilization for biofuel production and their application,

Unit III

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

Unit IV

Introduction of solar energy, collection and their application, Familiarization with solar energy gadgets: solarcooker, solar water heater, application of solar energy.

Unit V

Solar drying, solar pond, solar distillation, solar photovoltaic system and their application, introduction of windenergy and their application

Practical

Familiarization with renewable energy gadgets. To study biogas plants, To study gasifier, To study the production process of biodiesel, To study briquetting machine, To study the production process of bio-fuels. Familiarization with different solar energy gadgets. To study solar photovoltaic system: solar light, solar pumping, solar fencing. To study solar cooker, To study solar drying system. To study solar distillation and solar pond.

COURSE OUTCOMES (COs)

CO 1: Understanding the relative importance of different sources of energy for agriculturesector and their sustainability.

CO 2: Understanding various technological aspects of sustainable utilization of bio- and solarenergy

CO3: Applying the above knowledge for evaluating the different sources of sustainableenergy for agriculture sector.

CO4: The students will be able to practice the Renewable Energy and Green Technology designing for various places

CO5: The students will be able to practice Renewable Energy and Green Technology crafts

CO-PO Mapping matrix

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO6
CO 1	3	3	1	3	2	0
CO 2	3	3	2	3	3	0
CO 3	3	3	1	3	3	0
CO 4	1	0	3	3	2	0
CO 5	1	0	2	3	1	0

References

1. Renewable Energy Sources and Emerging Technologies, by Kothari D.P. , Singal K. C. , RanjanRakesh , New Arrivals.
2. Non-Conventional Energy Sources and Utilisation (Energy Engineering), by R.K. Rajput, S. ChandPublishing.
3. Renewable Energy Technologies: A Practical Guide for Beginners, Solanki Chetan Singh, PHI School Books.

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BSAG-2404: PROBLEMATIC SOILS AND THEIR MANAGEMENT

Course Code	Course Title	Credits	L	T	P
BSAG-2404	Problematic Soils and their Management	2(2+0)	2		0

Learning Objectives

- To know about the soil and different problem occur during cultivation.
- How to identify the problem and what are the reclamation method requires improving thesoil health.
- Students learn practically about the identification of problem soil and learn different methodto improve soil fertility, that necessary to improve the yield.
- To gain knowledge on the assessment irrigation water quality
- To learn about modern tools to asses the extent of types of problematic soils

Theory

Unit I : Soil health and Soil quality and Wastelands

Soil degradation: Concept, types, factors and processes. Soil quality and soil health: definition and concept, soil quality indicators. Characteristics of healthy soils. Distribution of Waste land and problem soils in India. Their categorization based on properties

Unit II :Soil constraints- Chemical

Saline soils, alkali Soils, saline-alkali soils, degraded alkali soils, coastal saline soils: definition, formation, characteristics, effect on plant growth, reclamation and management. Acid and acidsulphate soils: definition, formation, characteristics, effect on plant growth, reclamation and management. Calcareous Soil: definition, formation, characteristics, effect on plant growth, reclamation and management.

Unit III: Soil constraints- Physical and polluted soil

Slow permeable, excessively permeable, surface crusting, sub surface hard pan and fluffy paddy soils. Eroded soils and compacted soils: definition, formation, characteristics, effect on plant growth, reclamation and management. Submerged soils and flooded soils: definition, formation, characteristics, effect on plant growth, reclamation and management. Polluted soils: definition, sources and their remediation. Water pollution: definition, sources and their remediation.

Unit IV: Irrigation Water Quality and Use

Quality of irrigation water – Criteria used for assessing the quality of irrigation water – Water quality appraisal – Effect of poor quality water on soil and crop growth – Management of poor quality irrigation water.

Unit V: Assessment and bioremediation

Remote sensing and GIS in diagnosis and management of problem soils. Land capability and classification, land suitability classification. Problem soils under different agro ecosystems. Bioremediation of problem soils through multipurpose tress (MPTs**).** Current stream of thoughts.

COURSE OUTCOMES (COs)

CO1: The students get knowledge about different kind of problem soil in India and theircharacteristics

CO2: Students gain knowledge in methods of reclamation of problem soils

CO3: The students gain practical knowledge of laboratory to test the problem soil.

CO4: Identify processes resulting in deterioration of soil physical and chemical properties

CO5: Students gains knowledge on importance of quality irrigation water for soil and crops

CO-PO Mapping Matrix

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	1	1	1	-	-	1
CO2	2	1	1	-	-	-
CO3	-	1	1	-	-	-
CO4	1	1	-	-	-	-
CO5	1	1	-	-	1	1

References:

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2. Das, D.K 2013 Introductory Soil Science. Kalyani Publishers, New Delhi
3. Das, D.K.2019 Problematic soils and their management Kalyani Publishers, Delhi
4. Mehra, R.K.2017.Textbook of Soil Science. ICAR, New Delhi
5. Somani.L.L 1990 Alkali Soils and their Reclamation and management. DivyajoytiPrakashan, Jodhpur

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BSAG-2405: PRODUCTION TECHNOLOGY FOR FRUIT AND PLANTATION CROPS

Course Code	Course Title	Credits	L	T	P
BSAG-2405	Production Technology for Fruit and Plantation Crops	2(1+1)	1		1

Learning objectives

- To impart knowledge on cultural management of Tropical fruit crops.
- To impart knowledge on cultural management of Subtropical fruit crops.
- To impart knowledge on cultural management of temperate fruit crops.
- To impart knowledge on cultural management of Arid and Semi-Arid zone fruit crops.
- To impart knowledge on cultural management of Plantation crops.

Theory

Unit I: Introduction and Major Fruit crops:

Importance and Scope of fruit and plantation crop industry in

India. Importance of rootstocks. Production technology of major fruits - Mango, Banana, and Citrus.

Unit II: Tropical and Subtropical fruit crops

Production technology of Guava, Sapota, Grape, Pineapple, Papaya, Fig and Iitchi.

Unit III: Temperate fruit crops:

Production technology of Apple, Pear, Peach, Plum strawberry

Unit IV: Arid and Semi-Arid zone fruit crops:

Production technology of Minor fruits -Aonla, Jamun,Date palm, Ber, Pomegranate andJackfruit.

Unit V: Plantation crops:

Production technology of Coconut, Arecanut, Cashew, Tea, Coffee, Rubber, Oil palm andPalmyrah and current stream of thoughts

Practical

Seed propagation. Scarification and stratification of seeds. Propagation methods for fruit and plantation crops. Description and identification of fruit. Preparation of plant bio regulators and their uses, Important pests, diseases and physiological disorders of above fruit and plantation crops, Visit to commercial orchards.

COURSE OUTCOMES (COs)

CO 1: The students will be able to practice the production technology aspects of Tropical,Subtropical, Temperate and Arid zone fruits.

CO 2: The students can demonstrate Sexual and Asexual method of propagation in Fruitcrops.

CO 3: The students can demonstrate important production techniques and diagnose problemsin cultivation of tropical and arid zone fruits.

CO 4: The students will be able to practice the production technology aspects of Plantationcrops.

CO 5: The students can demonstrate important production techniques and diagnose problemsin cultivation of Plantation crops.

CO-PO Mapping matrix

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6
CO 1	3	3	1	1	2	0
CO 2	3	2	1	2	1	0
CO 3	3	3	1	1	2	0
CO 4	3	3	1	1	2	0
CO 5	3	2	1	1	2	0

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1. Veera raghavathatham, D., M. Jawaharlal, S. Jeeva and S. Rabindran 1996. ScientificFruit culture, Suri Associates, Coimbatore.
2. Bose, T.K. 1988. Fruits of India – Tropical and Sub-tropical, Naya Prakash Publications, Calcutta.

3. Gardner, V.R., F.F. Bradford and H.D. Hooker. 1952. Fundamentals of fruit production.Mc Graw Hill Book Co., Inc. London.
4. Kumar N, A. Khader P. Rangaswami and Irulappan I. 2000. Introduction to Spices,Plantation Crops, Medicinal and Aromatic Plants. Oxford and IBH.
5. Peter, K.V. 2002. Plantation crops – National Book Trust of India – New Delhi.

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3. http://www.indianspices.com/
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BSAG-2406: PRINCIPLES OF SEED TECHNOLOGY

Course Code	Course Title	Credits	L	T	P
BSAG-2406	Principles of Seed Technology	3(1+2)	1		2

Learning objectives

- To make the students to understand the importance of quality seed
- To impart the students about the genetic and agronomic of principles involved in qualityseed production
- To impart the knowledge about the techniques of seed production
- To create awareness about the seed laws pretending to the quality seeds
- To impart knowledge to the students about the seed testing methods for assessing thequality of the seeds.

Theory

Unit I: Introduction to seed quality concept

Introduction to seed technology – definitions – concept, role and goals of seed technology – differences between scientifically produced seed and grain used as seed. Deterioration of cropvarieties – Factors responsible for loss of genetic purity – Maintenance of genetic purity duringseed production – Safeguards for maintenance of genetic purity- Definition – Characters of good quality seed – factors affecting seed quality – classes ofseed – Nucleus seed, Beeder seed, foundation and certified seeds.

Unit II: Seed production techniques of various agricultural crops

Foundation and certified seed production of important cereal crops – Rice, Maize and Sorghum Foundation and certified seed production of important pulse crops – Red gram, Black gram and green gram. Foundation and certified seed production of important oilseed crops – Sesame, Sun flower and Groundnut. Foundation and certified seed production of Fiber crop – Cotton - Foundation and certified seed production of important vegetables – Tomato, Brinjal and Bhendi.

Unit III: Post harvesting seed handling techniques and seed certification.

Seed drying – Methods of seed drying – Sun drying – Forced air drying – Principle

of forcedair drying – Seed drying – heated air drying system – management of seed drying operations - seed treatment its importance. Seed Processing – principles – equipments Seed certification – Phases of seed certification – Procedure for seed certification – Field inspection.

Unit IV: Seed storage techniques and seed marketing

Method of application and seed packing- Seed storage – General principles – Stages, factors affecting Seed longevity during storage – Measures for pest and disease control during storage. Seed marketing- Structure and organization – Sales generation activities, Promotional media – Factors affecting seed marketing – Role of WTO and OECD in seed marketing.

Unit V: Seed quality testing, legislation and marketing

Varietal identification through Grow Out Test (GOT) and Electrophoresis - Molecular Biochemical test – Detection of genetically modified crops – Transgene contamination innon-GM crops – GM crops and organic seed production - Seed Act 1966 – Main features of the Seed Act, 1966 – Seed Act Enforcement- Duties and powers of seed inspectors,- Offences and penalties- Seed Control Order 1983.

Practical

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

COURSE OUTCOMES (COs)

CO 1: Acquire knowledge on seed quality characteristics, varietal deterioration and variousprinciples of seed production

CO 2: Understand the Foundation and Certified Seed production techniques and post harvest processes of various Agricultural crops.

CO 3: Understand the Foundation and Certified Seed production techniques and post harvest processes of Important Horticultural crops.

CO 4: Import knowledge about seed certification, Legislation, Storage and Marketing

CO 5: Acquire knowledge on various seed quality testing procedure, Molecular varietalidentification techniques and seed production cost analysis.

CO-PO Mapping Matrix

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	-	-	-	3	3
CO2	2	2	1	2	2	2
CO3	3	-	-	-	3	-

CO4	-	-	-	**2**	-	-
CO5	-	-	-	-	-	-

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BSAG-2407: FARMING SYSTEM & SUSTAINABLE AGRICULTURE

Course Code	Course Title	Credits	L	T	P
BSAG-2407	Farming System & Sustainable Agriculture	1(1+0)	1		0

Learning objectives

- Aims at incurring knowledge on various aspects of organic farming and its importance in present world scenario and its impact on environment and soil health
- To impart knowledge on varied farming enterprises and their integration for sustainableproductivity
- Students will gain knowledge about organic inputs for sustainable agriculture
- To develop skills on managing farm resource and improving nutritional standards forbetterment of health
- Students will get exposure on innovative organic farm products and certification

Theory

Unit I: Farming System

Farming System-scope, importance, and concept. Types and systems of farming system and factors affecting types of farming. Farming system components and their maintenance. Interaction between different enterprises with cropping – scope and advantages of integrated farming system – Integrated farming system models for different agro eco – systems. Indices for evaluation of farming systems.

Unit II: Cropping system

Cropping system – definition, principles, concepts, various types of cropping systems. Interactions between different cropping systems. Cropping scheme – determinants – principles. Efficient cropping system and their evaluation. Allied enterprises and their importance. Tools for determining production and efficiencies in cropping and farming

Unit III: Resource Management

Sustainable agriculture-problems and its impact on agriculture - indicators of sustainability - adaptation and mitigation. Conservation agriculture strategies in agriculture - HEIA, LEIA and LEISA and its techniques for sustainability. Resource use efficiency and optimization techniques - Crop residue management, resource management under constraint situations. Resource cycling and flow of energy in different farming system and environment.

Unit IV: Organic farming for sustainable Agriculture

Organic farming- concepts, principles and its scope in India- organic ecosystem and their concepts. Organic nutrient resources and its fortification. Restrictions to nutrient use in organic farming. Choice of crops and varieties in organic farming. Organic waste recycling methods. Indigenous Technical Knowledge (ITK) in organic agriculture. Fundamentals of insect, pest, disease and weed management under organic mode of production.

Unit V: Organic certification and Labelling

Operational structure of NPOP - Certification process and 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. Current stream of thoughts.

COURSE OUTCOMES (COs)

CO 1: To gain the information and acquire practical knowledge on various types of cropping systems.

CO 2: To understand interaction between different farm enterprises and to gain the information about the impact of organic farming and indigenous practices

CO 3: To understand the procedure followed for organic certification as per NPOP guidelines and to evaluate different resource management techniques in conservation agriculture.

CO 4: To know about : Low-cost input technologies for sustainable crop production

CO 5: To know about conservation agriculture strategies in agriculture

CO-PO Mapping Matrix

CO/PO	PO 1	PO2	PO3	PO4	PO5	PO6
CO1	2	2	-	3	2	1
CO2	2	1	3	-	3	-
CO3	1	3	3	-	2	2

CO4	**1**	**1**	**3**	**-**	**1**	**-**
CO5	**3**	**2**	**2**	**3**	**2**	**-**

References

1. Dahama A. K. 2007. Organic Farming for Sustainable Agriculture, Agro Bios (India),Jodhpur.
2. Gehlot. D. 2012. Organic Farming – Standards, Accreditation, Certification and Inspection,Agribios (India) publishers, Jodhpur.
3. Joshi and Prabhakar Shetty T.K. 2006. Sustainability through Organic Farming. Mukund Kalyani Publishers Ludhiana.
4. Palaniappan, S P and Annadurai, K. 2008, Organic Farming: Theory and Practice-ScientificPublishers (India) Ltd., Jodhpur.
5. Jayanthi. C., Devasenapathy, P and C. Vennila. 2007. Farming systems, Principles andPractices. Sathish Serial publishing house, Delhi.

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3. http://nsdl.niscair.res.in/123456789/670Revised Organic farming.pdf
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BSAG-2408: AGRICULTURAL MARKETING TRADE & PRICES

Course Code	Course Title	Credits	L	T	P
BSAG-2408	Agricultural Marketing Trade & Prices	3(2+1)	2		1

Learning objectives

- To give exposure to the Under Graduate students on market concepts
- To understand domestic and export trade
- To study risk in agricultural marketing, marketing institutions involved, price dynamics and the role of government in regulation of markets
- To know the impact of WTO in agriculture
- To study the price stabilization measures

Theory

Unit I: Agricultural Marketing – Nature and Scope

Agricultural Marketing: Concepts and definitions of market, marketing, agricultural marketing,classification and characteristics of agricultural markets. - Producer's surplus – meaning and its types, marketable and marketed surplus, factors affecting marketable surplus of agri- commodities. Approaches to the study of marketing - Market forces - Nature and determinants of demand and supply of farm products. Marketing of agricultural versus manufactured goods.Modern marketing systems versus traditional agricultural marketing systems

Unit II: Marketing Functions and Marketing efficiency

Marketing process and functions: Marketing process - concentration, dispersion andequalization; exchange functions – buying and selling; physical functions – storage, transportand processing; facilitating functions – packaging, branding, grading, quality control and labeling (AGMARK); Standardization, Finance, Storage and Warehousing, Processing, Value Addition and Risk Taking -Market functionaries and marketing channels: Types and importance of agencies involved in agricultural marketing; meaning and definition of marketing channel; number of channel levels; marketing channels for different farm products;Market integration-over space, time and form: Meaning, definition and types Marketing efficiency; marketing costs, margins and price spread; factors affecting cost of marketing, reasons for higher marketing costs of farm commodities; ways of reducing marketing costs; - Market Structure, Conduct and Performance paradigm (SCP) – Marketing mix and market segmentation - Market Structure: Meaning, Components, Dynamics of Conduct and Performance – Price determination under perfect and imperfect competition.

