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SYLLABUS

Under Graduate Programme

B.Sc. (Hons) Agriculture

As per VI Deans' Committee Report

Faculty of Agriculture

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2025

SRI KARAN NARENDRA AGRICULTURE UNIVERSITY JOBNER (JAIPUR)- 303329

PUBLICATION NO. SKNAU/2025/115

SYLLABUS

Under Graduate Programme
Agriculture Stream

(As per VI Deans' Committee Report)

2025-26

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SRI KARAN NARENDRA AGRICULTURE UNIVERSITY,

JOBNER-303329 JAIPUR (RAJ.)

Foreword

It gives me immense pleasure to present the revised syllabus of the Undergraduate Degree Programme in Agriculture, developed in accordance with the recommendations of the VI Deans' Committee Report of the Indian Council of Agricultural Research (ICAR). This curriculum has been carefully designed to meet the emerging challenges in the field of agriculture and allied sciences while preparing our students to contribute meaningfully towards the nation's food and nutritional security.

Agriculture continues to be the backbone of India's economy and society, and in the present era of rapid globalization, climate change, resource depletion, and technological advancement, the role of trained human resources becomes even more critical. The revised syllabus focuses not only on imparting scientific knowledge but also on developing practical skills, entrepreneurial abilities, and professional competencies among the students. It integrates experiential learning, rural agricultural work experience, and skill development to ensure that our graduates are well prepared to address real-world problems of farmers, agribusinesses, and rural communities.

This curriculum also emphasizes interdisciplinarity, innovation, and sustainability. It introduces new courses on emerging areas such as climate-smart agriculture, information technology, agripreneurship, value addition, and natural resource management, thus aligning agricultural education with the changing national and global scenario. Furthermore, it encourages students to imbibe ethical values, leadership qualities, and social responsibility while pursuing academic excellence.

I congratulate Dr. M.R. Choudhary, Dean and Faculty Chairman, the faculty members, experts, and committee members who have contributed their knowledge and efforts in preparing this syllabus with utmost dedication.

I wish our students, teachers, and all stakeholders great success in implementing this curriculum and in advancing the mission of agricultural education and development.

Jobner, 2025

(Balraj Singh)

Kulguru, SKNAU, Jobner

SRI KARAN NARENDRA AGRICULTURE UNIVERSITY, JOBNER-303329 JAIPUR (RAJ.)

Preface

It is with great satisfaction that we present the revised syllabus of the Undergraduate Degree Programme in Agriculture, prepared in line with the recommendations of the VI Deans' Committee Report of the Indian Council of Agricultural Research (ICAR). This curriculum revision is a significant step towards modernizing agricultural education and equipping our students with the knowledge, skills, and outlook required to address the challenges and opportunities in contemporary agriculture.

The Undergraduate programme in Agriculture is the cornerstone of agricultural education and plays a pivotal role in preparing graduates who can serve the farming community, contribute to national development, and pursue higher education and research with confidence. The revised syllabus emphasizes a balanced blend of theoretical learning, practical exposure, and field-based training. Special focus has been given to experiential learning, skill enhancement, and entrepreneurship development, enabling students to become not only job seekers but also job creators.

This curriculum also gives due importance to emerging areas such as climate-smart agriculture, precision farming, protected cultivation, agribusiness management, ICT applications, and sustainable natural resource management. The inclusion of Rural Agricultural Work Experience (RAWE) and Student READY programmes ensures that students gain hands-on experience and direct interaction with farming realities, thereby bridging the gap between classroom learning and field application.

We believe this revised syllabus will contribute significantly to producing competent, innovative, and socially responsible graduates who are capable of contributing to agricultural growth, food security, and rural transformation. The document reflects the collective efforts of faculty members, subject matter experts, and academic committees who have devoted their time and expertise in designing a curriculum that is relevant, comprehensive, and forward-looking.

On behalf of the Faculty of Agriculture, I extend my sincere thanks to all contributors and stakeholders involved in this task.

Jobner, 2025

(M. R. Choudhary)
Dean & faculty chairman

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Courses for B.Sc. (Hons.) Pt-I, Agriculture

As Per VI Deans Report

B.Sc. (Hons.) Agriculture Pt-I, Semester – I

S. No.	Course No.	Course Title	Discipline	Credit Hours
1	ICF 111	Induction cum Foundation Course (Deekshaarambh) 02 weeks	ADSW	2 (0+2) NG
2	SEC 111	Production of Vermi-Compost & Bio-Organics	Soil Science	2 (0+2)
3	SEC 112	Seed Production and Seed Testing	GPB/ Agronomy	2 (0+2)
4	EXT 111	Communication Skills	Agril Ext.	2 (1+1)
5	EXT 112	Rural Sociology and Educational Psychology	Agril Ext.	2 (2+0)
6	AGRON 111	Fundamentals of Agronomy	Agronomy	3 (2+1)
7	AGRON 112	Farming Based Livelihood Systems	Agronomy	3 (2+1)
8	SOIL 111	Fundamentals of Soil Science	Soil Science	3 (2+1)
9	HORT 111	Fundamentals of Horticulture	Horticulture	3 (2+1)
10	NCC 111/ NSS 111	National Cadet Corps (NCC)/ National Service Scheme (NSS) (To be continued)	NCC/NSS	1(0+1)
11	MATH 111/ BIO 111	Introductory Mathematics (For Ag. & Bio.) Introductory Biology (For Maths)	Mathematics/ Ento.	1(1+0) NG
			Total	**21 (11+10)**

ICF 111 Deeksharambh (Induction-cum-Foundation Programme)

0+2 (NG) दीक्षा आरम्भ

A course entitled "Deeksharambh" (0+2, cr. hrs, Non-gradial) has been introduced Sixth Deans' Committee Report of ICAR in the first semester for duration of two weeks to acquaint students to learn from each other's life experiences, traditional values and traditional cultures and values and other activities as mentioned in below in activities. This course is just like orientation of newly admitted students. It is also recommended that a faculty should be assigned as Incharge "Deeksharambh" preferably ADSW.

Objective

1. To give a broad view and application areas of the subject of study
2. Helping students from different backgrounds for cultural Integration
3. Knowing about the operational framework of academic process in university
4. Instilling life and social skills, leadership qualities, team working spirit
5. Developing social awareness, ethics and values, creativity
6. Helping students to identify the traditional values and indigenous cultures along with diverse potentialities both in indigenous and developed scenario.

Activities

- The details of activities/ schedules will be decided by the parent universities. The structure shall include, but not restricted to:
- Discussions on operational framework of academic process in university, as well as interactions with academic and research managers of the University
- Creating awareness on the subject of study, and the traditional values and indigenous cultures along with diverse potentialities both in indigenous and developed scenario
- Interaction with alumni, business leaders, perspective employers, outstanding achievers in related fields, and people with inspiring life experiences
- Group activities to identify the strength and weakness of students (with expert advice for their improvement) as well as to create a platform for students to learn from each other's life experiences
- Field visits to related fields/ establishments
- Sessions on personality development (instilling life and social skills, social awareness, ethics and values, team work, leadership, etc.) and communication skills

SEC-111 Production of Vermi-compost and Bio-organics 2 (0+2)

(Skill Enhancement Course)

Vermicompost: Definition and objectives of vermitechnology. Importance of vermicomposting in utilization of Agriculture waste and organic recycling of nutrients. Classification of earthworms. Method of preparation of vermicompost. Method and doses of vermicompost application for cereals, vegetables, tress and pots. Role of vermicomposting in organic farming and soil fertility. Identification of earthworms.

Preparation of vermicompost, vermin-wash, panchgavya, Jivamrit etc. Separation and procurement of vermiculture and vermicompost. Analysis for quality standards and fractionation of vermicompost-C:N ratio, Moisture, Organic Carbon, Nitrogen, Phosphorus, Potassium and Micronutrient. Drawing of flow-sheet chart and preparation of vermicompost/bio-organics production project. Visit of compost & vermicompost unit to study the various components & their utilization

Lecture Schedule – Practical

S. No.	Topic	Cr. Hrs.
1.	Definition of vermitechnology	1
2.	Importance of vermicompost in utilization of Agriculture waste, and organic recycling of nutrients	1
3.	Classification of earth worms	1
4.	Method of preparation of vermicompost	3
5.	Method and doses of vermicompost application for cereals, pulses, trees, vegetables and pots	2
6.	Role of vermicomposting in organic farming and soil fertility	1
7.	Identification of earthworms	1
8.	Preparation of beds for vermicompost and inoculation of vermiculture	2
9.	Preparation of vermin-wash, panchgavya, Jivamrit etc.	2
10.	Separation and procurement of vermiculture and vermicompost	2
11.	Maintenance of vermiclture	1
12.	Preservation and packing of vermicompost	1
13.	Determination of quality standards of vermicompost (C:N ratio, Moisture, Organic Carbon, Nitrogen, Phosphorus, Potassium and Micronutrient)	08
14.	Fractionation of vermicompost	1

15.	Drawing of flow-chart and prepration of vermicompost	1
16.	Preparation of project for production of vermicompost/bio-organics	1
17.	Visit of compost & vermicompost unit to study the various components & their utilization	1
	Total Credit Hours	**30**

Suggested Readings:

1. Bhatnagar, R.K. and Palta, R.K. (2002). Vermiculture and vermicomposting. Kalyani Publishers, Ludhiana.
2. Clive A. Edwards, Norman Q. Arancon, and Rhonda L. Sherman (2011). Vermiculture Technology: Earthworms, Organic Wastes, and Environmental Management". CRC Press. ISBN: 9781439809877
3. Insam H., Franke-Whittle I., Goberna M (2010). Microbes at Work: From Wastes to Resources, Springer-Verlag.ISBN: 9783642112039
4. Anshu B. Gupta (2018). Vermicompost: Practices in India. Publisher: Astral International, ISBN: 9789386652991
5. Dr. M. Gunasekaran (2021). Vermiculture Biotechnology: An Option for Organic Waste Management Scientific Publishers (India), ISBN: 9788172339281
6. Dr. Arun K. Sharma (2020). Vermicomposting for Sustainable Agriculture, New India Publishing Agency, ISBN: 9789385516812

SEC 112 Seed Production and Seed Testing 2 (0+2)

(Skill Enhancement Course)

Seed, seed morphology and anatomy, different types of seed and its production standards, public and private seed organizations, seed production of different classes of important crops, seed germination and its types, seed testing laboratory, seed marketing and storage, seed quality testing: seed sampling and lot numbers, seed moisture, physical purity, seed germination and viability test, Genetic purity test: Grow out test, NDUS test, VCU and variety identification.

Seed certification: procedure, seed certification standards of different crops, field inspection and preparation of field inspection report, visit to seed production farms, seed processing, visit to seed processing plant, visit to seed testing laboratories, seed markets, model mandies and storage godown.

Lecture Schedule – Practical

S. No.	Topic	Cr. Hrs.
1.	Introduction to Seed, importance of seeds in agriculture	1
2.	Seed Morphology and Anatomy	1
3.	Classification of Seeds	1
4.	Seed production standards	1
5.	Public and Private Seed Organizations and their roles	1
6.	Seed production in cereals crops	1
7.	Crop-specific seed production standards in pulse crops	1
8.	Crop-specific seed production standards in oilseeds crops	1
9.	Crop-specific seed production standards in seed spices	1
10.	Crop-specific seed production standards in vegetable crops	1
11.	Seed germination and its types	1
12.	Introduction to seed testing laboratories, equipment, and procedures	1
13.	Demonstration of seed sampling techniques, including primary and composite sampling; Assigning and managing seed lot numbers based on standards	1
14.	Seed moisture testing	1
15.	Physical purity test and preparing reports	1
16.	Seed germination test	1
17.	Seed viability test	1
18.	Grow out test, NDUS test	1

19.	Introduction to VCU testing and its role in seed certification	1
20.	Seed certification procedure	1
21.	Field inspection and preparation of field inspection report	1
22.	Visit to seed production farms	1
23.	Seed cleaning, drying, and grading techniques	1
24.	Visit to seed processing unit	1
25.	Seed marketing and distribution	1
26.	Seed packaging, labeling, and storage techniques	1
27.	Visit to seed godowns, seed markets and model mandies	2
28.	Visit to seed testing laboratories	2
	Total Credit Hours	**30**

Suggested Readings:

1. Sharma, M. K., Dr. Manohar Ram, Kakaraliya B. L. and Sharma, L.K. (2022). "SEED SCIENCE TREATISE" AGRIBIOS publication, Jodhpur.
2. Agrawal, PK and Dadlani, M.1987.Techniques in Seed Science and Technology, South Asian Publishers, New Delhi.
3. Agrawal, RL. 1997. Seed Technology, Oxford & IBH Publishing.
4. Joshi, AK and Singh, BD.2004. Seed Science and Technology, Kalyani Publishers, NewDelhi.
5. McDonald, MB and Cope land LO. 1997. Seed Science and Technology, Scientific Publisher, Jodhpur.
6. Ramamoorthy K, Sivasubramaniam, K and Kannan, M. 2006. Seed Legislation in India. Agrobios (India), Jodhpur, Rajasthan.
7. Singhal, NC. 2003. Hybrid Seed Production in Field Crops, Kalyani Publications, NewDelhi
8. Tunwar, NS and Singh, SV. 1988. Indian Minimum Seed Certification Standards.
9. Central Seed Certification Board, Ministry of Agriculture, New Delhi.
10. हरवेन्द्र सिंह तौमर 2016 बीज प्रोद्योगिकी, अमन पब्लिशिंग हाउस , मेरठ (उ.प्र.)
11. आर.के. सिंह 2018 बीज प्रोद्योगिकी, कल्याणी प्रकाशन, न्यू दिल्ली
12. फूलचंद गुप्ता और रतन लाल अग्रवाल 2014 बीज कार्यिकी एवम बीज परीक्षण, प्रकाशन निदेशालय, गो. ब. पन्त कृषि एवम प्रोद्योगिकी, उतराखंड

EXT-111 Comunication Skills 2(1+1)

Theory

Communication: Meaning, definition types, elements; Principles, Functions and models of Communication. Communication Process: The magic of effective communication; Building self-esteem and overcoming fears; Concept, nature and significance of communication process; Verbal and non-verbal communication; Barriers in communication, Linguistic and non- linguistic barriers to communication and reasons behind communication gap/ miscommunication.

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

Structural and Functional Grammar: Sentence structure, modifiers, connecting words, verbals and phrases; Developing presentation skills. Public speaking- Meaning, definitions, elements, types, voice modulation. Teaching: Learning process: Meaning & definition of teaching. Steps of teaching and learning, learning experience & learning situation, elements of learning situation & its characteristics, Principles of learning and their implication of teaching.

Practical

Listening and note taking; Writing skills: precis writing, summarizing and abstracting; Reading and comprehension (written and oral) of general and technical articles; Micro-presentations and

Impromptu Presentations: Feedback on presentations; Stage manners: grooming, body language, voice modulation, speed; Group discussions; Public speaking exercises; vocabulary building exercises; Interview Techniques; organization of events.

Lecture Schedule- Theory

S.No.	Topic	Cr. Hrs.
1.	Communication: Meaning, definition types, elements; Principles. Functions and models of Communication.	1
2.	Communication Process: The magic of effective communication; Building self-esteem and overcoming fears; Concept, nature and significance of communication process;	1
3.	Verbal and non-verbal communication; barriers in communication, Linguistic and non- linguistic barriers to communication and reasons behind communication gap/ miscommunication.	2
4.	Basic Communication Skills: Listening, Speaking, Reading and Writing Skills	1

5.	Precis writing/ abstracting/ Summarizing	1
6.	Style of technical communication Curriculum vitae/resume writing; Innovative methods to enhance vocabulary, analogy questions.	2
7.	Structural and Functional Grammar: Sentence structure, modifiers, connecting words, verbal's and phrases.	2
8.	Developing presentation skills. Public speaking- Meaning, definitions, elements, types, voice modulation.	2
9.	Teaching: Learning process: Meaning & definition of teaching. Steps of teaching and learning, learning experience	1
10.	Learning situation, elements of learning situation & its characteristics, Principles of learning and their implication of teaching.	2
	Total Credit Hours	**15**

Lecture Schedule – Practical

S.No.	Topic	Cr. Hrs.
1.	Listening and note taking	2
2.	Writing skills and precis writing	2
3.	Summarizing and abstracting	2
4.	Reading and comprehension (written and oral) of general and technical articles;	2
5.	Micro-presentations	1
6.	Impromptu Presentations: Feedback on presentations; Stage manners: grooming, body language, voice modulation, speed	2
7.	Group discussions	1
8.	Public speaking exercises	1
9.	Vocabulary building exercises	1
10	Interview Techniques; organization of events.	1
	Total Credit Hours	**15**

Suggested Readings:

1. Mondal, Sagar 2018. Communication Skills and Personality Development, Entrepreneurship Development and Business Communication. Kalyani Publishers, New Delhi.
2. Sandhu, A. S. (1999). Textbook on Agricultural Communication; process and methods oxford RIBH Publishing co. Pvt. Ltd. New Delhi.
3. Berlo, David K. (1960). The process of Communication. New Yark, Holt, Rinehart and Winston Inc.
4. Dahama, O. P. and Bhatnagar, O.P., 1998, Education and Communication for Development, Oxford and IBH publishing Co. Pvt. Ltd., New Delhi.

5. Jalihal, K. A. and Veerabhadraiah, V., 2007, Fundamentals of Extension Education and Management in Extension, Concept publishing company, New Delhi.
6. Kumar, S. and Pushpa Lata. 2011. Communication Skills. Oxford University Press.
7. Ray, G. L., 1991 (1st Edition), Extension Communication and Management, Kalyani Publishers, Ludhiana {7th revised edition - 2010}.
8. Supe, S. V., 2013 (2nd Edition), A Text Book of Extension Education, Agrotech Publishing Academy, Udaipur.
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10. Dale. 2012. How to Win Friends and Influence People in the Digital Age. Simon & Schuster.
11. Verma, K.C. 2013. The Art of Communication. Kalpaz.
12. Mohan Krishna and Meera Banerjee. 1990. Developing Communication Skills. Macmillan India Ltd. New Delhi.
13. Adivi Reddy, A., 2001, Extension Education, Sree Lakshmi press, Bapatla.
14. Kumar, S. and Pushpa Lata. 2011. Communication Skills. Oxford University Press.
15. Sagar Mondal and Ray, G. L., Text Book on Rural Development, Entrepreneurship and Communication Skills, Kalyani Publications.
16. R Velusamy Textbook on Rural Sociology and Educational Psychology.

EXT-112 Rural Sociology & Educational Psychology 2 (2+0)

Objective

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

Theory:

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

Social Stratification: Meaning, definition, functions, basis for stratification, forms of social stratification- characteristics and- differences between class and caste system. Cultural concepts: culture, customs, folkways, mores, taboos, rituals. Traditions: Meaning, definition and their role in Agricultural Extension. Social Values and Attitudes: Meaning, definition, types and role of social values and attitudes in agricultural Extension. Social Institutions: Meaning, definition, major institutions in rural society, functions, and their role in agricultural Extension. Social Organizations: Meaning, definition, types of organizations and role of social organizations in agricultural Extension. Social process –Meaning, definition, types and their importance in agricultural extension, Social Control: Meaning, definition, need of social control and means of social control. Social change: Meaning, definition, nature of social change, dimensions of social change and factors of social change. Rural leader and leadership: Meaning, definition, types of leaders in rural context, classification, roles of leader, different methods of identification and selection of professional and lay leaders. Training of Leaders: Meaning, definition, methods of training, Advantages and limitations in use of local leaders in Agricultural Extension, Psychology and educational psychology: Meaning, definition, scope, and importance of educational psychology in Agricultural Extension.

Lecture Schedule- Theory

S. No.	Topic	Cr. Hrs.
1.	Sociology and rural sociology: Meaning, definition, scope, importance of rural sociology in Agricultural Extension, and interrelationship between rural sociology and Agricultural Extension.	2
2.	Indian Rural Society: important characteristics, differences and relationship between rural and urban societies.	2

3.	Social Groups: Meaning, definition, classification, factors considered information and organization of groups, motivation in group formation and role of social groups in Agricultural Extension.	3
4.	Social Stratification: Meaning, definition, functions, basis for stratification, forms of social stratification- characteristics and-differences between class and caste system	2
5.	Cultural concepts: culture, customs, folkways, mores, taboos, rituals. Traditions: Meaning, definition and their role in Agricultural Extension.	2
6.	Social Values and Attitudes: Meaning, definition, types and role of social values and attitudes in agricultural Extension.	2
7.	Social Institutions: Meaning, definition, major institutions in rural society, functions, and their role in agricultural Extension.	2
8.	Social Organizations: Meaning, definition, types of organizations and role of social organizations in agricultural Extension	2
9.	Social process –Meaning, definition, types and their importance in agricultural extension,	2
10.	Social Control: Meaning, definition, need of social control and means of social control.	2
11.	Social change: Meaning, definition, nature of social change, dimensions of social change and factors of social change	2
12.	Rural leader and leadership: Meaning, definition, types of leaders in rural context, classification, roles of leader, different methods of identification and selection of professional and lay leaders.	3
13.	Training of Leaders: Meaning, definition, methods of training, Advantages and limitations in use of local leaders in Agricultural Extension.	2
14.	Psychology and educational psychology: Meaning, definition, scope, and importance of educational psychology in Agricultural Extension.	2
	Total Credit Hours	**30**

Suggested Readings:

1. Chidambaram, J.B. 1973. Introductory rural sociology. New York, John Wilex and Sons.
2. Desai, A.R. 1978. Rural sociology in India. Bombay, Popular Prakashan, 5th Rev. ed.
3. Dahama O. P. and Bhatnagar, O.P. Education and Communication for Development
4. Ray, G. L. -Extension Communication and Management
5. Sandhu A. S. -Textbook on Agricultural Communication
6. Doshi, S.L. 2007. Rural sociology. Rawat Publishers, Delhi.
7. Jayapalan, N. 2002. Rural sociology. Altanic Publishers, New Delhi.

8. Sharma, K.L. 1997. Rural society in India. Rawat Publishers, Delhi.

9. Bhatia, H.R. 1965. A Text Book of Educational Psychology, Asia Publishing House, New Delhi.

10. Pujari, D. 2002. Educational Psychology in Agriculture, Agrotech Publishing Academy, Udaipur

11. Bhushan, V. and Sachdeva, D.R. 2010. An introduction to Sociology, Kitab Mahal, New Delhi.

12. Rao, C.N.S. 2015. Sociology, S. Chand & Company, New Delhi.

13. Maslow, A.H (1970) Motivation and personality. Harper and Row publishers, New York.

14. Sagar Mondal and Ray, G. L., Text Book on Rural Development, Entrepreneurship and Communication Skills, Kalyani Publications.

AGRON 111 Fundamentals of Agronomy 3(2+1)

Objective

To impart the basic and fundamental knowledge of Agronomy

Theory

Agronomy and its scope: Definition, meaning and scope of agronomy; art, science and business of crop production, relation of agronomy with other disciplines of agricultural science, fields crops and classification, importance, ecology and ecosystem. Seeds and sowing: Definitions of crops, variety and seed. Factors affecting crop stands establishment: good quality seed, proper tillage, time of sowing seed rate, depth and method of sowing: broadcasting, drilling, dibbling, transplanting etc. Tillage and tilth: Definition, objectives, types, advantages and disadvantages of tillage including conservation tillage. Crop density and geometry: Plant geometry and planting geometry, its effect on growth and yield.

Crop nutrition: Definition of essential nutrients, criteria of essentiality, functional elements, classification of essential nutrients, role of macro and micro nutrients. Nutrient absorption, active and passive absorption of nutrients, forms of plant nutrients absorbed by plants, Combined /un- combined forms. Manures and fertilizers, nutrient use efficiency: Sources of nutrients: Inorganic (fertilizers), organic (manures) and bio-fertilizers; their classification and characteristics, method of preparation and role of organic manures in crop production. Integrated nutrient management (INM): Meaning, different approaches and advantages of INM. Green manure- role in crop production: Definition, objectives types of green manuring, desirable characteristics, advantages and limitations of green manuring.

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

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

Practical

A visit to Instructional Crop farm and study on field crops, Identification of crops, seeds, fertilizers, pesticides, Crops and cropping systems in different Agro-climatic zones of the state, Study of some preparatory tillage implements, Study of inter tillage implements, Practice of ploughing / puddling, Study and practice of inter cultivation in field crops, Numerical exercises on calculation of seed, plant population and fertilizer requirement,

Study of yield contributing characters and yield estimation of crops, Identification of weeds in different crops, Seed germination and viability test of seed, Practice on time and method of application of manures and fertilizers.

Lecture Schedule- Theory

S. No.	Topic	Cr. Hrs.
1.	Agronomy and its scope: Definition, meaning and scope of agronomy	1
2.	Art, science and business of crop production, relation of agronomy with other disciplines of agricultural science	1
3.	Field crops and classification, importance, ecology and ecosystem	2
4.	Seeds and sowing: Definitions of crops, variety and seed	1
5.	Factors affecting crop stands establishment: good quality seed, proper tillage, time of sowing seed rate, depth and method of sowing: broadcasting, drilling, dibbling, transplanting etc	2
6.	Tillage and tilth: Definition, objectives, types, advantages and disadvantages of tillage including conservation tillage	2
7.	Crop density and geometry: Plant geometry & planting geometry and its effect on growth & yield	1
8.	Crop nutrition: Definition of essential nutrients, criteria of essentiality, functional elements, classification of essential nutrients, role of macro and micro nutrients	2
9.	Nutrient absorption, active and passive absorption of nutrients, forms of plant nutrients absorbed by plants, Combined /un-combined forms	2
10.	Manures and fertilizers, nutrient use efficiency: Sources of nutrients: Inorganic (fertilizers), organic (manures) and bio-fertilizers; their classification and characteristics, method of preparation and role of organic manures in crop production	2
11.	Integrated Nutrient Management (INM): Meaning, different approaches and advantages of INM	1
12.	Green manure- role in crop production: Definition, objectives, types of green manuring, desirable characteristics, advantages and limitations of green manuring	1
13.	Water management: Water resources of the world, India and the state	1
14.	Soil moisture constants, gravitational water, capillary water and hygroscopic water	2
15.	Weeds: Definition, importance and basics of classification of weeds and their control	2
16.	Agro- climatic zones of India and the state	1
17.	Cropping systems: Factors affecting cropping systems, major cropping patterns and systems in the country	2

18.	Sustainable agriculture: Definition, concept importance, practices and their future, natural resources and conservation pollution and pollutants	1
19.	Allelopathy: Meaning and importance in crop production	1
20.	Growth and development of crops: Definition, meaning and factors affecting growth and development	2
	Total Credit Hours	**30**

Lecture Schedule – Practical

S. No.	Topic	Cr. Hrs.
1.	A visit to instructional crop farm and study on field crops	1
2.	Identification of crops, seeds, fertilizers and pesticides	1
3.	Crops and cropping systems in different agro-climatic zones of the state	1
4.	Study of some preparatory tillage implements	1
5.	Study of inter tillage implements	1
6.	Practice of ploughing/puddling	1
7.	Study and practice of inter cultivation in field crops	1
8.	Numerical exercises on calculation of seed rate and plant population	1
9.	Numerical exercises on calculation of fertilizer requirement	1
10.	Study of yield contributing characters and yield estimation of crops	1
11.	Identification of weeds in different crops	1
12.	Seed germination and viability test of seed	2
13.	Practice on time and method of application of manures and fertilizers	2
	Total Credit Hours	**15**

Suggested Readings:

1. Rao, V. S. 1992. Principles of Weed Science. Oxford and IBH Publishing Co. Ltd. New Delhi.
2. Reddy Yellamanda, T. and Shankar Reddy, G. H. 1995. Principles of Agronomy. Kalyani Publishers, Ludhiana.
3. Reddy, S. R. 2008. Principle of Crop Production, Kalyani Publisher, Ludhiana.
4. Yawalkar, K. S. and Agarwal J. P. 1977. Manures and Fertilizers. Agricultural Horticultural Publishing House, Nagpur.
5. Das, T. K. 2013. Weed Science Basics and Applications, Jain Brothers, Delhi
6. Michael, A. M. 1978. Irrigation Theory and Practice, Vikas Publishing House, New Delhi.
7. Singh S., Singh A., Sharma, J. and Checham, S.2024. New Horizon in Climate Smart Agriculture. Vital Biotech Publisher, Kota. 184p.
8. Agronomic Terminology 1987. Indian Society of Agronomy, New Delhi.
9. Meena, B.R. and Yadav, S. 2022. Fundamentals of Agronomy. Agrotech Publishing Academy, Hiran Magri, Udaipur.