Unit III: Pricing, Promotion Strategies and Marketing Institutions

Product Life Cycle (PLC) and competitive strategies: Meaning and stages in PLC; Pricing and promotion strategies: pricing considerations and approaches – cost based and competition based pricing; market promotion – advertising, personal selling, sales promotion and publicity – their meaning and merits and demerits, characteristics of PLC; strategies in different stages of PLC; Role of Government in agricultural marketing - Public sector institutions - CWC, SWC, FCI and DMI – their objectives and functions; cooperative marketing in India; New EXIM policy of India – Advantages of AEZs, ITPO, Export Promotion Councils, APEDA, MPEDA, and Commodity Boards.

Unit IV: Trade in Agricultural Products

International Trade: Concept of International Trade and its need - Free trade, Autarky and its needs -Theories of Trade: Absolute and comparative advantage; Present status and prospects of Agricultural exports / imports from India and their share - Barriers to Trade: Tariff and non- tariff barriers - Trade policy instruments – Terms of Trade - Role of institutions like UNCTAD and GATT - WTO in promoting trade in agricultural products - Free Trade Agreements – AoA and its implications on Indian agriculture: Sanitary and Phyto-sanitary issues, Market Access, Domestic Support and Export Subsidies - IPR.

Unit V: Agricultural Prices and Risk Analysis

Agricultural Prices and Policy: Meaning and functions of price; administered prices; need for agricultural price policy; Objectives of Price Policy and Price Stabilization – Role of CACP – Concept of MSP, FRP (SMP) and SAP – Price Parity - Procurement of food grains and buffer stock,FCI- Risk in marketing: Meaning and Importance - Types of risk in marketing: Speculation and Hedging - Forward and Futures trading; an overview of futures trading; – Roleof Contract Farming in risk mitigation.

Practical

Plotting and study of demand and supply curves and calculation of elasticities**;** Study of relationship between market arrivals and prices of some selected commodities; Computation of marketable and marketed surplus of important commodities; Study of price behaviour over time for some selected commodities; Construction of index numbers; Visit to a local market to study various marketing functions performed by different agencies, identification of marketing channels for selected commodity, collection of data regarding marketing costs, margins and price spread and presentation of report in the class; Visit to market institutions – NAFED, SWC, CWC, cooperative marketing society, etc. to study their organization and functioning; Application of principles of comparative advantage of international trade.

COURSE OUTCOMES (COs)

CO1: To understand the marketing channels of different commodities.

CO2: To gain the practical knowledge of price spread and it simplications.

CO3: To know the role of marketing institutions and trade in agricultural products like WTO and APEDA.

CO4: Gain practical knowledge on FCI, CWC and regulated market activities.

CO5: Role of CACP for price fixation, and price stabilization measures.

CO-PO Mapping Matrix

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	-	-	2	-	-	-
CO2	-	-	2	-	-	2
CO3	-	-	-	1	-	-
CO4	-	-	-	2	-	-
CO5	1	-	-	-	-	1

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1. AcharyaS.S.andAgarwal,N.L.,2011,AgriculturalMarketinginIndia,OxfordandIBH PublishingCo.Pvt.Ltd.,NewDelhi.
2. Jhingan, M.L.,2011. International Economics, Vrinda Publications(P)Ltd.,New Delhi.
3. Acharya S.S. and Agarwal, N.L., 1994. Agricultural Prices–Analysis and Policy, Oxford and IBH Publishing Co.Pvt.Ltd., New Delhi.
4. Kahlon A. S. and S. D. Tyagi, 2000. Agricultural Price Policy in India - Allied PublishersPvt. Ltd. Bombay.
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BSAG-2409: INTRODUCTORY AGRO-METEOROLOGY & CLIMATE CHANGE

Course Code	Course Title	Credits	L	T	P
BSAG-2409	Introductory Agro-meteorology & Climate Change	2(1+1)	1		1

Learning objectives

- To know the basic concepts of agricultural meteorology and recording various weatherelements in observatory.
- To understand about solar radiation, temperature and relative humidity on cropproduction
- To be familiar with cyclones, El Nino and La -Nina
- To study of clouds, precipitation, drought, flood and evapotranspiration.
- To study about different Agro climatic zones of India and Bihar, importance ofweather forecasting.

Theory

Unit -I: Introduction to Meteorology and Agrometerology

Introduction to meteorology – branches, importance in crop production, scope of atmosphere -lower and upper- composition and its characters. Agro climatic zones of India and Bihar

Unit -II: Solar radiation, light and temperature

Importance of solar radiation - sun and its thermal properties, different types of solar radiation and its effect on crop growth, lights and its influence on crop productivity, bandwidth, temperature, air and soil. Crop response to different conditions - factors affecting solar radiations, light and temperature.

Unit- III: Atmospheric pressure and wind

Atmospheric pressure - variation in atmospheric pressure, causes of variation, pressure and wind system of the world, wind, daily and seasonal variation of wind speed, cyclone, anti-cyclone. Effect of wind on crops - movement of air mountain and valley winds- land and sea breezes.

Unit -IV: Atmospheric humidity, precipitation and clouds

Atmospheric humidity-effect of humidity on crops concept of saturation, vapour pressure and process of condensation, evaporation, evapotranspiration, PET, different forms of precipitation and condensation, cloud seeding (artificial rain

making). Clouds- clouds formation, WMO classification and characteristics. Rainfall- importance of rainfall on crops, types of rain fall. Monsoon- definition, origin and distribution of South West Monsoon and North West Monsoon, mechanism and importance in Indian agriculture.

Unit -V: Climate change and weather forecasting

Various types of weather hazards influencing crop growth - modification of micro climate, climatic normal, livestock, and crops. Global warming- impact of El-nina. Weather forecasting -principles and types. Current stream of thoughts.

Practical

Visit of Agro-meteorological Observatory, site selection of observatory, exposure of instruments and weather data recording. Measurement of total, shortwave and long wave radiation, and its estimation using Planck's intensity law. Measurement of albedo and sunshine duration, computation of Radiation Intensity using BSS. Measurement of maximum and minimum air temperatures, its tabulation, trend and variation analysis. Measurement of soil temperature and computation of soil heat flux. Determination of vapor pressure and relative humidity. Determination of dew point temperature. Measurement of atmospheric pressure and analysis of atmospheric conditions. Measurement of wind speed and wind direction, preparation of wind rose. Measurement, tabulation and analysis of rain. Measurement of open pan evaporation and evapotranspiration. Computation of PET and AET.

COURSE OUTCOMES (COs)

CO1: To gain knowledge about role of weather elements in crop growth and how to recordvarious weather elements

CO2: To construct information about effect of solar radiation, temperature and relativehumidity on crop production

CO 3: To comprehend knowledge with cyclones, El Nina and La Nina

CO4: To create awareness on cloud types, precipitation, drought, flood and evapotranspiration.

CO 5: To formulate cropping pattern for different Agro climatic zones of India and Bihar,importance of weather forecasting.

CO-PO Mapping Matrix

CO/PO	PO 1	PO2	PO3	PO4	PO5	PO6
CO1	2	1	1	1	1	2
CO2	-	2	-	-	-	2
CO3	-	1	-	-	-	-
CO4	-	2	-	-	-	-
CO5	-	2	1	-	-	1

References

1. Bhardwaj. V. 2020. Climatic Change and Management of Weather for

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2. Laxmi Lal. 2021. Introduction to Agrometeorology. Agrotech Publishing Academy. Udaipur.
3. Lenka D.2006. Climate Weather and Crops in India, Kalyani Publishers, Ludhiana.
4. Prasad Rao.G.S.L.H.V.2015. Agricultural Meteorology, Eastern Economy Edition (PH1)Learning Pvt Limited Publishers, Delhi.
5. Reddy.S.R.2014.Introduction to Agriculture and Agrometeorology, Kalyani Publishers,Ludhiana.

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2. https://agrifair.in/wp-content/uploads/2021/01/Introductory-Agrometeorology-and-Climate-Change.pdf
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ELECTIVE COURSE

A student can select one elective course out of the following and offer during the 4th Semester

S.N.	Course Code	Courses	Credit Hours
1	BSAG-2410	Agribusiness Management	3(2+1)
2	BSAG-2411	Agrochemicals	3(2+1)
3	BSAG-2412	Commercial Plant Breeding	3(1+2)
4	BSAG-2413	Landscaping	3(2+1)
5	BSAG-2414	Food Safety and Standards	3(2+1)
6	BSAG-2415	Bio-pesticides & Bio-fertilizers	3(2+1)
7	BSAG-2416	Protected Cultivation	3(2+1)
8	BSAG-2417	Micro propagation Technologies	3(1+2)
9	BSAG-2418	Hi-tech. Horticulture	3(2+1)
10	BSAG-2419	Weed Management	3(2+1)
11	BSAG-2420	System Simulation and Agro-advisory	3(2+1)
12	BSAG-2421	Agricultural Journalism	3(2+1)

V SEMESTER

S. No.	Course Code	Course Title	Credits
1	BSAG-3501	Principles of Integrated Pest and Disease Management	3(2+1)
2	BSAG-3502	Manures, Fertilizers and Soil Fertility Management	3 (2+1)
3	BSAG-3503	Pests of Crops and Stored Grain and their Management	3 (2+1)
4	BSAG-3504	Diseases of Field and Horticultural Crops and their Management –I	3 (2+1)
5	BSAG-3505	Crop Improvement-I *(Kharif Crops)*	2 (1+1)

6	BSAG-3506	Entrepreneurship Development and Business Communication	2 (1+1)
7	BSAG-3507	Geo-informatics, Nano-technology and Precision Farming	2 (1+1)
8	BSAG-3508	Practical Crop Production – I (*Kharif* crops)	2 (0+2)
9	BSAG-3509	Intellectual Property Rights	1(1+0)
10	BSAG-3510/	Elective Course	3 credit
	BSAG-3511/		
	BSAG-3512/		
	BSAG-3513/		
	BSAG-3514/		
	BSAG-3515/		
	BSAG-3516/		
	BSAG-3517/		
	BSAG-3518/		
	BSAG-3519/		
	BSAG-3520/		
	BSAG-3521		
Total			**21(12+09)+ 3**

BSAG-3501: PRINCIPLES OF INTEGRATED PEST AND DISEASE MANAGEMENT

Course Code	Course Title	Credits	L	T	P
BSAG-3501	**Principles of Integrated Pest and Disease Management**	**3(2+1)**	**2**		**1**

Learning objectives

- To learn about beneficial insect and harmful pest
- To acquaint with the knowledge of management techniques of insect and pest
- To gain knowledge about the forecasting of insect and pest
- To learn the techniques of IPM
- To study about the methods of application of pesticides

Theory

Unit I

Categories of diseases, IDM: Introduction, history, importance, concepts, principles and toolsof IDM. Economic importance of diseases and pest risk analysis.

Unit II

Methods of detection and diagnosis of diseases. Calculation and dynamics of economic injury level and importance of economic threshold level.

Unit III

Methods of control: Host plant resistance, cultural, mechanical, physical, legislative, biological and chemical control. Ecological management of crop environment. Introduction to conventional pesticides for the disease management.

Unit IV

Survey: surveillance and forecasting of diseases. Development and validation of IDM module. Implementation and impact of IDM and IDM module for disease.

Unit V

Safety issues in pesticide uses. Political, social and legal implication of IDM. Case histories of important IDM programmes.

Practical

Methods of diagnosis and detection of various insect pests, and plant diseases, Methods of insect pests and plant disease measurement, Assessment of crop yield losses, calculations based on economics of IPM,Identification of biocontrol agents, different predators and natural enemies. Mass multiplication of *Trichoderma, Pseudomonas, Trichogramma*, NPV etc. Identification and nature of damage of important insect pests and diseases and their management. Crop (agro- ecosystem) dynamics of a selected insect pest and diseases. Plan & assess preventive strategies (IPM module) and decision making. crop monitoring attacked by insect, pest and diseases . Awareness campaign at farmers fields.

COURSE OUTCOMES (COs)

CO 1: Knowing the history, economic importance and principles of IDM

CO 2: Having in depth knowledge in detection, diagnosis, economic injury level and economicthreshold level of plant diseases

CO 3: Being updated with the different principles of plant disease management with ecologicalmanagement of crop environment

CO 4: Having expertise in plant disease survey, forecasting and development and validation ofIDM module

CO 5: Acquainted with the safety issues in pesticide uses with political, social and legalimplication of IDM.

CO-PO Mapping matrix

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	3	-	1	1	-
CO2	3	3	-	1	1	-
CO3	3	3	-	1	1	-
CO4	3	3	-	1	1	-
CO5	3	3	-	1	1	-

References

1. Chaube, H.S. and Pundhir, V.S. 2005. Crop Diseases and their Management. Prentice HallIndia Learning Private Limited.
2. Nene,Y.L. and Thapliyal, P.N. 2018. Fungicides in Plant Disease Control. Fourth edition.Medtech Publishers.
3. Sharma, P.D. 2016. Plant Pathology. Second edition. Rastogi Publications, Meerut.
4. Singh, R.S. 2001. Plant Disease Management. Oxford and IBH Publishing Co. Pvt., Ltd.,238p.
5. Ravichandra N.G. 2018. Agrochemicals in Plant disease management. Scientific Publishers

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3. https://www.apsnet.org/edcenter/disimpactmngmnt/casestudies/Pages/PlantDiseaseDiagnosis.aspx
4. https://www.apsnet.org/edcenter/disandpath/prokaryote/intro/Pages/Bacteria.aspx
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BSAG-3502: MANURES, FERTILIZERS AND SOIL FERTILITY MANAGEMENT

Course Code	Course Title	Credits	L	T	P
BSAG-3502	Manures, Fertilizers and Soil Fertility Management	3 (2+1)	2		1

Learning objectives

- To gain knowledge on plant nutrients and basic principles of soil fertility.
- To important knowledge on soil fertility evaluation
- To learn about types of commercial fertilizers and its effect on soil and crop
- To understand the importance of organic manures for sustainable agriculture.
- To gain the knowledge about problem soils and their reclamation as well as analytical knowledge on soil available nutrients.

Theory

Unit I-Soil fertility and Plant nutrition

Introduction to soil fertility and productivity- factors affecting. Essential plant nutrient elements- functions, deficiency systems, Plant nutrient toxicity symptoms and remedies measures.

Unit II- Fertilizers and Manures

Fertilizers – Definition - classification –Manufacturing process of nitrogen, phosphorus, potassium, secondary and micronutrient. Manures – definition- classification – effect on soils and plants. Fertilizer control order.

Unit III- Nutrient transformation

Fate of applied major, secondary and micronutrients in soils and its effect on soil properties

Unit IV- Problem soils and Soil organic matter

Acid, calcareous and salt affected soils – characteristics and management. Soil organic matter, Role of microorganisms in organic matter- decomposition – humus formation. Importance of C: N ratio and pH in plant nutrition, soil buffering capacity.

Unit V- Soil fertility evaluation and Fertilizer use efficiency

Soil fertility evaluation and methods, critical limits of plant nutrient elements and hunger signs. Luxury consumption, nutrient interactions. Soil test crop response and targeted yield concept. Integrated plant nutrient management. Methods of fertilizer application. Bio fertilizer. Fertilizer use efficiency and management. Effect of potential toxic elements in soil productivity. Current streams of thoughts.

Practical

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

COURSE OUTCOMES (COs)

CO1: The students get knowledge on various kinds of problematic soils
CO2: The students will learn how to maintain the soil health.
CO3: The students acquire practical knowledge of nutrient analysis soil.
CO4: The students gain knowledge on nutrients essential for crop growth and development
CO5: The knowledge gained useful in making decisions on nutrient dose, choice of fertilizers/manures and method of application etc.

CO-PO Mapping matrix

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO 1	1	2	1	-	-	1
CO 2	1	2	1	1	-	-
CO 3	1	1	1	-	-	-
CO 4	-	2	-	1	-	1
CO 5	1	2	1	1	1	-

References

1. Dilip Kumar Das, 2007. Micronutrients: Their behaviour in soils and plants. Kalyani Publishers, New Delhi.
2. Gupta, P. K. 2012. A Handbook of Soil, Fertilizer and Manure. Agrobios (India), Jodhpur.
3. John L. Havlin, James D. Beaton, Samuel L. Tisdale and Werner L. Nelson.2011.Soil Fertility and Fertilizers- An Introduction to Nutrient Management. PHL Learning Pvt. Ltd., New Delhi.
4. Kolay, A.K 2007. Manures and Fertilizers. Atlantic Publishers and Distribution (P)
5. Mengel, K., E.A. Kirkby, H.Kosegarten and T.Apple. 2006. Principles of PlantNutrition, 5th ed. Springer International.

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BSAG-3503: PESTS OF CROPS AND STORED GRAIN AND THEIR MANAGEMENT

Course Code	Course Title	Credits	L	T	P
BSAG-3503	Pests of Crops and Stored Grain and their Management	3 (2+1)	2		1

Learning Objectives:

- To study the distribution, bionomics and symptoms of damage of pests of crops andstorage.
- To distinguish various symptoms of damage
- To identify different life stages of the major pests of crops and storage
- To discuss integrated pest management protocols for major crops and pests
- To perform rearing and collection of major pests for better understanding of their biologyand identification characters

Theory

Economic Classification of Insect Pests, Distribution, Bionomics, Symptoms of damage and Integrated management strategies for insects and non-insect pests such as mites, nematodes,rodents, birds and other vertebrates of the following crops.