AGRON 112 Farming Based Livelihood Systems 3 (2+1)

Objectives

To make the students aware about farming-based livelihood systems in agriculture

To disseminate the knowledge and skill how farming-based systems can be a source of livelihood

Theory

Status of agriculture in India and different states, Income of farmers and rural people in India, Livelihood-Definition, concept and livelihood pattern in urban and rural areas, Different indicators to study livelihood systems. Agricultural livelihood systems (ALS): Meaning, approach, approaches and framework, Definition of farming systems and farming based livelihood systems, Prevalent farming systems in India contributing to livelihood. Types of traditional and modern farming systems. Components of farming system/ farming-based livelihood systems- Crops and cropping systems, Livestock (Dairy, Piggery, Goatry, Poultry, Duckry etc.), Horticultural crops, Agro--forestry systems, Aqua culture Duck/Poultry cum Fish, Dairy cum Fish, Piggery cum Fish etc., small, medium and large enterprises including value chains and secondary enterprises as livelihood components for farmers, Factors affecting integration of various enterprises of farming for livelihood. Feasibility of different farming systems for different agro-climatic zones, Commercial farming-based livelihood models by NABARD, ICAR and other organizations across the country, Case studies on different livelihood enterprises associated with the farming. Risk and success factors in farming-based livelihood systems, Schemes and programs by Central and State Government, Public and Private organizations involved in promotion of farming-based livelihood opportunities. Role of farming-based livelihood enterprises in 21st Century in view of circular economy, green economy, climate change, digitalization and changing life style.

Practical

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

Case study of Start-Ups in agri-sectors. Preparation of cropping scheme and evaluation of farming system by indices.

Lecture Schedule- Theory

S. No.	Topic	Cr. Hrs.
1.	Status of agriculture in India and different states	1
2.	Income of farmers and rural people in India	1
3.	Livelihood-Definition, concept and livelihood pattern in urban & rural areas	2
4.	Different indicators to study livelihood systems	2
5.	Agricultural livelihood systems (ALS): Meaning, approach, approaches and framework	2
6.	Definition of farming systems and farming based livelihood systems	2
7.	Prevalent farming systems in India contributing to livelihood	2
8.	Types of traditional and modern farming systems	2
9.	Components of farming system/ farming based livelihood systems	2
10.	Crops and cropping systems; Livestock, (Dairy, Piggery, Goatry, Poultry, Duckery etc.); Horticultural crops; Agro-forestry systems; Aqua culture Duck/Poultry cum Fish, Dairy cum Fish, Piggery cum Fish etc.	3
11.	Small, medium and large enterprises including value chains and secondary enterprises as livelihood components for farmers	2
12.	Factors affecting integration of various enterprises of farming for livelihood	1
13.	Feasibility of different farming systems for different agro-climatic zones	1
14.	Commercial farming based livelihood models by NABARD, ICAR and other organizations across the country	1
15.	Case studies on different livelihood enterprises associated with the farming	1
16.	Risk & success factors in farming based livelihood systems	1
17.	Schemes & programmes by Central & State Government, Public & Private organizations involved in promotion of farming based livelihood opportunities	2
18.	Role of farming based livelihood enterprises in 21st Century in view of circular economy, green economy, climate change, digitalization & changing life style	2
	Total Credit Hours	**30**

Lecture Schedule – Practical

S.No.	Topic	Cr. Hrs.
1.	Survey of farming systems and agricultural based livelihood enterprises	2
2.	Study of components of important farming-based livelihood models/ systems in different agro-climatic zones	1
3.	Study of production and profitability of crop based, livestock based, processing based and integrated farming-based livelihood models	2
4.	Field visit of innovative farming system models	1
5.	Visit of agribased enterprises and their functional aspects for integration of production, processing & distribution sectors	2
6.	Study of agri-enterprises involved in industry and service sectors (Value chain models)	2
7.	Learning about concept of project formulation on farming-based livelihood systems along with cost & profit analysis	2
8.	Case study of Start-Ups in agri-sectors.	1
9.	Preparation of cropping scheme	1
10.	Evaluation of farming system by indices	1
	Total Credit Hours	**15**

Suggested Readings:

1. Dixon, J. and A. Gulliver with D. Gibbon. 2001. Farming Systems and Poverty: Improving Farmers' Livelihoods in a Changing World. FAO and World Bank, Rome, Italy and Washington, DC, USA
2. Ashley, C.; Carney, D. 1999. Sustainable Livelihoods: Lessons from Early Experience; Department for International Development: London, UK, Volume 7. [Google Scholar]
3. Reddy, S.R. 2016. Farming System and Sustainable Agriculture, Kalyani Publishers, New Delhi.
4. Panwar et al. 2020. Integrated Farming System models for Agricultural Diversification, Enhanced Income and employment, Indian Council of Agricultural Research, New Delhi.
5. Singh, J.P., et al. 2015. Region Specific Integrated Farming System Models, ICAR-Indian Institute of Farming Systems Research, Modipuram.
6. Walia, S. S. and U. S. Walia, 2020. Farming System and Sustainable Agriculture, Scientific Publishers, Jodhpur, Rajasthan.
7. Livelihood Improvement of Under privileged Farming Community: Some Experiences from Vaishali, Samastipur, Darbhanga and Munger Districts of Bihar by B. P. Bhatt, Abhay Kumar, P.K. Thakur, Amitava Dey Ujjwal Kumar, Sanjeev Kumar, B.K Jha, Lokendra Kumar, K. N. Pathak, A. Hassan, S. K. Singh, K. K. Singh and K. M. Singh ICAR Research Complex for Eastern Region ICAR Parisar, P.O. Bihar Veterinary College, Patna 800 014, Bihar.

8. Carloni, A. 2001. Global Farming Systems Study: Challenges and Priorities to 2030 – Regional Analysis: Sub-Saharan Africa, Consultation Document, FAO, Rome, Italy
9. Evenson, R.E. 2000. Agricultural Producitivity and Production in Developing Countries'. In FAO, The State of Food and Agriculture, FAO, Rome, Italy
10. Agarwal, A. and Narain, S. 1989. Towards Green Villages: A strategy for Environmentally, Sound and Participatory Rural Development, Center for Science and Environment, New Delhi, India

SOIL 111 Fundamentals of Soil Science 3 (2+1)

Objective

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

Theory

Soil: Pedological and edaphalogical concepts. Rocks and minerals, weathering, Silicate clays: constitution and properties, sources of charge, ion exchange, cation and anion exchange capacity and base saturation (after buffering capacity), Soil formation, Soil organic matter, Pedogenic processes, Soil colloids: inorganic and organic, Properties of soil colloids and Ion exchange in soils, Soil profile, soil texture, soil structure. Bulk density and particle density, soil consistency, soil temperature, soil air, soil water. Soil reaction and buffering capacity. Soil taxonomy, keys to soil orders. Soils of India.

Practical

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

Lecture Schedule- Theory

S. No.	Topic	Cr. Hrs.
1.	Soil: Pedological and edaphalogical concepts.	1
2.	Rocks and minerals	2
3.	Weathering of rocks - Chemical, Physical and Biological	2
4.	Silicate clays: constitution and properties	2
5.	Sources of charge on soil colloid	1
6.	Ion exchange, cation and anion exchange capacity and base saturation (after buffering capacity)	1
7.	Soil formation	2
8.	Soil organic matter	1
9.	Pedogenic processes	2
10.	Soil colloids: inorganic and organic	1
11.	Properties of soil colloids and Ion exchange in soils	2
12.	Soil profile	1
13.	Soil texture	1

14.	Soil structure	1
15.	Bulk density and particle density	1
16.	Soil consistency	1
17.	Soil temperature	1
18.	Soil air	1
19.	Soil water	2
20.	Soil reaction and buffering capacity	1
21.	Soil taxonomy	1
22.	Keys to soil orders	1
23.	Soils of India	1
	Total Credit Hours	**30**

Lecture Schedule – Practical

S. No.	Topic	Cr. Hrs.
1.	Study of general properties of minerals	1
2.	Study of minerals-silicate and non-silicate minerals	1
3.	Study of rocks-igneous, sedimentary and metamorphic rocks	1
4.	Study of a soil profile	1
5.	Collection and processing of soil for analysis	1
6.	Study of soil texture-feel method, mechanical analysis	1
7.	Determination of bulk density of undisturbed soil by core sampler method	1
8.	Determination of bulk density of disturbed soil by R D bottle methods	1
9.	Determine of particle density of soil by RD bottle and computation of porosity of soil	1
10.	Determination of soil colour by munsell colour chart	1
11.	Study of soil structure and aggregate analysis	1
12.	Determination of soil moisture	1
13.	Determination of soil moisture constants- field capacity; water holding capacity	1
14.	Study of infiltration rate of soil,	1
15.	Determination of pH and Electrical conductivity of soil.	1
	Total Credit Hours	**15**

Suggested Readings:

1. Introductory Soil Science – By Dilip Kumar Das, Kalyani Publishers
2. Soil Fertility and Nutrient Management – By S. S. Singh, Kalyani Publishers
3. Soil Fertility and Fertilizers – By Samual L. Tisdale, Werner L. Nelson and James D. Beaton, Macmillan Publishing Company, New York
4. The Nature and Properties of Soils – By Harry O. Buckman and Nyle C.
5. Fundamentals of Soil Science (2015) - by Indian Society of Soil Science (ISSS), Div. of Soil Science, IARI, New Delhi
6. Textbook of Soil Science (2018) – by Biswas, S.K. Mukherjee, McGraw-Hill Education

HORT 111 Fundamentals of Horticulture 3 (2+1)

Objectives

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

Theory

Horticulture: Its different branches, importance and scope, Horticulture and botanical classification, soil and climate for horticultural crops. Plant propagation: methods and propagation structures, seed dormancy and seed germination, Merits and demerits of sexual and asexual propagation.

Principles of orchard establishment, principles and methods of training and pruning of fruit crops, Juvenility and flower bud differentiation, unfruitfulness in horticultural crops, pollination, pollinizers and pollinators, fertilization and parthenocarpy, importance of bio regulators in horticultural crops, irrigation and its methods, Fertilizer application in horticultural crops. Importance of medicinal and aromatic plants.

Practical

Identification and nomenclature of fruits, Layout of an orchard, pit making and system of planting, Nursery raising techniques of fruit crops, Understanding of plant propagation structures, Propagation through seeds and plant parts, Propagation techniques for horticultural crops, Container, potting mixture, potting and repotting, Training and pruning methods on fruit crops, Preparation of fertilizer mixture and application, Preparation and application of PGRs, Layout of different irrigation systems, Maturity studies, harvesting, grading, packaging and storage.

Lecture Schedule- Theory

S. No.	Topic	Cr. Hrs.
1.	Horticulture: Its different branches, importance and scope.	2
2.	Horticulture and botanical classification.	2
3.	Soil and climate for horticultural crops.	1
4.	Plant propagation: methods.	3
5.	Propagation structures.	1
6.	Seed dormancy and seed germination.	2
7.	Merits and demerits of sexual and asexual propagation.	2

8.	Principles of orchard establishment.	2
9.	Principles and methods of training and pruning of fruit crops.	2
10.	Juvenility and flower bud differentiation, unfruitfulness in horticultural crops.	3
11.	Pollination, pollinizers and pollinators, fertilization and parthenocarpy.	2
12.	Importance of bio regulators in horticultural crops.	2
13.	Irrigation and its methods.	2
14.	Fertilizer application in horticultural crops.	2
15.	Importance of medicinal and aromatic plants.	2
	Total Credit Hours	**30**

Lecture Schedule – Practical

S. No.	Topic	Cr. Hrs.
1.	Identification and nomenclature of fruit.	1
2.	Layout of an orchard, pit making and system of planting.	2
3.	Nursery raising techniques of fruit crops.	1
4.	Understanding of plant propagation structures.	1
5.	Propagation through seeds and plant parts.	1
6.	Propagation techniques for horticultural crops.	2
7.	Container, potting mixture, potting and repotting.	1
8.	Training and pruning methods on fruit crops.	1
9.	Preparation of fertilizer mixture and application.	1
10.	Preparation and application of PGR.	1
11.	Layout of different irrigation systems.	1
12.	Maturity studies.	1
13.	Harvesting, grading, packaging and storage.	1
	Total Credit Hours	**15**

Suggested Readings:

1. Chadha, K. L., Handbook of Horticulture (2002) ICAR, New Delhi
2. D. K. Salunkhe and S. S. Kadam, A Handbook of Fruit Science and Technology (2013) CRC Press
3. Jitendra Singh, Basic Horticulture (2011) Kalyani Publications, New Delhi
4. K. V. Peter, Basics Horticulture (2009) New India Publishing Agency
5. Kausal Kumar Misra and Rajesh Kumar, Fundamentals of Horticulture 2014 Biotech Books

6. Kumar, N., Introduction to Horticulture (1990) Rajyalakshmi publications, Nagarcoil, Tamilnadu
7. Neeraj Pratap Singh, Basic concepts of Fruit Science (2005) IBDC Publishers
8. Prasad and Kumar, Principles of Horticulture 2nd Edn. 2014 Agrobios (India)
9. S. Prasad and U. Kumar, A handbook of Fruit Production (2010) Agrobios (India)
10. Singh Jitender, Precision farming. NIPA
11. Singh, H.P. Advances in Horticulture Biotechnology Vol.-7: Diagnostics for Horticulture crops Westville
12. Singh, H.P., Advances in horticulture Biotechnology, Vol-1: Fruit Crops Westville
13. Kapoor, B., Ethnobotany: A recent approach, Madhu
14. Basra, A.S., Plant Growth Regulators in Agriculture & Horticulture: Their Role and commercial use IBD
15. Swain, S. Precision, Farming in Horticulture: Approaches and Strategies NPH
16. Sharma, N., Biometrical methods in Horticultural Sciences NIPA

MATH 111 Introductory Mathematics 1+0 (NG)

Objective:

It is need based non-gradial paper for B.Sc. (Ag) Hons students coming from non-mathematics background in +2 level. The syllabus is designed to introduce and familiarize the students with simple mathematical terms that may be useful in their further studies.

Theory:

Differential Calculus: Derivative and Differentiation notation. Differentiation formulae for constant, logarithm ($\log x$), exponential (e^x, a^x), power (x^n) and trigonometric functions ($\sin x$, $\cos x$, $\tan x$, $\cot x$, $\sec x$, $\operatorname{cosec} x$). Linearity property of differentiation. Differentiation of sum, difference, product and quotient of any two among these functions.

Integral Calculus: Indefinite Integration notation and formulae obtained as an inverse process of differentiation only. Linearity property of integration.

Matrices: Definition and notations of Matrices, rows and columns of matrix, order of a matrix, rectangular and square matrices, diagonal of a square matrix, null/ zero and unit/identity matrices. Equality of matrices. Addition, Subtraction, Scalar Multiplication of Matrices. Linearity property of Matrices. Matrix Multiplication, Transpose of Matrix.

Determinant: Notation and evaluation of determinant of order 2x2 and 3x3.

Lecture Schedule- Theory

S. No.	Topic	Cr. Hrs.
1.	Derivative and Differentiation notation. Constant, logarithm function. Differentiation formulae for constant, logarithm ($\log x$).	1
2.	Introduction to exponential and trigonometric functions Differentiation formulae for exponential (e^x, a^x) and trigonometric functions ($\sin x$, $\cos x$, $\tan x$, $\cot x$, $\sec x$, $\operatorname{cosec} x$),	1
3.	Differentiation formulae for power (x^n) for different values of n	1
4.	Linearity property of differentiation. Differentiation of sum, difference of any two functions	1
5.	Differentiation of product of any two functions	1
6.	Differentiation of quotient of any two functions	1
7.	Indefinite Integration notation and formulae obtained as an inverse process of differentiation only. Linearity property of integration	2
8.	Definition and notations of Matrices, rows and columns of matrix, order of a matrix, rectangular and square matrices,	1

9.	Diagonal of a square matrix, null/ zero and unit/identity matrices. Equality of matrices.	1
10.	Addition, Subtraction, Scalar Multiplication of Matrices.	1
11.	Linearity property of Matrices, Matrix Multiplication	2
12.	Transpose of Matrix, Determinant: notation and evaluation of determinant of order 2x2. evaluation of determinant of order 3x3	2
	Total Credit Hours	**15**

Suggested Readings:

1. Mathematics Part I Textbook for Class XII (2024), NCERT, New Delhi.
2. Mathematics Part II Textbook for Class XII (2024), NCERT, New Delhi.
3. D.C. Gokhroo and S.L. Bhargava (1986), Elementary Calculus, Jaipur Publishing House, Jaipur.

BIO 111 Introductory Biology 1 (1+0)

Objective

1. To know the introduction to the living world, diversity and characteristics of life
2. To study the binomial nomenclature and classification Cell and cell division
3. To study the morphology of flowing plants. Seed and seed germination

Theory

Introduction to the living world, diversity and characteristics of life, origin of life, Evolution and Eugenics. Binomial nomenclature and classification Cell and cell division. Morphology of flowing plants. Seed and seed germination. Plant systematic- viz; Brassicaceae, Fabaceae and Poaceae. Role of animals in agriculture. Animal Kingdom: Basis of classification, classification of animal kingdom upto phylum, Role of honeybees in agriculture

Lecture Schedule- Theory

S.No.	Topic	Cr. Hrs.
1	Introduction to the living world	1
2	Diversity and characteristics of life, Origin of life,	1
3	Evolution and Eugenics, Binomial nomenclature and classification.	1
4	Introduction, structure and function of cell and cell organelles.	1
5	Structure and functions of tissues.	1
6	Cell division: Mitosis	1
7	Cell division: Meiosis	1
8	Morphology of flowing plants – General morphology, Root with their modifications	1
9	Morphology of flowing plants– Stem and leaf with their modifications	1
10	Morphology of flowing plants– Flower and fruit with their modifications	1
11	Seed and seed germination	1
12	Plant systematic- viz; Brassicaceae, Fabaceae and Poaceae	1
13	Role of animals in agriculture	1
14	Animal Kingdom: Basis of classification, classification of animal kingdom upto phylum	1
15	Role of honeybees in agriculture	1

Suggested Reading:

1. Saxena and Sarabhai. 1989. Text Book of Botany. Rastogi Publication, Meerut
2. Sahu, A.C. A text Book of Practical Botany. Kalyani Publisher, New Delhi
3. Sharma, O.P. Plant Taxonomy. Tata McGraw-Hill Education, New Delhi
4. Kaushik, M.P. 2003. Modern Text Book of Botany. Prakash Publication, Muzaffer Nagar (UP)
5. Pandey, B.P. 2001. Plant Anatomy. S. Chand & Company. Ltd, New Delhi
6. Bendre, A. & Kumar, A. 2012. A Text Book of Practical Botany, Vol I & II. Rastogi Publication, Meerut
7. Rastogi V.B. Organic Evolution. Rastogi Publication.

NCC 111/ NSS 111 1 (0+1)

NCC 111 National Cadet Corps (NCC-I) 1 (0+1)

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

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

NSS 111 National Service Scheme (NSS-I) 1 (0+1)

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

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

The entire four courses should be offered continuously for two years. A student enrolled in NSS course should put in at least 60 hours of social work in different activities in a semester other than five regular one-day camp in a year and one special camp for duration of 7 days at any semester break period in the two years. Different activities will include orientation lectures and practical works. Activities directed by the Central and State Government have to be performed by all the volunteers of NSS as per direction.

Introduction and Basic Components of NSS

Orientation: history, objectives, principles, symbol, badge; regular programs under NSS. Organizational structure of NSS, Code of conduct for NSS volunteers, points to be considered by NSS volunteers' awareness about health.

NSS program activities: Concept of regular activities, special camping, day camps, basis of adoption of village/slums, conducting survey, analyzing guiding financial patterns of scheme, youth program/ schemes of GOI, coordination with different agencies and maintenance of diary. Understanding youth. Definition, profile, categories, issues and challenges of youth; and opportunities for youth who is agent of the social change.

Community mobilization: Mapping of community stakeholders, designing the message as per problems and their culture; identifying methods of mobilization involving youth-adult partnership. Social harmony and national integration.

Indian history and culture, role of youth in nation building, conflict resolution and peace-building. Volunteerism and shramdaan. Indian tradition of volunteerism, its need, importance, motivation, and constraints; shaman as part of volunteerism

Citizenship, constitution, and human rights: Basic features of constitution of India, fundamental rights and duties, human rights, consumer awareness and rights and rights to information. Family and society. Concept of family, community (PRIs and other community- based organizations) and society.

Courses for B.Sc. (Hons.) Pt-I, Agriculture

As Per VI Deans Report

B.Sc. (Hons.) Agriculture Pt-I, Semester – II

S.No.	Course No.	Course Title	Discipline	Credit Hours
1	SEC 121	Mushroom Production Technology	Plant Pathology	2(0+2)
2	SEC 122	Post-harvest Processing Technology	Horticulture	2(0+2)
3	EXT 121	Personality Development	Agril Ext.	2(1+1)
4	AGMET 121	Environmental Studies and Disaster Management	Agril. Meteorology#	3(2+1)
5	SOIL 121	Soil Fertility Management	Soil Science	3(2+1)
6	ENT 121	Fundamentals of Entomology	Entomology	3(2+1)
7	LPM 121	Livestock and Poultry Management	LPM	2(1+1)
8	PPATH 121	Fundamentals of Plant Pathology	Plant Pathology	3(2+1)
9	NCC/ NSS 121	NCC /NSS (To be continued)	NCC/NSS	1(0+1)
			Total	**21 (10+11)**

SEC: Skill Enhancement Course, # sharing may be between Agronomy and Soil Science

SEC 121 Mushroom Production Technology 2 (0+2)

(Skill Enhancement Course)

Introduction to Mushroom (Concept, Types, Nutritional values, uses etc.), Aquaintance with basic lab equipments & Principle of sterilization, Preparation of media for raising of Pure culture, Spawn and its Production, Climate conditions, material requirements for mushroom cultivation, Preparation of Straw, Seeding and Packing of Straw, Cultivation procedure of common edible mushrooms, Preparation of different mushroom products (Value addition products-Pickle, Sweets, Snacks, etc.). Diseases and mould problems in mushroom cultivation, Economics of Mushroom.

Lecture Schedule – Practical

S.No.	Topic	Cr. Hrs.
1	Introduction to Mushroom (Concept, Types, Nutritional values, uses etc.)	4
2	Aquaintance with basic lab equipments & principle of sterilization,	2
3	Preparation of media for raising of Pure culture, Spawn and its Production,	4
4	Climate conditions, material requirements for mushroom cultivation	2
5	Preparation of Straw, Seeding and Packing of Straw	4
6	Cultivation procedure of common edible mushrooms	4
7	Preparation of different mushroom products (Value addition products-Pickle, Sweets, Snacks, etc.).	4
8	Diseases and mould problems in mushroom cultivation	3
9	Economics of Mushroom.	3
	Total Credit Hours	**30**

Suggested Readings:

1. Biswas, S., Datta, M., Ngachan, S. V. 2012. Mushrooms: A Manual for Cultivation. PHI learning private limited, New Delhi.
2. Dhingra, O.D. and Sinclair, J.B.1986. Basic PlantPathology Methods. CRCPress, London,Tokyo.
3. Kratika Sharma.2015. Mushroom: Cultivation and Processing.ICAR- Central Arid Zone Research Institute (CAZRI), Jodhpur, Rajasthan, India International Journal of Food Processing Technology. 5, 9-12.
4. Manjit Singh, Bhuvnesh Vijay, Shwet Kamal and G.C. Wakchaure. 2011. Mushrooms Cultivation, Marketing and Consumption. Directorate of Mushroom Research (ICAR) Chambaghat, Solan –173213 (HP). YugantarPrakashan Pvt. Ltd, WH-23, Mayapuri Industrial Area, Phase-I, New Delhi.
5. Philip G. Mile and Shu-Ting Chang.1997. Mushroom Biology Concise Basics and Current Developments. World Scientific Publishing Co. Pte. Ltd., Singapore.
6. S.R. Chang and W. A. Hayes.1978. The Biology and Cultivation of Edible Mushrooms. Academic Press New York San Francisco London.
7. Shu-Ting Chang and Philip G. Miles. 2004. Mushrooms Cultivation, Nutritional Value, Medicinal Effect, and Environmental Impact. CRC Press LLC.

SEC 122 Post Harvest Processing Technology 2 (0+2)

Identification and applications of different types of packaging and containers for shelf life extension. Identification of important tools/ equipments/ machines and chemicals required for PHT laboratory. Extraction and preservation of pulps and juices. Preparation of Jam, Jelly and Marmalade and Pickles. Different beverages like RTS, nectar, cordial, barley water and squash. Osmotically dried products, fruit bars, preserve and candy. Tomato products like sauce, ketchup, chutney, soup, puree, paste, etc. Canned products. Quality evaluation of products- Physico-chemical (Moisture, TSS, acidity, and ascorbic acid etc.) and sensory. Visit to processing/ industry. Effect of temperature on shelf life and quality of produce (drying and dehydration).

Lecture Schedule – Practical

S. No.	Topic	Cr. Hrs.
1.	Identification and applications of different types of packaging and containers for shelf life extension.	1
2.	Identification of important tools/ equipment's/ machines and chemicals required for PHT laboratory.	1
3.	Extraction and preservation of pulps and juices.	2
4.	Preparation of Jam.	2
5.	Preparation of Jelly.	2
6.	Preparation of Marmalade and Pickles.	2
7.	Different beverages like RTS, nectar, and cordial.	2
8.	Different beverages like barley water and squash.	2
9.	Osmotically dried products, fruit bars, preserve and candy.	3
10.	Tomato products like sauce and ketchup.	2
11.	Tomato products like chutney, soup, puree, paste, etc.	2
12.	Canned products.	2
13.	Quality evaluation of products- Physico-chemical (Moisture, TSS, acidity, and ascorbic acid etc.) and sensory.	3
14.	Visit to processing/ industry.	2
15.	Effect of temperature on shelf life and quality of produce (drying and dehydration).	2
	Total Credit Hours	**30**

Suggested Readings:

1. Lal, G. Siddappa G.S. and Tandon, G.L. 1967. Fruit and Vegetable Preservation. ICAR Publication.
2. Srivastava, R.P. and Kumar, Sanjeev. 2002. Fruit and Vegetable preservation. Principles and Practices. International Book Distributing Company, Lucknow, UP.
3. नायर, एस. सदाशिवन एवं शर्मा, एच.सी. 1995. फल एवं तरकारी परिरक्षण प्रोद्यागिकी, राजस्थान ग्रन्थ अकादमी, जयपुर।
4. Mitra, S. K. Post Harvest Physiology and Storage of Tropical and Sub-tropical Fruits (1997) CAB International
5. Morris, T. N. Principles of Fruit Preservation (2006) Biotech Books, Delhi
6. Saraswathy, S. et. al. Post harvest Management of Horticultural Crops (2008) Agribios
7. Srivastava, R. P. & Sanjeev Kumar Fruits and vegetable Preservation – Principles and Practice (2002) International Book Distributing Co., Lucknow140
8. Verma, L. R. and Joshi, V. K. Post Harvest Technology of Fruits and Vegetables Vol. I & II. (2000) Indus Publishing Co., New Delhi
9. Vijay, K. Text Book of Food Sciences and Technology (2001) ICAR
10. Mayani, Desai, Vagadia Post Harvest management of Horticultural crops Jaya Publishing House Ed. M.K. Jatav, et al. Good management Practices for Horticultural Crops NIPA
11. Sharma, Satish Post Harvest of Horticultural Crops- Practical manual Series Vol.2 NIPA
12. Rosa L.A. Fruit and Vegetable Phytochemicals: Chemistry, Nutritional Value and Stability BioGreen
13. Ryall, A. Handling, transportation and Storage of Fruits & Vegetables Vol.1 2nd Ed 20. (Vegetables & Melons) Sci Int

EXT-121 Personality Development 2 (1+1)

Objective

To make students realize their potential strengths, cultivate their inter-personal skills and improve employability.

Theory:

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

Foundations of individual behavior and factors influencing individual behavior, Models of individual behavior, Perception and attributes and factors affecting perception, Attribution theory and case studies on Perception and Attribution. Learning: Meaning and definition, theories and principles of learning , Learning and organizational behavior, Learning and training, learning feedback. Attitude and values, Intelligence- Meaning, definition, types of Intelligence, theories of intelligence, measurements of intelligence, factors influencing intelligence, importance of intelligence in Agricultural Extension. intelligence and Organizational behavior, emotional intelligence. Motivation- theories and principles, Teamwork and group dynamics.

Practical:

MBTI personality analysis, Learning Styles and Strategies, Motivational needs, Firo-B, Interpersonal Communication, Teamwork and team building, Group Dynamics, Win-win game, Conflict Management, Leadership styles, Case studies on Personality and Organizational Behavior.

Lecture Schedule- Theory

S.No.	Topic	Cr. Hrs.
1.	Personality Definition, Nature of personality, theories of personality and its types.	2
2.	The humanistic approach - Maslow's self-actualization theory, shaping of personality, determinants of personality, Myers-Briggs Typology Indicator, Locus of control and performance, Type A and Type B Behaviours, personality and Organizational Behaviour.	3
3.	Foundations of individual behavior and factors influencing individual behavior, Models of individual behavior.	2
4.	Perception and attributes and factors affecting perception, Attribution theory and case studies on Perception and Attribution.	1
5.	Learning: Meaning and definition, theories and principles of learning, Learning and organizational behavior, Learning and training, learning	1

	feedback.	
6.	Attitude and values, Intelligence- Meaning, definition, types of Intelligence.	1
7.	Theories of intelligence, measurements of intelligence, factors influencing intelligence, importance of intelligence in Agricultural Extension.	2
8.	Intelligence and Organizational behavior, emotional intelligence.	1
9.	Motivation- theories and principles, Teamwork and group dynamics.	2
	Total Credit Hours	**15**

Lecture Schedule – Practical

S.No.	Topic	Cr. Hrs.
1	MBTI personality analysis,	2
2	Learning Styles and Strategies	2
3	Motivational needs and Firo-B	2
4	Interpersonal Communication, Teamwork and team building	2
5	Group Dynamics	2
6	Win-win game and conflict Management	2
7	Leadership styles	1
8	Case studies on Personality and Organizational Behavior.	2
	Total Credit Hours	**15**

Suggested Readings:

1. Mondal, Sagar 2018. Communication Skills and Personality Development, Entrepreneurship Development and Business Communication. Kalyani Publishers, New Delhi
2. Andrews, Sudhir. 1988. How to Succeed at Interviews. 21st (rep.) New Delhi.Tata McGraw- Hill.
3. Heller, Robert. 2002. Effective Leadership. Essential Manager series. Dk Publishing.
4. Hindle, Tim. 2003. Reducing Stress. Essential Manager series. Dk Publishing.
5. Kumar, Pravesh. 2005. All about Self- Motivation. New Delhi. Goodwill Publishing House Lucas, Stephen. 2001. Art of Public Speaking. New Delhi. Tata - Mc-Graw Hill.
6. Mile, D.J. 2004. Power of Positive Thinking. Delhi. Rohan Book Company.
7. Smith, B. 2004. Body Language. Delhi: Rohan Book Company.
8. Shaffer, D. R. 2009. Social and Personality Development (6th Edition). Belmont, CA: Wadswor

AGMET 121 Environmental Studies and Disaster Management 3 (2+1)

Objective

To expose and acquire knowledge on the environment and to gain the state-of-the-art - skill and expertise on management of disasters

Theory

Introduction to Environment - Environmental studies: Definition, scope and importance Multidisciplinary nature of environmental studies - Segments of Environment - Spheres of earth Lithosphere - Hydrosphere - Atmosphere - Different layers of atmosphere.

Natural Resources: Classification - Forest resources, Water resources, Mineral resources, Food resources, Energy resources, Land resources and Soil resources. Ecosystems: Concept of an ecosystem - Structure and function of an ecosystem - Energy flow in the ecosystem. Types of ecosystem. Biodiversity and its conservation: Introduction, definition, types. Biogeographical classification of India. Importance and value of biodiversity. Biodiversity hot spots. Threats and conservation of biodiversity.

Environmental Pollution: Definition, cause, effects and control measures of: a. Air pollution. b. Water pollution. c. Soil pollution. d. Marine pollution. e. Noise pollution. f. Thermal pollution h. Light pollution.

Solid waste management: Classification of solid wastes and management methods, Composting, Incineration, Pyrolysis, Biogas production, Causes, effects and control measures of urban and industrial wastes.

Social Issues and the Environment: Urban problems related to energy. Water conservation, rain water harvesting, watershed management.

Environmental ethics: Issues and possible solutions, climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Environment protection act. Air (Prevention and control of pollution) Act. Water (Prevention and control of Pollution) Act. Wildlife Protection Act. Forest Conservation Act. Human Population and the Environment:

Environment and human health: Human Rights, Value Education. Women and Child Welfare. Role of Information Technology in Environment and human health.

Disaster management: Disaster definition - Types - Natural Disasters - Floods, drought, cyclone, earthquakes, landslides, avalanches, volcanic eruptions, Heat and cold waves.

Man Made Disasters: Nuclear disasters, chemical disasters, biological disasters, building fire, coal fire, forest fire, oil fire, road accidents, rail accidents, air accidents, sea accidents. International and National strategy for disaster reduction. Concept of disaster management, national disaster management framework; financial arrangements; role of NGOs,

community-based organizations and media in disaster management. Central, state, district and local administration in disaster control; Armed forces in disaster response; Police and other organizations in disaster management.

Practical

Visit to a local area to document environmental assets river/forest/grassland/hill/mountain. Energy: Biogas production from organic wastes. Visit to wind mill / hydro power / solar power generation units. Biodiversity assessment in farming system. Floral and faunal diversity assessment in polluted and un polluted system. Visit to local polluted site - Urban/Rural/Industrial/Agricultural to study of common plants, insects and birds. Environmental sampling and preservation. Water quality analysis: pH, EC and TDS. Estimation of Acidity, Alkalinity. Estimation of water hardness. Estimation of DO and BOD in water samples. Estimation of COD in water samples. Enumeration of E. coli in water sample. Assessment of Suspended Particulate Matter (SPM). Study of simple ecosystem – Visit to pond/river/hills. Visit to areas affected by natural disaster.

Lecture Schedule- Theory

S.No.	Topic	Cr. Hrs.
1	Introduction to environment - Environmental studies: Definition, scope and importance; Multidisciplinary nature of environmental studies; Segments of environment	01
2	Spheres of earth- Lithosphere, hydrosphere and atmosphere; Different layers of atmosphere	01
3	Natural resources: classification - Forest resources, water resources, mineral resources, food resources, energy resources, land resources and soil resources	02
4	Ecosystems: Concept, types, structure and function of an ecosystem	01
5	Energy flow in the ecosystem	01
6	Biodiversity and its conservation: Introduction, definition and types; Biogeographical classification of India; Importance and value of biodiversity; Biodiversity hot spots; Threats and conservation of biodiversity	02
7	Environmental pollution: Definition, cause, effects and control measures of: a. Air pollution. b. Water pollution. c. Soil pollution. d. Marine pollution. e. Noise pollution. f. Thermal pollution h. Light pollution	03
8	Solid waste management: Classification of solid wastes and management methods	01
9	Composting, incineration, pyrolysis and biogas production	01
10	Causes, effects and control measures of urban and industrial wastes	01
11	Social issues and the environment: Urban problems related to energy	01

12	Environmental ethics: Issues and possible solutions- climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust	02
13	Water conservation, rain water harvesting and watershed management	01
14	Environment protection act; Air (Prevention and control of pollution) act; Water (Prevention and control of pollution) act; Wildlife protection act; Forest conservation act	02
15	Human population and the environment, environment and human health, human rights Value education; Women and child welfare	02
16	Role of information technology in environment and human health	01
17	Disaster management: Disaster definition and types; Natural disasters - Floods, drought, cyclone, earthquakes, landslides, avalanches, volcanic eruptions, heat and cold waves	02
18	Manmade disasters: Nuclear disasters, chemical disasters, biological disasters, building fire, coal fire, forest fire, oil fire, road accidents, rail accidents, air accidents and sea accidents	02
19	International and national strategy for disaster reduction; Concept of disaster management; National disaster management framework; Financial arrangements	01
20	Role of NGOs, community-based organizations and media in disaster management	01
21	Central, state, district and local administration in disaster control; Armed forces in disaster response; Police and other organizations in disaster management	01
	Total Credit Hours	**30**

Lecture Schedule – Practical

S.No.	Topic	Cr. Hrs.
1	Visit to a local area to document environmental assets river/forest/ grassland/hill/mountain	1
2	Energy: Biogas production from organic wastes	1
3	Visit to wind mill / hydro power / solar power generation units	1
4	Biodiversity assessment in farming system	1
5	Floral and faunal diversity assessment in polluted and un polluted system	1
6	Visit to local polluted site - Urban/rural/industrial/agricultural to study of common plants, insects and birds	1
7	Environmental sampling and preservation	1
8	Water quality analysis: pH, EC and TD	1
9	Estimation of acidity and alkalinity	1

10	Estimation of water hardness	1
11	Estimation of DO, BOD and COD in water samples	1
12	Enumeration of E. coli in water sample	1
13	Assessment of suspended particulate matter (SPM).	1
14	Study of simple ecosystem – Visit to pond/river/hills	1
15	Visit to areas affected by natural disaster	1
	Total Credit Hours	**15**

Suggested Readings:

1. De, A.K. 2010. Environmental chemistry. Published by New Age International Publishers, New Delhi. ISBN:13–978 81 224 2617 5. 384 pp
2. Dhar Chakrabarti, P.G. 2011. Disaster management - India's risk management policy frameworks and key challenges. Published by Centre for Social Markets (India), Bangalore. 36 pp.
3. Erach Bharucha, Text book for Environmental studies. University Grants Commission, New Delhi
4. Parthiban, K.T. Vennila, Prasanthrajan, S., Umesh, M. and Kanna, S. 2023. Forest, Environment, Biodiversity and Sustainable development. Narendra Publishing House, New Delhi, India. (In Press).
5. Prasanthrajan M. and Mahendran, P.P. 2008. A text book on Ecology and Environmental Science. ISBN 81-8321-104-6. Agrotech Publishing Academy, Udaipur - 313 002. First Edition: 2008
6. Prasanthrajan M. 2018. Objective environmental studies and disaster management. ISBN 9789387893825. Scientific publishers, Jodhpur, India. Pp. 146.
7. Sharma, P.D. 2009. Ecology and Environment, Rastogi Publications, Meerut, India
8. Tyler Miller and Scot Spoolman. 2009. Living in the Environment (Concepts, Connections, and Solutions). Brooks/cole, Cengage learning publication, Belmont, USA

SOIL 121 Soil Fertility Management 3 (2+1)

Objective

To provide a comprehensive knowledge of soil fertility, plant nutrition, fertilizers, and nutrient management

Theory

History of soil fertility and plant nutrition. Criteria of essentiality & Forms of nutrients in soil, Role, deficiency and toxicity symptoms of essential plant nutrients, Mechanisms of nutrient transport to plants, Factors affecting nutrient availability to plants. Chemistry of ammonium sulphate, urea, SSP & rock phosphate in soil, Soil fertility evaluation & Soil testing. Critical levels of different nutrients in soil & Indicator plants. Soil health indicators, Introduction and importance of manures and fertilizers. Fertilizer recommendation approaches. Chemical fertilizers: classification, composition,properties of major fertilizers, properties of secondary fertilizers, properties micronutrient fertilizers, properties of Complex fertilizers, properties of customized fertilizers, properties of water soluble fertilizers, properties of nano fertilizers, Soil amendments, Slow release nitrogenous fertilizers, Fertilizer Control Order, Time and methods of fertilizer recommendations to crops, Factor influencing nutrient use efficiency (NUE), Methods of fertilizer application under rainfed and irrigated conditions, STCR/RTNM/ IPNS/INM, Soil organic carbon, Carbon sequestration and Carbon trading, Preparation and properties of major manures (FYM, Compost, Vermicompost, Green manuring, Oilcakes).

Practical

Introduction of analytical instruments and their principles and calibration; Rapid plant tissue tests, Estimation of organic carbon in soils, Estimation of available N in soils, Estimation of soil extractable P in soils; Estimation of exchangeable K in soils; Estimation of exchangeable 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.

Lecture Schedule- Theory

S. No.	Topic	Cr. Hrs.
1.	History of soil fertility and plant nutrition.	1
2.	Criteria of essentiality & Forms of nutrients in soil	1
3.	Role, deficiency and toxicity symptoms of essential plant nutrients,	2
4.	Mechanisms of nutrient transport to plants,	1
5.	Factors affecting nutrient availability to plants.	1

6.	Chemistry of ammonium sulphate, urea, SSP & rock phosphate in soil	2
7.	Soil fertility evaluation & Soil testing.	1
8.	Critical levels of different nutrients in soil & Indicator plants.	1
9.	Soil health indicators	1
10.	Introduction and importance of manures and fertilizers.	1
11.	Fertilizer recommendation approaches.	1
12.	Chemical fertilizers: classification	1
13.	Chemical fertilizers: composition	1
14.	Properties of major fertilizers	1
15.	Properties of secondary fertilizers	1
16.	Pproperties micronutrient fertilizers	1
17.	Properties of Complex fertilizers	1
18.	Properties of customized fertilizers	1
19.	Properties of water-soluble fertilizers and nano fertilizers	1
20.	Soil amendments	1
21.	Slow release nitrogenous fertilizers	1
22.	Fertilizer Control Order	1
23.	Time and methods of fertilizer recommendations to crops	1
24.	Factor influencing nutrient use efficiency (NUE),	1
25.	Methods of fertilizer application under rainfed and irrigated conditions.	1
26.	STCR/RTNM/ IPNS/INM	1
27.	Soil organic carbon, Carbon sequestration and Carbon trading	1
28.	Preparation and properties of major manures (FYM, Compost, Vermicompost, Green manuring, Oilcakes).	1
	Total Credit Hours	**30**

Lecture Schedule – Practical

S. No.	Topic	Cr. Hrs.
1.	Introduction of analytical instruments and their principles & calibration	1
2.	Rapid plant tissue tests	1
3.	Estimation of organic carbon in soils	1
4.	Estimation of available N in soils	1
5.	Estimation of soil extractable P in soils	1
6.	Estimation of exchangeable K in soils	1

7.	Estimation of exchangeable Ca and Mg in soils	1
8.	Estimation of soil extractable S in soils	1
9.	Estimation of DTPA extractable Zn in soils	1
10.	Estimation of N in plants	2
11.	Estimation of P in plants	2
12.	Estimation of K in plants	1
13.	Estimation of S in plants	1
	Total Credit Hours	**15**

Suggested Readings:

1. Introductory Soil Science, by Dilip Kumar Das, Kalyani Publishers
2. Soil Fertility and Nutrient Management, by S. S. Singh, Kalyani Publishers
3. Soil Fertility and Fertilizers, by Samual L. Tisdale, Werner L. Nelson and James D. Beaton, Macmillan Publishing Company, New York
4. The Nature and Properties of Soils, by Harry O. Buckman and Nyle C.

ENT 121 Fundamentals of Entomology 3 (2+1)

Objective

1. To know the history of entomology, classification of insects and their relationship with other arthropods
2. To study the various morphological characters of class insect and their importance for classification of insects
3. To get an idea about the different physiological systems of insects and their roles in growth and development and communications of insects
4. To study the characteristics of commonly observed insect orders and their economically important families

Theory

History of Entomology in India. Major points related to dominance of Insects in Animal kingdom. Classification of phylum Arthropoda up to classes. Relationship of class Insecta with other classes of Arthropoda. Morphology: Structure and functions of insect cuticle and moulting. Body segmentation. Structure of head, thorax and abdomen. Structure and modifications of insect antennae, mouth parts, legs, Wing venation, modifications and wing coupling apparatus. Metamorphosis and diapause in insects. Types of larvae and pupae. Structure and functions of digestive, circulatory, excretory, respiratory, nervous, secretary (Endocrine) and reproductive system, in insects. Types of reproduction in insects. Major sensory organs. Insect Ecology: Introduction, Environment and its components. Effect of abiotic factors and biotic factors. Categories of pests. Systematics: Taxonomy – importance, history and development and binomial nomenclature. Definitions of Biotype, Sub-species, Species, Genus, Family and Order. Classification of class Insecta up to Orders, basic groups of present day insects with special emphasis to orders and families of Agricultural importance like Orthoptera: Acrididae, Tettigoniidae, Gryllidae, Gryllotalpidae; Dictyoptera: Mantidae, Blattidae; Odonata; Isoptera: Termitidae; Thysanoptera: Thripidae; Hemiptera: Pentatomidae, Coreidae, Cimicidae, Pyrrhocoridae, Lygaeidae, Cicadellidae, Delphacidae, Aphididae, Coccidae, Lophophidae, Aleurodidae, Pseudococcidae; Neuroptera: Chrysopidae; Lepidoptera: Pieridae, Papiloinidae, Noctuidae, Sphingidae, Pyralidae, Gelechiidae, Arctiidae, Saturnidae, Bombycidae; Coleoptera: Coccinellidae, Chrysomelidae, Cerambycidae, Curculionidae, Bruchidae, Scarabaeidae; Hymenoptera: Tenthridinidae, Apidae. Trichogrammatidae, lchneumonidae, Braconidae, Chalcididae; Diptera: Cecidomyiidae, Tachinidae, Agromyziidae, Culicidae, Muscidae, Tephritidae.

Practical

Methods of collection and preservation of insects including immature stages; External features of Grasshopper/cockroach; 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); 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.

Lecture Schedule- Theory

S.No.	Topic	Cr. Hrs.
1	History of Entomology in India.	1
2	Major points related to dominance of Insects in Animal kingdom.	1
3	Classification of phylum Arthropoda upto classes. Relationship of class Insecta with other classes of Arthropoda.	1
4	Morphology: Structure and functions of insect cuticle and moulting.	1
5	Body segmentation- structure of head, thorax and abdomen.	1
6	Structure and modifications of insect antennae.	1
7	Structure and modifications of insect mouth parts.	2
8	Structure and modifications of insect leg.	1
9	Wing venation, modifications and wing coupling apparatus.	1
10	Metamorphosis and diapause in insects, types of larvae and pupae.	1
11	Structure and functions of digestive system.	1
12	Structure and functions of circulatory and excretory system.	2
13	Structure and functions of respiratory system.	1
14	Structure and functions of nervous system.	1
15	Structure and functions of secretory (endocrine) system	1
16	Structure and functions of reproductive system and types of reproduction in insects.	1
17	Structure of major sensory organs.	1
18	Insect Ecology: Introduction, Environment and its components. Effect of abiotic factors and biotic factors. Categories of pests.	2
19	Systematics: Taxonomy- importance, history and development and binomial nomenclature. Definitions of Biotype, Sub-species, Species, Genus, Family and Order.	1
20	Classification of class Insecta up to Orders, basic groups of present-day insects with special emphasis to orders and families of	1

	Agricultural importance:	
21	Orthoptera: Acrididae, Tettigoniidae, Gryllidae, Gryllotalpidae; Dictyoptera: Mantidae, Blattidae; Odonata; Isoptera: Termitidae. Thysanoptera: Thripidae.	2
22	Hemiptera: Pentatomidae, Coreidae, Cimicidae, Pyrrhocoridae, Lygaeidae, Cicadellidae, Delphacidae, Aphididae, Coccidae, Lophophidae, Aleurodidae, Pseudococcidae. Neuroptera: Chrysopidae	1
23	Lepidoptera: Pieridae, Papiloinidae, Noctuidae, Sphingidae, Pyralidae, Gelechiidae, Arctiidae, Saturnidae, Bombycidae.	1
24	Coleoptera: Coccinellidae, Chrysomelidae, Cerambycidae, Curculionidae, Bruchidae, Scarabaeidae;	1
25	Hymenoptera: Tenthridinidae, Apidae, Trichogrammatidae, lchneumonidae, Braconidae, Chalcididae.	1
26	Diptera: Cecidomyiidae, Tachinidae, Agromyziidae, Culicidae, Muscidae, Tephritidae;	1
	Total Credit Hours	**30**

Lecture Schedule – Practical

S.No.	Topic	Cr. Hrs.
1	Methods of collection and preservation of insects including immature stages.	1
2	External features of Grasshopper/Cockroach.	1
3	Types of insect antennae, mouthparts and legs.	2
4	Wing venation, types of wings and wing coupling apparatus.	1
5	Types of insect larvae and pupae	1
6	Dissection of digestive system in insects (Grasshopper/ Cockroach)	1
7	Study of characters of orders Orthoptera, Dictyoptera with their families of agricultural importance.	1
8	Study of characters of orders Odonata, Isoptera, Thysanoptera with their families of agricultural importance.	1
9	Study of characters of order Hemiptera and diptera with its families of agricultural importance.	1
10	Study of characters of order Lepidoptera with its families of agricultural importance.	1
11	Study of characters of order Coleoptera with its families of agricultural importance.	1
12	Study of characters of orders Hymenoptera and Neuroptera with their families of agricultural importance.	1
13	Pesticide appliances and their maintenance.	1
14	Sampling techniques for estimation of insect population and	1

	damage.	
	Total Credit Hours	**15**

Suggested Reading:

1. Fundamentals of Ecology - Eugene. P. Odum and Gray W. Barrett
2. Imm's General Text book of Entomology Vol. I & II. — O.W. Rechards and R.G. Davies
3. Introduction to the study of Insects –D. J. Borror and DeLong's
4. Principles of Insect Morphology – R.E. Snodgrass
5. Insect Structure and Function – R.F. Chapman
6. A Text Book of Entomology – Mathur and Upadhyay
7. General and Applied Entomology – B.V. David and T.N. Ananthakrishnan.

LPM 121 Livestock and Poultry Management 2 (1+1)

Theory

Role of livestock in the national economy. Reproduction in farm animals and poultry. Housing principles, space requirements for different species of livestock and poultry. Management of calves, growing heifers and milch animals. Management of sheep and goat. Incubation, hatching and brooding in poultry. Management of growers and layers. Important Indian and exotic breeds of cattle, buffalo, sheep, goat and poultry. Conservation of indigenous breeds and breeding policy for livestock in Rajasthan. Classification of feedstuffs. Feeding of livestock and poultry. Introduction of livestock and poultry diseases. Prevention (including vaccination schedule) and control of important diseases of livestock and poultry.

Practical

External body parts of cattle, buffalo, sheep, 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, sheep, goat 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.

Lecture Schedule- Theory

S.No.	Topic	Cr. Hrs.
1	Role of livestock in the national economy.	1
2	Reproduction in farm animals and poultry.	1
3	Housing principles, space requirements for different species of livestock and poultry.	2
4	Management of calves, growing heifers and milch animals.	1
5	Management of sheep and goat.	1
6	Incubation, hatching and brooding in poultry.	1
7	Management of growers and layers in poultry.	1
8	Important Indian and exotic breeds of cattle and buffalo.	1
9	Important Indian and exotic breeds of sheep and goat.	1
10	Important Indian and exotic breeds of poultry.	1
11	Conservation of indigenous breeds and breeding policy for	1

	livestock in Rajasthan.	
12	Classification of feedstuffs. Feeding of livestock and poultry.	1
13	Introduction of livestock and poultry diseases.	1
14	Prevention (including vaccination schedule) and control of important diseases of livestock and poultry.	1
	Total Credit Hours	**15**

Lecture Schedule – Practical

S. No.	Topic	Cr. Hrs.
1	External body parts of cattle and buffalo.	1
2	External body parts of sheep, goat and poultry.	1
3	Handling and restraining of livestock.	1
4	Identification methods of farm animals and poultry.	1
5	Visit to IDF and IPF to study breeds of livestock and poultry.	1
6	Daily routine farm operations and farm records.	1
7	Judging of cattle, buffalo, sheep, goat and poultry.	1
8	Culling of livestock and poultry.	1
9	Planning and layout of housing for different types of livestock.	1
10	Computation of rations for livestock.	1
11	Formulation of concentrate mixtures.	1
12	Clean milk production, milking methods.	1
13	Hatchery operations, incubation and hatching equipments.	1
14	Management of chicks, growers and layers. Debeaking, dusting and vaccination.	1
15	Economics of cattle, buffalo, sheep, goat, swine and poultry production.	1
	Total Credit Hours	**15**

Suggested Readings:

1. Banerjee, G.C. 2013. A Text Book of Animal Husbandry. 8th Ed.ICAR.
2. Choudhary J.L. and Gupta Lokesh. 2016. A Text Book of Animal Husbandry.Somani Publication
3. Devendra C and Mecleroy GB 1982. Goat and Sheep Production in Tropics.
4. Sastry NSR and Thomas, Ck 2006. Livestock Production and Management. Kalyani
5. Singh, RA. 1996. Poultry Production. 3rd Ed Kalyani.
6. Thomas CK and Sastry, NSR. 1991. Dairy Bovine Production. Kalyani.
7. जगदीश प्रसाद, 2018. पशुधन और कुकुट प्रबधन, कल्याणी.

PPATH 121 Fundamentals of Plant Pathology 3 (2+1)

Objectives

- To get acquainted with the role of different microorganisms in the development of plant disease
- To get general concepts and classification of plant diseases
- To get knowledge of general characteristics of fungi, bacteria, virus, and other microorganisms causing plant diseases
- To acquaint the students with reproduction in fungi and bacteria causing plant diseases
- To get acquainted with various plant disease management principles and practices

Theory

Introduction to Plant Pathology: Concept of disease in plants; Different terms used in Plant Pathology, History of Plant Pathology with special references to India; Causes of plant disease: Inanimate and animate causes; Classification of plant disease; Parasitism and pathogenesis; Development of disease in plants: Disease Triangle, Disease cycle; Fungi and their morphology, reproduction and classification of fungi only key from kingdom to Phylum; Bacteria: Morphology, reproduction classification of phytopathogenic bacteria; Other plant pathogens: Mollicutes; Flagellate protozoa; FVB; Green algae and parasitic higher plants; Viruses and viroids, virus transmission; Principles of Plant disease management: Disease management with chemicals, Host resistance, cultural and biological method of Integrated Disease Management (IDM).

Practical

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

Lecture Schedule- Theory

S.No.	Topic	Cr. Hrs.
1	Introduction to Plant Pathology: Concept of disease in plants; Different terms used in Plant Pathology, History of Plant Pathology with special references to India	3
2	Causes of plant disease: Inanimate and animate causes;	3

3	Classification of plant disease	2
4	Parasitism and pathogenesis	2
5	Development of disease in plants: Disease Triangle, Disease cycle	3
6	Fungi and their morphology, reproduction and classification of fungi only key to kingdom to Phylum	4
7	Bacteria: Morphology, reproduction classification of phytopathogenic bacteria	4
8	Other plant pathogens: Mollicutes; Flagellate protozoa; FVB; Green algae and parasitic higher plants	2
9	Viruses and viroids, virus transmission	3
10	Principles of Plant disease management	2
11	Disease management with chemicals, Host resistance, cultural and biological method of Integrated Disease Management (IDM).	2
	Total Credit Hours	**30**

Lecture Schedule – Practical

S.No.	Topic	Cr. Hrs.
1	Study of the microscope, Acquaintance with laboratory material and equipment	1
2	Study of different plant disease symptoms	1
3	Microscopic examination of general structure of fungi	1
4	Simple staining of bacteria: Direct and indirect staining, Gram staining of bacteria	2
5	Microscopic examination of fungal diseased specimen; Microscopic examination of bacterial diseased specimen	2
6	Preparation of culture media	2
7	Isolation of plant pathogens: Fungi and bacteria	2
8	Purification of plant pathogens; Study on plant disease diagnosis: Koch's Postulates,	2
9	Characteristics, formulation, methods of application and calculation on fungicides.	2
	Total Credit Hours	**15**

Suggested Readings:

1. Alexopoulos, C.J.; Mims, C.W. & Blackwell, M.2017. Introductory Mycology. Wiley India Pvt. ltd. New Delhi.
2. Dhingra, O.D. and Sinclair, J.B. 1986. Basic Plant Pathology Methods. CRC Press, London, Tokyo.
3. G.N. Agrios. 2020. PlantPathology. 5h Edition. Acad. Press. ISBN: 9780128224298 Page Count: 898

4. H.C. Dube. (2014). Modern Plant Pathology. 3rd Edition. AGROBIOS (INDIA), Jodhpur, ISBN: (10): 81-7754-353-9, 978-817754-3537.

5. H.C. Dube. (2016). A Text Book of Fungi Bacteria and Virus 3rd Edition.Student Edition Jodhpur ISBN (10): 81-88826-38-3, 978-81-88826-38-4 Page count:270.

6. Jayaraman and Verma. 2020. Fundamental of Plant Bacteriology. Kalyani Publishers.

7. K.K. Mandal. 2019. Plant Bacteriology. Kalyani Publishers.

8. K.R. Aneja. 2018. Experiments in Microbiology, Plant Pathology, Tissue culture and Microbial Biotechnology. 5h Edition. New Age International Publishers.

9. Manoj Kumar Kalita. 2020. Fundamemtal of Plant Pathology. Kalyani Publishers.

10. Mehrotra, R.S. and Aggarwal, A. 2007. Plant Pathology. 7th edn. Tata Mc Graw Hill Publ. Co. Ltd.

11. Nene, Y.L. and Thapliyal, P.N. 1993. Fungicides in Plant Disease Control. 3rd Ed. Oxford & IBH, New Delhi.

12. R. S. Singh.2024. An Introduction to Principles of Plant Pathology 11th Edition. India: CBS Publishers & Distributors. ISBN: 9788120417465, 8120417461. Page count:458

13. Verma, J.P. 1998. The Bacteria. Malhotra Publ. House, New Delhi.

14. बी. पी. सिंह. 2004. पादप रोग विज्ञान, रमा पब्लिशिंग हाउस.