Unit I: Pests of Cereals, Millets and Pulses

Rice, Wheat, Maize, Sorghum, Cumbu, Ragi, Tenai; Redgram, Greengram, Blackgram, Bengal gram, Cowpea and Soybean

Unit II: Pests of Oilseeds, Cotton, Sugarcane, Green manures, Forage crops andTobacco

Groundnut, Castor, Sesame, Sunflower, Safflower, Linseed, Jatropa, Mustard; Cotton; Sugarcane; Sunhemp, Sesbania, Daincha, Glyricidia; Lucerne, Subabul; Tobacco

Unit III: Pests of Vegetables, Tubers, Spices and Plantation crops

Brinjal, Tomato, Bhendi, Crucifers, Cucurbits, Moringa, Amaranthus, Potato, Sweet Potato, Tapioca, Yam; Chillies, Onion, Garlic, Ginger, Turmeric, Coriander, Curry leaf, Cardamom, Pepper and Betel vine; Coconut, Arecanut, Coffee, Tea, Rubber, Cocoa

Unit IV: Pests of Fruits and Forest trees

Mango, Sapota, Citrus, Cashew, Banana, Grapevine, Guava, Jack, Custard apple, Pomegranate, Pineapple, Papaya, Aonla, Ber, Tamarind, Apple; Neem, Teak, Sandalwood, Eucalyptus, Casuarina

Unit V: Pests of Flower crops, Ornamentals, Medicinal plants and stored products

Rose, Jasmine, Crossandra, Chrysanthemum, Tuberose, Cut flowers, Greenhouse crops and Mushroom, Lawn and Turf; Gloriosa, Coleus, Phyllanthus, Periwinkle, Aswagantha, Senna; Stored grains, Dry fruits and Nuts; Locusts and their management. Current Streams ofThoughts in pest management.

Practical

Identification of different types of damage. Identification and study of life cycle and seasonal history of various insect pests attacking crops and their produce: (a) Field Crops; (b) Vegetable Crops; (c) Fruit Crops; (d) Plantation, gardens, Narcotics, spices

& condiments. Identification of insect pests and Mites associated with stored grain. Determination of insect infestation by differentmethods. Assessment of losses due to insects. Calculations on the doses of insecticides application technique. Fumigation of grain store / godown. Identification of rodents and rodent control operations in godowns. Identification of birds and bird control operations in godowns. Determination of moisture content of grain. Methods of grain sampling under storage condition. Visit to Indian Storage Management and Research Institute, Hapur and Quality Laboratory, Department of Food., Delhi. Visit to nearest FCI godowns.

COURSE OUTCOMES (COs)

CO1: Define bionomics, symptoms of damage and integrated management strategies forpests of cereals, millets and pulses

CO2: Discuss bionomics, symptoms of damage and integrated management strategies for pests of Oilseeds, Cotton, Sugarcane, Green Manures, Forage Crops and Tobacco

CO3: Explain bionomics, symptoms of damage and integrated management strategies forpests of Vegetables, Tubers, Spices and Plantations

CO4: Define bionomics, symptoms of damage and integrated managementstrategies for pests of Fruits, Ornamentals and Medicinal Plants

CO5: Discuss bionomics, symptoms of damage and integrated management strategies for pests of Tree, Lawn, Stored Products, Mushroom and greenhouse crops

CO-PO Mapping Matrix

CO/PO	PO 1	PO2	PO3	PO4	PO5	PO6
CO1	3	3	3	2	3	3
CO2	3	3	3	2	3	3
CO3	3	3	3	2	3	3
CO4	3	3	3	2	3	3
CO5	3	3	3	2	3	3

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4. Parvatha Reddy. 2010. *Insect, Mite and Vertebrate Pests and their Management in Horticultural Crops.* Scientific Publishers, Jodhpur. 384p.
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BSAG-3504: DISEASES OF FIELD AND HORTICULTURAL CROPS AND THEIRMANAGEMENT -I

Course Code	Course Title	Credits	L	T	P
BSAG-3504	Diseases of Field and Horticultural Crops and their Management –I	3 (2+1)	2		1

Learning objectives

- To acquire knowledge on etiology, symptoms, epidemiology and management of diseasesof cereals and millets.
- To acquire knowledge on etiology, symptoms, epidemiology and management of diseasesof pulses and oilseed crops.
- To learn about the etiology, symptoms, epidemiology and management of diseases ofcash crops.
- To learn about the etiology, symptoms, epidemiology and management of diseases ofFruit crops and vegetable crops.
- To learn about the etiology, symptoms, epidemiology and management of diseases ofspices and plantation crops.

Theory

Symptoms, etiology, disease cycle and management of major diseases of following crops:

Field Crops:

Unit I:

Rice: blast, brown spot, bacterial blight, sheath blight, false smut, khaira and tungro; Maize: stalk rots, downy mildew, leaf spots; Sorghum: smuts, grain mold and anthracnose.

Unit II:

Bajra : Downy mildew and ergot; Finger millet: Blast and leaf spot; Groundnut: early and late leaf spots, wilt, Castor: Phytophthora blight, Soybean: Rhizoctonia blight, bacterial spot, seed and seedling rot andmosaic.

Unit III:

Pigeon pea: Phytophthora blight, wilt and sterility mosaic; Black & Green gram: Cercospora leaf spot and anthracnose, web blight and yellow mosaic; Tobacco: black shank, black root rot and mosaic.

Horticultural Crops:

Unit IV:

Guava: wilt and anthracnose; Banana: Panama wilt, bacterial wilt, Sigatoka and

bunchy top; Papaya: foot rot, leaf curl and mosaic, Pomegranate: bacterial blight; Cruciferous vegetables: Alternaria leaf spot and black rot; Brinjal: Phomopsis blight and fruit rot and Sclerotinia blight.

Unit V:

Tomato: Damping off, wilt, early and late blight, buck eye rot and leafcurl and mosaic; Okra: Yellow Vein Mosaic; Beans: anthracnose and bacterial blight; Ginger: soft rot; Colocasia: Phytophthora blight; Coconut: wilt and bud rot; Tea: blister blight; Coffee: rust.

Practical

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

COURSE OUTCOMES (COs)

CO1: Acquainted with identifying and managing diseases of cereals and pulses

CO2: Acquainted with identifying and managing diseases in oilseeds and cash crops

CO3: Having in depth knowledge in identifying and managing diseases in fruits andvegetables

CO4: Having in depth knowledge in identifying and managing diseases in spices and plantation

CO5: Having in depth knowledge in identifying and managing diseases in flower crops

CO-PO Mapping matrix

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	2	3	-	1	1	-
CO2	2	3	-	1	1	-
CO3	2	3	-	1	1	-
CO4	2	3	-	1	1	-
CO5	2	3	-	1	1	-

References

1. Agrios, G.N. 2005. Plant Pathology, Academic Press, New York.
2. Darwin Christdhas Henry L. and Lewin Devasahayam H. 2011. Crop Diseases – Identification, Treatment and Management, New India Publishing Agencies, New Delhi.
3. Mehrota, R.S. and Ashok Aggarwal 2017. Plant Pathology – Third Edition, McGraw HillEducation, New Delhi.
4. Devappa V., Dinesh Singh and Jahagirdar S. 2017. Diseases of Ornamental Crops. Todayand Tomorrows Printers and Publishers.
5. Dinesh Singh, Chowdappa P. and Pratibha Sharma. 2014. Diseases of Vegetable Crops: Diagnosis and Management. Today and Tomorrows Printers and Publishers.
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5. https://www.icco.org/pests-diseases/
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BSAG-3505: CROP IMPROVEMENT-I (*KHARIF CROPS*)

Course Code	Course Title	Credits	L	T	P
BSAG-3505	Crop Improvement-I *(Kharif Crops)*	2 (1+1)	1		1

Learning Objectives

- To impart knowledge about the origin, evolution and modes of reproduction for different Kharif crops.
- To impart knowledge about the floral biology, crossing techniques, objectives of breeding and wild species as donors for resistant traits.
- To impart knowledge about the Genetics and Genomic relationship of Yield and Quality characters for different Kharif crops.
- To impart knowledge about the Biotic and Abiotic stress resistance breeding for different Kharif crops.
- To provide insight into recent advances in improvement of cereals, millets, pulses, oil seeds, fibre crops, vegetables using conventional and modern biotechnological approaches.

Theory

Unit I: Mode of reproduction and pollination control in kharif crops

Introduction - definition, aim, objectives and scope of crop improvement - Breeding objectives and important concepts of breeding self-pollinated, cross pollinated and vegetatively propagated crops - Centers of origin - Law of homologous series - types of centres of diversity - gene sanctuaries - genetic erosion - main reasons of genetic erosion - extinction - introgression - gene banks -Types of gene banks - distribution of crop species.

Unit II: Breeding methods for cereals, pulses, millets and oilseed crops

Centres of origin, distribution of species, wild relatives in different cereals, millets, pulses and oil seeds - **Cereals -** rice, maize - **Millets -** sorghum, pearl millet and ragi - **Pulses** - redgram, urdbean, mungbean, soybean - **Oilseeds -** groundnut , sesamum and castor.

Unit III: Breeding methods for fodder, fibre and cash crops

Centres of origin, distribution of species, wild relatives in different fodder crops, fibre crops andcash crops - **Fodder crops -** Napier grass and Para grass - **Fibre crops** - Cotton - **Cash crops** - Tobacco.

Unit IV: Breeding methods for vegetable and fruit crops

Centres of origin, distribution of species, wild relatives in different vegetable crops and horticultural crops - **Vegetable crops** - Tomato, brinjal, chilli, bhendi- **Horticultural crops -** Mango, banana, guava, papaya.

Unit V: Hybrid seed production for kharif crops

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 ofhybrids and varieties for yield, adaptability, stability, abiotic and biotic stress tolerance and quality (Physical, chemical, nutritional) - Seed production technology in self-pollinated, cross pollinated and vegetatively propagated crops - Hybrid seed production technology in maize, rice, sorghum, pearl millet and pigeon pea - Ideotype concept and climate resilient crop varieties for future - Breeding for drought , salinity, water logging, high temperature and low temperature tolerant varieties in different crops.

Practical

Floral biology, emasculation and hybridization techniques in different crop species; viz., Rice, Jute, Maize, Sorghum, Pearl millet, Ragi, Pigeonpea, Urdbean, Mungbean, Soybean, Groundnut, Seasame, Caster, Cotton, Cowpea, Tobacco, Brinjal, Okra and Cucurbitaceous crops. Maintenance breeding of different *kharif* crops. Handling of germplasm and segregating populations by different methods like pedigree, bulk and single seed decent methods; Study of field techniquesfor seed production and hybrid seeds production in *Kharif* crops; Estimation of heterosis, inbreeding depression and heritability; Layout of field experiments; Study of quality characters, donor parents for different characters; Visit to seed production plots; Visit to AICRP plots of different field crops.

COURSE OUTCOMES (COs)

CO1: The course will acquaint the student with importance of floral biology, participatory plantbreeding.

CO 2: Knowledge about the objectives of breeding in *Kharif* crops.

CO 3: Knowledge about various breeding methods of *Kharif* crops.

CO 4: Knowledge about different hybridization techniques for *Kharif* crops.

CO 5: Knowledge about hybrid seed production for *Kharif* crops.

CO-PO Mapping Matrix

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	2	-	-	-	-	-

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CO2	-	-	-	**3**	-	
CO3	-	**2**	-	-	-	-
CO4	-	-	-	-	-	**2**
CO5	-	-	**3**	-	**3**	-

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2. Kalloo, G.1994.Vegetable Breeding.Panima Educational Book Agency, New Delhi.
3. Sharma,J.R. 1994. Principles and Practice of Plant Breeding.Tata McGraw Hill PublishingCompany Ltd.,New Delhi.
4. Phundn Singh, 2006. Essentials of Plant Breeding.KalyaniPublishers,New Delhi.
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BSAG-3506: ENTREPRENEURSHIP DEVELOPMENT AND BUSINESS COMMUNICATION

Course Code	Course Title	Credits	L	T	P
BSAG-3506	Entrepreneurship Development and Business Communication	2 (1+1)	1		1

Learning objectives

- To familiarize the students to understand with key concepts and processes in entrepreneurship and business development.
- To introduce key debates around entrepreneurship and small businesses.
- To provide context to the processes in the form differences between small and large firmsand economic environment.
- To understand the function and types of entrepreneurship.
- To develop various managerial skills among the students.

Theory

Unit I: Entrepreneurship

Concept of Entrepreneur, Entrepreneurship, Agri- Entrepreneurship, concept,

need,scope and opportunities of Rural and Agri Enterprises, Entrepreneurial Characteristics, Impact of economic reforms in agribusiness and agri enterprise and over view of Agri Business in the Country.

Unit II: Entrepreneurship Development Programmes

Entrepreneurship Development Programmes (EDPs)-objectives, phases, Government policies and programmes and schemes EDP Process-Stages, Developing organizational skills (controlling, supervision, monitoring and evaluation) Achievement Motivation, Problem solving skills

Unit III: Enterprise Management

Managing an enterprise, SWOT analysis, Time Management. for Entrepreneurship Development, Financing an Enterprise and Venture Capital Institutional Support to entrepreneurs.

Unit IV: Business communication

Business written communication skills and Negotiation Skills, Managerial skills (planning, budgeting, coordination, decision making), Business Leadership skills (communication, direction and motivation skills),

Unit V: Project Management

Project- meaning, importance, project formulation, project report components and management. Supply Chain Management- Meaning, definition, process, advantages and disadvantages, Total quality Management: Meaning, definition, process, advantages and current stream of thoughts.

Practical

Assessing entrepreneurial traits, problem solving skills, managerial skills and achievement motivation, exercise in creativity, time audit through planning, monitoring and supervision, identification and selection of business idea, preparation of business plan and proposal writing, visit to entrepreneurship development institute and entrepreneurs.

COURSE OUTCOMES (COs)

At the end of the course students will be able to

CO 1: Develop entrepreneurial competencies among the students

CO 2: Learn about principles to develop an enterprise or any business unit

CO 3: Gain expertise on SWOT analysis

CO 4: Exposure on entrepreneurial traits and culture

CO 5: To gain knowledge about enterprise and project management

Co-Po Mapping Matrix

CO/PO	PO 1	PO2	PO3	PO4	PO5	PO6
CO1	2	0	2	0	3	3

CO2	1	0	0	2	0	3
CO3	2	2	0	0	3	3
CO4	2	0	1	0	0	3
CO 5	1	0	0	0	0	3

References

1. Anil Kumar S, Poornima S C, Mini K Abraham and Jayashree K 2003 Entrepreneurship development, New Age International Publishers, New Delhi-110002
2. Sagar Mondal 2020, Entrepreneurship Development and Business Communication, KalyaniPublisher, New Delhi.
3. Indu Grover 2008 Handbook on Empowerment & Entrepreneurship, Agrotech PublicAcademy
4. Mohanty S K, 2009, Fundamentals of Entrepreneurship, Prentice Hall of India, New Delhi
5. Sagar Mondal & G L Ray 2009 Text book of Entrepreneurship, Rural development andCommunication skills.

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BSAG-3507: GEO-INFORMATICS, NANO-TECHNOLOGY AND PRECISIONFARMING

Course Code	Course Title	Credits	L	T	P
BSAG-3507	Geo-informatics, Nano-technology and Precision Farming	2 (1+1)	1		1

Learning Objectives

- To introduce the basic concepts of precision farming
- To create awareness about various applications of remote sensing and GIS in precisionagriculture
- To impart knowledge to the students on the nanotechnology in precision farming
- Evaluate the role of geoinformatics in agriculture
- To gain knowledge on crop simulation models

Theory

Unit I: Precision farming

Precision agriculture: concepts and techniques; their issues and concerns for Indian agriculture.

Unit II: Geo-informatics

Geo-informatics- definition, concepts, tool, and techniques; Remote sensing concepts and application in agriculture; Image processing and interpretation. Crop discrimination and yield monitoring, soil mapping. Fertilizer recommendation using geospatial technologies. Spatial data and their management in GIS. Global positioning system (GPS), components and its functions andtheir use in Precision Agriculture

Unit III: Techniques to precision farming

Introduction to crop simulation models and their uses for optimization of agricultural inputs. STCR approach for precision agriculture

Unit IV: Basics Nanotechnology

Nanotechnology, definition, concepts and techniques, brief introduction about nano scaleeffects, nano-particles, nano-pesticides, nano-fertilizers, nano-sensors.

Unit V: Applications of nanotechnology

Use of nanotechnology in seed, water, fertilizer, plant protection for scaling-up farm productivity. Current stream of thoughts

Practical

Introduction to GIS software, spatial data creation and editing. Introduction to image processing software. Visual and digital interpretation of remote sensing images. Generation of spectral profiles of different objects. Supervised and unsupervised classification and acreage estimation. Multispectral remote sensing for soil mapping. Creation of thematic layers of soil fertility based on GIS. Creation of productivity and management zones. Fertilizers recommendations based of VRT and STCR techniques. Crop stress (biotic/abiotic) monitoring using geospatial technology. Use of GPS for agricultural survey. Formulation, characterization and applications of nanoparticles in agriculture. Projects formulation and execution related to precision farming.