NCC 121/NSS 121 1 (0+1)

NCC 121 National Cadet Corps (NCC-II) 1 (0+1)

- Arms Drill-Attention, stand at ease, stand easy. Getting on parade. Dismissing and falling out. Ground/take up arms, examine arms. Shoulder from the order and vice-versa, present from the order and vice-versa. Saluting at the shoulder at the halt and on the march. Short/ long trail from the order and vice- versa. Guard mounting, guard of honor, Platoon/Coy Drill. cleaning, and sight setting. Loading, cocking, and unloading. The lying position and holding.
- Trigger control and firing a shot. Range Procedure and safety precautions. Aiming and alteration of sight. Theory of groups and snap shooting. Firing at moving targets. Miniature range firing. Characteristics of Carbine and LMG.
- Introduction to map, scales, and conventional signs. Topographical forms and technical terms.
- The grid system. Relief, contours, and gradients. Cardinal points and finding north. Types of bearings and use of service protractor. Prismatic compass and its use. Setting a map, finding north and own position. Map to ground and ground to map. Knots and lashings, Camouflage and concealment, Explosives and IEDs.
- Field defenses obstacles, mines and mine lying. Bridging, waterman ship. Field water supplies, tracks and their construction. Judging distance. Description of ground and indication of landmarks. Recognition and description of target. Observation and concealment. Field signals. Section formations. Fire control orders. Fire and movement. Movement with/without arms. Section battle drill. Types of communication, media, latest trends and developments.

NSS 121 National Service Scheme (NSS-II) 1 (0+1)

- Importance and role of youth leadership
- Meaning, types and traits of leadership, qualities of good leaders; importance and roles of youth leadership, Life competencies
- Definition and importance of life competencies, problem-solving and decision-making interpersonal communication. Youth development programs
- Development of youth programs and policy at the national level, state level and voluntary sector; youth-focused and youth-led organizations
- Health, hygiene and sanitation. Definition needs and scope of health education; role of food, nutrition, safe drinking water, water borne diseases and sanitation (Swachh Bharat Abhiyan) for health; national health programs and reproductive health. Youth health, lifestyle, HIV AIDS and first aid. Healthy lifestyles, HIV AIDS, drugs and substance abuse, home nursing and first aid. Youth and yoga. History, philosophy, concept, myths, and misconceptions about yoga; yoga traditions and its impacts, yoga as a tool for healthy lifestyle, preventive and curative method.

Courses for B.Sc. (Hons.) Pt-II, Agriculture

As Per VI Deans Report

B.Sc. (Hons.) Agriculture Pt-II, Semester – III

S. No	Course No.	Course Title	Discipline	Credit Hours
1	SEC 211	Nutrition for Livestock and Poultry	LPM	2 (0+2)
2	AGECON 211	Entrepreneurship Development and Business Management*	Agril Economics	3 (2+1)
3	PEDU 211	Physical Education, First Aid and Yoga Practices	NSO	2 (0+2)
4	GPB 211	Principles of Genetics	GPB	3 (2+1)
5	AGRON 211	Crop Production Technology-I (Kharif crops)	Agronomy	3 (2+1)
6	HORT 211	Production Technology of Fruit and Plantation Crops	Horticulture	2 (1+1)
7	EXT 211	Fundamentals of Extension Education	Agril. Ext. Edu.	2 (1+1)
8	NEMA 211	Fundamentals of Nematology	Nematology	2 (1+1)
9	SOIL 211	Problematic Soils and Their Management	Soil Science	2 (1+1)
10	NCC 211/ NSS 211	National Cadet Corps (NCC)/ National Service Scheme (NSS) (To be continued)	NCC/NSS	1 (0+1) NG
			Total	**21 (10+11)**

SEC: Skill Enhancement Course

* sharing may be between Agril. Economics and Agril. Extension Education

SEC-211 Nutrition for Livestock and Poultry 2 (0+2)

Practical

Familiarization of various feed stuff and round the year fodder production their selection and classification. Collection, preservation and storage of feed and fodder. Damages or loss of various nutrients during transfer and storage and methods to prevent them. Conservation of green fodder through silage and hay and their uses in livestock feeding. Improving nutrient state of low-quality fodder by Physical methods. Improving nutrient state of low-quality fodder by Chemical methods. Improving nutrient state of low-quality fodder by Biological methods. Cost of calculations of feed and fodder production. Formulation of rations for cattle and buffalo with conventional and unconventional feed ingredient. Formulation of rations for sheep and goat with conventional and unconventional feed ingredient. Formulation of rations for poultry with conventional and unconventional feed ingredient. Formulation of rations for feeding of livestock during scarcity. Visit to the feed plant and fodder farm.

Lecture Schedule – Practical

S. No.	Title of Topic	Cr. Hrs.
1	Familiarization of various feed stuff and round the year fodder production their selection and classification.	3
2	Collection, preservation and storage of feed and fodder.	2
3	Damages or loss of various nutrients during transfer and storage and methods to prevent them.	2
4	Conservation of green fodder through silage and hay and their uses in livestock feeding.	3
5	Improving nutrient state of low-quality fodder by Physical methods.	2
6	Improving nutrient state of low-quality fodder by Chemical methods.	2
7	Improving nutrient state of low-quality fodder by Biological methods.	2
8	Cost of calculations of feed and fodder production.	1
9	Formulation of rations for cattle and buffalo with conventional and unconventional feed ingredient.	3
10	Formulation of rations for sheep and goat with conventional and unconventional feed ingredient.	3
11	Formulation of rations for poultry with conventional and unconventional feed ingredient.	3
12	Formulation of rations for feeding of livestock during scarcity.	2
13	Visit to the feed plant and fodder farm.	2
	Total Credit Hours	**30**

Suggested Readings:

1. Banerjee, G.C. 2013. A Text Book of Animal Husbandry. 8th Ed. ICAR.
2. Choudhary J.L. and Gupta Lokesh. 2016. A Text Book of Animal Husbandry.Somani Publication
3. Devendra C and Mecleroy GB 1982. Goat and Sheep Production in Tropics.
4. Sastry NSR and Thomas, Ck 2006. Livestock Production and Management. Kalyani
5. Singh, RA. 1996. Poultry Production. 3rd Ed Kalyani.
6. Thomas CK and Sastry, NSR. 1991. Dairy Bovine Production. Kalyani.

AGECON- 211 Entrepreneurship Development and Business Management 3 (2+1)

Objective

- To provide student an insight into the concept and scope of entrepreneurship
- To expose the student to various aspects of the establishment and management of a small business unit
- To enable the student to develop financially viable agribusiness proposal

Theory

Development of entrepreneurship, motivational factors, social factors, environmental factors, characteristics of entrepreneurs, entrepreneurial attributes/competencies. Concept, need for and importance of entrepreneurial development. Evolution of entrepreneurship, objectives of entrepreneurial activities, types of entrepreneurs, functions of entrepreneurs, importance of entrepreneurial development, and process of entrepreneurship development. Environment scanning and opportunity identification need for scanning: spotting of opportunity, scanning of environment identification of product/service: starting a project; factors influencing sensing the opportunities. Infrastructure and support systems: good policies, schemes for entrepreneurship development; role of financial institutions, and other agencies in entrepreneurship development. Steps involved in functioning of an enterprise. Selection of the product/services, selection of form of ownership; registration, selection of site, capital sources, acquisition of manufacturing know how, packaging and distribution. Planning of an enterprise, project identification, selection, and formulation of project; project report preparation, Enterprise Management. Production management: product, levels of products, product mix, quality control, cost of production, production controls, Material management. Production management: raw material costing, inventory control. Personal management: manpower planning, labour turn over, wages /salaries. Financial management /accounting: funds, fixed capital and working capital, costing and pricing, long term planning and short-term planning, book keeping, journal, ledger, subsidiary books, annual financial statement, taxation. Marketing management: market, types, marketing assistance, market strategies. Crisis management: raw material, production, leadership, market, finance, natural etc.

Practical

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

Lecture Schedule- Theory

S. No.	Topic	Cr. Hrs.
1.	Development of entrepreneurship, motivational factors, social factors, environmental factors, characteristics of entrepreneurs, entrepreneurial attributes/competencies.	3
2.	Concept, need for and importance of entrepreneurial development.	1
3.	The evolution, objectives, types, functions, importance, and development process of entrepreneurship.	2
4.	Environment scanning, opportunity identification, and factors influencing project initiation	3
5.	Infrastructure, support systems, and the role of policies, schemes, and institutions in entrepreneurship development	2
6.	Key steps in enterprise functioning: product selection, ownership, registration, site selection, capital, and distribution	3
7.	Planning of an enterprise, project identification, selection, and formulation of project; project report preparation, Enterprise Management.	2
8.	Production management: product, levels of products, product mix, quality control, cost of production, production controls.	3
9.	Material management. Production management: raw material costing, inventory control.	2
10.	Personal management: manpower planning, labour turn over, wages /salaries.	2
11.	Financial management and accounting: capital, costing, planning, bookkeeping, and taxation	3
12.	Marketing management: market, types, marketing assistance, market strategies.	2
13.	Crisis management: raw material, production, leadership, market, finance, natural etc.	2
	Total Credit Hours	**30**

Lecture Schedule – Practical

S. No.	Topic	Cr. Hrs.
1.	Concept of Time-Value of Money	1
2.	Numerical Exercises on Project Appraisal Techniques using Undiscounted Measures	1
3.	Project Appraisal Techniques with discounted Measures	3
4.	SWOT Analysis of Indian agro-industries	2
5.	Preparation of Detailed Project Report (DPR)	1
6.	Collaborative Team Project (Generating innovative business ideas, writing a comprehensive business plan including feasibility study,	3

	covering key areas such as market analysis, target audience, competitive landscape, funding requirements, and risk management.)	
7.	Visit to small scale industries/agro-industries.	1
8.	Interaction with successful entrepreneurs/ agric-entrepreneurs.	2
9.	Visit to financial institutions and support agencies.	1
	Total Credit Hours	**15**

Suggested Readings:

1. Charantimath, P. M. 2009, Entrepreneurship Development and Small Business Enterprises. Pearson Publications, New Delhi.
2. Desai, V. 2015, Entrepreneurship: Development and Management, Himalaya Publishing House.
3. Gupta, C.B. 2001. Management Theory and Practice. Sultan Chand & Sons.
4. Indu Grover. 2008. Hand book on Empowerment and Entrepreneurship. Agro tech Public Academy.
5. Khanka, S.S. 1999. Entrepreneurial Development. S. Chand & Co.
6. Mehra, P.2016, Business Communication for Managers. Pearson India, New Delhi.
7. Pandey, M. and Tewari, D. 2010, The Agri business Book. IBDC Publishers, Lucknow.
8. Singh, D. 1995. Effective Managerial Leadership. Deep & Deep Publ.
9. Singhal, R. K. 2013, Entrepreneurship Development & Management, Katson Books.
10. Tripathi, P. C. and Reddy, P.N. 1991. Principles of Management.Tata McGraw Hill.
11. Vasant Desai,1997. Small Scale Industries and Entrepreneurship. Himalaya Publ.
12. सागर मंडल, उद्यमिता विकास और व्यवसाय संचार

PEDU 211 Physical Education, First Aid and Yoga Practices 2 (0+2)

Objectives

i) To make the students aware about Physical Education, First Aid and Yoga Practices

ii) To disseminate the knowledge and skill how to perform physical training, perform first aid and increase stamina and general wellbeing through yoga

Lecture Schedule – Practical

S. No.	Topic	Cr. Hrs.
1.	Physical education; Training and Coaching - Meaning and Concept	1
2.	Methods of Training: aerobic and anaerobic exercises; Calisthenics, weight training, circuit training, interval training, Fartlek training	1
3.	Effects of Exercise on Muscular, Respiratory, Circulatory and Digestive systems	1
4.	Balanced Diet and Nutrition: Effects of Diet on Performance	1
5.	Physiological changes due to ageing and role of regular exercise on ageing process	1
6.	Personality, its dimensions and types	1
7.	Role of sports in personality development	1
8.	Motivation and Achievements in Sports	1
9.	Learning and Theories of learning	1
10.	Adolescent Problems and its Management	1
11.	Posture; Postural Deformities; Exercises for good posture	1
12.	Yoga: History of Yog, Types of Yog, Introduction to Yog	1
13.	Asanas (Definition and Importance): Padmasan, Vajrasan, Shushankasan, Paschimottasan, Utthirasan, Tadasan, Padahastasan, Ardhachandrasan, Bhujangasan, Unapadasan, Sarvangasan, Parvatasan, Patanasan, Shishupalanasan – left leg-right leg, Pavanmuktasan, Halasan, Sarpasan, Ardhadhunarsan, Savasan	3
14.	Suryanamaskar, Pranayam (Definition and Importance): Omkar, Suryabhedan, Chandrabhedan	2
15.	Anulom-Vilom, Shitali, Shitkari, Bhastrika, Bhramari	1
16.	Meditation (Definition and Importance), Yogic Kriyas (Kapalbhati), Tratak, Jalneti and Tribandh	1
17.	Mudras (Definition and Importance): Gyanmudra, Dhyanmudra, Vayumudra, Akashmudra, Pruthvimudra, Shunyamudra, Suryamudra, Varunmudra, Pranmudra, Apanmudra, Vyunmudra, Uddanmudra	3
18.	Role of yoga in sports	1
19.	Teaching of Asanas – demonstration, practice, correction and	1

	practice	
20.	History of sports and ancient games, Governance of sports in India	1
21.	Important national sporting events	1
22.	Awards in Sports	1
23.	History, latest rules, measurements of playfield, specifications of equipment, skill, technique, style and coaching of major games (Cricket, Football, Table Tennis, Badminton, Volleyball, Basketball, Kabaddi, Kho-Kho) and Athletics	2
24.	Need and requirement of first aid, First Aid equipment and upkeep. First aid techniques related to Respiratory system, Heart, Blood and Circulation, Wounds and Injuries, Bones, Muscles, Nervous system, Gastrointestinal tract, Skin, Burns, Poisoning, Bites and Stings, Sense organs, Handling and transport of injured persons, Sports injuries and their treatments	1
	Total Credit Hours	**30**

GPB 211 Principles of Genetics 3 (2+1)

Objective

To make the students acquainted with both principles and practices in the areas of classical genetics, modern genetics, quantitative genetics and cytogenetics.

Theory

Pre and post Mendelian concepts of heredity, Mendelian principles of heredity, Study of model organisms (Drosophila, Arabidopsis, Garden pea, E. coli, and mice), Architecture of chromosomes, chromonemata, chromosome matrix, chromomeres, centromere, secondary constriction and telomere, special types of chromosomes, Chromosomal theory of inheritance, cell cycle and cell division-mitosis and meiosis. Probability and Chi-square. Dominance relationships, Epistatic interactions with example, Introduction and definition of cytology, genetics and cytogenetics and their interrelation.

Multiple alleles, pleiotropism and pseudoalleles, Sex determination and sex linkage, sex limited and sex influenced traits, Blood group genetics, Linkage and its estimation, crossing over mechanism, chromosome mapping, Structural and numerical variations in chromosomes and their implications, Use of haploids, dihaploids and double haploids in Genetics, Mutation: classification, mutagenic agents, methods of inducing mutations. Qualitative and quantitative traits, Polygenes and continuous variations, multiple factor hypothesis, Cytoplasmic inheritance. Nature, structure and types of DNA & RNA, Replication of genetic material, Protein synthesis, Transcription and translational mechanism of genetic material, Gene concept: Gene structure, function and regulation.

Practical

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

Lecture Schedule- Theory

S. No.	Topic	Cr. Hrs.
	Pre and post Mendelian concepts of heredity	1
	Mendelian principles of heredity	1
	Cell division-mitosis and meiosis	1
1.	Study of model organisms (Drosophila, Arabidopsis, Garden pea, E.	1

	coli, and mice)	
2.	Architecture of chromosomes, chromonemata, chromosome matrix, chromomeres, centromere, secondary constriction and telomere	1
3.	Special types of chromosomes	1
4.	Chromosomal theory of inheritance- cell cycle	1
5.	Probability and Chi-square	1
6.	Dominance relationships, Epistatic interactions with example	1
7.	Introduction and definition of cytology, genetics and cytogenetics and their interrelation	1
8.	Multiple alleles, Blood group genetics, pleiotropism and pseudoalleles	1
9.	Sex determination and sex linkage	1
10.	Sex linked, Sex limited and sex influenced traits	1
11.	Linkage and its estimation	1
12.	Crossing over mechanism, chromosome mapping	1
13.	Structural and numerical variations in chromosomes and their implications	2
14.	Use of haploids, dihaploids and double haploids in Genetics	1
15.	Mutation, classification	1
16.	Methods of inducing mutations, mutagenic agents and induction of mutation	1
17.	Qualitative and quantitative traits, Polygenes and continuous variations	1
18.	Multiple factor hypothesis	1
19.	Cytoplasmic inheritance	1
20.	Nature, structure and Types of DNA and RNA	2
21.	Replication of genetic material	1
22.	Protein synthesis: Transcription	1
23.	Translational mechanism of genetic material	1
24.	Gene concept	1
25.	Gene structure, function and regulation	1
	Total Credit Hours	**30**

Lecture Schedule – Practical

S. No.	Topic	Cr. Hrs.
1.	Study of microscope	1
2.	Study of cell structure	1
3.	Practice on mitotic and meiotic cell division	2
4.	Experiments on monohybrid, dihybrid, trihybrid, test cross and back cross	2
5.	Experiments on epistatic interactions including test cross and back cross	2
6.	Experiments on probability and chi-square test	1
7.	Determination of linkage	1
8.	Cross-over analysis through two-point test cross data	1
9.	Cross-over analysis through three-point test cross analysis	1
10.	Study on sex linked inheritance in Drosophila	1
11.	Study on models on DNA and RNA structures.	2
	Total Credit Hours	**15**

Suggested Readings:

1. Fundamentals of Genetics: B. D. Singh
2. Genetics: M. W. Strickberger.
3. Principles of Genetics: Gardner, Simmons and Snustad.
4. Principles of Genetics: Sinnott, Dunn and Dobzhansky
5. कोशिका जीव विज्ञान और आनुवंशिकी, डॉ अशोक जांगिड़ व दाता जागृति तंवर, , जैन प्रकाशन मंदिर
6. आनुवंशिकी के आधार, बी डी सिंह, मेडटेक प्रकाशक

AGRON 211 Crop Production Technology-I (Kharif Crops) 3 (2+1)

Objectives

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

Theory

Origin, geographical distribution, economic importance, soil and climatic requirements, varieties, cultural practices and yield of Kharif crops. Cereals- rice, maize, sorghum, pearl millet, finger millet and other minor millets, pulses- pigeonpea, mungbean, mothbean and urdbean; oilseeds- groundnut, soybean, sesame, castor; fibre crops- cotton and jute; forage crops- sorghum, cowpea, cluster bean, maize, guinea and napier.

Practical

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

Lecture Schedule- Theory

S.No.	Topic	Cr. Hrs.
1.	Rice- Importance, origin, distribution, production, soil and climatic requirement	1
2.	Rice- Improved varieties, nursery raising, seed and sowing, intercultural operations/ weed management, fertilizer and water management	1
3.	Rice- Plant protection measures, harvesting, processing and yield	1
4.	Maize- Importance, origin, distribution, production, soil and climatic requirement, improved varieties, seed and sowing	1
5.	Maize- Intercultural operations/weed management, fertilizer and water management, plant protection measures, harvesting and yield	1
6.	Sorghum- Importance, origin, distribution, production, soil and climatic requirement and improved varieties for grain and forage	1
7.	Sorghum- Seed and sowing, intercultural operations/weed management, fertilizer, water management, plant protection measures, harvesting and yield for grain and forage sorghum and cutting	1

	management in forage	
8.	Pearl millet- Importance, origin, distribution, production, soil and climatic requirement (grain & forage).	1
9.	Pearl millet- Improved varieties, (grain and forage) seed and sowing, intercultural operation/weed management, mid-season corrections, intercropping and fertilizer management (grain & forage)	1
10.	Pearl millet- Water management, plant protection measures, harvesting, yield and cutting management in forage	1
11.	Pigeon pea- Importance of pulses and pigeon pea, origin, distribution, soil and climatic requirement and improved varieties	1
12.	Pigeon pea- Seed and sowing, intercultural operations/weed management fertilizer and water management, plant protection measures, harvesting and yield	1
13.	Groundnut- Importance of oilseeds and groundnut, origin, distribution, production, soil and climatic requirements	1
14.	Groundnut- Growth habits, improved varieties, seed and sowing, pegging, intercultural operations/ weed management, fertilizer, and water management, plant protection measures, harvesting, shelling and yield	1
15.	Soybean- Importance, origin, distribution, production, soil and climatic requirement, improved varieties, seed and sowing	1
16.	Soybean- Fertilizer, water and weed management, plant protection measures, harvesting and yield	1
17.	Cotton- Importance, origin, distribution, production, soil and climatic requirements, types of cotton and improved varieties	1
18.	Cotton- Seed and sowing, intercultural operations; weed management, fertilizer, and water management	1
19.	Cotton- Plant protection measures, harvesting, quality and yield	1
20.	Jute- Importance, origin, distribution, production, soil and climatic requirements, types of jute and improved varieties	1
21.	Jute- Seed and sowing, intercultural operations/weed management, fertilizer and water management, plant protection measures, harvesting, quality and yield	1
22.	Clusterbean - Package of practices	1
23.	Sesame- Package of practices	1
24.	Castor - Package of practices	1
25.	Urdbean - Package of practices	1
26.	Mungbean and mothbean - Package of practices	1
27.	Cowpea - Package of practices	1
28.	Napier - Package of practices	1
29.	Guinea - Package of practices	1

30.	Minor millets - Package of practices	1
	Total Credit Hours	**15**

Lecture Schedule – Practical

S.No.	Topic	Cr. Hrs.
1.	Identification of seeds, crops and other inputs of kharif season	1
2.	Sowing methods of different kharif crops	1
3.	Seed bed preparation of kharif crops including rice nursery and transplanting	1
4.	Working out seed rate, real value, seed size, depth and germination related numerical	1
5.	Seed treatment and preparation of seed material for sowing	1
6.	Preparation of seed material for planting of grasses	1
7.	Fertilizer application in crops, including top dressing and foliar feeding	1
8.	Identification of weeds in kharif season crops	1
9.	Morphological description of kharif season crops	1
10.	Irrigation operation in various crops	1
11.	Judging physiological maturity in standing crops	1
12.	Process of hay and silage making	1
13.	Effect of seed size on germination and seedling vigour	1
14.	Yield attributes and calculation on theoretical yield and harvest index	1
15.	Visit of important agronomic and forage experiments at farm and recording biometric observations	1
	Total Credit Hours	**15**

Suggested Readings:

1. B. Gurarajan, R. Balasubramanian and V. Swaminathan. Recent Strategies on Crop Production. Kalyani Publishers, New Delhi.
2. Chidda Singh.1997. Modern techniques of raising field crops. Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi.
3. Rajendra Prasad. Textbook of Field Crops Production - Commercial Crops. Volume II ICAR Publication.
4. S.R. Reddy. 2009. Agronomy of Field Crops. Kalyani Publishers, New Delhi.
5. S.S. Singh. 2005. Crop Management. Kalyani Publishers, New Delhi.
6. UAS, Bangalore. 2011. Package of Practice. UAS, Bangalore.
7. Subhash Chandra Bose, M. and Balakrishnan, V. 2001. Forage Production. South Asian Publishers, New Delhi.

HORT 211 Production Technology of Fruit and Plantation Crops

2 (1+1)

Objectives

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

Theory

Production status (area, production, productivity and export potential), importance and scope of fruit and plantation crop industry in India; nutritional value and classification of fruit and plantation crops. Crop production techniques in tropical, sub-tropical and temperate fruit crops: Climate and soil requirements, varieties, propagation and use of rootstocks, planting density and systems of planting: High density and ultra-high density planting, cropping systems, after care – training and pruning; water, nutrient and weed management, fertigation, special horticultural techniques, plant growth regulation, important disorders, maturity indices and harvest, value addition.

Fruit crops: mango, banana, papaya, guava, sapota, citrus, grape, litchi, pineapple, pomegranate, apple, pear, peach, strawberry, nut crops Jackfruit and minor fruits- date, ber, custard apple, bael, aonla

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

Practical

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

Lecture Schedule- Theory

S. No.	Topic	Cr. Hrs.
1.	Production status (area, production, productivity and export potential.	1
2.	Importance and scope of fruit and plantation crop industry in India.	1
3.	Nutritional value and classification of fruit crops and plantation crops.	1
4.	Crop production techniques in tropical, sub-tropical and temperate fruit crops: Climate and soil requirements, varieties, propagation and use of rootstocks, planting density and systems of planting: High density and ultra-high-density planting, cropping systems, after care – training and pruning; water, nutrient and weed management, fertigation, special horticultural techniques, plant growth regulation, important disorders, maturity indices and harvest, value addition.	
5.	Fruit crops: mango and banana.	1
6.	Papaya, guava and sapota.	2
7.	Citrus.	1
8.	Grape and litchi.	1
9.	Pineapple and pomegranate.	1
10.	Apple, pear and peach.	1
11.	Strawberry, nut crops, Jackfruit.	1
12.	Minor fruits- date, ber and custard apple.	1
13.	Bael and aonla.	1
14.	Crop production techniques in palms and plantation crops: Climate and soil requirements, varieties, propagation, nursery management, planting and planting systems, cropping systems, after care, training and pruning for plantation crops, water, nutrient and weed management, intercropping, multi-tier cropping system, mulching, special horticultural practices, maturity indices, harvest and yield, pests and diseases, processing- value addition.	
15.	Palms: Coconut, Arecanut, Oil palm and Palmyra palm.	1
16.	Plantation crops: Tea, Coffee, Cocoa, Cashewnut and Rubber.	1
	Total Credit Hours	**15**

Lecture Schedule – Practical

S. No.	Topic	Cr. Hrs.
1.	Propagation techniques, selection of planting material, varieties, important cultural practices for mango, banana.	1
2.	Papaya and Guava.	1
3.	Sapota and grapes.	1

4.	Citrus (mandarin and acid lime).	1
5.	Pomegranate and jackfruit.	1
6.	Preparation and application of PGR's for propagation.	2
7.	Micro propagation, protocol for mass multiplication and hardening of fruit crops.	2
8.	Identification and description of varieties, mother palm and seed nut selection, nursery practices, seedling selection, fertilizers application, nutritional disorders, pests and diseases of Coconut, Arecanut and cocoa.	2
9.	Tea and coffee.	2
10.	Rubber and cashew.	1
11.	Visit to commercial orchard and plantation industries.	1
	Total Credit Hours	**15**

Suggested Readings:

1. Banday, F. A. and Sharma, M. K. 2010 Advances in temperate fruit production. Kalyani Publishers, Ludhiana
2. Bose, T. K., S. K. Mitra and D. Sanyal 2001. Fruits: Tropical and Subtropical (2 volumes) Naya Udyog, Calcutta.
3. Bose, T. K., S. K. Mitra, A. A. Farooqi and M. K. Sadhu (Eds). 1999. Tropical Horticulture Vol.1. Naya Prokash, Calcutta.
4. Chadha, K. L. 2001. Handbook of Horticulture. ICAR, Delhi
5. Chadha, T. R. 2001 Textbook of temperate fruits. ICAR, New Delhi
6. Chattopadhyay, T.K. 2001. A Text Book on Pomology (4 volumes). Kalyani Publishers, Ludhiana.
7. Chattopadhyay. 1998. A textbook on pomology (sub-tropical fruits) vol. III. Published by M/s. Kalyani publishers, Ludhiana, New Delhi, Noida. UP.
8. Chudawat, B. S.1990. Arid fruit culture Oxford &IBH, New Delhi
9. Das, B. C. and Das S. N. Cultivation of minor fruits. Kalyani Publishers, Ludhiana
10. David Jackson and N.E. Laone, 1999. Subtropical and temperate fruit production. CABI publications
11. H. P. Singh and M. M. Mustafa 2009. Banana-new innovations Westville publishing House, New Delhi
12. Kumar, N. 1997. Introduction to Horticulture. Rajalakshmi Publications, Nagercoil, Tamil Nadu.
13. Mitra, S.K., T.K. Bose and D.S. Rathore. 1991. Temperate fruits. Horticulture and allied Publishers, Calcutta.
14. Pal, J. S. 1997. Fruit Growing. Kalyani Publishers, New Delhi.
15. Radha, T. and Mathew, L.2007. Fruit crops. New India publishing Agency
16. Rajput, CBS and Srihari babu, R.1985. Citriculture, Kalyani Publishers, Ludhiana

17. Sadhu, M. K. and P.K. Chattopadhyay. 2001. Introductory Fruit Crops. Naya Prokash, Calcutta.

18. Singh, S. P. 2004. Commercial Fruits. Kalyani Publishers, Ludhiana

19. Symmonds. 1996. Banana, II Edn.Longman, London

20. Veeraragavathatham, D., Jawaharlal, M., Jeeva, S., Rabindran, R and Umapathy, G. 2004 (2nd edition). Scientific fruit culture. Published by M/s. Suri associates, 1362/4, Velraj Vihar Complex, Thadagam Road, Coimbatore- 2

21. W.S. Dhillon. 2013. Fruit production in India. Narendra publishing House, New Delhi

22. Kavino, M, V. Jegadeeswari, R. M. Vijayakumar and S. Balkrishnan. 2018. Production Technology of Fruits and Plantation Crops by Narendra Publishing House.