COURSE OUTCOMES (COs)

CO1: Concepts and techniques of Precision agriculture

CO2: Learn about tools and techniques of geoinformatics used in precision farming

CO3: Precision agriculture can address both economic and environmental issues thatsurround production agriculture today.

CO4: Learn about tools and techniques of nanotechnology in relation to agriculture

CO5: Application of crop simulation models.

CO-PO Mapping Matrix

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	1	1	1	1	1	-
CO2	-	-	1	1	1	-

CO3	**-**	**1**	**1**	**-**	**2**	**-**
CO4	**-**	**-**	**1**	**-**	**-**	**1**
CO5	**-**	**-**	**-**	**1**	**-**	**1**

Reference book

1. Choudhary, S. 2011. Applied Nanotechnology in Agriculture. Arise Publishers & Distributors
2. Krishna, K.K. 2013. Precision Farming: Soil Fertility and Productivity Aspects. Apple Academic Press
3. Reddy. S.R. 2021. Geoinformatics and Nanotechnology for Precision Farming. Kalyanipublisher, Ludhiana.
4. Sanjeev Kumar, S.N. Saravaiya, and A.K. Pandey. 2021. Precision Farming and ProtectedCultivation: Concepts and Applications. CRC Press
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BSAG-3508: PRACTICAL CROP PRODUCTION – I (KHARIF CROPS)

Course Code	Course Title	Credits	L	T	P
BSAG-3508	Practical Crop Production – I (*Kharif* crops)	2 (0+2)	0		2

Learning objectives

- Crop planning, raising field crops in multiple cropping systems. Field preparation, seed, treatment, nursery raising, sowing, nutrient, water and weed management. Management of insect- pests diseases of crops. Harvesting, threshing, drying winnowing, storage and marketing of produce. The emphasis will be given to seed production, mechanization, resource conservation and integrated nutrient, insect- pest and disease management technologies. Preparation of balance sheet including cost of cultivation, net returns per student as well as per team of 8-10 students.
- Each student will be allotted a minimum land area of 100/200 m2. He / she will do all field operations in the allotted land from field preparation to harvest and processing.
- Field preparation, seed, treatment, nursery raising, sowing, nutrient, water and weed management and management of insect-pests diseases of crops, harvesting,threshing, drying,winnowing, storage and marketing of produce.
- Rice (Transplanted or direct sown)

Learning objectives on Transplanted rice:

- Rice ecosystems - Climate and Weather - Seasons and varieties of India and Bihar.

- Preparation of nursery - Application of manures to nursery - seed treatment Forming nursery beds and sowing seeds – Weed and water management and plant protection to nursery.
- Preparation of main field - Application of organic manures - Green manuring Bio-fertilizers - Pulling out seedlings and transplanting - Rajarajan 1000 (SRI) - Application of herbicides - Water management - Nutrient management - Plant protection measures - Mechanization in rice cultivation

- Recording growth, yield attributes and yield.
Harvesting, threshing, drying and cleaning the produce – Working out cost of cultivation and economics

Practical

Crop planning, raising field crops in multiple cropping systems: Field preparation, seed, treatment,nursery raising, sowing, nutrient, water and weed management and management of insect-pests diseases of crops, harvesting, threshing, drying winnowing, storage and marketing of produce. The emphasis will be given to seed production, mechanization, resource conservation and integrated nutrient, insect-pest and disease management technologies. Preparation of balance sheet including cost of cultivation, net returns per student as well as per team of 8-10 students.

COURSE OUTCOMES (COs)

CO1: To acquire skill in various agronomic practices that can bring improvedcrop yield.
CO2: To gain hands on experience on cultivation of crops individually.
CO3: To understand the different sowing methods for garden land crops
CO4: To apply different seed treatment techniques
CO5: To evaluate different harvesting methods and processing

CO-PO Mapping Matrix

CO/PO	PO 1	PO2	PO3	PO4	PO5	PO6
CO1	3	2	1	-	1	3
CO2	1	2	3	-	2	-
CO3	2	1	-	-	-	-
CO4	1	-	-	-	2	-
CO5	2	-	-	3	-	1

References

1. Crop Production Guide. 2020. Directorate of Agriculture, Chennai and Bihar Agricultural University, Coimbatore.
2. Rajendra Prasad. 2006. Text Book on Field Crop Production, Indian Council of Agrl. Research,New Delhi.
3. K Annadurai and B Chandrasekaran. 2009. A Text Book of Rice Science. Scientific Publishers, Chennai
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BSAG-3509: INTELLECTUAL PROPERTY RIGHTS

Course Code	Course Title	Credits	L	T	P
BSAG-3509	Intellectual Property Rights	1(1+0)	1		0

Learning objectives

1. To provide knowledge to students about basic concepts of Intellectual Property Rights
2. To explain its relevance and importance inWTO and Agriculture
3. To know the composition of IPR
4. To understand the protection of plant varieties and farmers rights
5. To study the biological diversity acts

Theory

Unit I: Introduction IPR

Introduction and meaning of intellectual property, brief introduction to GATT, WTO, TRIPS and WIPO, Treaties for IPR protection: Madrid Protocol, Berne Convention, BudapestTreaty, etc.

Unit II: Components of IPR

Types of IP and legislations covering IPR in India: Patents, copy rights, trademark, industrial design, geographical indication, integrated circuits and trade secrets.

Unit III : Acts of IPR

Patents Act 1970,Patent systems in India, patentability, process and product patent, filing of patent, patent specifications, patent claims, patent opposition and revocation, infringement, compulsory licensing, Patent Cooperation Treaty, patent search and patent database.

Unit IV : Protection of Plant varieties (PPV &FR)

Origin, history including a brief introduction to UPOV for protection of plant varieties, protection of plant varieties under UPOV and PPV & FR Act of India , Plant Breeders rights, registration of plant varieties under PPV & FR Act 2001, breeders, researcher and farmers rights. Traditional knowledge - meaning and rights of TK holders.

Unit V: Convention of Biological Diversity

Convention on Biological Diversity, International Treaty on Plant Genetic Resources for Food and Agriculture (ITPGRFA), Indian Biological Diversity Act, 2002 and its salient features, access and benefit sharing.

COURSE OUTCOMES (COs)

CO1: Understand the impact of WTO in Agriculture

CO2: Understand the IPR acts in India

CO3: Understand the patent systems in India.

CO4: Understand the Protection of plant varieties under UPOV and PPV & FR Act of India

CO5: Know the features of biological diversity and benefit sharing

CO-PO Mapping Matrix

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	-	-	3	-	-	-
CO2	-	3	-	-	-	-
CO3	2	2	-	-	-	2
CO 4	-	-	2	-	-	-
CO5	-	1		1	-	-

References

1. Vinod V. Sople, 2014. Managing intellectual Property : The Strategic imperative. PHILearning Private Limited , New Delhi.
2. Acharya, N.K, Textbook of Intellectual Property Rights, 2002. Asia Law House,Hyderabad, Keith, E. Maskus,2000. Intellectual Property Rights in Global Economy, InstituteforInternational Economics.
3. Jennewein, Klaus,2004, Intellectual Property Management, Springer Verlag ,US.
4. Ganguli P., 2001. Intelectual Property Rights: Unleashing Knowledge Economy,Mc Graw hill.

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2. https://www.smartzworld.com/notes/intellectual-property-rights-pdf-notes-ipr-pdf- notes/
3. https://www.iare.ac.in/sites/default/files/lecture_notes/IARE_IPR_NOTES_0.pdf
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ELECTIVE COURSE

A student can select one elective course out of the following and offer during the 5th Semester

S.N.	Course Code	Courses	Credit Hours
1	BSAG-3510	Agribusiness Management	3(2+1)
2	BSAG-3511	Agrochemicals	3(2+1)
3	BSAG-3512	Commercial Plant Breeding	3(1+2)
4	BSAG-3513	Landscaping	3(2+1)
5	BSAG-3514	Food Safety and Standards	3(2+1)
6	BSAG-3515	Bio-pesticides & Bio-fertilizers	3(2+1)
7	BSAG-3516	Protected Cultivation	3(2+1)
8	BSAG-3517	Micro propagation Technologies	3(1+2)
9	BSAG-3518	Hi-tech. Horticulture	3(2+1)
10	BSAG-3519	Weed Management	3(2+1)
11	BSAG-3520	System Simulation and Agro-advisory	3(2+1)
12	BSAG-3521	Agricultural Journalism	3(2+1)

VI SEMESTER

S. No.	Course Code		Course Title	Credits	L	T	P
1	BSAG-3601		Rainfed Agriculture & Watershed Management	2 (1+1)	1		1
2	BSAG-3602		Protected Cultivation and Secondary Agriculture	2 (1+1)	1		1
3	BSAG-3603		Diseases of Field and Horticultural Crops and their Management-II	3 (2+1)	2		1
4	BSAG-3604		Post-harvest Management and Value Addition of Fruits and Vegetables	2 (1+1)	1		1
5	BSAG-3605		Management of Beneficial Insects	2 (1+1)	1		1
6	BSAG-3606		Crop Improvement-II *(Rabi crops)*	2 (1+1)	1		1
7	BSAG-3607		Practical Crop Production –II (*Rabi* crops)	2 (0+2)	0		2
8	BSAG-3608		Principles of Organic Farming	2 (1+1)	1		1
9	BSAG-3609		Farm Management, Production & Resource Economics	2 (1+1)	1		1
10	BSAG-3610		Principles of Food Science and Nutrition	2(2+0)	2		0
11	Elective Course	BSAG-3611	Agribusiness Management	3(2+1)	2		1
		BSAG-3612	Agrochemicals	3(2+1)	2		1
		BSAG-3613	Commercial Plant Breeding	3(1+2)	1		2
		BSAG-3614	Landscaping	3(2+1)	2		1
		BSAG-3615	Food Safety and Standards	3(2+1)	2		1
		BSAG-3616	Biopesticides & Biofertilizers	3(2+1)	2		1
		BSAG-3617	Protected Cultivation	3(2+1)	2		1
		BSAG-3618	Micro propagation Technologies	3(1+2)	1		2
		BSAG-3619	Hi-tech. Horticulture	3(2+1)	2		1
		BSAG-3620	Weed Management	3(2+1)	2		1
		BSAG-3621	System Simulation and Agro-advisory	3(2+1)	2		1
		BSAG-3622	Agricultural Journalism	3(2+1)	2		1
Total				**21 (11+10)+3**			

BSAG-3601: RAINFED AGRICULTURE & WATERSHED MANAGEMENT

Course Code	Course Title	Credits	L	T	P
BSAG-3601	**Rainfed Agriculture & Watershed Management**	**2 (1+1)**	**1**		**1**

Learning objectives

- To teach the students about the basic aspects and concepts of rain fed agriculture
- To learn about soil and water conservation techniques
- To enrich knowledge about drought management in different crops
- To acquire knowledge on water harvesting and contingent crop planning
- To enrich knowledge on watershed management

Theory

Unit I: Rain fed agriculture

Rain fed agriculture - introduction, types- history of rain fed agriculture in India - Problems and prospects of rainfed agriculture in India, characteristic features. Importance and need for development

Unit II: Soil and moisture conservation

Soil moisture conservation, climatic constraints, soil moisture constraints, cultivation practices and socio-economic constraints. Soil and water conservation techniques- In-situ soil moisture conservation- Fertilizer use in dry lands – use of organic manures – introduction of legumes in crop rotation – organic recycling and bio-fertilizer use in dry land.

Unit III: Drought and contingent crop planning

Drought - definition, classification of drought, types. Effect of moisture stress on physio- morphological characteristics drought. Efficient utilization of water through soil and crop management practices, Contingent crop planning for aberrant weather conditions. Management of crops in rain fed areas.

Unit IV: Watershed management

Water harvesting, importance and its techniques. Watershed management - Definition, concept, objectives, need and advantages, principles and components of watershed management. Action plan and organizational requirement of watershed. Current stream of thoughts.

Unit V: Secondary agriculture

Post-harvest technology- introduction- physical properties of cereals, pulses and oilseed- PHT equipment design and operation- Drying and dehydration, moisture measurement, EMC, drying, various drying method- commercial grain dryer (deep bed dryer, flat bed dryer, tray dryer, fluidized bed dryer, recirculatory dryer and solar dryer). Material handling equipment; conveyer and elevators- principle, working and selection.

Practical

Studies on climate classification, studies on rainfall pattern in rainfed areas of the country and pattern of onset and withdrawal of monsoons. Studies on cropping

pattern of different rainfed areas in the country and demarcation of rainfed area on map of India. Interpretation of meteorological data and scheduling of supplemental irrigation on the basis of evapo-transpiration demand of crops. Critical analysis of rainfall and possible drought period in the country, effective rainfall and its calculation. Studies on cultural practices for mitigating moisture stress. Characterization and delineation of model watershed. Field demonstration on soil & moisture conservation measures. Field demonstration on construction of water harvesting structures. Visit to rainfed research station/watershed.

COURSE OUTCOMES (COs)

CO 1: The students acquire knowledge on basic aspects of rainfed agriculture and its management

CO 2: The students acquaints of the soil and water conservation techniques

CO 3: The students gain knowledge on various drought management techniques in differentcrops

CO 4: The student gets well-versed in contingent crop planning and water harvesting

CO 5: Understand technologies for threshing, shelling and drying of cereals, pulses and oilseeds.

CO-PO Mapping matrix

CO/PO	PO 1	PO2	PO3	PO4	PO5	PO6
CO1	3	2	2	-	-	2
CO2	3	2	-	-	2	
CO3	3	1	2	2	-	2
CO4	2	2	1	3	2	-
CO5	2	1	-	-	3	-

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BSAG-3602: PROTECTED CULTIVATION AND SECONDARY AGRICULTURE

Course Code	Course Title	Credits	L	T	P
BSAG-3602	Protected Cultivation and Secondary Agriculture	2 (1+1)	1		1

Learning objectives

- To learn about the nursery practices, planting methods of vegetable crops.
- To learn about the cultivation techniques, maturity indices, harvesting techniques of vegetable crops.
- To learn about the nursery practices, propagation methods of spice crops.
- To learn about the cultivation techniques, harvesting techniques of spice crops.
- To provide knowledge on protected cultivation of vegetable crops.

Theory

Unit I : **Green House Technology** – introduction, advantages of Green houses, plant response to Green-house environment parameter for plant growth in a Green-house – light, temperature, soil temperature, air movement and humidity.

Unit II: **Types of Green-houses** – Based on shape, utility, construction, covering materials, suitability and cost.

Unit III: Design principles – site selection, orientation, size, spacing and height of green house; components of Green house; Desirable environmental conditions for growth of a plant, cost estimation and economic analysis.

Unit IV : **Design criteria** for cooling arrangements in a Green-house – Ventilation, Evaporative cooling and movable insulation ; Design criteria for heating arrangement in a Green-house – Direct solar gain, indirect solar gain, external sources of heating; Equipments for Green-house – Temperature, radiation, photosynthesis and Leaf area Index measurement.

Unit V : **Engineering properties of agricultural materials** – hydroscopic, physical, thermal, chemical and aerodynamic; basic drying theory – Equilibrium moisture content; Mechanical during types – thin bed and deep bed drying; Commercial grain dryer – solar cabinet drier, portable batch dryer, Recirculating batch dryer and tray dryer; Material handling equipment – bucket elevator and screw conveyor – components, function and suitability.

Practical

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

COURSE OUTCOMES (COs)

CO 1: The students will be able to practice the nursery techniques and planting methods ofvegetable crops

CO 2: The students will be able to understand the cultivation techniques of vegetable crops.

CO 3: The students will be to diagnose problems in cultivation of vegetable crops.

CO 4: The students will be able to practice the protected cultivation of vegetable crops

CO 5: The students will be able to practice production techniques of spice crops

CO-PO Mapping matrix

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6
CO 1	3	3	1	3	2	0
CO 2	3	3	2	3	3	0
CO 3	3	3	1	3	3	0
CO 4	3	3	3	3	1	0
CO 5	3	3	2	3	3	0

References

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4. http://ucanr.org/freepubs/docs/8129.pdf
5. http://www.sus-veg-thai.de/

BSAG-3603: DISEASES OF FIELD AND HORTICULTURAL CROPS AND THEIRMANAGEMENT-II

Course Code	Course Title	Credits	L	T	P
BSAG-3603	Diseases of Field and Horticultural Crops and their Management-II	3 (2+1)	2		1

Learning objectives

- To acquaint with the symptoms, etiology, disease cycle and management of diseases ofwheat and pulse crops.
- To acquaint with the symptoms, etiology, disease cycle and management practices ofimportant diseases of oilseeds and cash crops.
- To know about the symptoms, etiology, disease cycle and management practices of important diseases of fruits and vegetables crops.
- To know about the symptoms, etiology, disease cycle and management practices of important diseases of spices and plantation crops.
- To know about the symptoms, etiology, disease cycle and management practices of important diseases of flower crops.