23. Kumar, N.J. B.M. Md. Abdul Khaddar, Ranga Swamy, P. and Irulappan, I. 1997. Introduction to spices, Plantation crops and Aromatic plants. Oxford & IBH, New Delhi.

24. Nair. 1979. Cashew, CPCRI, Kerela

25. Sharma, A., Kumar, P., Tripathi, V.K. 2024. Production Technology of Fruits and Plantation Crops. Elite Publishing House

26. Thampan, P.K.1981. Handbook of coconut palm. Oxford &IBH, New Delhi.

27. Thompson, P.K.1980. Coconut. Oxford &IBH, New Delhi

28. V. Ponnuswami, M. Kumar; S. Ramesh Kumar and C. Krishnamoorthy 2015. Fruit and Plantation Crops Narendra Publishing House.

EXT-211 Fundamentals of Extension Education 3 (2+1)

Objectives

- State the importance of extension education in agriculture
- Familiarize with the different types of agriculture and rural development programs launched by govt. of India
- Classify the types of extension teaching methods
- Elaborate the importance and different models of communication
- Explain the process and stages of adoption along with adopters' categories

Theory

Education: Meaning, definition and Types; Extension Education and Agricultural Extension Education: meaning, definition, scope, importance and process; objectives and principles of Extension Education; Extension Programme planning: Meaning, Process, Principles and Steps in Programme Development. Extension systems in India: extension efforts in pre-independence era (Sriniketan, Marthandam, Firka Development Scheme, Gurgaon Experiment, etc.) and post-independence era (Etawah Pilot Project, Nilokheri Experiment, etc.); Reorganized Extension System (T&V system) various extension/ agriculture development programs launched by ICAR/ Govt. of India (IADP, IAAP, HYVP, KVK, IVLP, ORP, ND, NATP, NAIP, etc.). Social Justice and poverty alleviation programme: ITDA, IRDP, SGSY, NRLM, Women Development Programme: RMK, MSY etc. New trends in agriculture extension: privatization extension, cyber extension/ e-extension, market-led extension, farmer-led extension, expert systems, etc., Attributes of Innovation, DWCRA, Commodity Interest Groups (CIGs)., Farmers Producer Group (FPG).

Rural Development: concept, meaning, definition; various rural development programs launched by Govt. of India. Community Development: meaning, definition, concept and principles, Philosophy of C.D. Extension administration: meaning and concept, principles and functions. Monitoring and evaluation: concept and definition, monitoring and evaluation of extension programs; transfer of technology: concept and models, capacity building of extension personnel; extension teaching methods: meaning, classification, individual, group and mass contact methods, ICT Applications in TOT (New and Social Media), media mix strategies; Agriculture journalism. Diffusion and adoption of innovation: concept and meaning, process and stages of adoption, adopter categories.

Practical

To get acquainted with university extension system. Group discussion- exercise; Identification of rural leaders in village situation; 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/PRI and other development departments at district level; visit to NGO/FO/FPO and learning from their experience in rural development; understanding PRA techniques and their application in village development planning; exposure to mass media: visit to community radio and television studio for understanding the process of programme production; script writing, writing for print and electronic media, developing script for radio and television.

Lecture Schedule- Theory

S. No.	Topic	Cr. Hrs.
1.	Education: Meaning, definition and Types; Extension Education	1
2.	Agricultural Extension Education: meaning, definition, scope, importance and process; objectives and principles of Extension Education.	2
3.	Extension Programme planning: Meaning, Process, Principles and Steps in Programme Development.	2
4.	Extension systems in India: extension efforts in pre-independence era (Sriniketan, Marthandam, Firka Development Scheme, Gurgaon Experiment, etc.)	2
5.	Post-independence era (Etawah Pilot Project, Nilokheri Experiment, etc.)	1
6.	Reorganized Extension System (T&V system) various extension/ agriculture development programs launched by ICAR/ Govt. of India (IADP, IAAP, HYVP, KVK, IVLP, ORP, ND, NATP, NAIP, etc.).	6
7.	Social Justice and poverty alleviation programme: ITDA, IRDP, SGSY, NRLM.	2
8.	Women Development Programme: RMK, MSY etc.	1
9.	New trends in agriculture extension: privatization extension, cyber extension/ e-extension, market-led extension, farmer-led extension, expert systems, etc.	2
10.	Attributes of Innovation, DWCRA, Commodity Interest Groups (CIGs)., Farmers Producer Group (FPG).	1
11.	Rural Development: concept, meaning, definition; various rural development programs launched by Govt. of India. Community Development: meaning, definition, concept and principles, Philosophy of C.D..	2
12.	Extension administration: meaning and concept, principles and functions.	1
13	Monitoring and evaluation: concept and definition, monitoring and	1

	evaluation of extension programs	
14	Transfer of technology: concept and models, capacity building of extension personnel	1
15	Extension teaching methods: meaning, classification, individual, group and mass contact methods,	1
16	ICT Applications in TOT (New and Social Media), media mix strategies	1
17	Agriculture journalism.	1
18	Diffusion and adoption of innovation: concept and meaning, process and stages of adoption, adopter categories.	2
	Total Credit Hours	**30**

Lecture Schedule – Practical

S. No.	Topic	Cr. Hrs.
1.	To get acquainted with university extension system.	1
2.	Group discussion- exercise;	1
3.	Identification of rural leaders in village situation	1
4.	Preparation and use of AV aids	1
5.	Preparation of extension literature (leaflet, booklet, folder, pamphlet news stories and success stories)	2
6.	Presentation skills exercise	1
7.	Micro teaching exercise	1
8.	A visit to village to understand the problems being encountered by the villagers/ farmers	1
9.	To study organization and functioning of DRDA/PRI and other development departments at district level	1
10	Visit to NGO/FO/FPO and learning from their experience in rural development	1
11	Understanding PRA techniques and their application in village development planning;	2
12	Exposure to mass media: visit to community radio and television studio for understanding the process of programme production	1
13	Script writing, writing for print and electronic media, developing script for radio and television.	1
	Total Credit Hours	**15**

Suggested Readings:

1. Adivi Reddy, A., 2001, Extension Education, Sree Lakshmi press, Bapatla.

2. Dahama, O. P. and Bhatnagar, O. P., 1998, Education and Communication for Development, Oxford and IBH publishing Co. Pvt. Ltd., New Delhi.
3. Jalihal, K. A. and Veerabhadraiah, V., 2007, Fundamentals of Extension Education and Management in Extension, Concept publishing company, New Delhi.
4. Sagar Mondal, 2020., Fundamentals of Agricultural Extension Education, Kalyani Publications.
5. Rathore, O. S. et al. 2012. Handbook of Extension Education, Agrotech Publishing Academy, Udaipur.
6. Dudhani, C.M., Hirevenkatgoudar, L.V., Manjunath, L. Hanchinal, S.N. and Patil, S.L. 2004. Extension Teaching Methods and Communication Technology, UAS, Dharwad.
7. Sandhu, A.S. 1993. Text book on Agricultural Communication: Process and Methods. Oxford and IBH Publishing Pvt. Ltd, New Delhi.
8. Singh, A.K., Lakhan Singh, R. and Roy Burman. 2006. Dimensions of Agricultural Extension. Aman Publishing House, Meerut
9. Muthaiah Manoraharan, P. and Arunachalam, R., Agricultural Extension, Himalaya Publishing House (Mumbai).
10. Rathore, O. S. et al., 2012, Handbook of Extension Education, Agrotech Publishing Academy, Udaipur.
11. Ray, G. L., 1991 (1st Edition), Extension Communication and Management, Kalyani Publishers, Ludhiana {7th revised edition - 2010}.
12. Supe, S. V., 2013 (2nd Edition), A Text Book of Extension Education, Agrotech Publishing Academy, Udaipur.
13. Van Den Ban, A. W. and Hawkins, H. S., Agricultural Extension, S. K .Jain for CBS Publishers & Distributors, New Delhi.
14. Debabrata Das Gupta. Extension Education. Agrobios (India), Agro house behind Nasrani Cinema, Chaupasani Road, Jodhpur- 342402, Phone -0291-2642319, Fax-0291-2643993, Email- agrobios@sify.com
15. Sharma, O. P. & Somani, L. L. 2012. Dimension of Agricultural Extension, Agroteh Publishing Academy. Udaipur.

NEMA 211 Fundamentals of Nematology 2 (1+1)

Objectives

- To impart knowledge on history, economic importance of plant parasitic nematodes, morphology, biology, host parasitic relationship of nematodes.
- To impart knowledge on nematode pests of different crops of national and local importance and their management.

Theory

Introduction: History of phyto-nematology, habitat and diversity, economic importance of nematodes. General characteristics of plant parasitic nematodes. Nematode: definition, general morphology, and biology. Classification of nematodes up to family level with emphasis on groups containing economically important genera. Classification of nematodes on the basis of feeding/ parasitic habit. Symptomatology, role of nematodes in disease development, Interaction between plant parasitic nematodes and disease-causing fungi, bacteria, and viruses. Nematode pests of crops: Rice, wheat, vegetables, pulses, oilseed and fiber crops, citrus, and banana; Different methods of nematode management: Cultural methods, physical; methods, biological methods, Chemical methods, Plant Quarantine, Plant resistance and INM.

Practical

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

Lecture Schedule- Theory

S. No.	Topic	Cr. Hrs.
1.	Nematode: definition, History of phyto-nematology, General characteristics of plant parasitic nematodes.	1
2.	Habitat and diversity, economic importance of nematodes.	1
3.	General morphology and biology.	3
4.	Classification of nematodes up to family level with emphasis on groups containing economically important genera.	2
5.	Classification of nematodes on the basis of feeding/ parasitic habit. Symptomatology, role of nematodes in disease development, Interaction between plant parasitic nematodes and disease-causing	2

	fungi, bacteria, and viruses.	
6.	Nematode pests of crops: Rice, wheat, vegetables, pulses, oilseed and fiber crops, citrus, and banana.	3
7.	Different methods of nematode management: Cultural methods, physical; methods, biological methods, Chemical methods, Plant Quarantine, Plant resistance and INM.	3
	Total Credit Hours	**15**

Lecture Schedule – Practical

S. No.	Topic	Cr. Hrs.
1.	Sampling methods, collection of soil and plant samples.	1
2.	Extraction of nematodes from soil and plant tissues following Cobb's sieving and decanting technique, Baermann funnel technique.	2
3.	Picking and counting of plant parasitic nematode.	2
4.	Identification of economically important plant nematodes up to generic level with the help of keys and description: Meloidogyne, Pratylenchus; Heterodera, Tylenchulus, Xiphinema, and Helicotylenchus etc.	5
5.	Study of symptoms caused by important nematode pests of cereals, vegetables, pulses, etc.	3
6.	Methods of application of nematicides and organic amendments.	2
	Total Credit Hours	**15**

Suggested Readings:

1. Webster J.M. (1972) Economic Nematology. Academic Press Inc,
2. Zukerman, B.M., Mai, W.F., and Rohde R.A (1971) Plant Parasitic Nematodes (Vol-1). Academic Press Inc; pp 345
3. Gopal Swaroop and Das Gupta 1986. Plant Parasitic Nematodes of India Problems and Progress. ICAR, New Delhi. Pp 504
4. Wallia, R.K. and Bajaj, H.K. (2013) Text Book on Introductory Plant Nematology. ICAR, New Delhi pp227.
5. Wallia, R.K. and Bajaj, H.K. (2017) Padap Parjeevi Sutrakrumi: Ek Mool Granth (Introductory Nematology) (Hindi). Scientific Publisher, India pp310.
6. Sushil Kumar and B.P. Singh. Padap Sutrakarmi Vigyan (Hindi). Rama Publishing House.
7. Jonathan, E.I, I. Cannayane, K. Devrajan, S. Kumar, and S. Ramakrishan, Agricultural Nematology. TNAU, Coimbatore.
8. Upadhyay, K.D and Dwivedi, K. 1997. A text book of plant nematology. Amman Publishing House Aman publishing house, Meerut
9. Bajaj, H.K., Kanwar, R.S. and Gupta, D.C. (2011). Handbook of Practical Nematology. Scientific Publisher, Jodhpur pp150
10. Bohra, A., and Anamika (2012). Plant Nematology: A Fundamental Approach. Agrobios Jodhpur.pp286.

SOIL 211: Problematic Soils and their Management 2 (1+1)

Theory

Soil quality and health, Distribution of Waste land and problem soils in India, Categorization of Problem soils based on properties. Reclamation and management of Acid soils, Saline, Sodic soils, Acid Sulphate soils, Eroded and Compacted soils, polluted soils. Contaminated soils (Pesticide contamination, Heavy metal contamination), Mined soils (Coal mined, Oil mined), Management of Riverine soils, Waterlogged soils, Irrigation water – quality and standards, utilization of saline water in agriculture. Use of Remote sensing and GIS in diagnosis and management of problem soils. Irrigation and water quality. Multipurpose tree (MPT) species, bio remediation through MPTs of soils, land capability and classification, land suitability classification.

Practical

Determination of pHs and EC of saturation extract of problematic soil. Determination of redox potential in soil, Estimation of water soluble and exchangeable cations in soil and computation of SAR and ESP and characterization of problematic soil. Determination of Gypsum requirement of alkali / sodic soil. Determination of lime requirement of acidic soil. Determination of Quality of irrigation water (pH, EC, Ca, Mg, Na, CO_3, HCO_3, Cl, SAR and RSC), Determination of nitrate (NO_3^-) from irrigation water, Determination of dissolved oxygen and free carbon dioxide levels in water samples.

Lecture Schedule- Theory

S. No.	Topic	Cr. Hrs.
1.	Soil quality and health	1
2.	Distribution of waste land and problem soils in India.	1
3.	Categorization of problem soils based on properties	1
4.	Reclamation and management of acid soils	1
5.	Reclamation and management saline, sodic soils, acid sulphate soils	1
6.	Eroded and compacted soils	1
7.	Polluted soils, contaminated soils (pesticide contamination, heavy metal contamination), mined soils (coal mined, oil mined)	1
8.	Management of riverine soils, waterlogged soils	1
9.	Irrigation water – quality and standards,	1
10.	Utilization of saline water in agriculture	1
11.	Use of remote sensing and GIS in diagnosis and management of problem soils	1

12.	Multipurpose tree (MPT) species	1
13.	Bio remediation through MPTS of soils	1
14.	Land capability and classification, land suitability classification	1
15.	Redox potential in soil	1
	Total Credit Hours	**15**

Lecture Schedule – Practical

S. No.	Topic	Cr. Hrs.
1	Determination of pHs and EC of saturation extract of problematic soil	1
2	Determination of water-soluble Ca in soil	1
3	Determination of water-soluble Mg in soil	1
4	Determination of water-soluble sodium and Potassium in soil	1
5	Determination of exchangeable Ca++ and Mg++ in soil	1
6	Determination of Na+ and K+ in soil	1
7	Computation of SAR and ESP and characterization of problematic soil	1
8	Determination of gypsum requirement of sodic soil	1
9	Determination of lime requirement of acid soil	1
10	Determination of pH and EC of ground water	1
11	Determination of Ca++ and Mg++ in ground water	1
12	Determination of sodium in ground water	1
13	Determination of CO_3^{2-} , HCO^{3-} , Cl-, SAR and RSC in ground waters	1
14	Determination of nitrate (NO3-) in irrigation water	1
15	Determination of dissolved oxygen and free carbon dioxide levels in water samples.	1
	Total Credit Hours	**15**

Suggested Readings:

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

Courses for B.Sc. (Hons.) Pt-II, Agriculture

As Per VI Deans Report

B.Sc. (Hons.) Agriculture Pt-II, Semester – IV

S. No	Course No.	Course Title	Discipline	Credit Hours
1	SEC 221	Horticulture Nursery Management	Horticulture	2 (0+2)
2	HORT 221	Production Technology of Vegetables and Spices	Horticulture	2 (1+1)
3	COMP 221	Agricultural Informatics & Artificial Intelligence	Computer Sci.	3 (2+1)
4	AGECON 221	Principles of Agricultural Economics and Farm Management	Agril Economics	2 (2+0)
5	AGENGG 221	Farm Machinery and Power	Agril. Engg.	2 (1+1)
6	AGRON 221	Crop Production Technology-II (Rabi Crops)	Agronomy	3 (2+1)
7	AGRON 222	Water Management	Agronomy/ Soil Sci.	2 (1+1)
8	AGON 223	Principles and Practices of Natural Farming	Agronomy	2 (1+1)
9	GPB 221	Basics of Plant Breeding	GPB	3 (2+1)
10	NCC 221/ NSS 221	NCC /NSS (to be continued)	NCC/NSS	1 (0+1) NG
			Total	21 (12+9)

SEC: Skill Enhancement Course

SEC 221 Horticulture Nursery Management 2 (0+2)

Layout of model nursery, Tools and equipment-identification and application. Different methods of breaking seed dormancy stratification, scarification and use of plant growth regulators. Extraction and storage of healthy seeds, seed bed preparation, Identification and raising of rootstocks for different fruit plants, soil solarization, preparation of potting mixtures. Selection of healthy scion wood, practices in different methods of plant propagation like cutting, layering, budding and grafting in fruit plants. Micropropagation-explant preparation, media preparation, culturing–meristem tip culture, axillary bud culture, micro-grafting and hardening of plants. Nursery management practices i.e. weed control, irrigation, nutrition, removal of sprouts etc. Protection of nursery plants against adverse climatic conditions. Familiarization with propagation structures mist chamber, greenhouse, glasshouse, polyhouse and net house; and their maintenance. Diagnosis and control of important diseases and pests in the nursery, lifting and packing of nursery plants, Visit to commercial tissue culture laboratories and accredited nurseries. Nursery registration act.

Lecture Schedule – Practical

S. No.	Topic	Cr. Hrs.
1.	Layout of model nursery.	2
2.	Tools and equipment-identification and application.	1
3.	Different methods of breaking seed dormancy stratification, scarification and use of plant growth regulators.	2
4.	Extraction and storage of healthy seeds.	2
5.	Seed bed preparation.	2
6.	Identification and raising of rootstocks for different fruit plants.	2
7.	Soil solarization.	1
8.	Preparation of potting mixtures.	2
9.	Selection of healthy scion wood, practices in different methods of plant propagation like cutting, layering, budding and grafting in fruit plants.	2
10.	Micropropagation-explant preparation, media preparation, culturing–meristem tip culture, axillary bud culture, micro-grafting and hardening of plants.	2
11.	Nursery management practices i.e. weed control, irrigation, nutrition, removal of sprouts etc.	2
12.	Protection of nursery plants against adverse climatic conditions.	2
13.	Familiarization with propagation structures mist chamber, greenhouse, glasshouse, polyhouse and net house; and their maintenance.	2

14.	Diagnosis and control of important diseases and pests in the nursery, lifting and packing of nursery plants.	2
15.	Visit to commercial tissue culture laboratories and accredited nurseries.	2
16.	Nursery registration act.	2
	Total Credit Hours	**30**

Suggested Readings:

1. Hartmann, H. T., D. E. Kester, F. T. Davies and R. L. Geneve. 1996. Plant Propagation, Principles and Practices. 6th ed. Prentice Hall: Upper Saddle River, New Jersey.
2. Jack Eingels (1987). Landscaping Principles and Practices. Book published by Delmar Publishers Inc.
3. Randhawa G.S., A. Mukhopadhyay (2001). Floriculture in India. Book published by Allied Publishers Limited, New Delhi
4. Rahudkar W.B., Bhujbal BG, Madhuri Sonawane, Hemraj Rajput, 2010, YCMOU, Textbook Publication No. AGR 227 Horticulture Nursery Management.
5. Awasthi Dinesh, Jaggi Raman, Padmanand V, 2006. Manual for Enterpreneurs by Entrepreneurship Development Institute of India, Ahmedabad
6. ICAR 2019. Handbook of Horticulture 2nd edition ICAR Vol 1 and 2. New Delhi.
7. Sharma R R and Krishna Hare 2017. Textbook of Plant Propagation and Nursery Management. C B S Publishers. New Delhi.
8. Sharma R R and Srivastava Manish 2004. Plant Propagation and Nursery Management. IBDC Publishers. New Delhi

HORT 221 Production Technology of Vegetables and Spices 2 (1+1)

Objectives

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

Theory

Importance of vegetables and spices in human nutrition and national economy, kitchen gardening, brief about origin, area, climate, soil, improved varieties and cultivation practices such as time of sowing, transplanting techniques, planting distance, fertilizer requirements, irrigation, weed management, harvesting and yield, physiological disorders of important vegetable and spices (tomato, okra, brinjal, chili, capsicum, cucumber, bitter gourd, bottle gourd, sweet potato, cassava and moringa, pumpkin, watermelon, muskmelon, French bean, peas; cole crops such as cabbage, cauliflower, knol-khol; bulb crops such as onion, garlic; root crops such as carrot, radish, beetroot; tuber crops such as potato; leafy vegetables such as amaranth, palak, perennial vegetables: Drumstick and curry leaf, spice crops like turmeric, zinger, garlic, coriander, cumin, black pepper, cardamom, fenugreek, fennel, clove, nutmeg, cinnamon, tamarind and herbal spices).

Practical

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

Lecture Schedule- Theory

S. No.	Topic	Cr. Hrs.
1.	Importance of vegetables and spices in human nutrition and national economy, kitchen gardening.	1
2.	Brief about origin, area, climate, soil, improved varieties and cultivation practices such as time of sowing, transplanting techniques, planting distance, fertilizer requirements, irrigation, weed management, harvesting and yield, physiological disorders of important vegetable and spices:	
3.	Tomato, Brinjal, chili and capsicum.	1
4.	Cucumber, bitter gourd, Bottle gourd and pumpkin.	1
5.	Watermelon and muskmelon.	1

6.	Sweet potato, cassava and moringa.	1
7.	French bean, peas; and okra.	1
8.	Cole crops such as cabbage, cauliflower and knol-khol.	1
9.	Bulb crops such as onion and garlic.	1
10.	Root crops such as carrot, radish and beetroot.	1
11.	Tuber crops such as potato.	1
12.	Leafy vegetables such as amaranth and palak.	1
13.	Perennial vegetables: Drumstick and curry leaf.	1
14.	Spice crops like turmeric, zinger, garlic, coriander and cumin.	1
15.	Black pepper and cardamom.	1
16.	Fenugreek, fennel, clove, nutmeg, cinnamon, tamarind and herbal spices.	1
	Total Credit Hours	**15**

Lecture Schedule – Practical

S. No.	Topic	Cr. Hrs.
1.	Identification of vegetables and spice crops and their seeds.	1
2.	Description of varieties.	1
3.	Propagation methods - rapid multiplication techniques - seed collection and extraction.	2
4.	Nursery raising.	1
5.	Direct seed sowing and transplanting.	1
6.	Study of morphological characters of different vegetables and spices.	2
7.	Fertilizers applications.	2
8.	Harvesting and post-harvest practices.	2
9.	Economics of vegetables and spices cultivation.	2
10.	Visit to spice gardens.	1
	Total Credit Hours	**15**

Suggested Readings:

1. B. R. Choudhary, A Text book on production technology of vegetables (2009) Kalyani Publishers
2. K. S. Yawalkar, Vegetable crops in India (2008) Agri-Horticultural Pub. House. Nagpur
3. K.V.Kamath, Vegetable Crop Production (2007) Oxford Book Company
4. M. K. Rana, Olericulture in India (2008) Kalyani Publishers
5. M. S. Dhaliwal, Handbook of Vegetable Crops (2008) Kalyani Publishers

6. Nath Prem, Vegetables for the Tropical Regions (1994) ICAR New Delhi
7. P. Hazra, Modern Technology in Vegetable Production (2011) New India Publishing Agency, New Delhi
8. Pruthi, J.S., Major Spices of India- Crop Management Postharvest Technology (1993) ICAR 128.
9. Pruthi, J.S. Minor Spices of India- Crop Management Postharvest Technology (2001) ICAR
10. S. Thamburaj Text book of vegetable, tuber crops and Spices (2014) ICAR
11. Shanmugavelu, K.G. Kumar, N and Peter, K.V., Production technology of spices and plantation crops (2005) Agrosis, Jodhpur
12. Singh, D. K., Modern Vegetable varieties and production (2007) IBN publishers, Technology International Book Distributing Co, Lucknow
13. Singh, Umashankar, Indian Vegetables (2008) Anmol Publications. Pvt.Ltd. New Delhi
14. T. K. Bose, Vegetable Crops (2002) Nayaprakash, Kolkata
15. T. R. Gopal Krishnan, Vegetable Crops (2007) New India Publishing Agency. New Delhi
16. D. N. Singh et al., Winter Vegetables: Advances & Developments Satish Serial Pub. House
17. Ramchandra R.K., Breeding of Vegetable crops Jaya Publishing House
18. Sharma & Katoch, Practicals on Vegetable Production Technology Jaya Publishing House
19. Mishra, R., Diseases of Vegetable crops and their integrated management: A colour Handbook NIPA
20. Boswell, V.R., Seeds Production: Vegetables & Root Crops ISPG

COMP-221 Agricultural Informatics and Artificial Intelligence 3 (2+1)

Objectives

i) To acquaint students with the basics of computer applications in agriculture, multimedia, database management, application of mobile app and decision- making processes, etc.

ii) To provide basic knowledge of computers with applications in agriculture.

iii) To make the students familiar with agricultural informatics, its components and applications in agriculture and Artificial intelligence.

Theory

Introduction to Computers, Anatomy of Computers, Memory Concepts, Units of Memory, Operating System: Definition and types, Applications of MS-Office for creating, Editing and Formatting a document, Data presentation, Tabulation and graph creation, Statistical analysis, Mathematical expressions.

Number System's & representation of number systems; Introduction to machine, assembly & high-level languages, programming concepts - algorithms and flowcharts; Local area network (LAN), Wide area network (WAN), Network Topologies. Operating System, types of operating system, functions of operating system. Database, concepts and types, creating database, Uses of DBMS in Agriculture, Internet and World Wide Web (WWW): Concepts and components.

e-Agriculture, Concepts, design and development, Application of innovative ways to use information and communication technologies (IT) in Agriculture, Computer Models in Agriculture: Statistical, weather analysis and crop simulation models, concepts, structure, inputs- outputs files, limitation, advantages and application of models for understanding plant processes, sensitivity, verification, calibration and validation, IT applications for computation of water and nutrient requirement of crops, Computer-controlled devices (automated systems) for Agri-input management, Smartphone mobile apps in agriculture for farm advice: Market price, postharvest management etc., Preparation of contingent crop planning and crop calendars using IT tools, Digital India and schemes to promote digitalization of agriculture in India.

Introduction to artificial intelligence, background and applications, the role of digital transformation in agriculture, IoT and Big Data; Use of AI in agriculture for autonomous crop management, and health, monitoring livestock health, intelligent pesticide application, yield mapping and predictive analysis, automatic weeding and harvesting, sorting of produce, and other food processing applications; Concepts of smart agriculture, use of AI in food and nutrition science etc.

Practical

Study of computer components, accessories, practice of important DoS Commands, Introduction of different operating systems such as Windows, Unix/ Linux, creating files and 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, Handling macros. MS-ACCESS: Creating Database, preparing queries and reports, Demonstration of Agri- information system.

Introduction to World Wide Web (WWW) and its components, Internet and its applications, search engines, emailing services, composing messages, sending and receiving emails, attachments, junk mails, spam, trash, etc. Use of smart phones and other devices in agro-advisory and dissemination of market information.

Introduction to HTML, HTML structure, HTML tags, Elements and attributes, Basic Formatting Tags, HTML Headers, Paragraphs, Lists – ordered and unordered, images, hyperlinks – text and images, tables, iframe, Meta tags, etc.