Theory

Symptoms, etiology, disease cycle and management of following diseases:

Field Crops:

Unit I:

Wheat: rusts, loose smut, karnal bunt, powdery mildew, Alternaria blight,and ear cockle; Sugarcane: red rot, smut, wilt, grassy shoot, ratoon stunting and PokkahBoeng; Sunflower: Sclerotinia stem rot and Alternaria blight.

Unit II:

Mustard: Alternaria blight, white rust, downy mildew and Sclerotinia stem rot; Gram: wilt, grey mould and Ascochyta blight; Lentil: rust and wilt; Cotton: anthracnose, vascular wilt, and black arm; Pea: downy mildew, powdery mildew and rust.

Horticultural Crops:

Unit III:

Mango: Anthracnose, malformation, bacterial blight and powdery mildew; Citrus: canker and gummosis; Grape vine: downy mildew, Powdery mildew and anthracnose;

Unit IV:

Apple: scab, powdery mildew, fire blight and crown gall; Peach: leaf curl. Strawberry: leaf spot. Potato: early and late blight, black scurf, leaf roll, and mosaic; Cucurbits: downy mildew, powdery mildew, wilt;

Unit V:

Onion and garlic: purple blotch, and Stemphylium blight; Chillies: anthracnose and fruit rot, wilt and leaf curl; Turmeric: leaf spot Coriander: stem gall Marigold: Botrytis blight; Rose: dieback, powdery mildew and black leaf spot.

Practical

Identification and histopathological studies of selected diseases of field and horticultural crops covered in theory. Field visit for the diagnosis of field problems. Collection and preservation of plant diseased specimens for herbarium.

COURSE OUTCOMES (COs)

CO 1: Acquainted with identifying and managing diseases of cereals and pulses
CO 2: Acquainted with identifying and managing diseases in oilseeds and cash crops
CO 3: Having in depth knowledge in identifying and managing diseases in fruits andvegetables
CO 4: Having in depth knowledge in identifying and managing diseases in spices andplantation
CO 5: Having in depth knowledge in identifying and managing diseases in flower crops

CO-PO Mapping matrix

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	2	3	-	1	1	-
CO2	2	3	-	1	1	-
CO3	2	3	-	1	1	-
CO4	2	3	-	1	1	-
CO5	2	3	-	1	1	-

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BSAG-3604: POST-HARVEST MANAGEMENT AND VALUE ADDITION OFFRUITS AND VEGETABLES

Course Code	Course Title	Credits	L	T	P
BSAG-3604	Post-harvest Management and Value Addition of Fruits and Vegetables	2 (1+1)	1		1

Learning objectives

- To make the students learn the basics and principles of postharvest technology.
- To impart knowledge recent innovations in packaging of various horticultural crops.
- To make them familiarize with the storage and value addition of horticultural crops
- To make the students acquire knowledge on various postharvest management technologies on fruits and vegetables such as Jam, Jelly Candy, Squash and Picklepreparations.
- To familiarize the students to gain knowledge on conventional and modern packagingmethods.

Theory

Unit I: Importance of post-harvest processing of fruits and vegetables, extent and possiblecauses of postharvest losses.

Unit II: Pre-harvest factors affecting postharvest quality, maturity, ripening and changesoccurring during ripening.

Unit III: Respiration and factors affecting respiration rate. Harvesting and field handling .Storage (ZECC, cold storage, CA, MA, and hypobaric).

Unit IV: Value addition concept, Principles and methods of preservation; Intermediate moisture food- Jam, jelly, marmalade, preserve, candy – Concepts and Standards, Fermentedand non-fermented beverages.

Unit V: Tomato products- Concepts and Standards; Drying/ Dehydration of fruits and vegetables – Concept and methods, osmotic drying. Canning – Concepts and Standards, packaging of products and current stream of thoughts.

Practical

Applications of different types of packaging, 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 and candy and tomato products, canned products. Quality evaluation of products -- physico-chemical and sensory. Visit to processing unit/industry.

COURSE OUTCOMES (COs)

CO 1: The students will learn the basics and principles of postharvest technology.

CO 2: The students will learn the recent innovations in packaging of various horticulturalcrops.
CO3: The students will get familiarised with the storage and value addition of horticulturalcrops
CO 4: The students will acquire knowledge and Prepare various postharvest management technologies on fruits and vegetables such as Jam, Jelly Candy, Squash and Pickle preparations.
CO 5: The students will gain knowledge on conventional and modern packaging methods.

CO-PO Mapping Matrix

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6
CO 1	3	3	1	3	2	0
CO 2	3	3	2	2	3	0
CO 3	3	3	1	3	3	0
CO 4	3	3	2	3	2	0
CO 5	3	3	3	2	3	0

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BSAG-3605: MANAGEMENT OF BENEFICIAL INSECTS

Course Code	Course Title	Credits	L	T	P
BSAG-3605	Management of Beneficial Insects	2 (1+1)	1		1

Learning Objectives:

- To study the beneficial insect with respect lo its commercial use in agriculture.
- To study about the commercial methods of rearing
- To acquaint students with the insect,pest and disease of honey bee
- To familiarize student about the silk worm and their biology
- To study about the morphology and biology of lac insect

Theory

Unit I: Importance of beneficial Insects, Beekeeping and pollinators, bee biology, commercial methods of rearing, equipment used, seasonal management, bee enemies and disease. Bee pasturage, bee foraging and communication. Insect pests and diseases of honey bee. Role of pollinators in cross pollinated plants.

Unit II: **Types of silkworm**, voltinism and biology of silkworm. Mulberry cultivation, mulberry varieties and methods of harvesting and preservation of leaves. Rearing, mounting and harvesting of cocoons.

Unit III: **Pest and diseases of silkworm**, management, rearing appliances of mulberrysilkworm and methods of disinfection, types of disinfectants, byproducts of sericulture.

Unit IV: **Species of lac insect**, morphology, biology, host plant, lac production – seed lac, button lac, shellac, lac- products. Uses of lac. Minor productive insects Cochineal insect, Gall insect, Food and Medicinal value of insects, Asthetic and Scientific value of insets.

Unit V: **Identification of major parasitoids** and predators commonly being used in biological control. Insect orders bearing predators and parasitoids used in pest control and their mass multiplication techniques. Important species of pollinator, weed killers and scavengers with their importance.

Practical

Honey bee species, castes of bees. Beekeeping appliances and seasonal management, bee enemies and disease. Bee pasturage, bee foraging and communication. Types of silkworm, voltinism and biology of silkworm. Mulberry cultivation, mulberry varieties and methods of harvesting and preservation of leaves. Species of lac insect, host plant identification. Identification of other important pollinators, weed killers and scavengers. Visit to research and training institutions devoted to beekeeping, sericulture, lac culture and natural enemies. Identification and techniques for mass multiplication of natural enemies.

COURSE OUTCOMES (COs)

CO 1: Students can adopt apiculture, sericulture and lac culture as an entrepreneur according to agro climatic zone.

CO 2: To understand commercial methods of rearing, equipment, seasonal management, insectpest and disease and important species for commercial use of honey bee, silkworm and lac insect.

CO 3: Identification of different bio control agents (Predator, Parasite and Parasitoids) and their use for sustainable pest management.

CO 4: Learn about mass multiplication technique of biological control agents and established a bio control lab in future as an entrepreneur.

CO-PO Mapping Matrix

CO/PO	PO 1	PO2	PO3	PO4	PO5	PO6
CO1	2	1	1	2	3	-
CO2	2	-	-	-	3	4
CO3	3	-1	-	3	3	-
CO4	2	-	1	1	1	-
CO5	1	-	-	-	2	1

References

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BSAG-3606: CROP IMPROVEMENT-II (RABI CROPS)

Course Code	Course Title	Credits	L	T	P
BSAG-3606	Crop Improvement-II *(Rabi crops)*	2 (1+1)	1		1

Learning objectives

- To impart knowledge about the origin, evolution and modes of reproduction for different Rabi Crops.
- To impart knowledge about the floral biology, crossing techniques, objectives of breeding and wild species as donors for resistant traits.
- To impart knowledge about the Biotic and Abiotic stress resistance breeding for different Rabi Crops .
- To impart knowledge about the Hybrid Seed Production Technologies for different Rabi Crops .
- To provide insight into recent advances in improvement of cereals, pulses, oil seeds fodder, Cash crop, Vegetables and Flowers using conventional and modern biotechnological approaches.

Theory

Unit I: Introduction to crop improvement

Introduction-definition, aim, objectives and scope of Crop Improvement - Breeding objectives and important concepts of breeding self-pollinated, cross pollinated and vegetatively propagated crops- Centers of origin-Law of homologous series- types of centres of diversity- gene sanctuaries genetic erosion-main reasons of genetic erosion-extinction-introgression- gene banks-types of gene banks-distribution of

crop species.

Unit II: Crop improvement for cereals and pulses

Centres of origin, distribution of species, wild relatives –Study of genetics of qualitative and quantitative characters for rabi crops- 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 parameters (physical, chemical, nutritional) in different rabicrops. **Cereals** – Wheat, Oat and Barley- **pulses**- Chickpea, Lentil, Field pea-

Unit III: Crop improvement for oilseeds, fodder and cash crops

Centres of origin, distribution of species, wild relatives –Study of genetics of qualitative and quantitative characters for rabi crops- 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 parameters (physical, chemical, nutritional) in different rabicrops.**Oilseeds** – Rapeseed, Mustard and Sunflower- **fodder crops** – Berseem and Leucerne- C**ash** crop - Sugarcane .

Unit IV: Crop improvement for vegetables and flowers crops

Centres of origin, distribution of species, wild relatives –Study of genetics of qualitative and quantitative characters for rabi crops- Important concepts of breeding self- pollinated, crosspollinated 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 parameters (physical, chemical, nutritional) in different *Rabi* crops. **Vegetables** –Bitter guard, Snake guard, Bottle guard, Pumpkin, Cucumber and Potato– **Flowers**- Rose, Chrysanthmum , Marigold and Gerbera.

Unit V: Seed production and resistance breeding

Seed production technology in self-pollinated, cross pollinated and vegetatively propagated *Rabi* crops-Hybrid seed production technology in Wheat, Sunflower, Rapeseed , Mustard and Cucurbits - Ideotype concept and climate resilient crop varieties for future – Breeding for drought, salinity, water logging, high temperature and low temperature tolerant varieties in different *Rabi* crops.

Practical

Floral biology, emasculation and hybridization techniques in different crop species namely Wheat, Oat, Barley, Chickpea, Lentil, Field pea, Rajma, Horse gram, Rapeseed Mustard, Sunflower, Safflower, Potato, Berseem. Sugarcane, Tomato, Chilli, Onion; Handling of germplasm and segregating populations by different methods like pedigree, bulk and single seed decent methods; Study of field techniques for seed production and hybrid seeds production in *Rabi* crops; Estimation of heterosis, inbreeding depression and heritability; Layout of field experiments; Study of quality characters, study of donor parents for different characters; Visit to seed production plots; Visit to AICRP plots of different field crops

COURSE OUTCOMES (COs)

CO1: Acquire knowledge on floral biology and selection of proper breeding method for majorRabi Crops

CO 2: Cultivate skill in emasculation and pollination methods for major Rabi Crops

CO 3: Gain expertise on hybrid seed production techniques for major Rabi Crops

CO 4: Learn to use different selection procedures for selection of superior genotypes for majorRabi Crops.

CO 5: To get an overview about the breeding aspects about Rabi Crops

CO-PO Mapping Matrix

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5
CO 1	1	-	-	-	-
CO 2	-	-	3	-	-
CO 3	-	-	-	-	2
CO 4	-	-	-	-	-
CO 5	-	-	-	-	-

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BSAG-3607: PRACTICAL CROP PRODUCTION –II (RABI CROPS)

Course Code	Course Title	Credits	L	T	P
BSAG-3607	Practical Crop Production –II (*Rabi* crops)	2 (0+2)	0		2

Learning Objectives:

- Identify common Rabi crops grown in the region.
- Understand the characteristics and requirements of each crop (e.g., wheat, barley, pulses, oilseeds).
- Understand crop rotation strategies to maintain soil fertility and manage pests and diseases effectively.
- Develop skills in land preparation, including tillage, soil amendment, and weed control.
- Understand the economic aspects of crop production, including input costs, yield estimation, and price forecasting.
- Learn about marketing strategies and value addition opportunities for Rabi crops.

Practical

Crop planning, raising field crops in multiple cropping systems: Field preparation, seed, treatment,nursery raising, sowing, nutrient, water and weed management and management of insect-pests diseases of crops, harvesting, threshing, drying winnowing, storage and marketing of produce. The emphasis will be given to seed production, mechanization, resource conservation and integrated nutrient, insect-pest and disease management technologies. Preparation of balance sheet including cost of cultivation, net returns per student as well as per team of 8-10 students.

COURSE OUTCOMES (COs)

CO 1: To gain knowledge about cultivation aspects of maize
CO 2: To demonstrate various seed treatment methods for maize
CO 3: To evaluate different methods of planting techniques
CO 4: To acquire knowledge on mechanized farming practices
CO 5: To construct methodologies in harvesting, processing and value addition

CO-PO Mapping matrix

CO/PO	PO 1	PO2	PO3	PO4	PO5	PO6
CO1	3	1	1	-	3	-
CO2	2	-	-	-	3	-
CO3	2	-	-	3	3	-
CO4	2	-	1	1	1	-
CO5	1	-	-	-	2	1

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BSAG-3608: PRINCIPLES OF ORGANIC FARMING

Course Code	Course Title	Credits	L	T	P
BSAG-3608	Principles of Organic Farming	2 (1+1)	1		1

Learning Objectives:

- Aims at incurring knowledge on various aspects of organic farming and its importance in present world scenario and its impact on environment and soil health
- To impart knowledge on varied farming enterprises and their integration for sustainableproductivity
- Students will gain knowledge about organic inputs for sustainable agriculture
- To develop skills on managing farm resource and improving nutritional standards forbetterment of health
- Students will get exposure on innovative organic farm products and certification

Theory

Unit I: **Components and principles of Organic farming:** Organic farming : Definition, Scope, Principles and Concepts- Relevance, Ethics and Objectives and Characteristics -History of organic farming- Global scenario- biodiversity: Importance and measure to preserve biodiversity- Pre requisites for Organic farming: Soil organic carbon: status and improvement strategies

Unit II : **Organic Sources of nutrients**- Manures and other inputs- on farm and off farm sources- organic waste recycling- methods- soil and crop management – intercropping, crop rotation- green manures, cover crops, mulching – Biofertilizers.

Unit III: Non- chemical weed and pest disease management methods: Preventive, physical, cultural, mechanical and biological measures- Bio-intensive pest and

disease management.

Unit IV: Indigenous Technical Knowledge (ITK): ITK in organic agriculture – scientific rationale- soil, nutrient, weed, water management- Prospects and problems in organic farming

Unit V: **Organic Certification :** Organic certification – NPOP guidelines- Certification Types and Agencies in India- Crop production standards- Quality considerations- labeling and accreditation process- Marketing and export potential of organic products.

Practical

Visit of organic farms to study the various components and their utilization; Preparation of enrich compost, vermicompost, bio-fertilizers/bio-inoculants and their quality analysis; Indigenous technology knowledge (ITK) for nutrient, insect, pest disease and weed management; Cost of organic production system; Post harvest management; Quality aspect, grading, packaging and handling.

COURSE OUTCOMES (COs)

CO 1: To gain the information and acquire practical knowledge on various types of cropping systems.

CO 2: To understand interaction between different farm enterprises and to gain the information about the impact of organic farming and indigenous practices

CO 3: To understand the procedure followed for organic certification as per NPOP guidelines and to evaluate different resource management techniques in conservation agriculture.

CO 4: To know about: Low-cost input technologies for sustainable crop production

CO 5: To know about conservation agriculture strategies in agriculture

CO-PO Mapping Matrix

CO/PO	PO 1	PO2	PO3	PO4	PO5	PO6
CO1	2	2	-	3	2	1
CO2	2	1	3	-	3	-
CO3	1	3	3	-	2	2
CO4	1	1	3	-	1	-
CO5	3	2	2	3	2	-

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BSAG-3609: FARM MANAGEMENT, PRODUCTION & RESOURCE ECONOMICS

Course Code	Course Title	Credits	L	T	P
BSAG-3609	Farm Management, Production & Resource Economics	2 (1+1)	1		1

Learning Objectives:

- To provide knowledge get the students about the principles of farm management
- To help the students in using different method sand tools for decision making in farm management
- To explain ways for profit maximization through optimizing resource use
- To know the risk and uncertainty in production
- To understand the common property resources

Theory

Unit I: Production Economics and Farm Management - Nature and Scope

Meaning and concept of farm management, objectives and relationship with other sciences. Meaning and definition of farms, its types and characteristics, factors determining types and size of farms. Types of farming: Specialized, Diversified, and Mixed farming – Systems of farming: Peasant Farming, State Farming, Capitalistic, Collective and Co – operative Farming.

Unit II: Factor – Product, Factor – Factor and Product – Product Relationships

Principles of farm management: concept of production function and its characteristics and its type, use of production function in decision-making on a farm. Factor-Product relationship. meaning, Definition – Laws of Returns. Meaning and concept of cost, types of costs, cost curves - and their inter-relationship - shut down and break-even points, importanceof cost in managing farm business and estimation of gross farm income, net farm income, family labor income and farm business income. Economies of Scale – Economies of Size -Determination of Optimum Input and Output – Physical and Economic Optimum. Factor –Factor relationship: Least Cost Combination of inputs; Product – Product relationship: OptimumCombination of Products – Principle of Equi – Marginal Returns – Principle of Opportunity Cost and MinimumLoss Principle. Law of Comparative Advantage.

Unit III: Farm Planning and Budgeting

Farm business analysis: meaning and concept of farm income and profitability, technicaland economic efficiency measures in crop and livestock enterprises. Importance of farm records and accounts in managing a farm, various types of farm records needed to maintain on farm, farm inventory, balance sheet, profit and loss accounts. Meaning and importance of farm planning and budgeting, partial and complete budgeting, steps in farm planning and budgeting - linear programming, appraisal of farm resources, selection of crops and livestock's enterprises.

Unit IV: Risk and Uncertainty in Agriculture Production

Concept of risk and uncertainty occurrences in agriculture production, nature and sources of risks and their management strategies, Crop / livestock / machinery insurance. Weather based crop insurance - Features and determinants of compensations.

Unit V: Resource Economics

Resource Economics: Concepts, Classification, differences between Natural Resource Economics (NRE) and agricultural economics, unique properties of natural resources. Natural Resources - Issues – Scarcity of resources – Factors mitigating scarcity – Property Rights:Common Property Resources (CPRs): meaning and characteristics of CPRs –Externalities:meaning and types - positive and negative externalities in agriculture, Inefficiency and welfare loss, solutions; Important issues in economics and management of common property resources of land, water, pasture and forest resources.

Practical

Preparation of farm layout. Determination of cost of fencing of a farm. Computation of depreciation cost of farm assets. Application of equi-marginal returns/opportunity cost principle in allocation of farm resources. Determination of most profitable level of inputs use in a farm production process. Determination of least cost combination of inputs. Selection of most profitableenterprise combination. Application of cost principles including CACP concepts in the estimation of cost of crop and livestock enterprises. Preparation of farm plan and budget, farm records and accounts and profit & loss accounts. Collection and analysis of data on various resources in India.

COURSE OUTCOMES (COs)

CO1: Understand the concepts, nature and Scope of farm management
CO2: Know the importance of farm planning and budgeting.
CO3: Work out the cost of cultivation for different crops
CO4: Importance of farm record sand accounts and farm business analysis

CO5: Understand the natural resources issues and CPR

CO-PO Mapping Matrix

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	2	-	-	-	-	-
CO2	3	-	-	-	-	-
CO3	-	2	3	-	-	-
CO4	-	-	-	-	-	2
CO5	1	-	2	-	-	-

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BSAG-3610: PRINCIPLES OF FOOD SCIENCE AND NUTRITION

Course Code	Course Title	Credits	L	T	P
BSAG-3610	Principles of Food Science and Nutrition	2(2+0)	2		0

Learning objectives:

- The impart knowledge on microbes and their diversity, sources of contamination in food.
- To make the students to know the principle underlying food preparation and preservationtechnologies.
- To have a knowledge on the fermentation technologies of producing value-added foodsby microbes and their spoilage.
- To impart knowledge on nutritive value on foods, spoilage and develop skills and techniques on pasteurization and

preservation methods.

- To learn advanced techniques on food production, processing, packing and qualitycontrol.

Theory

Unit I: Introduction to Food and Microflora

Food in relation to health – food groups – incidence and behavior of microorganism in food – source of contamination in food.

Unit II: Nutritive Value and Preservation

Composition and nutritive value – rice, wheat, bajra, ragi, raw rice, groundnut, black gram – breakfast cereal – idly - chapathi and cakes. Principles and method of food preservation – physical method – high temperature, low temperature, drying, osmotic pressure, irradiation, chemical method – class I and class II chemical, other adulterants.

Unit III: Fermented Food and Spoilage

Fermentation of pickles, sauerkraut, bread, vinegar, idly. Single cell proteins – microbialspoilage of different types of food – cereals, fruits and vegetables, meat and sea foods.

Unit IV: Milk, Egg, Fats and Oils

Milk – composition – nutritive value, spoilage, pasteurization. Egg – structures, composition, nutritive value, spoilage. Fats and oils – composition, emulsion, rancidity, smoking point, roleof fat/oil in cookery.

Unit V: Novel Food Production, Processing, Packing and Quality Control

Mushroom, spirulina, leaf protein concentrates (LPC), packaging material, package forms, andtechniques Aseptic packaging, referable containers, modified and control atmosphere packaging, microwaveable containers, and other package forms. Food manufacturing practice, quality control, Food safety Laws and standards.

COURSE OUTCOMES (COs)

CO 1 - The students would thoroughly understand about the nutritional properties.
CO 2 - The students exposed to food microbes and awareness in wellbeing.
CO 3 - To have knowledge on the fermentation technologies of producing value-added foods by microbes and their spoilage
CO 4 - The students would expose to the principles involving the food preservation.
CO 5 - The students will gain knowledge on the role of microorganism in food and processingtechniques.

CO – PO Mapping Matrix

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6
CO 1	2	-	-	-	-	-
CO 2	-	2	-	-	-	-
CO 3	-	2	-	-	-	-

CO 4	**-**	**-**	**-**	**-**	**2**	**-**
CO 5	**-**	**-**	**-**	**-**	**-**	**3**

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ELECTIVE COURSE

A student can select one elective course out of the following and offer during the 6th Semester

S.N.	Course Code	Courses	Credit Hours
1	BSAG-3611	Agribusiness Management	3(2+1)
2	BSAG-3612	Agrochemicals	3(2+1)
3	BSAG-3613	Commercial Plant Breeding	3(1+2)
4	BSAG-3614	Landscaping	3(2+1)
5	BSAG-3615	Food Safety and Standards	3(2+1)
6	BSAG-3616	Bio-pesticides & Bio-fertilizers	3(2+1)
7	BSAG-3617	Protected Cultivation	3(2+1)
8	BSAG-3618	Micro propagation Technologies	3(1+2)
9	BSAG-3619	Hi-tech. Horticulture	3(2+1)
10	BSAG-3620	Weed Management	3(2+1)
11	BSAG-3621	System Simulation and Agro-advisory	3(2+1)
12	BSAG-3622	Agricultural Journalism	3(2+1)

VII SEMESTER

BSAG-4701: RURAL AGRICULTURAL WORK EXPERIENCE (RAWE) AND AGRO-INDUSTRIAL ATTACHMENT (AIA)

- This program will be undertaken by the students during the seventh semester for a total duration of 20 weeks with a weightage of 0+20 credit hours in two parts, namely, RAWE and AIA.

- It will consist of general orientation and on-campus training by different faculties followed by village attachment/unit attachment in university/ college/ KVK or a research station.
- The students would be attached with the agro-industries to get an experience of the industrial environment and working.
- Due weightage in terms of credit hours will be given depending upon the duration of stay of students in villages/ agro-industries.
- At the end of RAWE/AIA, the students will be given one week for project report preparation, presentation and evaluation.

VII Semester			
No.	**BSAG-4701: Rural Agricultural Work Experience and Agro-industrial Attachment (RAWE &AIA)**		
	Activities	**No. of weeks**	**Credit Hours**
1	General orientation & On campus training by different faculties	1	14
2	Village attachment	8	
	Unit attachment in Univ./College. KVK/ Research Station Attachment	5	
3	Plant clinic	2	02
	Agro-Industrial Attachment	3	04
4	Project Report Preparation, Presentation and Evaluation	1	
Total weeks for RAWE & AIA		**20**	**20**

The Rural Agricultural Work Experience (RAWE) helps the students primarily to understand the rural situations, status of agricultural technologies adopted by the farmers to prioritize the farmers' problems and to develop skills & attitude of working with farm families for overall development in rural area. The timings for RAWE can be flexible for specific regions to coincide with the main cropping season.

RAWE COMPONENT-I: VILLAGE ATTACHMENT TRAINING PROGRAMME

Sl. No.	Activity	Duration
1	Orientation and Survey of Village	1 week
2	Agronomical Interventions	1 week
3	Plant Protection Interventions	1 week
4	Soil Improvement Interventions (Soil sampling and testing)	1 week
5	Fruit and Vegetable production interventions	1 week
6	Food Processing and Storage interventions	1 week
7	Animal Production Interventions	1 week
8	Extension and Transfer of Technology activities	1 week

RAWE COMPONENT –II: AGRO INDUSTRIAL ATTACHMENT

❖ Students shall be placed in Agro-and Cottage industries and Commodities

Boards for 03 weeks.

- ❖ Industries include Seed/Sapling production, Pesticides-insecticides, Post harvest-processing- value addition, Agri-finance institutions, etc.

ACTIVITIES AND TASKS DURING AGRO-INDUSTRIAL ATTACHMENT PROGRAMME

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

VIII SEMESTER

MODULES FOR SKILL DEVELOPMENT AND ENTREPRENEURSHIP

A student has to register 20 credits opting for two modules of (0+10) credits each (total 20 credits) from the following package of modules in the **VIII semester.**

The Experiential Learning Programme (ELP) /Hands on Training (HOT)

Experiential Learning/Hands on Training (HOT) helps the student to develop competence, capability, capacity building, acquiring skills, expertise, and confidence to start their ownenterprise and turn job creators instead of job seekers. ELP provides the students an excellent opportunity to develop analytical and entrepreneurial skills, and knowledge through meaningful hands on experience, confidence in their ability to design and execute projectwork.

The main objectives of ELP are:

- To promote professional skills and knowledge through meaningful hands on experience
- To build confidence and to work in project mode
- To acquire enterprise management capabilities

The Experiential Learning Programme (ELP) shall be run for full year by making two groups and rotating activities of the final year in two groups.
The students will register for any of two modules, listed below, of 0+10 credit hours each. A separate certificate should be issued to the students after successful completion of ELP. Allotment of ELP amongst students to different modules should

be done strictly on the basis of merit at the end of semester.

Sl. No.	Course Code	Title of the module	Cred its
1	BSAG-4801	Production Technology for Bioagents and Biofertilizer	0+10
2	BSAG-4802	Seed Production and Technology	0+10
3	BSAG-4803	Mushroom Cultivation Technology	0+10
4	BSAG-4804	Soil, Plant, Water and Seed Testing	0+10
5	BSAG-4805	Commercial Beekeeping	0+10
6	BSAG-4806	Poultry Production Technology	0+10
7	BSAG-4807	Commercial Horticulture	0+10
8	BSAG-4808	Floriculture and Landscaping	0+10
9	BSAG-4809	Food Processing	0+10
10	BSAG-4810	Agriculture Waste Management	0+10
11	BSAG-4811	Organic Production Technology	0+10
12	BSAG-4812	Commercial Sericulture	0+10

NOTE: In addition to above ELP modules other important modules may be given to the students by University.

EVALUATION OF EXPERIENTIAL LEARNING PROGRAMME (ELP)/ HANDS- ON TRAINING (HOT)

S.No.	Parameters	Max. Marks
1.	Project Planning and Writing	10
2.	Presentation	10
3.	Regularity	10
4.	Monthly Assessment	10
5.	Output delivery	10
6.	Technical Skill Development	10
7.	Entrepreneurship Skills	10
8.	Business networking skills	10
9.	Report Writing Skills	10
10.	Final Presentation	10
	Total	**100**

ELECTIVE COURSE

A student can select three elective courses out of the following and offer during 4th, 5th and 6th semesters.

S.N.	Course Code			Courses	Credit Hours
	IV semester	V semester	VI semester		
1	BSAG-2410	BSAG-3510	BSAG-3611	Agribusiness Management	3(2+1)
2	BSAG-2411	BSAG-3511	BSAG-3612	Agrochemicals	3(2+1)
3	BSAG-2412	BSAG-3512	BSAG-3613	Commercial Plant Breeding	3(1+2)
4	BSAG-2413	BSAG-3513	BSAG-3614	Landscaping	3(2+1)
5	BSAG-2414	BSAG-3514	BSAG-3615	Food Safety and Standards	3(2+1)
6	BSAG-2415	BSAG-3515	BSAG-3616	Bio pesticides & Bio fertilizers	3(2+1)
7	BSAG-2416	BSAG-3516	BSAG-3617	Protected Cultivation	3(2+1)
8	BSAG-2417	BSAG-3517	BSAG-3618	Micro propagation Technologies	3(1+2)
9	BSAG-2418	BSAG-3518	BSAG-3619	Hi-tech. Horticulture	3(2+1)
10	BSAG-2419	BSAG-3519	BSAG-3620	Weed Management	3(2+1)
11	BSAG-2420	BSAG-3520	BSAG-3621	System Simulation and Agro-advisory	3(2+1)
12	BSAG-2421	BSAG-3521	BSAG-3622	Agricultural Journalism	3(2+1)

BSAG-2410/ BSAG-3510/BSAG-3611: AGRI-BUSINESS MANAGEMENT

Course Code			Courses	Credit Hours	L	T	P
IV semester	V semester	VI semester					
BSAG-2410	BSAG-3510	BSAG-3611	Agribusiness Management	3(2+1)	2	-	1

Learning objectives

- To impart skill, training, proficiency in decision making
- To enhance ability ,to direct, to coordinate and control the work at all levels of management for the farm graduates
- To use the knowledge and skill gained for starting new agribusiness and managing the business.
- To study the marketing management
- To know the preparation of bankable projects

Theory

Unit I: Agribusiness and Management

Agribusiness – Definition – Nature and Scope – Transformation of agriculture intoagribusiness, various stakeholders and components of agribusiness systems. Structure ofAgribusiness (input, farm and product sectors) - Agribusiness Management - Distinctive features of Agribusiness - Importance of Agribusiness in Indian Economy and New Agricultural Policy – Agri-value chain: Understanding primary and support activities and their linkages. Business environment – PEST and

SWOT analysis. Management – Definition and Importance – Management functions – Nature. Management - Skills, Levels and functional areas of management. Forms of Business Organisation – Sole Proprietorship – Partnership –Private and Public Limited - Cooperatives.

Unit II: Management Functions

Management functions: Roles and activities, organizational culture. Planning – Definition – Types of plans (Purpose or Mission, Goals or Objectives, Strategies, Policies, Procedures, Rules, Programme, Budget). Steps in planning and implementation – Characteristics of Sound plan. Objectives – MBO. Organizing – Principles of Organizing – Concept of Depart mentation-Delegation- Centralization – Decentralization. Staffing – Concept – Human Resource Planning

– Process. Directing – Concept – Principles – Techniques, Supervision. Motivation – Concept - Maslow's Need Hierarchy Theory – Types – Techniques. Communication – Definition and Process – Models – Types – Barriers. Leadership – Definition – Styles – Difference between leadership and management. Controlling – Concept - Steps – Types – Importance – Process.

Unit III: Functional areas of management

Functional areas: Operations, Human Resources, Finance and Marketing – Meaning and scope. Operations management: meaning – physical facilities – implementing the plan. Inventorycontrol: meaning – inventory model – EOQ.

Unit IV: Marketing management

Financial management of agribusiness: Financial statements and their importance – Balance sheet, Network analysis and Cash flow analysis. Marketing management: meaning, definition – market segmentation, targeting and positioning – 4Ps of marketing mix and marketing strategies. Consumer behavior analysis Product Life Cycle (PLC). Sales and distribution management. Pricing policy, various pricing methods.

Unit V: Preparation of bankable project

Project management: Definition – classification of agricultural projects – Project cycle:Identification, Formulation, Appraisal, Implementation, Monitoring and Evaluation. Projectappraisal and evaluation of bankable projects – Pay Back Period, BCR, NPW and IRR. Agro-based industries – importance and need – Types of agro-based industries – institutionalarrangements. Procedure to set up agro-based industries, constraints in establishing agro-based industries- Laws and policies related to agri-business in India.

Practical

Study of agri-input markets: Seed, fertilizers, pesticides. Study of output markets: grains, fruits, vegetables, flowers. Study of product markets, retails trade commodity trading, and value added products. Study of financing institutions- Cooperative, Commercial banks, 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 prices of agricultural commodities. Net present worth technique for selection

of viable project. Internal rate of return.

COURSE OUTCOMES (COs)

CO1: To understand the opportunities in agribusiness sectors
CO2: To understand the marketing mix, and supply chain management in agribusiness.
CO3: To know the management functions and how to prepare agribusiness project.
CO4: To understand the components of business plan
CO5: To know the importance of financial management

CO-PO Mapping Matrix

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	2	-	2	-	-	-
CO2	3	-	2	-	-	-
CO3	-	-	3	-	-	2
CO4	2		-		2	-
CO5	-	2	-	-		-

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BSAG-2411/ BSAG-3511/BSAG-3612: AGROCHEMICALS

Course Code			Courses	Credit Hours	L	T	P
IV semester	V semester	VI semester					
BSAG-2411	BSAG-3511	BSAG-3612	Agrochemicals	3(2+1)	2	-	1

Learning Objectives:

- The students are expected to gain both theoretical as well as practical knowledge onagrochemicals-their type and role in agriculture,
- The student learn the effect on environment, soil, human and

animal health; managementof agrochemicals for sustainable agriculture

- Understand how more efficient use of agrochemicals can build and improve the health ofthe soil
- Understand that reducing use of agrochemicals does not reduce productivity
- Identify the characteristics of a sustainable farm with regards to agrochemical use

Theory

Unit 1: Agrochemicals- overview

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

Unit II:- Herbicides and bio pesticides

Herbicides-Major classes, properties and important herbicides. Fate of herbicides. Plant bio- pesticides for ecological agriculture, Bio-insect repellent.