Lecture Schedule- Theory

S. No.	Topic	Cr. Hrs.
1	Introduction to Computers	1
2	Anatomy of Computers	1
3	Memory Concepts	1
4	Units of Memory	1
5	Operating System: Definition and Types	1
6	Applications of MS-Office: Creating, Editing, and Formatting Documents	1
7	Applications of MS-Office: Data Presentation and Graph Creation	1
8	Applications of MS-Office: Statistical Analysis and Mathematical Expressions	1
9	Number Systems and Representation of Number Systems	1
10	Introduction to Machine, Assembly, and High-Level Languages	1
11	Programming Concepts: Algorithms and Flowcharts	1
12	Networking: Local Area Network (LAN) and Wide Area Network (WAN)	1
13	Network Topologies: Star, Bus, Ring, and Mesh	1
14	Operating Systems: Types and Functions	1
15	Database: Concepts, Types, and Applications in Agriculture	1

16	Creating Databases and Uses of DBMS in Agriculture	1
17	Internet and World Wide Web (WWW): Concepts and Components	1
18	e-Agriculture: Concepts, Design, and Development	1
19	IT Applications in Agriculture: Innovative Uses of ICT	1
20	Computer Models in Agriculture: Statistical and Weather Analysis Models	1
21	Computer Models in Agriculture: Structure, Input-Output Files, and Limitations	1
22	Computer-Controlled Devices for Agri-Input Management	1
23	Smartphone Mobile Apps in Agriculture: Market Price, Farm Advice, Postharvest Management	1
24	Preparation of Contingent Crop Planning and Crop Calendars Using IT Tools	1
25	Digital India and Schemes Promoting Digitalization of Agriculture	1
26	Introduction to Artificial Intelligence: Background and Applications	1
27	IoT and Big Data in Agriculture: Concepts and Applications	1
28	Use of AI in Agriculture: Autonomous Crop and Livestock Management	1
29	Smart Agriculture: Concepts and Applications	1
30	Role of Digital Transformation in Agriculture	1
	Total Credit Hours	**30**

Lecture Schedule – Practical

S. No.	Topic	Cr. Hrs.
1.	Study of Computer Components and Accessories, Practice of Important DOS Commands	1
2.	Introduction to Different Operating Systems (Windows, Unix/Linux)	1
3.	File Management: Creating Files and Folders	1
4.	Use of MS-Word: Creating, Editing, and Formatting a Scientific Document	1
5.	MS PowerPoint: Creating and Presenting a Scientific Presentation	1
6.	MS-Excel: Creating a Spreadsheet and Writing Expressions	1
7.	Statistical Tools and Data Analysis in MS-Excel	1
8.	Creating Graphs and Handling Macros in MS-Excel	1
9.	MS-Access: Creating Databases and Preparing Queries	1
10.	Demonstration of Agri-Information Systems using MS-Access	1
11.	Introduction to WWW, Internet Applications, and Search Engines	1

12.	Emailing Services: Composing Messages, Sending, and Receiving Emails	1
13.	Use of Smartphones and Devices in Agro-Advisory and Market Information	1
14.	Introduction to HTML: Structure, Tags, Elements, and Attributes	1
15.	Basic HTML Formatting: Headers, Paragraphs, Lists, Images, Hyperlinks, and Tables	1
	Total Credit Hours	**15**

Suggested Readings:

1. Fundamentals of Computer by V. Rajaroman.
2. Introduction to Information Technology by Pearson.
3. Introduction to Database Management System by C. J. Date.
4. Concepts and Techniques of Programming in C by Dhabal Prasad Sethi and Manoranjan, Wiley India.
5. Introductory Agri Informatics by Mahapatra, Subrat K et al, Jain Brothers Publication.
6. Russell, Stuart, Artificial Intelligence: A Modern Approach, Pearson Edition 2013.
7. Nilson N.J. 2001. Principles of Artificial Intelligence. Narosa.

AGECON 221 Principles of Agricultural Economics and Farm Management 2 (2+0)

Objectives

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

Theory

Economics: Meaning, scope and subject matter, definitions, activities, approaches to economic analysis; micro- and macro-economics, positive and normative analysis. Nature of economic theory; rationality assumption, concept of equilibrium, economic laws as generalization of human behavior. Basic concepts: Goods and services, desire, want, demand, utility, cost and price, wealth, capital, income and welfare. Agricultural economics: meaning, definition, characteristics of agriculture, importance and its role in economic development. Agricultural planning and development in the country. Demand: meaning, law of demand, demand schedule and demand curve, determinants, utility theory; law of diminishing marginal utility, equi-marginal utility principle. Consumer's equilibrium and derivation of demand curve, concept of consumer surplus. Elasticity of demand: concept and measurement of price elasticity, income elasticity and cross elasticity. Production: process, creation of utility, factors of production. Laws of returns: Law of variable proportions and law of returns to scale. Cost: Cost concepts, short run and long run cost curves. Supply: Stock v/s supply, law of supply, supply schedule, supply curve, determinants of supply, elasticity of supply. Distribution theory: meaning, factor market and pricing of factors of production. Concepts of rent, wage, interest and profit. National income: Meaning and importance, circular flow, concepts of national income accounting and approaches to measurement, difficulties in measurement. Population: Importance, Money: meaning and functions of money, classification of money, general price index, inflation and deflation. Farm Management, Meaning, Definition, objective, its relation with other sciences. Farm Types. Farm Planning and Budgets. Principles of Farm Management. Economic systems: Concepts of economy and its functions, important features of capitalistic, socialistic and mixed economies, GST and its implication on Indian economy.

Lecture Schedule- Theory

S. No.	Topic	Cr. Hrs.
1.	Economics: Meaning, scope and subject matter, definitions, activities, approaches to economic analysis; micro- and macro-economics, positive and normative analysis.	1
2.	Nature of economic theory; rationality assumption, concept of equilibrium, economic laws as generalization of human behavior.	1
3.	Basic concepts: Goods and services, desire, want, demand, utility, cost and price, wealth, capital, income and welfare.	1
4.	Agricultural economics: meaning, definition, characteristics of agriculture, importance and its role in economic development.	1
5.	Agricultural planning and development in the country.	1
6.	Demand: meaning, law of demand, demand schedule and demand curve, determinants.	2
7.	Utility theory; law of diminishing marginal utility, equi-marginal utility principle.	1
8.	Consumer's equilibrium and derivation of demand curve, concept of consumer surplus.	1
9.	Elasticity of demand: concept and measurement of price elasticity, income elasticity and cross elasticity.	2
10.	Production: process, creation of utility, factors of production.	1
11.	Laws of returns: Law of variable proportions and law of returns to scale.	1
12.	Cost: Cost concepts, short run and long run cost curves.	2
13.	Supply: Stock v/s supply, law of supply, supply schedule, supply curve, determinants of supply, elasticity of supply.	2
14.	Concepts of rent, wage, interest and profit.	1
15.	National income: Meaning and importance, circular flow, concepts of national income accounting and approaches to measurement, difficulties in measurement.	3
16.	Farm Management, Meaning, Definition, objective, its relation with other sciences. Farm Types. Farm Planning and Budgets.	2
17.	Seven Principles of Farm Management	4
18.	Money: meaning and functions of money, classification of money, general price index, inflation and deflation.	1
19.	Economic systems: Concepts of economy and its functions, important features of capitalistic, socialistic and mixed economies,	1
20.	GST and its implication on Indian economy.	1
	Total Credit Hours	**30**

Suggested Readings:

1. Johl, S. S. and T. R Kapur. 2009. Fundamentals of Farm Business Management. Kalyani Publishers
2. S. Subha Reddy, P. Raghu Ram, T. V. Neelakanta and I. Bhvani Devi.2004. Agricultural Economics. Oxford & IBH publishing Co. Pvt. Ltd
3. एन. एल. अगरवाल, १९७७, भारतीय कृषि का अर्थतंत्र, राजस्थान हिंदी ग्रन्थ अकादमी, जयपुर
4. केशवप्रसाद 'सरस' २०२१, आधुनिक भारत में कृषि अर्थशास्त्र, कल्याणी पब्लिशर्स.

AGENGG 221 Farm Machinery and Power 2 (1+1)

Objectives

To acquaint the students with the basic knowledge of farm implement, engine and their operations.

Theory

Status of Farm Power in India, Sources of Farm Power, LC. engines, working principles of I C engines, comparison of two stroke and four stroke cycle engines, Study of different components of LC. engine, LC. engine terminology and numerical, Familiarization with different systems of LC. engines: Air cleaning, cooling, lubrication ,fuel supply and hydraulic control system of a tractor, Familiarization with Power transmission system : clutch, gear box, differential and final drive of a tractor, Tractor types, Cost analysis of tractor power, Estimation of field capacity and power requirements of implements Familiarization with Primary and Secondary Tillage implement, implement for intercultural operations, Familiarization with sowing and planting equipment, Familiarization with Plant Protection equipment, Familiarization with harvesting and threshing equipment.

Practical

Study of different components of LC. 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, Familiarization with different types of primary and secondary tillage implements: mould board plough, disc plough and disc harrow. Familiarization with seed metering mechanism and calibration of seed drill, Familiarization with different types of sprayers and dusters Familiarization with different inter- culture implement, Familiarization with harvesting and threshing equipments and machinery.

Lecture Schedule- Theory

S. No.	Topic	Cr. Hrs.
1.	Sources of farm power and its status in India and Rajasthan.	1
2.	LC. engines, working principles of I C engines, comparison of two stroke and four stroke cycle engines	1
3.	Study of different components of l.C. engine, I.C. engine terminology and numerical.	2
4.	Air supply and exhaust system- Pre-cleaners, oil-soaked element type and oil bath type air cleaners; Fuel supply system	1

5.	Lubricating system- splash system and forced feed system; Cooling system- thermosiphon system and forced circulation system	1
6.	Transmission system- clutch, gear box, differential, final drive, P.T.O. shaft and hydraulic control system	1
7.	Tractor types, Estimation of operational cost of a tractor	1
8.	Familiarization with Primary and Secondary Tillage implement	1
9.	Numerical on field capacity and power requirement of implements	2
10.	Familiarization with implement with intercultural operations	1
11.	Familiarization with sowing and planting equipment	1
12.	Familiarization with Plant Protection equipment	1
13.	Familiarization with harvesting and threshing equipment	1
	Total Credit Hours	**15**

Lecture Schedule – Practical

S.No.	Topic	Cr. Hrs.
1.	Study of different components of I.C. engine.	1
2	To study air cleaning and cooling system of engine,	1
3	Study of transmission system.	1
4	Study of transmission system-clutch, gear box, differential, final drive and P.T.O.	1
5	Familiarization with brake, steering, hydraulic control system of engine,	1
6	Tractor driving	3
7	Daily and periodic maintenance of tractor	1
8	Study of power tiller and garden tractor	1
9	Study of primary and secondary tillage implements: mould board plough, discplough	1
10	Study of secondary tillage implements- cultivators, harrows and hoes	1
11	Study of seed metering mechanism and calibration of seed drill and numericals	1
12	Study of different types of sprayers and dusters	1
13	Study of harvesting machinery- reaper and thresher	1
	Total Credit Hours	**15**

Suggested Readings:

1. Principles of Agricultural Engineering. Vol. I.2012. Michael, A.M.and T.P. Ojha. Jain Brothers, Jodhpur.
2. Farm Tractors, Maintenance and Repair.1989. Rai and Jain. Tata Mc Graw Hill Publ. New Delhi.
3. Elements ofF arm Machinery. 1989. Srivastava, A.C. Oxford IBH Publ. Company, New Delhi.
4. Elements ofAgricultural Engineering, Vol. I & III. 1989. Singha!, O.P. Suraj Prakashan,Allahabad.
5. Element of Agricultural Engineering. 1990. Sahay, Jagdishwar. Agro. Book Agency, New Chitragupta Nagar, Patna

AGRON 221 Crop Production Technology-II (Rabi Crops) 3 (2+1)

Objectives

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

Theory

Origin, geographical distribution, economic importance, soil and climatic requirements, varieties, cultural practices and yield of Rabi crops. Cereals- wheat and barley. Pulses- chickpea, lentil, field peas and rajmash. Oilseed- rapeseed, mustard, taramira, sunflower, safflower and linseed. Sugar crops-sugarcane and sugar beet. Medicinal and aromatic crops- mentha, lemon grass and citronella. Forage crops- barseem, lucerne and oat; potato, quinoa, tobacco.

Practical

Sowing methods of wheat and sugarcane; identification of rabi crops and weeds in rabi season crops; working out seed rate and real value related numerical; calculation of fertilizer doses; study of morphological characteristics of rabi crops; study of yield contributing characters and calculation on theoretical yield and harvest index; 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.

Lecture Schedule- Theory

S.No.	Topic	Cr. Hrs.
1	Wheat- Origin, geographical distribution, economic importance, soil and climatic requirements	1
2	Wheat- Improved varieties, seed and sowing, intercultural operations/ weed management	1
3	Wheat- Water and nutrient management and importance of CRI stage.	1
4	Wheat- Plant protection, harvesting and yield and acquaintance about triticale	1
5	Barley- Origin, geographical distribution, economic importance, soil, climatic requirements and improved varieties	1
6	Barley- Seed and sowing, intercultural operations/ weed management, nutrient and water management, plant protection measures, harvesting and yield	1
7	Chickpea- Origin, geographical distribution, economic importance of pulses and chickpea, soil, climatic requirements and improved varieties	1

8	Chickpea- Seed and sowing, intercultural operations/weed management, nutrient and water management, plant protection measures, harvesting and yield	1
9	Rapeseed and mustard- Origin, geographical distribution, economic importance of oilseed and rapeseed & mustard, classification, soil, climatic requirements and improved varieties	1
10	Rapeseed and mustard- Seed and sowing, intercultural operations/weed management, nutrient and water management, plant protection measures, harvesting and yield	
11	Sugarcane- Origin, geographical distribution, economic importance, soil and climatic requirements	1
12	Sugarcane- Improved varieties, seed and transplanting, intercultural operations/weed management and nutrient management	1
13	Sugarcane- Water management and plant protection measures	1
14	Sugarcane- Maturity, harvesting and yield and factors affecting quality	1
15	Lucerne- Origin, geographical distribution, economic importance, soil, climatic requirements, improved varieties and seed and sowing	1
16	Lucerne- Weed, nutrient and water management, cutting management and yield.	1
17	Potato- Origin, geographical distribution, economic importance, soil, climatic requirements, improved varieties, seed and sowing	1
18	Potato- Seed plot technique, intercultural operations/weed management, nutrient and water management, plant protection measures, harvesting and yield	1
19	Lentil- Package of practices	1
20	Field Pea - Package of practices	1
21	Rajmash and Taramira - Package of practices	1
22	Sunflower- Package of practices	1
23	Safflower - Package of practices	1
24	Linseed- Package of practices	1
25	Sugarbeet- Package of practices	1
26	Medicinal and aromatic crops- Mentha, lemon grass and citronella	1
27	Berseem - Package of practices	1
28	Oats - Package of practices	1
29	Tobacco- Package of practices	1
30	Quinoa - Package of practices	1
	Total Credit Hours	**30**

Lecture Schedule – Practical

S.No.	Topic	Cr. Hrs.
1.	Sowing methods of wheat and sugarcane	2
2.	Identification of rabi crops and weeds in rabi season crops	1
3.	Working out seed rate and real value related numerical	1
4.	Calculation of fertilizer doses	1
5.	Study of morphological characteristics of rabi crops	1
6.	Study of yield contributing characters and calculation on theoretical yield and harvest index	2
7.	Yield and juice quality analysis of sugarcane	1
8.	Study of important agronomic experiments of rabi crops at experimental farms	2
9.	Study of rabi forage experiments	1
10.	Oil extraction of medicinal crops	2
11.	Visit to research stations of related crops	1
	Total Credit Hours	**15**

Suggested Readings:

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

AGRON 222 Water Management 2 (1+1)

Objectives

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

Theory

Irrigation: definition and objectives; Importance: Function of water for plant growth, water resources and irrigation development for different crops in India; Soil plant water relationships; Available and unavailable soil moisture, distribution of soil moisture, water budgeting, rooting characteristics, moisture extraction pattern, effect of moisture stress on crop growth. Methods of soil moisture estimation, evapotranspiration and crop water requirement; effective rainfall, different approaches of scheduling of irrigation; Methods of irrigation: surface and sub-surface, pressurized methods, viz., sprinkler and drip irrigation, their suitability, merits and limitations, fertigation, economic use of irrigation water; Layout of different irrigation systems, Irrigation efficiency and water use efficiency, conjunctive use of water, irrigation water quality and its management. Water management of different crops (rice, wheat, maize, groundnut, sugarcane, mango, banana and tomato); quality of irrigation water, irrigation management practices for different soils and crops, drip, sprinkler. Layout of underground pipeline system, Irrigation automation, Artificial Intelligence and climate-based irrigation practices and its management.

Practical

Determination of bulk density by field method; Determination of soil moisture content by gravimetric method, tensiometer, electrical resistance block and neutron moisture meter; Determination of field capacity by field method; Determination of permanent wilting point; Measurement of irrigation water by using water measuring devices viz., flumes, weirs, notches, orifices; Calculation of irrigation water requirement (Problems); Determination of infiltration rate; Demonstration of furrow method of irrigation; Demonstration of check basin and basin method of irrigation; Visit to farmers' field and cost estimation of drip irrigation system; Demonstration of filter cleaning, fertigation, injection and flushing of laterals; layout for different methods of irrigation, Erection and operation of sprinkler irrigation system; Measurement of emitter discharge rate, wetted diameter and calculation

of emitter discharge variability; Visit to irrigation research centre/station and visit to command area.

Lecture Schedule- Theory

S. No.	Topic	Cr. Hrs.
1.	Irrigation: Definition, objectives and its importance; Function of water for plant growth	1
2.	Water resources and irrigation development for different crops in India	1
3.	Soil plant water relationships	1
4.	Available and unavailable soil moisture; Distribution of soil moisture	1
5.	Water budgeting; Rooting characteristics and moisture extraction pattern; Effect of moisture stress on crop growth	1
6.	Methods of soil moisture estimation; Evapotranspiration and crop water requirement	1
7.	Effective rainfall; Different approaches of scheduling of irrigation	1
8.	Methods of irrigation: surface and sub-surface	1
9.	Pressurized methods, viz., sprinkler and drip irrigation, their suitability, merits and limitations; Fertigation; Economic use of irrigation water; Layout of different irrigation systems	1
10.	Irrigation efficiency and water use efficiency	1
11.	Conjunctive use of water; Irrigation water quality and its management	1
12.	Water management of different crops (rice, wheat, maize, groundnut, sugarcane, mango, banana and tomato)	1
13.	Irrigation management practices for different soils and crops	1
14.	Layout of underground pipeline system; Irrigation automation	1
15.	Artificial Intelligence and climate-based irrigation practices and its management	1
	Total Credit Hours	**15**

Lecture Schedule – Practical

S. No.	Topic	Cr. Hrs.
1.	Determination of bulk density by field method	1
2.	Determination of soil moisture content by gravimetric method, tensiometer, electrical resistance block and neutron moisture meter	1
3.	Determination of field capacity by field method	1
4.	Determination of permanent wilting point	1
5.	Measurement of irrigation water by using water measuring devices	1

	viz., flumes, weirs, notches and orifices	
6.	Calculation of irrigation water requirement (Problems)	1
7.	Determination of infiltration rate	1
8.	Demonstration of furrow method of irrigation	1
9.	Demonstration of check basin and basin method of irrigation	1
10.	Visit to farmers' field and cost estimation of drip irrigation system	1
11.	Demonstration of filter cleaning, fertigation, injection and flushing of laterals	1
12.	Layout for different methods of irrigation; Erection and operation of sprinkler irrigation system	1
13.	Measurement of emitter discharge rate, wetted diameter and calculation of emitter discharge variability	1
14.	Visit to irrigation research centre/station and visit to command area	1
15.	Calculation of irrigation efficiency	1
	Total Credit Hours	**15**

Suggested Readings:

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

AGRON 223 Principles and Practices of Natural Farming 2 (1+1)

Objectives

1. To provide comprehensive understanding and knowledge to students about natural farming.
2. To teach students the concept, need and principles of native ecology-based production under natural farming.
3. To impart practical knowledge of natural farming and related agricultural practices in Indian and global environmental and economic perspectives.

Theory

Indian Heritage of Ancient Agriculture, History of Natural Farming, Importance of natural farming in view of climate change, soil health, water use carbon sequestration, biodiversity conservation, food security and nutritional security, and sustainable development goals (SDGs), Concept of natural farming; Definition of natural farming; Objective of natural farming, Essential characteristics and Principles of natural farming; Scope and importance of natural farming. Main Pillars of natural farming; Methods/types/schools of natural farming. Characteristics and design of a natural farm, Concept of ecological balance, ecological engineering and community responsibility in natural versus other farming systems, Introduction to concept of ecological, water, carbon and nitrogen foot prints, Concept and evaluation of ecosystem services, integration of crops, trees and animals, cropping system approaches, Biodiversity, indigenous seed production, farm waste recycling, water conservation and renewable energy use approaches on a natural farm, Rearing practices for animals under natural farming, Nutrient management in natural farming and their sources, Insect, pest, disease and weed management under natural farming; Mechanization in natural farming, Processing, labelling, economic considerations and viability, certification and standards in natural farming, marketing and export potential of natural farming produce and products. Initiatives taken by Government (central/state), NGOs and other organizations for promotion of natural farming and chemical free agriculture, Case studies and success stories in natural farming and chemical free traditional farming, Entrepreneurship opportunities in natural farming.

Practical

Visit of natural farm and chemical free traditional farms to study the various components and operations of natural farming principles at the farm; Indigenous technical knowledge (ITK) for seed, tillage, water, nutrient, insect-pest, disease and weed management; On-farm inputs preparation methods and protocols, Studies in green manuring in-situ and green leaf manuring, Studies on different types of botanicals and animal urine and dung based non-

aerated and aerated inputs for plant growth, nutrient, insect and pest and disease management; Weed management practices in natural farming; Techniques of Indigenous seed production- storage and marketing, Partial and complete nutrient and financial budgeting in natural farming; farming; Evaluation of ecosystem services in natural farming (Crop, Field and System).

Lecture Schedule- Theory

S. No.	Topic	Cr. Hrs.
1.	Indian heritage of ancient agriculture; History and importance of natural farming in view of climate change, soil health, water use carbon sequestration, biodiversity conservation, food security and nutritional security and sustainable development goals (SDGs)	1
2.	Concept, definition, objectives, essential characteristics and principles of natural farming; Scope and importance of natural farming	1
3.	Main pillars/ components of natural farming	1
4.	Methods/types/schools of natural farming; Characteristics and design of a natural farm	1
5.	Concept of ecological balance, ecological engineering and community responsibility in natural versus other farming systems; Introduction to concept of ecological, water, carbon and nitrogen foot prints	1
6.	Concept and evaluation of ecosystem services; Integration of crops, trees and animals, cropping system approaches	1
7.	Biodiversity; Indigenous seed production; Farm waste recycling; Water conservation and renewable energy use approaches on a natural farm	1
8.	Rearing practices for animals under natural farming	1
9.	Nutrient management in natural farming and their sources	1
10.	Insect, pest, disease and weed management under natural farming	1
11.	Mechanization in natural farming	1
12.	Processing, labelling, economic considerations and viability; Certification and standards in natural farming; Marketing and export potential of natural farming produce and products	1
13.	Initiatives taken by Government (central/state), NGOs and other organizations for promotion of natural farming and chemical free agriculture	1
14.	Case studies and success stories in natural farming and chemical free traditional farming	1
15.	Entrepreneurship opportunities in natural farming	1
	Total Credit Hours	**15**

Lecture Schedule – Practical

S. No.	Topic	Cr. Hrs.
1.	Visit of natural farm and chemical free traditional farms to study the various components and operations of natural farming principles at the farm	1
2.	Indigenous technical knowledge (ITK) for seed, tillage, water, nutrient, insect-pest, disease and weed management	2
3.	On-farm inputs preparation methods and protocols	2
4.	Studies in green manuring in-situ and green leaf manuring	2
5.	Studies on different types of botanicals and animal urine and dung based non-aerated and aerated inputs for plant growth, nutrient, insect and pest and disease management	2
6.	Weed management practices in natural farming	1
7.	Techniques of Indigenous seed production- storage and marketing	2
8.	Partial and complete nutrient and financial budgeting in natural farming	1
9.	Evaluation of ecosystem services in natural farming (Crop, Field and System).	2
	Total Credit Hours	**15**

Suggested Readings:

1. Boeringa, R. (Eed.). 1980. Alternative Methods of Agriculture. Elsevier, Amsterdam, 199 pp.
2. Das, P., Das, S.K., Arya, H.P.S., Reddy, G. Subba, Mishra, A. and others: Inventory of Indigenous Technical Knowledge in Agriculture: Mission mode Project on Collection, Documentation and Validation of Indigenous Technical Knowledge, Document 1 To 7, Indian Council of Agricultural Research, New Delhi.
3. Ecological Farming -The seven principles of a food system that has people at its heart. May 2015, Greenpeace.
4. FAO. 2018. The 10 elements of agro-ecology: guiding the transition to sustainable food and agricultural system. https://www.fao.org/3/i9037en/i9037en.pdf Agro ecosystem Analysis for Research and Development Gordon R. Conway.1985.
5. Fukuoka, M. 1978. The One-Straw Revolution: An Introduction to Natural Farming. Rodale Press, Emmaus, PA. 181 pp
6. Fukuoka, M. 1985. The Natural Way of Farming: The Theory and Practice of Green Philosophy. Japan Publications, Tokyo, 280 pp.
7. Hill S.B and Ott. P. (Eeds.). 1982. Basic Techniques in Ecological Farming Berkhauser Verlag, Basel, Germany, 366 pp.
8. INFRC. 1988. Guidelines for Nature Farming Techniques. Atami, Japan. 38 pp.
9. Khurana, A. and Kumar, V. 2020. State of Organic and Natural Farming: Challenges and Possibilities, Centre for Science and Environment, New Delhi.

10. Nalini, S. 1996. Vrikshayurveda (The Science of Plant Life) by Surapala. AAHF Classic Bulletin 1. Asian Agri-History Foundation, Brig Sayeed Road, Secunderabad, AP (now Telengana), India. 94pp.

11. Nalini, S. 1999. Krishi-Parashara (Agriculture by Parashara) by Parashara. Brig Sayeed Road, Secunderabad, Telangana: AAHF Classic Bulletin, Asian Agri-History Foundation. 104pp.

12. Nalini, S. 2011. Upavana Vinoda (Woodland Garden for Enjoyment) by Sarangdhara (13th century CE): AAHF Classic Bulletin 8. Asian Agri-History Foundation, Brig Sayeed Road, Secunderabad, AP (now Telangana), India. 64p

13. Natural Asset Farming: Creating Productive and Biodiverse Farms by David B. Lindenmayer, Suzannah M. Macbeth, et al. (2022)

14. Natural Farming Techniques: Farming without tilling by Prathapan Paramu (2021)

15. Plenty for All: Natural Farming A to Z Prayog Pariwar Methodology by Prof. Shripad A. Dabholkar and Prayog Pariwar Prayog Pariwar (2021)

16. Reyes Tirado. 2015. Ecological Farming- The seven principles of a food system that has people at its heart. Greenpeace Research laboratories. University of Exeter, Ottho Heldringstraat.

17. Shamasastry, R. 1915. Kautilya's Arthashastra.

18. The Ultimate Guide to Natural Farming and Sustainable Living: Permaculture for Beginners (Ultimate Guides) by Nicole Faires (2016)

19. U. K. Behera. 2013. A text Book of Farming System. Agrotech Publishing House, Udaipur.

20ण कम लागत प्राकृतिक कृषिः आचार्य देवव्रत, pp 1-166.

GPB 221 Basics of Plant Breeding 3 (2+1)

Objectives

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

Theory

Historical development, concept, nature and role of plant breeding, major achievements and future prospects; Genetics in relation to plant breeding, modes of reproduction and apomixes, self-incompatibility and male sterility- genetic consequences, cultivar options, Plant genetic resources, its utilization and conservation, Domestication, Acclimatization and Introduction. Centres of origin/ diversity, Components of Genetic variation. Heritability and genetic advance. Pre-breeding and Universal Plant Breeder's equation. Genetic basis and breeding methods in self pollinated crops- mass and pure line selection, hybridization techniques and handling of segregating population. Multiline concept, Concepts of population genetics and Hardy-Weinberg Law, Genetic basis and methods of breeding cross-pollinated crops, modes of selection. Population movement schemes- Ear to Row method, Modified Ear to Row, Recurrent selection schemes. Heterosis and inbreeding depression, development of inbred lines and hybrids, composite and synthetic varieties. Breeding methods in asexually propagated crops, clonal selection and hybridization. Wide hybridization and pre-breeding. Polyploidy in relation to plant breeding. Mutation breeding-methods and uses. Breeding for important biotic and abiotic stresses. Participatory plant breeding, Speed breeding, Shuttle breeding and organic breeding. Variety Release and notification. Intellectual Property Rights, Patenting, Plant Breeders and Farmer's Rights.