Unit III: Fungicides

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

Unit IV: Insecticides

Introduction and classification of insecticides: inorganic and organic insecticides Organochlorine, Organophosphates, Carbamates, Synthetic pyrethroids Neonicotinoids, Biorationals, Insecticide Act and rules, Insecticides banned, withdrawn and restricted use, Fate of insecticides in soil & plant. IGRs Bio pesticides, Reduced risk insecticides, Botanicals, plant and animal systemic insecticides their characteristics and uses.

Unit V: Fertilizers

Fertilizers and their importance. Nitrogenous fertilizers: Feedstock's and Manufacturing of ammonium sulphate, ammonium nitrate, ammonium chloride, urea. Slow release N-fertilizers. Phosphatic fertilizers: feedstock and manufacturing of single superphosphate. Preparation of bone meal and basic slag. Potassic fertilizers: Natural sources of potash, manufacturing of potassium chloride, potassium sulphate and potassium nitrate. Mixed and complex fertilizers: Sources and compatibility–preparation of major, secondary and micronutrient mixtures. Complex fertilizers: Manufacturing of ammonium phosphates, nitro phosphates and NPK complexes. Fertilizer control order. Fertilizer logistics and marketing. Current stream of thoughts

Practical

Sampling of fertilizers and pesticides. Pesticides application technology to study about various pesticides appliances. Quick tests for identification of common fertilizers. Identification of anion and cation in fertilizer. Calculation of doses of insecticides to be used. To study and identify various formulations of insecticide available kin market. Estimation of

nitrogen in Urea. Estimation of water soluble P2O5 and citrate soluble P2O5 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. Determination of thiram. Determination of ziram content.

COURSE OUTCOMES (COs)

CO1: Students will gain knowledge on chemical composition and proper understanding ofChemistry of pesticides.
CO2: Students will acquire the skills on quality monitoring of crops and pesticides throughpractices.
CO3: Students will acquire knowledge on manufacture, nutrient content and use of variousfertilizers, slow-release fertilizers and fertilizer control order etc.
CO4: Students gain practical skills in analysis of pesticides and fertilizers
CO5: Students gain knowledge in act and rules pertaining to fertilizers and pesticides usage

Co-Po Mapping Matrix

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	1	1	-	-	1	-
CO2	-	1	-	-	-	-
CO3	1	2	1	-	1	-
CO4	-	1	-	-	-	1
CO5	1	1	-	1	-	-

References

1. Handa.S.K.2004.Principles of Pesticide Chemistry. Agrobios. Jabalpur
2. John Havlin, James Beaten, Samuel Tisdale, Werner Nelson, 2005.Soil Fertility and Fertilizers - An Introduction to Nutrient Management. 7th Edition, Prentice Hall. Upper Saddle River, New York
3. Sree Ramulu, U.S. 1979. Chemistry of Insecticides and Fungicides – Oxford and IBH Publishing Co., New Delhi
4. Yawalkar, K.S., J.P. Agarwal and S.Bokde.1972. Manures and Fertilizers Third revisedEdition Agri Horticultural Publishing House, Nagpur
5. Jayakumar, R and R. Jagannathan 2003.Weed Science Principles, Kalyani Publishers, Ludhiana.

E-references

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BSAG-2412/ BSAG-3512/ BSAG-3613: COMMERCIAL PLANT BREEDING

Course Code			Courses	Credit Hours	L	T	P
IV semester	V semester	VI semester					
BSAG-2412	BSAG-3512	BSAG-3613	Commercial Plant Breeding	3(1+2)	1	-	2

Learning objectives

- To expose the students to learn basic and applied principles of plant breeding.
- To help the students to understand the quality seed production of hybrids.
- To learn post harvest seed handling techniques.
- To impart knowledge on seed quality testing and marketing.
- To know the importance of seed certification.

Theory

Unit I: Reproductive systems in crop plants

Objectives and role of plant breeding - modes of reproduction - sexual and asexual - self and cross pollination - significance of fertilization. Self-incompatibility – classifications - mechanisms - application – measures to overcome and limitations. Male sterility systems – Introduction and classification – GMS, CMS and CGMS – inheritance and application- TGMS, PGMS, Gametocides, Transgenic male sterility and applications - Alternative methods: production of haploids and Tissue culture techniques- Biotechnological tools.

Unit II: Hybrid Seed Production

Advances in hybrid seed production of self and cross pollinated crops - rice, maize, sorghum, pearl millet, red gram, sunflower, sesame, castor, brassica, cotton and vegetables.

Unit III: Post harvest seed handling techniques

Seed drying - seed processing - importance - seed cleaning and grading - seed quality enhancement – Seed packaging and storage.

Unit IV: Seed quality testing and marketing

Seed quality assessment – genetic purity test - molecular markers. Seed marketing-policies and demand.

Unit V: Seed legislation and certification

Importance of seed quality regulation-seed act and rules – seeds control order 1983 and New Seed Bill, 2004 and seed labelling-IPR issues in commercial plant breeding. DUS testing – registration of varieties under PPV & FR Act. Seed certification – varietal release and notification systems in India.

Practical

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

COURSE OUTCOMES (COs)

CO 1: To enrich different types of male sterility system
CO 2: To provide knowledge on reproductive system in field and horticultural crops.
CO 3: Will acquire knowledge on hybrid seed production technologies for commercial seedproduction.
CO 4: Help to assess the seed quality and analyse the seed marketing.
CO 5: will know about seed rules, act and certification procedures to empower them tobecome entrepreneur.

CO – PO Mapping Matrix

CO/PO	PO1	PO2	PO3	PO4	PO5
CO1	3	2	3	2	1
CO2	3	2	3	2	3
CO3	2	3	2	1	2
CO4	1	2	3	2	1
CO5	3	1	2	3	2

References

1. Miller B. McDonald, Lawrence O. Copeland. 1997. Seed Production Principles and Practices.Springer, Boston, MA.
2. Hayward, M.D., N.O. Bosemark, I. Romagosa and M. Cerezo. 1993. Plant BreedingPrinciples and Prospects. Springer, Dordrecht.
3. Singh, B.D. 2009. Plant Breeding – Principles and Methods. Kalyani Publishers, NewDelhi.
4. George Acquabah. 2012. Principles of Plant and Breeding, John Wiley and Sons, New Delhi.
5. Singhal, N.C. 2003. Hybrid seed production in Field crops, Kalyani Publishers, New Delhi.

E- resources:

1. https://www.agrimoon.com/wp-content/uploads/Principles-of-Plant-Breeding.pdf
2. www.sciencedirect.com
3. www.seednet.gov.in
4. www.agricoop.nic.in
5. www.onlinelibrary.willey

BSAG-2413/BSAG-3513/BSAG-3614: LANDSCAPING

Course Code			Courses	Credit Hours	L	T	P
IV semester	V semester	VI semester					
BSAG-2413	BSAG-3513	BSAG-3614	Landscaping	3(2+1)	2	-	1

Learning objectives

- To impart knowledge on basic principles, components and practices of landscape gardening.
- To highlight the different styles of gardens and special features in a garden.
- To enable them in designing gardens using various tools and techniques
- To impart knowledge on the production technology of Cut and Loose flower crops.

- To impart comprehensive knowledge about the production technology of Medicinal and Aromatic crops

Theory

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.

Unit II: Trees: selection, propagation, planting schemes, canopy management, shrubs and herbaceous perennials: selection, propagation, planting schemes, architecture. Climber and creepers:

Unit III: Importance, Selection, Propagation, Planting, Annuals, selection, propagation, planting scheme, other garden plants: palms, ferns, grassesand cacti, succulents. Pot plants: selection, arrangement, management.

Unit IV: **Bio-aesthetic planning**: definition, need, planning; 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.

Unit V: **Bonsai:** principles and management, lawn: establishment and maintenance CAD application.

Practical

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

COURSE OUTCOMES (COs)

CO 1: The students will be able to practice the nursery techniques and planting methods ofcut and loose flower crops

CO 2: The students will beable to understand the cultivation techniques of medicinal andaromatic plants.

CO3: The students will be to diagnose problems in cultivation of flower crops under protectedcultivation.

CO4: The students will be able to practice the landscape designing for various places

CO5: The students will be able to practice horticultural crafts

CO-PO Mapping matrix

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6
CO 1	3	3	1	3	2	0
CO 2	3	3	2	3	3	0
CO 3	3	3	1	3	3	0
CO 4	1	0	3	3	2	0
CO 5	1	0	2	3	1	0

References

1. Bose, T.K. and P. Yadav. 1989. Commercial flowers. Naya Prakash Publications,Calcutta.
2. Kumar, N, Md. Abdul Khader, P. Rangasamy, and I. Irulappan, 1994. Spices, Plantation Crops, Medicinal and Aromatic plants, Rajalakshmi Publications, Nagercoil
3. Randhawa, G.S. and A. Mukhopadhyay. 1986. Floriculture in India. Allied Publishers
4. (P) Ltd., New Delhi.
5. Prajapati, Purohit, Sharma and Kumar. 2006. A Handbook of Medicinal plants-A complete source book. Agrobios, India
6. Nursadh Ali. 2008. Medicinal plants cultivation, Mittal publications, New Delhi.

E-references

1. www.herbs.org
2. www.intuxford.tripod.com
3. www.nmpb.nic.in
4. www.agrobiosindia.com
5. www.frlht.india.org

BSAG-2414/ BSAG-3514/BSAG-3615: FOOD SAFETY AND STANDARDS

Course Code			Courses	Credit Hours	L	T	P
IV semester	V semester	VI semester					
BSAG-2414	BSAG-3514	BSAG-3615	Food Safety and Standards	3(2+1)	2	-	1

Learning objectives

- To expose the students to learn basic and applied principles of Food Safety and Standards.
- To help the students to understand the quality measures of Food Safety and Standards.
- To learn Food Safety and Standards Handling techniques.
- To impart knowledge on Food Safety and Standards quality testing.
- To know the importance of Food Safety and Standards certification.

Theory

Unit I:**Food safety concepts:** Food safety- definition, importance and scope; Factors affecting food safety; Food hazards- meaning, biological,chemical, physical hazards; control and preventive measures; Hazard management during storage, processing, handling and distribution ; Sources of contamination;Waste disposal, pest and rodent; Water analysis: testing water quality-physic-chemical and microbiological, Surface sanitation -personnel and plant hygiene.

Unit II : **Food safety measures:** Food safety management- basic concepts; HACCP- principles, importance accreditation and auditing; Food safety practices-PRPs, GHPs, GMPs, SSOPs; TQM - Concept and need for quality, Components of TQM, Accreditation and Auditing; ISO series, Risk analysis; kaizen (or) continuous improvement.

Unit III : **Food quality criterion:** Food quality- meaning; sensory attributes, subjective and objective evaluation of foods, Food analysis- nutrient, microbial, pesticide, toxicant, heavy metals; Food additives- definition, common food additives and its functions, Food adulterants-meaning and types; Food packaging- functions, requirements**,** materials, package testing; Food labeling-definition, principles, requirements and nutritional labeling, nutrition claims.

Unit IV : **Food laws and standards**- need and importance; Indian food regulatory regime; global scenario- Codex Alimentarius Commission (CAC); other laws and standards related to food-National food legislation- AGMARK, BIS, FPO, PFA, FSSA and Essential commodities act; International organization- FAO, WTO, WHO and APEDA.

Unit V : **Novel approaches for food safety:** Genetically modified foods- meaning, role, merits and demerits.GM foods- golden rice, brinjal, tomtato, potato and kiwi; biofortification; Organic foods - meaning, advantages and limitations of organic farming; nutraceuticals/functional foods meaning, advantages and limitations.

Practical

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

COURSE OUTCOMES (COs)

CO 1: Understanding the basic concepts of food safety management.
CO2: Applying effective storage and hygienic methods to control the contamination.
CO3: Understanding the various methods and techniques for the microbial and chemicalassessment of fresh / processed food
CO4: Applying different methodologies and regulation for implementing HACCP, FSMS to ensure food safety
CO5: The students will be able to practice safety management, effective storage and hygienic methods.

CO-PO Mapping matrix

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6
CO 1	3	3	1	3	2	0
CO 2	3	3	2	3	3	0
CO 3	3	3	1	3	3	0
CO 4	1	0	3	3	2	0
CO 5	1	0	2	3	1	0

References

1. A Practical Guide to Food Laws and Regulations, Kiron Prabhakar, Bloomsbury Publishing

2. Food Processing: Recent Developments, Anilkumar G. Gaonkar Elsevier,
3. Fundamentals of Food Process Engineering, Romeo T. Toledo Springer Science & Business Media.
4. Food Technology an introduction, Anita Tull, Oxford University Press
5. Food Safety Management: Implementing a Food Safety Program in a Food Retail Business,King, Hal,Springer-Verlag New York

E-references

1. www.herbs.org
2. www.intuxford.tripod.com
3. www.nmpb.nic.in
4. www.agrobiosindia.com
5. www.frlht.india.org

BSAG-2415/ BSAG-3515/BSAG-3616: BIOPESTICIDES & BIOFERTILIZERS

Course Code			Courses	Credit Hours	L	T	P
IV semester	V semester	VI semester					
BSAG-2415	BSAG-3515	BSAG-3616	Bio pesticides & Bio fertilizers	3(2+1)	2	-	1

Learning objectives

- To impart knowledge on basic principles, components of Bio pesticides & Bio fertilizers.
- To highlight the different types of Bio pesticides & Bio fertilizers and special features in cultivation.
- To enable them in Explaining the application of mass production technology of bio-pesticides.
- To impart knowledge on the quality control and marketing of bio-fertilizers.
- To impart comprehensive knowledge about the Isolation , purification of important agents of bio-pesticides andbio-fertilizers

Theory

Unit I: History And Development of Biopesticides.

History and concept of biopesticides, importance-scope and potential of biopesticides, Definition, concept and classification of biopesticides viz., entomopathogens, Botanical pesticides. Botanicals and their uses.

Unit II: Mass Production of Biopesticides.

Mass production technology of biopesticides-virulence-pathogenicity and symptoms of entomopathogens-biocontrol of nematodes- uses of biopesticides-method of application of biopesticides. Quality control and limitations in production

Unit III: Importance of Biofertilizers

Biofertilizer-Introduction, scope, concept and development. Characteristic features of bacterial biofertilizers, *Azospirillum, Azotobacter, Pseudomonas, Rhizobium* and *Frankia* - Fungal biofertilizers-current scenario-list of cyanobacterial biofertilizers- Anabaena, Nostoc- AM mycorrhiza and ectomycorrhiza

Unit IV: Mass Production of Biofertilizer.

Phosphate solubilizing biofertilizer. Mechanism of phosphate solubilization and phosphate mobilization, K solubilization. Production technology- strain selection, sterilization, growth and fermentation, mass production of carrier based and liquid biofertilizers.

Unit V: Formulations and Delivery System of Biofertilizers

Formulation–types–carrier based and liquid inoculants. Equipment's–tangential flow filtration (TFF) - centrifugation-freeze drying. Application technologies- dosage, method and time of application of bio fertilizers for different crops. FCO specifications and quality control of bio fertilizers.

Practical

Isolation and purification of important biopesticides: *Trichoderma Pseudomonas, Bacillus, Metarhyzium* etc. and its production. Identification of important botanicals. Visit to biopesticide laboratory in nearby area. Field visit to explore naturally infected cadavers. Identification of entomopathogenic entities in field condition. Quality control of biopesticides.

Isolation and purification of *Azospirillum* , *Azotobacter, 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 OUTCOMES (COs)

CO 1: Understanding the basics of bio-pesticide and bio-fertilizers.

CO2: Explaining the application of mass production technology of bio-pesticides.

CO3: Describing the quality control and marketing of bio-fertilizers.

CO4: Understanding the Isolation , purification of important agents of bio pesticides andbio fertilizers.

CO5: Applying the mass multiplication and inoculums production of bio fertilizers.

CO-PO Mapping matrix

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6
CO 1	3	3	1	3	2	0
CO 2	3	3	2	3	3	0
CO 3	3	3	1	3	3	0
CO 4	1	0	3	3	2	0
CO 5	1	0	2	3	1	0

References

1. The complete technology book on Bio-fertilizer and organic farming,NIIR Board of National.
2. Principles of Agronomy - S. R. Reddy. Kalyani Publisher.
3. Manures and Fertilizers - K. S. Yawalkar, J.P. Agrawal and S. BokdeAgri-Horticultural Pub. House.
4. Fundamentals of Agronomy Gopal Chandra De. Oxford and IBH Publishing Co. PVT.
5. Integrated Pest Management. G.S.Dhaliwal and Ramesh Arora. Kalyani 3. Elements of Entomology: Rajendra Singh. Rastogi

Publications.

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1. www.intuxford.tripod.com
2. www.nmpb.nic.in
3. www.agrobiosindia.com
4. www.frlht.india.org

BSAG-2416/ BSAG-3516/ BSAG-3617: PROTECTED CULTIVATION

Course Code			Courses	Credit Hours	L	T	P
IV semester	V semester	VI semester					
BSAG-2416	BSAG-3516	BSAG-3617	Protected Cultivation	3(2+1)	2	-	1

Learning objectives

- To impart knowledge on Modern technologies of protected cultivation.
- To impart knowledge on the protected cultivation of crops.
- To sensitize the students on Protected cultivation crop management of field crops.
- To impart knowledge in precision techniques.
- To gain knowledge on mechanization in related to protected cultivation.

Theory

Unit I: Importance and methods of Protected cultivation in horticultural crops: 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.

Unit II: Greenhouse cultivation: 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 III: Protected cultivation technology for Flower crops: Greenhouse cultivation of important horticultural crops – Rose, Carnation, Chrysanthemum, Gerbera, Orchid, Anthurium.

Unit IV: Protected cultivation technology for Vegetable crops: Greenhouse cultivation of important horticultural crops- Lilium, Tulip, Tomato, Bell pepper, Cucumber, Strawberry, Pot plants, etc.

Unit V: Protected cultivation technology for Medicinal and Aromatic crops: Cultivation of economically important medicinal and aromatic plants. Off-season production of flowers and vegetables. Insect pest and disease management.

Practical

Raising of seedlings and saplings under protected conditions, use of protrays 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 ad misting.

COURSE OUTCOMES (COs)

CO 1: Understanding importance and scope of protected cultivation.
CO 2: The students will be gaining knowledge on protected cultivation of Horticultural crops.
CO 3: Students will be able to understand and acquire knowledge on Canopy managementand crop management techniques.
CO 4: Students will be able to gain knowledge on Precision Horticulture.
CO 5: The students will know about the Mechanization in Horticulture.

CO-PO Mapping matrix

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6
CO 1	3	0	2	2	2	0
CO 2	3	3	2	2	2	2
CO 3	3	3	2	2	2	2
CO 4	3	3	2	2	2	2
CO 5	3	0	2	2	2	3

References

1. Peter, K.V. S. Rajan and Baby Lissy Markose. 2007. *Propagation of Horticultural Crops. Horticulture Science Series-6*. New India Publishing Agency,Pitam Pura, New Delhi
2. Srivastava, K K. 2007.Canopy Management of Fruit Crops.International Book Distributingcompany.
3. Tiwari, G.N. 2003. Green House Technology for Controlled Environment. Narosa Publ.House
4. Jitendra Singh, S.K. Jain and L.K. Dashora. 2013.Precision Farming in Horticulture. NewIndia Publishing Agencies
5. S.C. Mandhar, 2014, Mechanization in Horticulture.Astral Publishing Co

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3. http://attra.ncat.org/attra-pub/manures.html
4. http://ucanr.org/freepubs/docs/8129.pdf
5. https://www.yumpu.com/en/document/read/16839007/canopy-management-in-fruit-crops-department-of-agriculture-co-

BSAG-2417/ BSAG-3517/BSAG-3618: MICRO PROPAGATION TECHNOLOGIES

Course Code			Courses	Credit Hours	L	T	P
IV semester	V semester	VI semester					
BSAG-2417	BSAG-3517	BSAG-3618	Micro propagation Technologies	3(1+2)	1		2

Learning objectives

- To impart knowledge on the concepts and principles of micropropagation.
- To impart knowledge on the pathways of plant regeneration under in vitro conditions .
- To sensitize the students micro propagation methods to conserve germplasm and vitro, production ofsecondary metabolites.
- To impart the approaches of biotechnology in micro-propagation .
- To gain knowledge on Evaluating the optimum nutrient composition required for growth of explant.

Theory

Unit I: **Introduction**, History of plant tissue culture-Concepts– Advantages and limitations, Factors affecting plant tissue culture.

Unit II: **Organogenesis and embryogenesis**, Micro propagation – stages of micro propagation, Ovule, ovary endosperm culture, synthetic seeds.

Unit III: **Callus culture**- cell culture, shoot tip culture – meristem/meristem tip culture for virus elimination-virus indexing- anther and microspore culture.

Unit IV: **Protoplast culture** and fusion techniques Applications, Somatic embryogenesis **(**direct and indirect), cell suspension culture.

Unit V: **Production of secondary metabolites**, somaclonal variation - *In vitro* mutagenesis- *In vitro* germplasm conservation.

Practical

Identification and use of equipments 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 OUTCOMES (COs)

CO 1: Understanding the concepts and principles of micro propagation.

CO 2: Recognizing the different pathways of plant regeneration under in vitro conditions.

CO 3: Applying various micro propagation methods to conserve germplasm and vitro, production ofsecondary metabolites.

CO 4: Applying the approaches of biotechnology in micro-propagation

CO 5: Analyzing the different sterilization techniques in plant tissue culture and evaluating the optimum nutrient composition required for growth of explant.

CO-PO Mapping matrix

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6
CO 1	3	0	2	2	2	0
CO 2	3	3	2	2	2	2
CO 3	3	3	2	2	2	2
CO 4	3	3	2	2	2	2
CO 5	3	0	2	2	2	3

References

1. Basics of Horticulture by K.V. Peter. New India Publishing Agency, New Delhi
2. Principles of Horticulture by C.R. Adams, M.P. Early. Routledge.
3. Terminology of Horticulture by Neeraj Pratap Singh. International Book Distributing Co (IBDCPublishers).
4. Basic Horticulture-Jitendra Singh. Kalyani Publisher.

BSAG-2418/ BSAG-3518/BSAG-3619: HI-TECH. HORTICULTURE

Course Code			Courses	Credit Hours	L	T	P
IV semester	V semester	VI semester					
BSAG-2418	BSAG-3518	BSAG-3619	Hi-tech. Horticulture	3(2+1)	2	-	1

Learning objectives

- To impart knowledge on Modern Nursery techniques of Horticulture crops.
- To impart knowledge on the protected cultivation of horticultural crops.
- To sensitize the students on crop management of horticultural crops.
- To impart knowledge in precision horticultural techniques.
- To gain knowledge on mechanization in horticultural crops

Unit I: Modern Nursery techniques

Introduction & importance; Modern Nursery techniques –media- micro grafting, micro propagation of horticultural crops - Field preparation and planting methods.

Unit II: Protected Cultivation

Importance and methods of Protected Cultivation-Advantages, Climate control – Temperature, Relative Humidity, transpiration, ventilation – heating and cooling systems – Co2 enrichment – light regulation etc., methods and techniques- Micro irrigation systems and its components

Unit III: Crop Management

High density planting, UHDP, meadow orcharding, Canopy management-pollarding, rejuvenation of senile orchards, high density orcharding –Fertilization - EC, pH-based fertilizer scheduling, Leaf Nutrient analysis, nutrient deficiency symptoms and its remedy, water soluble fertilizers-automation- mulch films-weed mat- hydroponics – NFT – aeroponics.

Unit IV: Precision Horticulture

Concept of Precision Horticulture: Remote sensing, Geographical Information System (GIS), Differential Geo-positioning System (DGPS), Variable Rate applicator (VRA), mobile mapping system and its application in precision farming – role of computers in developing comprehensive systems needed in site specific management (SSM) – IOT and AI Tools, geo referencing and photometric correction-Application in Horticultural crops.

Unit V: Mechanization in Horticulture

Mechanized seed sowing, grafting, transplanting- Mechanization in Pruning, tree pruners, Hedge trimmers, Brush cutters, Mowers, Mechanized sprayers - Drone sprayers, Aerial sprayers, Mechanization in harvesting – Fruit harvester, Tree shakers, washing units, Size and color graders – Mechanization in Packaging, Corking, Bottling and Labeling and QR Coding and Bar coding and Mechanized supply chain management of produce etc. Current stream of Thoughts.

Practical

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

COURSE OUTCOMES (COs)

CO1: The students will acquire knowledge on the Modern Techniques in NurseryTechnologies.

CO2: The students will be gaining knowledge on Protected cultivation of Horticultural crops.

CO3: Students will be able to understand and acquire knowledge on Canopy managementand crop management techniques.

CO 4: Students will be able to gain knowledge on Precision Horticulture.

CO 5: The students will know about the Mechanization in Horticulture.

CO-PO Mapping matrix

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6
CO 1	3	0	2	2	2	0
CO 2	3	3	2	2	2	2
CO 3	3	3	2	2	2	2
CO 4	3	3	2	2	2	2
CO 5	3	0	2	2	2	3

References

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BSAG-2419/ BSAG-3519/ BSAG-3620: WEED MANAGEMENT

Course Code			Courses	Credit Hours	L	T	P
IV semester	V semester	VI semester					
BSAG-2419	BSAG-3519	BSAG-3620	Weed Management	3(2+1)	2	-	1

Learning objectives

- To impart knowledge on weed biology and ecology and its usefulness in weed management.
- To develop the mastery of weed identification.
- To understand different methods of weed management including herbicides, their mode ofaction and selectivity and resistance for the effective weed control.
- To understand and develop technical knowledge on different herbicides and their usage,computation of herbicide doses.
- To acquire skills on herbicide application for better herbicidal effects and weed management.

Theory

Unit I: Weed biology and ecology

Introduction to weeds- definitions, characteristics of weeds, their harmful and beneficial effectson the ecosystem. Classification, reproduction and dissemination of weeds. Weed seed dormancy – crop weed competition, allelopathy and its application for weed management.

Unit II: Principles of weed management

Concepts of weed prevention, control and eradication. Methods of weed management- cultural, mechanical, chemical, biological and biotechnological methods. Integration of herbicides with non-chemical methods of weed management and IWM.

Unit III: Herbicides

Herbicides- definition, advantages and limitation of herbicide usage in India. New developments in herbicides- classification, formulations and methods of application. Conceptof adjuvants, surfactant and their use.

Unit IV: Behavior of herbicides and herbicide resistance

Introduction to mode of action of herbicides and selectivity. Herbicide absorption and translocation. Compatibility of herbicides with other agro-chemicals. Herbicide residue management- persistence, degradation and herbicide resistance.

Unit V: Weed management

Weed management in field crops. Aquatic, problematic, invasive alien weeds and their management. Sustainable weed management concepts for climate change. Current stream of thoughts.

Practical

Techniques of weed preservation. Weed identification and their losses study. Biology of important weeds. Study of herbicide formulations and mixture of herbicide. Herbicide and agro- chemicals study. Shift of weed flora study in long term experiments. Study of methods of herbicide application, spraying equipments. Calculations of herbicide doses and weed control efficiency and weed index.

COURSE OUTCOMES (COs)

CO 1: To create knowledge on facts and information from different sources, pertaining to weed biology and management and be able to explain how they are interrelated; demonstrated through successful completion of assignments.

CO 2: To critically assess different weed management strategies

CO 3: To synthesis idea about various herbicides, formulations and adjuvants

CO 4: To understand about mechanism and action of herbicides, persistence of herbicides.

CO 5: To construct information regarding management of weeds of field crops, aquatic andproblematic weeds.

CO-PO Mapping matrix

CO/PO	PO 1	PO2	PO3	PO4	PO5	PO6
CO1	2	2	2	1	1	-
CO2	3	2	2	-	-	-
CO3	-	-	2	-	2	-
CO4	-	-	-	-	2	-
CO5	2	1	2	1	2	2

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BSAG-2420/ BSAG-3520/ BSAG-3621: SYSTEM SIMULATION AND AGROADVISORY

Course Code			Courses	Credit Hours	L	T	P
IV semester	V semester	VI semester					
BSAG-2420	BSAG-3520	BSAG-3621	System Simulation and Agro-advisory	3(2+1)	2	-	1

Learning objectives

- To acquire knowledge on the basic aspects of crop models
- To impart knowledge on the crop growth model and response to weather ailments
- To be familiar with soil water and nutrient balance
- To studying about weather forecasting
- To know about crop weather calendar

Theory

Unit I: System and Models

System Approach for representing soil-plant-atmospheric continuum, system boundaries. Crop models - concepts and techniques, types of crop models, data requirements, relational diagrams.

Unit II: Validation of models

Evaluation of crop responses to weather elements - Elementary crop growth models-calibration, validation, verification and sensitivity analysis.

Unit III: Modelling techniques

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

Unit IV: Weather forecasting and verification

Weather forecasting- types, methods, tools and techniques, forecast verification; Value added weather forecast. ITK for weather forecast and its validity

Unit V: Simulation and Agromet Advisory Bulletins

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 and current stream of thoughts.

Practical

Preparation of crop weather calendars. Preparation of agro-advisories based on weather forecast using various approaches and synoptic charts. Working with statistical and simulation models for crop growth. Potential & achievable production; yield forecasting, insect & 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 agroadvisory.

COURSE OUTCOMES (COs)

CO1: Student can learn about the basic aspects of crop models concepts andtechniques.
CO2: Students can understand knowledge on crop growth model and response toweather elements.
CO3: Student learn about soil water and nutrient balance.
CO4: Student can study about concept and modelling techniques for estimation ofyields.
CO5: Student can study about weather forecasting and crop weather calendar

CO-PO Mapping matrix

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6
CO 1	1	2	-	1	-	0
CO 2	2	1	-	1	-	1
CO 3	3	1	-	1	1	1
CO 4	1	1	1	-	1	2
CO 5	1	1	1	-	1	1

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BSAG-2421/ BSAG-3521/ BSAG-3622: AGRICULTURAL JOURNALISM

Course Code			Courses	Credit Hours	L	T	P
IV semester	V semester	VI semester					
BSAG-2421	BSAG-3521	BSAG-3622	Agricultural Journalism	3(2+1)			

Learning objectives

- To acquaint the students with the concepts of Journalism and how to write the agriculturalnews for print and electronic media for effective transfer of technology.
- To impart knowledge on Agricultural Journalism and its role in agricultural development.
- To inculcate skills in script writing for different media.
- To gain knowledge about the photo journalism
- To understand the role of social media in Farm journalism

Theory

Unit I: Introduction to Journalism

Journalism: Definition, meaning, functions & its role. Different types of Journalism with examples, Agricultural Journalism-Nature, scope, importance of Agricultural Journalism in TOT, Journalist- definition, roles, responsibilities, Characteristics, Agricultural Journalist – definition, roles, responsibilities, Characteristics of Farm Journalist, Distinguishing features of farm journalism- Different from other types of journalism

Unit II: News, Newspapers and magazines

News-Characteristics of News, Types of News , sources of News, Agricultural News, Characteristics, the types and sources of Agricultural News, Newspapers and magazines as a communication media, Characteristics, kinds and functions of newspapers and magazines, Characteristics of newspaper and magazine readers, Form, content, style and language of newspapers andmagazines, Parts of newspapers and magazines

Unit III: News story and feature story

News story-Meaning, definition purpose, writing of news story, principles and parts, Agricultural story-Types- success story, feature story, news story, Feature story-Meaning, definition, purpose, writing of feature story, -principle-Parts, Writing news stories with differenttypes of leads,

Unit IV: Photo journalism, script writing for radio and TV

Photo journalism, meaning, role and its importance in transfer of technology, Use of art works, graphs, charts, maps in Agricultural Journalism, Writing attractive captions, Layout of Agricultural News, Readability, meaning, definition, concept and Measurement, Writing of radio script for delivering of radio talk, Writing of Story Board for Television and videoprogramme

Unit V: Social media and digital journalism

Role of social media in farm journalism, Editing of news story, Farm advertisement and role and its importance in Agricultural Journalism, Proof Reading, Digital Journalism- concept, definition, scope and significance, Concepts and principles, Photo journalism elements and techniques, Difference between traditional and e-journalism, E-journals and magazine in agriculture and current stream of thoughts.

Practical

Practice in interviewing. Covering agricultural events. Abstracting stories from research and scientific materials and from wire services. Writing different types of agricultural stories. Selecting pictures and artwork for the agricultural story. Practice in editing, copy reading, headline and title writing, proofreading, layouting. Testing copy with a readability formula. Visit to a publishing office.

COURSE OUTCOMES (COs)

CO 1: Describe the concepts of Journalism, agricultural journalism& characteristics ofagricultural news.

CO 2: Gain knowledge and skills in writing the Agricultural News stories and evaluation of them.

CO 3: Develop knowledge on print media and electronic media related to Agricultural Journalism.

CO 4: Develop skill in evaluation and measurement of readability of written News stories etc.

CO 5: Develop skill in preparation of radio scripts and story boards.

Co-Po Mapping Matrix

CO/PO	PO 1	PO2	PO3	PO4	PO5	PO6
CO1	1	2	2	2	3	1
CO2	-	-	1	1	-	-
CO3	1	1	-	1	2	1
CO4	-	-	2	-	-	1
CO 5	1	1	1	-	1	=

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