Practical

Plant Breeder's kit, Study of germplasm of various crops, Study of floral structures of self-pollinated and cross-pollinated crops, Emasculation and hybridization techniques in self and cross pollinated crops, Consequences of inbreeding on genetic structure of resulting populations, Study of male sterility system, Handling of segregating populations, Methods of calculating mean, range, variance, standard deviation CV. Designs used in plant breeding experiments, Lay out of field experiments, Analysis of Completely Randomized Design (CRD) and Randomized Block Design (RBD), Determination of components of variance and heritability. To work out the mode of pollination in a given crop and extent of natural out-crossing, Prediction of performance of double cross hybrids, Maintenance of breeding records and data collection, Screening tests for biotic and abiotic stresses.

Lecture Schedule- Theory

S. No.	Topic	Cr. Hrs.
1.	Concept, nature and role of plant breeding, major achievements and future prospects	1
2.	Historical development of Plant Breeding	1
3.	Genetics in relation to plant breeding	1
4.	Modes of reproduction and apomixes	1
5.	Self- incompatibility	1
6.	Male sterility-genetic consequences	1
7.	Plant genetic resources- utilization and conservation, cultivar options	1
8.	Domestication, Acclimatization and Introduction	1
9.	Centres of origin/ diversity	1
10.	Components of Genetic variation; Heritability and genetic advance	1
11.	Pre-breeding and Universal Plant Breeder's equation	1
12.	Genetic basis and breeding methods in self-pollinated crops-Mass and pure line selection	1
13.	Hybridization techniques	1
14.	Handling of segregating populations (Pedigree, Bulk & Backcross methods)	1
15.	Multiline concept	1
16.	Concepts of population genetics and Hardy-Weinberg Law	1
17.	Genetic basis and methods of breeding cross-pollinated crops, Modes of selection.	1
18.	Population improvement schemes- Ear to Row method, Modified Ear to Row, recurrent selection schemes	1
19.	Heterosis and inbreeding depression	1
20.	Development of inbred lines and hybrids	1
21.	Composite and synthetic varieties	1
22.	Breeding methods in asexually propagated crops, clonal selection and hybridization	1
23.	Wide hybridization	1
24.	Polyploidy in relation to plant breeding,	1
25.	Mutation breeding- methods and uses	1
26.	Breeding for important biotic and abiotic stresses	1
27.	Participatory plant breeding, Speed breeding, Organic breeding, Shuttle breeding	1
28.	Variety Release and notification	1

29.	Intellectual Property Rights, Patenting	1
30.	Plant Breeders and Farmer's Rights	1
	Total Credit Hours	**30**

Lecture Schedule – Practical

S. No.	Topic	Cr. Hrs.
1.	Plant Breeder's kit	1
2.	Study of germplasm of various crops	1
3.	Study of floral structures of self- pollinated crops	1
4.	Study of floral structures cross-pollinated crops	1
5.	Emasculation and hybridization techniques in self-pollinated crops	1
6.	Emasculation and hybridization techniques in cross pollinated crops	1
7.	Consequences of inbreeding on genetic structure of resulting populations	1
8.	Study of male sterility system	1
9.	Handling of segregating populations	1
10.	Methods of calculating mean, range, variance, standard deviation, and heritability. Designs used in plant breeding experiments,	1
11.	Layout of field experimentation, Analysis of CRD and RBD. Determination of components of variance and heritability.	1
12.	Maintenance of breeding records and data collection	1
13.	To work out the mode of pollination in a given crop and extent of natural out-crossing	1
14.	Prediction of performance of double cross hybrids	1
15.	Screening tests for biotic and abiotic stresses	1
	Total Credit Hours	**15**

Suggested Readings:

1. Principles of Plant Breeding (1st & 2nd Edition) by RW Allard.
2. Plant Breeding: Principles & Practices by JR Sharma.
3. Plant Breeding- B.D. Singh.
4. Principles and Procedures of Plant Breeding - Biotechnical and Conventional Approaches by GS Chahal and SS Gosal.
5. Principles of Plant Genetics and Breeding by George Acquaah.
6. पादप प्रजनन सिद्धांत एवं विधियां, बी डी सिंह, कल्याणी प्रकाशक

Courses for B.Sc. (Hons.) Pt-III, Agriculture

As Per VI Deans Report

B.Sc. (Hons.) Agriculture Pt-III, Semester – V

S. No.	Course No.	Course Title	Discipline	Credit Hours
1	AGECON 311	Agricultural Marketing and Trade	Agril. Economics	3 (2+1)
2	AGENGG 311	Renewable Energy in Agriculture and Allied Sector	Agril. Engineering	2 (1+1)
3	AGMET 311	Introduction to Agro-Meteorology	Agril. Meteorology	2 (1+1)
4	AGRON 311	Weed Management	Agronomy	2 (1+1)
5	AGF 311$	Introductory Agro forestry	Agroforestry$	2 (1+1)
6	ENT 311	Pest Management in Crops and Stored Grains	Entomology	3 (2+1)
7	PPATH 311	Diseases of Field & Horticultural Crops & Their Management	Plant Pathology	3 (2+1)
8	PPHYS 311	Fundamentals of Crop Physiology	Plant Physiology	3 (2+1)
9	GPB 311	Crop Improvement (Kharif Crops) – I	GPB	2 (1+1)
10	STR 311	Study Tour	-	2 (0+2) NG
11	NCC 311/ NSS 311	NCC /NSS (to be continued)	NCC/NSS	1 (0+1) NG
			Total	22 (13+9)

$ sharing may be between Agronomy and Horticulture

AGECON 311 Agricultural Marketing and Trade 3 (2+1)

Objectives

- To understand the fundamentals of agricultural marketing and trade
- To analyze the factors influencing supply and demand in agricultural markets
- To explore different marketing channels and strategies in agriculture
- To examine the role of government policies and regulations in agricultural markets

Theory

Agricultural Marketing: Concepts and definitions of market, marketing, agricultural marketing, market structure, marketing mix and market segmentation, classification and characteristics of agricultural markets; Demand, supply and producer's surplus of agri commodities: nature and determinants of demand and supply of farm products, producer's surplus– meaning and its types, marketable and marketed surplus, factors affecting marketable surplus of agri-commodities; Pricing and promotion strategies: pricing considerations and approaches–cost based and competition based pricing; market promotion – advertising, personal selling, sales promotion and publicity – meaning, merits and demerits; Marketing process and functions: Marketing process concentration, dispersion and equalization; exchange functions – buying and selling; physical functions–storage, transport and processing; facilitating functions– packaging, branding, grading, quality control and labeling (Agmark); Market functionaries and marketing channels: Types and importance of agencies involved in agricultural marketing; meaning and definition of marketing channel; number of channel levels; marketing channels for different farm products; Integration, efficiency, costs and price spread: Meaning, definition and types of market integration; marketing efficiency; marketing costs, margins and price spread; factors affecting cost of marketing; reasons for higher marketing costs of farm commodities; ways of reducing marketing costs; Role of Govt. in agricultural marketing: Public sector institutions- CWC, SWC, FCI, CACP, DMI and APMC– their objectives and functions; cooperative marketing in India; Risk in marketing: Types of risk in marketing; speculation and hedging; an overview of futures trading; Agricultural prices and policy: Meaning and functions of price; administered prices; need for innovations in agricultural price policy; Trade: Concept of International Trade and its need, theories of absolute and comparative advantage. Present status and prospects of international trade in agri-commodities; WTO; Agreement on Agriculture (AoA) and its implications on Indian agriculture; IPR; Role of government in agricultural marketing; Role of APMC and its relevance in the present-day context. Role of private sector in Agricultural Marketing.

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.

Lecture Schedule- Theory

S. No.	Topic	Cr. Hrs.
1.	Agricultural Marketing: Concepts and definitions of market, marketing, agricultural marketing	1
2.	Market structure, marketing mix and market segmentation, classification and characteristics of agricultural markets	2
3.	Demand, supply and producer's surplus of agri commodities: nature and determinants of demand and supply of farm products	1
4.	Producer's surplus– meaning and its types, marketable and marketed surplus, factors affecting marketable surplus of agri-commodities	1
5.	Pricing and promotion strategies: pricing considerations and approaches–cost based and competition-based pricing; market promotion – advertising, personal selling, sales promotion and publicity – meaning, merits and demerits	2
6.	Marketing process and functions: Marketing process concentration, dispersion and equalization; exchange functions – buying and selling;	2
7.	Physical functions–storage, transport and processing; facilitating functions– packaging, branding, grading, quality control and labeling (Agmark)	2
8.	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	2
9.	Integration, efficiency, costs and price spread: Meaning, definition and types of market integration	2
10.	Marketing efficiency; marketing costs, margins and price spread; factors affecting cost of marketing	2
11.	Role of Govt. in agricultural marketing: Public sector institutions-CWC, SWC, FCI, CACP, DMI, APMC – their objectives and	4

	functions; cooperative marketing in India	
12.	Risk in marketing: Types of risk in marketing, Speculation and hedging; an overview of futures trading	2
13.	Agricultural prices and policy: Meaning and functions of price; administered prices; need for innovations in agricultural price policy	2
14.	Trade: Concept of International Trade and its need, theories of absolute and comparative advantage	2
15.	Present status and prospects of international trade in agri-commodities	1
16.	WTO; Agreement on Agriculture (AoA) and its implications on Indian agriculture, IPR	1
17.	Role of private sector in Agricultural Marketing	1
	Total Credit Hours	**30**

Lecture Schedule – Practical

S. No.	Topic	Cr. Hrs.
1.	Plotting and study of demand and supply curves	1
2.	Calculation of elasticities	1
3.	Relationship between market arrivals and prices of selected commodities	1
4.	Computation of marketable and marketed surplus of important commodities	2
5.	Study of price behaviour over time for some selected commodities	2
6.	Construction of index numbers	1
7.	Visit to a local market and identify 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	3
8.	Visit to market institutions–NAFED, SWC, CWC, cooperative marketing society, etc. to study their organization and functioning	2
9.	Application of principles of comparative advantage of international trade	2
	Total Credit Hours	**15**

Suggested Readings:

1. Acharya, S. S. and Agarwal, N.L. 2006. Agricultural Marketing in India, Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi.
2. Chinna, S. S. 2005. Agricultural Economics and Indian Agriculture. Kalyani Pub, N Delhi.

3. Dominic Salvatore, Micro Economic Theory
4. Kohls Richard, L. and Uhl Josheph, N. 2002. Marketing of Agricultural Products, Prentice-Hall of India Private Ltd., New Delhi.
5. Kotler and Arm strong, 2005. Principles of Marketing, Pearson Prentice-Hall.
6. Lekhi, R. K. and Joginder Singh. 2006. Agricultural Economics. Kalyani Publishers, Delhi.
7. Memoria, C. B., Joshi, R. L. and Mulla, N. I. 2003. Principles and Practice of Marketing in India, Kitab Mahal, New Delhi.
8. Pandey Mukesh and Tewari, Deepali. 2004. Rural and Agricultural Marketing, International Book Distributing Co. Ltd, New Delhi.
9. Sharma, R. 2005. Export Management, Laxmi Narain Agarwal, Agra.
10. एन. एल. अगरवाल, १९७७, भारतीय कृषि का अर्थतंत्र, राजस्थान हिंदी ग्रन्थ अकादमी, जयपुर
11. केशवप्रसाद 'सरस' २०२१, आधुनिक भारत में कृषि अर्थशास्त्र, कल्याणी पब्लिशर्स.
12. केशवप्रसाद 'सरस' कृषि विपरण, व्यापार एवं मूल्य, कल्याणी पब्लिशर्स.
13. एन. एल. अगरवाल, १९७७, भारत में कृषि विपरण एवं अन्तर्राष्ट्रीय व्यापार, राजस्थान हिंदी ग्रन्थ अकादमी, जयपुर

AGENGG 311 Renewable Energy in Agriculture and Allied Sector 2 (1+1)

Objectives

To acquaint the students with the basic knowledge of renewable energy and its basic fundamentals

Theory

Classification of energy sources, contribution of these of sources in agricultural sector, Familiarization with biomass utilization for bio-fuel production and their application, Familiarization with different types of biogas plants and gasifiers, bio-alcohol, biodiesel. Familiarization with briquetting techniques, Introduction of solar energy, solar collectors and their application, Familiarization with solar energy gadgets: solar cooker, solar water heater, application of solar energy: solar drying, solar distillation, solar photovoltaic system and their application, introduction of wind energy and their application.

Practical

Familiarization with renewable energy gadgets. To study biogas plants, To study gasifier, To study briquetting machine, Familiarization with different solar energy gadgets. To study solar photovoltaic system: solar light, solar pumping, solar fencing. To study solar cooker, To study solar dryers. To study solar distillation system

Lecture Schedule- Theory

S. No	Topic	Cr. Hrs.
1	Classification of energy sources, contribution of these of sources in agricultural sector.	1
2	Familiarization with biomass utilization for biofuel production and their application	2
3	Familiarization with different types of biogas plants.	2
4	Biogas production techniques and various uses of biogases.	2
5	Biomass gasification and familiarization with different gasifiers	2
6	Concept of briquetting and familiarization with briquetting machines	1
7	Introduction of solar energy, solar collectors and their application	2
8	Solar thermal applications in different gadgets	2
9	Solar photovoltaic techniques and applications.	1
	Total Credit Hours	**15**

Lecture Schedule – Practical

S. No.	Topic	Cr. Hrs.
1.	Study of fixed dom and floating drum type biogas plants	1
2	Study of cross draft, updraft and down draft gasifiers	2
3	To study briquetting machine	1
4	Study of box type solar cooker	1
5	Study of solar water heating system	1
6	Study of solar distillation system	1
7	Study of solar dryer	2
8	Study of solar animal concentrate cooker	1
9	Study of solar photovoltaic water pumping system and visit to nearby solar photovoltaic water pumping system	2
10	Study of solar photovoltaic sprayer	1
11	Study of wind mill	1
12	Study of improved cooker	1
	Total Credit Hours	**15**

Suggested Readings:

1. G.D. Rai. Non-Conventional Energy Sources, Kh Publishers, New Delhi.
2. N. S. Rathore. A.K. Kurchania, N.L. Panwar. (2007). Non Conventional Energy Sources, Himanshu Publications.
3. N.S. Rathore. A. K. Kurchania, N.L. Panwar. (2007). Renewable Energy, Theory and Practice, Himanshu Publications.
4. K.C. Khandelwal. & S.S. Mandi. (1990). Biogas Technology

AGMET 311 Introduction to Agro-meteorology 2 (1+1)

Objectives

1. To introduce the students to the concept of weather and climate and underlying physical processes occurring in relation to plant and atmosphere
2. To impart the theoretical and practical knowledge of instruments/equipment used for measurement of different weather variables in an agro- meteorological observatory
3. To study the meteorological aspects of climate change in agriculture and allied activities

Theory

Meaning and scope of agricultural meteorology; Earth atmosphere: its composition, extent and structure; Atmospheric weather variables; Atmospheric pressure, its variation with height; Wind, types of wind, daily and seasonal variation of wind speed, cyclone, anticyclone, land breeze and sea breeze; Nature and properties of solar radiation, solar constant, depletion of solar radiation, short wave, long wave and thermal radiation, net radiation, albedo; Atmospheric temperature, temperature inversion, lapse rate, daily and seasonal variations of temperature, vertical profile of temperature, Application of Thermal time concept and Crop/Pest weather calendar; Energy balance of earth; Atmospheric humidity, concept of saturation, vapour pressure, process of condensation, formation of dew, fog, mist, frost, cloud; Precipitation, process of precipitation, types of precipitation such as rain, snow, sleet, and hail, cloud formation and classification; Artificial rainmaking. Monsoon- mechanism and importance in Indian agriculture; Weather hazards - drought, floods, frost, tropical cyclones and extreme weather conditions such as heatwave and cold-wave; Agriculture and weather relations; Modifications of crop microclimate, climatic normal for crop and livestock production. Weather forecasting- types of weather forecast and their uses. Climate change, climatic variability, global warming, causes of climate change and its impact on regional and national agriculture.

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, Use of synoptic charts, weather reports, weather forecasting-types and methods, crop weather calendar.

Lecture Schedule- Theory

S.No.	Topic	Cr. Hrs.
1	Meaning and scope of agricultural meteorology; Earth atmosphere: its composition, extent and structure	1
2	Atmospheric weather variables; Atmospheric pressure, its variation with height; Cyclone and anticyclone	1
3	Wind, types of wind, daily and seasonal variation of wind speed: Land breeze and sea breeze	1
4	Nature and properties of solar radiation, solar constant, depletion of solar radiation	1
5	Short wave, long wave and thermal radiation, net radiation and albedo	1
6	Atmospheric temperature, temperature inversion, lapse rate, daily and seasonal variations of temperature and vertical profile of temperature	1
7	Application of thermal time concept and crop/pest weather calendar	1
8	Energy balance of earth; Atmospheric humidity, concept of saturation and vapour pressure	1
9	Process of condensation; Formation of dew, fog, mist, frost and cloud	1
10	Precipitation, process of precipitation, types of precipitation such as rain, snow, sleet, and hail; Cloud formation and classification	1
11	Artificial rainmaking; Monsoon- mechanism and importance in Indian agriculture	1
12	Weather hazards - drought, floods, frost, tropical cyclones and extreme weather conditions such as heat wave and cold-wave	1
13	Modifications of crop microclimate; Climatic normal for crop and livestock production	1
14	Weather forecasting- types of weather forecast and their uses	1
15	Climate change, climatic variability, global warming, causes of climate change and its impact on regional and national agriculture.	1
	Total Credit Hours	**15**

Lecture Schedule – Practical

S.No.	Topic	Cr. Hrs.
1	Visit of agro-meteorological observatory, site selection of observatory, exposure of instruments and weather data recording	2
2	Measurement of total, shortwave and long wave radiation, and its estimation using Planck's intensity law	1
3	Measurement of albedo and sunshine duration; Computation of	1

	Radiation Intensity using BSS	
4	Measurement of maximum and minimum air temperatures, its tabulation, trend and variation analysis	1
5	Measurement of soil temperature and computation of soil heat flux	1
6	Determination of vapor pressure and relative humidity	1
7	Determination of dew point temperature	1
8	Measurement of atmospheric pressure and analysis of atmospheric conditions	1
9	Measurement of wind speed and wind direction, preparation of wind rose	1
10	Measurement, tabulation and analysis of rain	1
11	Measurement of open pan evaporation and evapotranspiration	1
12	Computation of PET and AET	1
13	Use of synoptic charts, weather reports and crop weather calendar	1
14	Weather forecasting types and methods	1
	Total Credit Hours	**15**

Suggested Readings:

1. Agricultural Meteorology by G.S.L.H.V. Prasado Rao
2. Fundamentals of Agrometeorology and Climate Change by G. S. Mahi and P. K. Kingra
3. Introduction to Agrometeorology and Climate Change by Alok Kumar Patra
4. Introduction to Agrometeorology by H. S. Mavi
5. Text Book of Agricultural Meteorology by M. C. Varshneya and P.B. Pillai
6. New Horizon in Climate Smart Agriculture by Singh S., Singh A., Sharma, J. and Checham, S.2024. Vital Biotech Publisher, Kota. 184p.

AGRON 311 Weed Management 2 (1+1)

Objectives

1. To teach students about principles of weed science
2. To impart practical knowledge of weed management in field and horticultural crops

Theory

Introduction to weeds, characteristics of weeds, their harmful and beneficial effects on ecosystem. Classification, reproduction and dissemination of weeds, crop-weed completion, factors of competition, factors affecting growth and development. Studies on weed seed bank, weed shifts. Concepts of weed management: physical, cultural, chemical and biological; principles and methods, integrated weed management. Implements for weed control, robotic weed control, weed management in organic/ natural farming. Herbicide classification and properties of important herbicides, concept of adjuvants, surfactants, herbicide formulation and their use, Nano herbicides, precision weed management; Mode of action of herbicides and selectivity phenomenon. Concept of herbicide mixture and utility in agriculture, Herbicide compatibility with agro-chemicals and their application, Herbicide resistance and its management. Weed management in different field and horticultural crops; aquatic weed management, weed management in cropping systems.

Practical

Techniques of weed preservation, weed identification and losses caused by weeds. Biology of important weeds. Study weeds in different situations, Study of herbicide formulations and mixture of herbicide. Study methods of herbicide application, Herbicide application equipment- their parts, use, maintenance and calibration. Weed control implements, Calculation of herbicide doses and requirement, weed control efficiency and weed index, Phytotoxicity of herbicides, Weed management in fallow lands, Management of problem and parasitic weeds.

Lecture Schedule- Theory

S. No.	Topic	Cr. Hrs.
1.	Introduction to weeds, characteristics of weeds and their harmful and beneficial effects on ecosystem	1
2.	Classification, reproduction and dissemination of weeds	1
3.	Factors affecting crop-weed competition; Factors affecting growth and development	1
4.	Studies on weed seed bank and weed shifts	1
5.	Concepts of weed management: Physical, cultural, chemical and biological principles and methods	2

6.	Integrated weed management	1
7.	Implements for weed control; Robotic weed control	1
8.	Weed management in organic/ natural farming	1
9.	Herbicide classification and properties of important herbicides	1
10.	Concept of adjuvants, surfactants, herbicide formulation and their use	1
11.	Nano herbicides; Precision weed management	1
12.	Mode of action of herbicides and selectivity phenomenon	1
13.	Concept of herbicide mixture and utility in agriculture; Herbicide compatibility with agro-chemicals and their application; Herbicide resistance and its management	1
14.	Weed management in different field and horticultural crops, aquatic weed management, weed management in cropping systems	1
	Total Credit Hours	**15**

Lecture Schedule – Practical

S.No.	Topic	Cr. Hrs.
1.	Techniques of weed preservation	1
2.	Weed identification and losses caused by weeds	2
3.	Biology of important weeds	1
4.	Study of weeds in different situations	1
5.	Study of herbicide formulations and mixture of herbicide	1
6.	Study of herbicide application methods	1
7.	Herbicide application equipment their parts, use, maintenance and calibration	2
8.	Weed control implements	1
9.	Calculation of herbicide doses and requirement	1
10.	Weed control efficiency and weed index	1
11.	Phytotoxicity of herbicides	1
12.	Weed management in fallow lands	1
13.	Management of problem and parasitic weeds	1
	Total Credit Hours	**15**

Suggested Readings:

1. Crafts, A.S. and Robbins, W.W. 1973. Weed Control. Tata McGraw-Hill Publishing Co. Ltd., New Delhi.
2. Gupta, O.P. 2015. Modern Weed Management. Agro Bios (India), Jodhpur.
3. Naidu, V.S.G.R. Handbook of Weed Identification. Directorate of Weed Research, Jabalpur.

4. Rajagopal, A., Aravindan, R. and Shanmugavelu, K.G. 2015. Weed management of Horticultural Crops. Agrobios (India), Jodhpur.
5. Ramamoorthy, K. and Subbian, P. Predominant Weed flora in hill –ecosystems. Agrobios (India), Jodhpur.
6. Rao, V.S. 2000. Principles of Weed Science. Oxford & IBH Publishing Co., New Delhi.
7. Subramanian, S., Mohammed Ali, A. and Jayakumar, R. 1991. All About Weed Control. Kalyani Publishers, Ludhiana.
8. Thakur, C. 1977. Weed Science. Metropolitan Book Co. Pvt. Ltd., New Delhi.
9. U.S. Walia 2018. Weed Management. Kalyani Publisher. 5th Revised Editions.

AGF 311 Introductory Agroforestry 2 (1+1)

Objectives

1. To study Agro forestry as an alternate system of land use
2. To study different types of Agro forestry for soil and water conservation.
3. To study the characteristics of Agro forestry in terms its potential for soil moisture conservation practices

Theory

Agro-forestry: Definition and scope of Agroforestry system, Type of Agroforestry system, potential of Agroforestry in India, Prevailing agroforestry system in India; MPTS-definition, role of MPTS in agroforestry system, its selection for different agroforestry system, MPTS of India, Ecological aspects of Agroforestry system, tree -crop interaction – competition, nutrient recycling; Traditional Agroforestry as a viable choice to conserve Agro biodiversity of India. Management of Agro-forestry system; Role of agroforestry in soil and water conservation; windbreak; Shelterbelt– definition, objectives.; Socio-economic aspects of Agroforestry system; Design and Diagnostic study of agroforetry system; Silviculture: Definition and scope; Pasture system in Rajasthan; Propagation of tree species, Regeneration by seed, coppice, root suckers, Transplanting, stump, branch cutting, rhizomes; Nursery bed preparation and management; Cultural practices for bare root and seedling, field handling of nursery stock; Management of tree species; Silviculture of important tree species, choice of species- site factors, root, crown and bole characteristics, phenology, nutritional and water requirement, ground operation, tending, harvesting utility etc. Horticulture and forage crops-based agroforestry models developed by ICAR-IGFRI; Agroforestry models developed by Indian council of Forestry Research and Education.

Practical

Identification of tree species in agro-forestry, Study of tree growth measurement, Study of environmental parameters affecting AF System, Plant propagation methods, Pre-sowing seed treatment, Preparation of nursery bed exercise, practicing propagation techniques for trees, Afforestation method, practical training, pruning, coppicing, pollarding etc. Planting pattern and designs for plantation, natural and artificial regeneration, Design and diagnostic survey of agroforestry system, Evaluation of agro-forestry system in different agro climatic zones, Exposure Visit to prevailing agroforestry systems of the state and related important institutions, Virtual visit of agroforestry models developed by ICAR-IGFRI, ICFRE.

Lecture Schedule- Theory

S.No.	Topic	Cr. Hrs.
1	Agro-forestry: Definition, scope and type of agroforestry system; Potential of agroforestry in India; Prevailing agroforestry system in India	2
2	MPTS- Definition, role of MPTS in agroforestry system, its selection for different agroforestry system, MPTS of India	1
3	Ecological aspects of agroforestry system; Tree -crop interaction - competition; Nutrient recycling	1
4	Traditional agroforestry as a viable choice to conserve agro biodiversity of India; Management of agro-forestry system	1
5	Role of agroforestry in soil and water conservation; Windbreak & shelterbelt– Definition & objectives	1
6	Socio- economic aspects of agroforestry system	1
7	Design and diagnostic study of agroforestry system	1
8	Silviculture: Definition, scope and important tree species; Pasture system in Rajasthan	1
9	Propagation of tree species; Regeneration by seed, coppice, root suckers, transplanting, stump, branch cutting and rhizomes	1
10	Nursery bed preparation and management	1
11	Cultural practices for bare root and seedling; Field handling of nursery stock; Management of tree species	1
12	Choice of species- Site factors, root, crown and bole characteristics, phenology, nutritional and water requirement, ground operation, tending, harvesting utility etc.	1
13	Horticulture and forage crops-based agroforestry models developed by ICAR-IGFRI	1
14	Agroforestry models developed by Indian Council of Forestry Research and Education.	1
	Total Credit Hours	**15**

Lecture Schedule – Practical

S.No.	Topic	Cr. Hrs.
1	Identification of tree species in agro-forestry	1
2	Study of tree growth measurement	1
3	Study of environmental parameters affecting AF System	1
4	Plant propagation methods	1
5	Pre-sowing seed treatment	1
6	Preparation of nursery bed exercise	1
7	Practicing propagation techniques for trees	1

8	Afforestation method	1
9	Practical training, pruning, coppicing, pollarding etc.	1
10	Planting pattern and designs for plantation	1
11	Natural and artificial regeneration	1
12	Design and diagnostic survey of agroforestry system	1
13	Evaluation of agro-forestry system in different agro climatic zones	1
14	Exposure visit to prevailing agroforestry systems of the state and related important institutions,	1
15	Virtual visit of agroforestry models developed by ICAR-IGFRI and ICFRE	1
	Total Credit Hours	**15**

Suggested Readings:

1. Nair, P.K. R. 1993. An Introduction to Agroforestry, Kluar Academic Publisher
2. Chundawat B. S. and S. K. Gautham. 2017. Textbook of Agroforestry. Oxford & IBH Publishing, (ISBN: 9788120408326)
3. Parthiban, K. T, N. Krishnakumar and M. Karthick. 2018. Introduction to Forestry, Scientific Publisher, Jodhpur. 350p
4. Divya M. P. and K. T. Parthiban. 2005. A Textbook on Social Forestry and Agroforestry.
5. Satish Serial Publishing, New Delhi (ISBN: 9384988952).

ENT 311 Pest Management in Crops and Stored Grains 3 (2+1)

Objective

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

Theory

Concept of IPM, Practices, scope and limitations of IPM. Classification of insecticides, toxicity of insecticides and formulations of insecticides, Biorational pesticides including insect repellents, antifeedants, Use of drones and AI in pest management.

Scientific name, order, family, distribution, identification, host range and nature of damage, biology and bionomics and management of important arthropod pests.

Polyphagous insect pests: Locust, grasshopper, white grub, termite and red hairy caterpillar.

Pests of field crops: Cereals and millets- Rice: Brown plant hopper, yellow stem borer, gundhi bug. Sorghum: Shootfly; Maize: Stem borer; Sugarcane: Pyrilla, whitefly, shoot borer. Pulses: Gram pod borer, cutworm. Tobacco: Tobacco caterpillar. Oilseeds: Mustard aphid, sawfly, painted bug, soybean girdle beetle, castor semilooper, castor capsule borer, sesame leaf and capsule borer. Cotton: Jassid, whitefly, spotted and pink bollworm, red cotton bug, mealy bug.

Pests of vegetables Brinjal- brinjal shoot and fruit borer; Tomato- Fruit borer (Covered in gram); Okra- Shoot and fruit borer (Covered in cotton). Potato: Tuber moth. Pea: Stem fly. Chilli: Thrips; Onion and garlic: Thrips. Cruciferous vegetables: Cabbage caterpillar, diamondback moth, semilooper, tobacco caterpillar (Covered in tobacco). Cucurbitaceous vegetables: Melon fruit fly, red pumpkin beetle, red vegetable mite.

Pests of fruit crops Mango: Mango hopper, mealy bug, stem borer, fruit fly; Guava: Fruit fly. Citrus: Citrus psylla, citrus caterpillar, bark eating caterpillar. Pomegranate: Anar butterfly; Ber: Fruit fly. Coconut: Black headed caterpillar; Apple: San Jose scale, woolly aphid.

Pests of ornamental crops: Rose aphid, hollyhock tinged bug, jasmine budworm.

Pests of spices and condiments: Aphid, seed midge.

Invasive insect pests: Fall army worm, Tomato leaf miner

Pests of stored grains and their management: Khapra beetle, lesser grain borer, rice weevil, red rust flour beetle, pulse beetle, Angoumois grain moth. Storage structures and methods of grain storage.

Rodents and their management.

Practical

Field visit, identification of major insect pests and their damage symptoms. Collection and preservation of major insect pests; collection of damage samples, their identification and herbarium preparation. Methods of monitoring of pest incidence in situ. Management strategies of insect pests of different crops. Storage structures and methods of grain storage. Spraying techniques for selected field and horticultural crops. Mass multiplication of NPV and entomopathogenic nematodes.

Lecture Schedule- Theory

S.No.	Topic	Cr. Hrs.
1	Concept of IPM, Practices, scope and limitations of IPM.	2
2	Classification of insecticides, toxicity of insecticides and formulations of insecticides.	2
3	Biorational pesticides including insect repellents, antifeedants, Use of drones and AI in pest management.	1
4	Polyphagous insect pests: Locust, grasshopper, white grub, termite and red hairy caterpillar	3
5	Pests of Field crops–Rice: Brown plant hopper, yellow stem borer, gundhi bug.	1
6	Sorghum: Shootfly; Maize: Stem borer.	1
7	Sugarcane: Pyrilla, whitefly, shoot borer.	1
8	Pulses: Gram pod borer, cutworm. Tobacco: Tobacco caterpillar	1
9	Oilseeds: Mustard aphid, sawfly, painted bug, soybean girdle beetle, castor semilooper, castor capsule borer, sesame leaf and capsule borer.	2
10	Cotton: Jassid, whitefly, spotted and pink bollworm, red cotton bug, mealy bug.	1
11	Pests of Vegetables crops: Brinjal- brinjal shoot and fruit borer; Tomato- Fruit borer (Covered in gram); Okra- Shoot and fruit borer (Covered in cotton). Potato: Tuber moth. Pea: Stem fly. Chilli: Thrips; Onion and garlic: Thrips.	2
12	Cruciferous vegetables: Cabbage caterpillar, diamondback moth, semilooper, tobacco caterpillar (Covered in tobacco).	1
13	Cucurbitaceous vegetables: Melon fruit fly, red pumpkin beetle, red vegetable mite.	1
14	Pests of Fruit crops: Mango: Mango hopper, mealy bug, stem borer, fruit fly; Guava: Fruit fly.	1
15	Citrus: Citrus psylla, citrus caterpillar, bark eating caterpillar.	1
16	Pomegranate: Anar butterfly; Ber: Fruit fly.	1

17	Coconut: Black headed caterpillar; Apple: San Jose scale, woolly aphid.	1
18	Pests of Ornamental Crops: Rose aphid, hollyhock tinged bug, jasmine budworm.	1
19	Pests of Spices and condiments: Aphid, seed midge	1
20	Invasive insect pests: Fall army worm, Tomato leaf miner	1
21	Pests of stored grains and their management: Khapra beetle, lesser grain borer, rice weevil, red rust flour beetle, pulse beetle, Angoumois grain moth.	2
22	Storage structures and methods of grain storage.	1
23	Rodents and their management.	1
	Total Credit Hours	**30**

Lecture Schedule – Practical

S.No.	Topic	Cr. Hrs.
1	Field visit, identification of major insect pests and their damage symptoms	3
2	Collection and preservation of major insect pests	1
3	Collection of damage samples, their identification and herbarium preparation	3
4	Methods of monitoring of pest incidence in situ	1
5	Management strategies of insect pests of different crops	1
6	Storage structures and methods of grain storage	1
7	Spraying techniques for selected field and horticultural crops	2
8	Mass multiplication of NPV and entomopathogenic nematodes.	3
	Total Credit Hours	**15**

Suggested Reading:

1. Integrated Pest Management: Concepts and approaches – GS Dhaliwal & R. Arora
2. Agricultural Pests of India and South East Asia, A.S. Athwal
3. A Textbook of Applied Entomology, K.P. Srivastava and G. S. Dhaliwal, Kalyani Publish.
4. Essentials of Pest Management: Key Information on Pest Identification and its Management, 2022. Prakash Rambhat Thalya and Ravi Chandra
5. A Text Book of Entomology, Vol. I – K.P. Srivastava.
6. Pest Management: Methods, Applications and Challenges, Tarique Hassan Askary, Agriculture, Agriculture Issues and policies, Books, Nova, Pest Control, Science and Technology,2022
7. Elements of Economic Entomology – B.V. David and V.V. Ramamurthy

PPATH 311 Diseases of Field & Horticultural Crops & Their Management 3 (2+1)

Objectives

- To study the symptoms produced on the host
- To study the etiology of the diseases
- To know about the disease cycle of the pathogens during pathogenesis
- To study the epidemiological factors responsible for disease development
- To study the management techniques for curbing the major diseases of field and horticultural crops

Theory

Symptoms, etiology, disease cycle, epidemiology and management of major diseases of the following field and horticultural crops: Field crops- Rice (blast, brown spot, sheath blight, bacterial leaf blight, tungro, khaira); Wheat (rusts, loose smut, Karnal bunt) Barley (Covered smut); Maize (sheath blight, southern blight, downy mildew); Sorghum (smuts); Bajra (downy mildew, ergot); Groundnut (early and late leaf spots, Collar rot); Soybean (Rhizoctonia blight); Gram (Ascochyta blight, wilt, root rot); Pea (powdery mildew); Black gram and Green gram (web blight, yellow mosaic); Sugarcane (red rot, smut, grassy shoot, ratoon stunting, PokahBoeng); Mustard (Alternaria blight, white rust, sclerotinia stem rot); Cotton (vascular wilts, black arm). Horticultural crops: Citrus (canker, gummosis); Guava (anthracnose); Banana (sigatoka, Panama wilt, bunchy top); Papaya (foot rot, leaf curl, ring spot) and Pomegranate (bacterial blight); Apple (scab, fire blight, crown gall) and Peach (leaf curl); Grapevine (downy mildew,); Coconut (bud rot, Cadang cadang), Tea (blister blight, red rust); Coffee (rust); Mango (malformation, Black tip); Potato (late blight, black scurf, black heart); Tomato (damping off, early and leaf curl, mosaic); Brinjal (Phomopsis blight and fruit rot, Sclerotinia blight); Chilli (anthracnose and fruit rot, leaf curl); Cucurbits (Crini virus, Gummy stem blight, powdery and downy mildew, root rot) ; Cruciferous vegetables (black rot); Beans (anthracnose, bacterial blight) and Okra (yellow vein mosaic); Ginger (soft rot), Coriander (stem gall); Cumin Blight and wilt.; Rose (dieback, powdery mildew, black leaf spot); Marigold (Botrytis blight); Ber (powdery mildew); Aonla (Rust).

Practical

To study the symptoms of different diseases of field and horticultural crops: Blast and brown spot of rice, sheath blight and bacterial leaf blight of rice, downy mildew and powdery mildew of cucurbits, Rhizoctonia of green gram / black gram, Alternaria blight of mustard, early blight, late blight of potato and tomato, Phomopsis blight of brinjal, powdery

mildew and rust of pea, stem gall of coriander, anthracnose and fruit rot of chilli, red rot of sugarcane. Acquaintance with fungicides, antibiotics and biopesticides and their use in management of diseases of horticultural crops. 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.

Lecture Schedule: Theory

S.No.	Topic	Cr. Hrs.
1	Symptoms, etiology, disease cycle, epidemiology and management of major diseases of the following field and horticultural crops: Field crops- Rice (blast, brown spot, sheath blight, bacterial leaf blight, tungro, khaira); Wheat (rusts, loose smut, Karnal bunt) Barley (Covered smut);	4
2	Maize (sheath blight, southern blight, downy mildew); Sorghum (smuts); Bajra (downy mildew, ergot); Groundnut (early and late leaf spots,collar rot); Soybean (Rhizoctonia blight); Gram (Ascochyta blight, wilt, root rot);	6
3	Pea (powdery mildew); Black gram and Green gram (web blight, yellow mosaic); Sugarcane (red rot, smut, grassy shoot, ratoon stunting, Pokah Boeng); Mustard (Alternaria blight, white rust, Sclerotinia stem rot); Cotton (vascular wilts, black arm).	5
4	Horticultural crops: Citrus (canker, gummosis) and Guava (anthracnose); Banana (sigatoka, panama wilt, bunchy top); Papaya (foot rot, leaf curl, ring spot) and Pomegranate (bacterial blight); Apple (scab, fire blight, crown gall) and Peach (leaf curl); Grapevine (downy mildew,);	5
5	Coconut (bud rot, Cadang cadang), Tea (blister blight, red rust) and Coffee (rust); Mango (malformation, Black tip);	2
6	Potato (late blight, black scurf, black heart) and Tomato (damping off, early and leaf curl, mosaic); Brinjal (phomopsis blight and fruit rot, Sclerotinia blight) and Chilli (anthracnose and fruit rot, leaf curl); Cucurbits (Crini virus, Gummy stem blight, powdery and downy mildew, root rot) and Cruciferous vegetables (black rot);	4
7	Beans (anthracnose, bacterial blight) and Okra (yellow vein mosaic); Ginger (soft rot), Coriander (stem gall); Cumin Blight and wilt	2
8	Rose (dieback, powdery mildew, black leaf spot) and Marigold (Botrytis blight) Ber (powdery mildew), Aonla (Rust);	2
	Total Credit Hours	**30**

Lecture Schedule – Practical

S.No.	Topics	Cr. Hrs.
1	To study the symptoms of different diseases of field and horticultural crops: Blast and brown spot of rice, sheath blight and bacterial leaf blight of rice	2
2	Downy mildew and powdery mildew of cucurbits, rhizoctonia of green gram / black gram,	2
3	Alternaria blight of mustard, early blight, late blight of potato and tomato, Phomopsis blight of brinjal,	2
4	Powdery mildew and rust of pea, stem gall of coriander, anthracnose and fruit rot of chilli, red rot of sugarcane,	2
5	Acquaintance with fungicides, antibiotics and biopesticides and their use in management of diseases of horticultural crops	2
6	Identification and histopathological studies of selected diseases of field and horticultural crops covered in theory.	2
7	Field visit for the diagnosis of field problems, Collection and preservation of plant diseased specimens for herbarium.	3
	Total Credit Hours	**15**

Suggested Readings:

1. G.N. Agrios. 2020. PlantPathology. 5h Edition. Acad. Press. ISBN: 9780128224298 Page Count: 898
2. Godika, S. Goyal, S.K. and Kumari P. 2021. Plant Pathology Jaya Publishingh House, Delhi.
3. H.C. Dube. 2014. Modern Plant Pathology. 3rd Edition. AGROBIOS (INDIA), Jodhpur, ISBN: (10): 81-7754-353-9, 978-817754-3537.
4. H.C. Dube. (2016). A Text Book of Fungi Bacteria and Virus 3rd Edition.Student Edition Jodhpur ISBN (10): 81-88826-38-3, 978-81-88826-38-4 Page count :270.
5. Manoj Kumar Kalita. 2018. Diseases of Field and Horticultural crops and their Management- I
6. Manoj Kumar Kalita. 2018. Diseases of Field and Horticultural crops and their Management- II
7. Mehrotra, R.S. and Aggarwal, A. 2007. Plant Pathology. 7th Edn. Tata Mc Graw Hill Publ. Co. Ltd.
8. Singh. R. S. 2000. Diseases of Fruit Crops. Oxford & IBH, New Delhi.
9. Singh. R. S. 2009. Plant Diseases.9th Edition. Oxford & IBH, New Delhi. ISBN: 9788120417465.
10. एस. के . गोयल एवं जीतेन्द्र शर्मा. 2023. फलों के रोग व प्रबंधन. मिलियन पब्लिशिंग.
11. जीतेन्द्र शर्मा, आर. पी. घासोलिया और शैलेश गोदिका. 2017. फसलो के रोग व प्रबंधन. पब्लिशिंग.
12. वाई के सिंह व ए. के. वर्मा. 2020. फील्ड तथा उद्यानिकी फसलो के रोग और उनका प्रबंधन-I कल्याणी पब्लिशिंग.
13. वाई के सिंह व ए. के. वर्मा. 2020. फील्ड तथा उद्यानिकी फसलो के रोग और उनका प्रबंधन-II कल्याणी पब्लिशिंग.

PPHYS 311 Fundamentals of Crop Physiology 3 (2+1)

Objectives

To explain about the basic physiological process of plant viz. plant cell and water relations, mineral nutrition, carbon metabolism, reproductive physiology and plant growth and development

Theory

Definitions of plant physiology and crop physiology: Importance of crop physiology; Relationship of crop physiology with other branches of crop science; Diffusion and osmosis; Physiological roles of water to crop plants; Definition of water potential and components of water potential: Water absorption by plants: Concept of active and passive absorption; Water loss by plants: Types of water loss: transpiration, stomatal physiology and guttation; Water use efficiency; Essential and beneficial elements; Passive and active transport of mineral element; Functions of essential elements; Criteria of essentiality of nutrients; Correction measures for nutrient deficiency symptoms; Foliar nutrition and root feeding significance; Aeroponics: Imbibition; Field capacity, permanent wilting point and available soil moisture; Apoplast, symplast and transmembrane, Ascent of sap theories and mechanism; Soil-plant-atmospheric continuum. Significance of transpiration. Stomatal opening and closing mechanisms. Definition of Cavitation and embolism. Antitranspirants types and examples. Hydroponics and sand culture. Overview of plant cell organelle and their functions. Brief outline of: Photosynthetic apparatus, pigment system, quantum requirement and quantum yield; Structure of chloroplast, Examples of different photosynthetic pigments (chlorophyll, carotenoids, phycobilins etc.). Difference between chlorophyll a and chlorophyll b. Structure of chlorophyll a and chlorophyll b, Short discussion on quantum requirement and quantum yield, Red drop and Emerson enhancement effect, Pigment system I and II.

Introduction to light reaction of photosynthesis, Light absorption by photosynthetic pigments and transfer of energy. Source of O2 during photosynthesis: Hill reaction; Brief introduction to cyclic and non-cyclic photo-phosphorylation: production of assimilatory powers: Introduction to C3, C4 and CAM pathways: Calvin Cycle, Hatch and Slack Cycle, CAM Cycle; Significance of these pathways (concept of photorespiration, absence of photorespiration in C4 plant: Productivity of C4 plant, CAM: an adaptive mechanism); Factors affecting photosynthesis (light, temperature, CO2, O2 etc.). Outline of the process of respiration: Definition and importance, Glycolysis, Kreb Cycle and ETC, Factors affecting respiration (O2, temperature, CO2 etc.). Terminologies / Definitions: Growth, Development and Differentiation. Measurement of plant growth (fresh weight, dry weight,

linear dimension, area etc.). Introduction to CGR, RGR, NAR etc. Photoperiodism: Photoperiodic Classification of plants: Short Day Plant, Long Day Plant, Day Neutral plant etc. Introduction to Photoperiodic induction site of photo-inductive perception, Role of Phytochrome, Introduction to Vernalization (What is vernalization, devernalization etc.), Meaning, classification (seasonal, sequential etc.), relation with abscission.

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

Practical

Demonstration of imbibition; Demonstration of osmosis; Demonstration of plasmolysis; Estimation of water potential (Chardakov's method); Estimation of relative water content; Estimation of photosynthetic pigments; Determination of transpiration rate; Determination of photosynthetic rate; Determination of respiration; Identification or deficiency and toxicity symptoms in plant; Identification of nutrients by hydroponic techniques; Study on structure and distribution of stomata; Plant growth analysis; Study on senescence and abscission and hormonal regulation of senescence; Demonstration of the effects of different PGRs on plants; Leaf anatomy of C3 and C4 plants.

Practical

Demonstration of imbibition; Demonstration of osmosis; Demonstration of plasmolysis; Estimation of water potential (Chardakov's method); Estimation of relative water content; Estimation of photosynthetic pigments; Determination of transpiration rate; Determination of photosynthetic rate; Determination of respiration; Identification or deficiency and toxicity symptoms in plant; Identification of nutrients by hydroponic techniques; Study on structure and distribution of stomata; Plant growth analysis; Study on senescence and abscission and hormonal regulation of senescence; Demonstration of the effects of different PGRs on plants; Leaf anatomy of C3 and C4 plants

Lecture Schedule- Theory

S. No.	Topic	Cr. Hrs.
1.	Definitions of plant physiology and crop physiology: importance of crop physiology; Relationship of crop physiology with other branches of crop science	1
2.	Diffusion and osmosis; physiological roles of water to crop plants; Definition of water potential and its components of water potential	1
3.	Water absorption by plants: concept of active and passive	1

	absorption	
4.	Water loss by plants: Types of water loss: transpiration, stomatal physiology and guttation; Water use efficiency	1
5.	Essential and beneficial elements; Passive and active transport of mineral element	1
6.	Functions of essential elements; Criteria of essentiality of nutrients; Correction measures for nutrient deficiency symptoms	1
7.	Foliar nutrition and root feeding significance; Aeroponics	1
8.	Imbibition; Field capacity, permanent wilting point and available soil moisture; Apoplast, symplast and transmembrane	1
9.	Ascent of sap theories and mechanism	1
10.	Soil-plant-atmospheric continuum. Significance of transpiration. Stomatalopening and closing mechanisms	1
11.	Definition of cavitation and embolism. Antitranspirants types and examples. Hydroponics and sand culture	1
12.	Overview of plant cell organelle and their functions.	1
13.	Brief outline of: Photosynthetic apparatus, pigment system, quantum requirement and quantum yield; Structure of chloroplast, Examples of different photosynthetic pigments (chlorophyll, carotenoids, phycobilins etc.).	1
14.	Difference between chlorophyll a and chlorophyll b. Structure of chlorophyll a and chlorophyll b, Short discussion on quantum requirement and quantum yield	1
15.	Introduction to light reaction of photosynthesis, Light absorption by photosynthetic pigments and transfer of energy.	1
16.	Red drop and Emerson enhancement effect, Pigment system I and II. Source of O2 during photosynthesis: Hill reaction	1
17.	Brief introduction to cyclic and non-cyclic photo-phosphorylation: production of assimilatory powers	1
18.	Introduction to C3, C4 and CAM pathways: Calvin Cycle, Hatch and Slack Cycle, CAM Cycle	2
19.	Significance of these pathways (concept of photorespiration, absence of photorespiration in C4 plant: Productivity of C4 plant, CAM: an adaptive mechanism); Factors affecting photosynthesis (light, temperature, CO2, O2 etc.)	1
20.	Outline of the process of respiration: Definition and importance, Glycolysis	1
21.	Kreb Cycle and ETC, Factors affecting respiration (O2, temperature, CO2 etc.)	1
22.	Terminologies / Definitions: Growth, Development and Differentiation. Measurement of plant growth (fresh weight, dry weight, linear dimension, area etc.).	1

23.	Introduction to CGR, RGR, NAR etc. Photoperiodism: Photoperiodic Classification of plants: Short Day Plant, Long Day Plant, Day Neutral plant etc.	1
24.	Introduction to Photoperiodic induction site of photo-inductive perception, Role of Phytochrome	1
25.	Introduction to Vernalization (What is vernalization, devernalization etc.), Meaning, classification (seasonal, sequential etc.), relation with abscission	1
26.	Physiological and biochemical changes during senescence, Abscission and its significance	1
27.	Concept of stay green, Hormonal regulation of senescence	1
28.	Terminologies / Definitions: Plant hormone, Plant growth regulators (PGR), Plant growth inhibitor. Recognized classes of PGR (Auxins, Gibberellins, Cytokinins, Ethylene and Abscisic acid)	1
29.	Major physiological roles of PGR, Agricultural uses of PGRs (IBA, NAA, 2, 4-D, GAs, Kinetin etc.).	1
	Total Credit Hours	**30**

Lecture Schedule – Practical

S. No.	Topic	Cr. Hrs.
1.	Demonstration of imbibition	1
2.	Demonstration of osmosis	1
3.	Demonstration of plasmolysis	1
4.	Estimation of water potential (Chardakov's method)	1
5.	Estimation of relative water content	1
6.	Estimation of photosynthetic pigments	1
7.	Determination of transpiration rate	1
8.	Determination of photosynthetic rate	1
9.	Determination of respiration	1
10.	Identification or deficiency and toxicity symptoms in plant	1
11.	Identification of nutrients by hydroponic techniques	1
12.	Study on structure and distribution of stomata	1
13.	Plant growth analysis and Study on senescence and abscission and hormonal regulation of senescence	1
14.	Demonstration of the effects of different PGRs on plants	1
15.	Leaf anatomy of C3 and C4 plants	1
	Total Credit Hours	**15**

Suggested Readings:

1. Devlin's Exercises in Plant Physiology by Robert Devlin, Francis H. Witham and David F. Blaydes
2. Fundamentals of Plant Physiology by Lincoln Taiz, Eduardo Zeiger, Ian Max Mølle and Angus Murphy
3. Plant Physiology by Robert M. Devlin and Francis H. Witham
4. Plant Physiology by Lincoln Taiz and Eduardo Zeiger
5. Plant Physiology by Frank B. Salisbury and Cleon W. Ross

GPB 311 Crop Improvement – I (Kharif Crops) 2 (1+1)

Objectives

1. To provide knowledge about Self-pollinated and cross pollinated Kharif crops
2. To learn about origin and distribution of Kharif crops
3. To design breeding objectives of major kharif crops
4. To impart information on different crop varieties for Kharif season

Theory

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

Practical

Botany of crops, floral biology, emasculation and hybridization techniques in different crop species, viz. rice, jute, maize, sorghum, pearl millet, minor millets, pigeopea, urdbean, mungbean, mothbean, clusterbean, cowpea, soybean, groundnut, sesame, castor, cotton, 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 techniques for seed production and hybrid seed production in kharif crops; Estimation of heterosis, inbreeding depression and heritability; Study of quality characters, donor parents for different characters; Visit to AICRP breeding/seed production plots of kharif crops in National Agricultural Institutes.

Lecture Schedule- Theory

S. No.	Topic	Cr. Hrs.
1.	Crop improvement aspects in Rice as mentioned in the syllabus such as centers of origin, distribution of species, wild relatives, floral biology, breeding objectives and procedures etc.	1
2.	Crop improvement aspects in Maize as mentioned in the syllabus such as centers of origin, distribution of species, wild relatives, floral biology, breeding objectives and procedures etc.	1

3.	Crop improvement aspects in Sorghum, Pearl millet and Ragi as mentioned in the syllabus such as centers of origin, distribution of species, wild relatives, floral biology, breeding objectives and procedures etc.	1
4.	Crop improvement aspects in Urd, Mung, Mothbean, Cowpea and clusterbean as mentioned in the syllabus such as centers of origin, distribution of species, wild relatives, floral biology, breeding objectives and procedures etc.	1
5.	Crop improvement aspects in Pigeonpea and Soybean as mentioned in the syllabus such as centers of origin, distribution of species, wild relatives, floral biology, breeding objectives and procedures etc.	1
6.	Crop improvement aspects in Groundnut and Sessame as mentioned in the syllabus such as centers of origin, distribution of species, wild relatives, floral biology, breeding objectives and procedures etc.	
7.	Crop improvement aspects in Cotton and Castor as mentioned in the syllabus such as centers of origin, distribution of species, wild relatives, floral biology, breeding objectives and procedures etc.	1
8.	Crop improvement aspects in Brinjal and okra as mentioned in the syllabus such as centers of origin, distribution of species, wild relatives, floral biology, breeding objectives and procedures etc.	1
9.	Crop improvement aspects in Tobacco and Jute as mentioned in the syllabus such as centers of origin, distribution of species, wild relatives, floral biology, breeding objectives and procedures etc.	1
10	Crop improvement aspects in Cucurbitaceous crops as mentioned in the syllabus such as centers of origin, distribution of species, wild relatives, floral biology, breeding objectives and procedures etc.	1
11.	Modern innovative approaches for development of hybrids and varieties for yield, adaptability, stability, biotic and abiotic stress tolerance and quality (physical, chemical, nutritional) of Kharif crops.	1
12.	Seed production technology in self pollinated, cross pollinated and vegetatively propagated crops of Kharif.	1
13.	Hybrid seed production technology in maize, rice, sorghum, pearl millet and pigeopea etc.	1
14	Ideotype concept with example of Kharif crops.	1
15	Biofortified and climate resilient Kharif crop varieties for future.	1
	Total Credit Hours	**15**

Lecture Schedule – Practical

S. No.	Topic	Cr. Hrs.
1.	Botany, floral biology, emasculation and hybridization techniques in Rice and Maize.	1
2.	Botany, floral biology, emasculation and hybridization techniques in Sorghum, Pearl millet and Ragi.	1

3.	Botany, floral biology, emasculation and hybridization techniques in Urd, Mung, Mothbean, Cowpea, Clusterbean and Pigeonpea.	1
4.	Botany, floral biology, emasculation and hybridization techniques in Soybean, Sesame and Groundnut.	1
5.	Botany, floral biology, emasculation and hybridization techniques in Cotton and Castor.	1
6.	Botany, floral biology, emasculation and hybridization techniques in Jute and Tobacco.	
7.	Botany, floral biology, emasculation and hybridization techniques in Brinjal and Okra.	1
8.	Botany, floral biology, emasculation and hybridization techniques in Cucurbitaceous crops.	
9.	Maintenance breeding of different kharif crops.	1
10.	Handling of germplasm and segregating populations by different methods like pedigree, bulk and single seed decent methods in Kharif crops.	1
11.	Study of field techniques for seed production and hybrid seeds production in Kharif crops.	1
12.	Estimation of heterosis, inbreeding depression and heritability.	1
13.	Study of quality characters in Kharif crops.	
14.	Donor parents for different characters in Kharif crops.	1
15.	Visit to AICRP breeding/seed production plots of Kharif crops in National Agricultural Institutes	1
	Total Credit Hours	**15**

Suggested Readings:

1. Breeding field crops -I by V.L. Chopra
2. Genetic improvement of field crops by C.B. Singh and D. Khare
3. Genetics and Breeding of Pulse crops by D.P. Singh
4. Vegetable breeding – Principles and Practices by Hari Har Ram
5. Breeding field crops by D.A. Sleper and J.M. Poehlman
6. Plant Breeding –theory and practice by S.K. Gupta
7. Breeding Asian field crops by J.M. Poehlman and D.N. Barthakur
8. Practical manuals on Crop Improvement I (Kharif crops) by Rajendra Kumar Yadav. Publisher: S.K. Kataria & Sons.
9. फसल उन्नयन - 1 (खरीफ फसलें), ओंकार सिंह, रामा पब्लिशिंग हाउस

Courses for B.Sc. (Hons.) Pt-III, Agriculture

As Per VI Deans Report

B.Sc. (Hons.) Agriculture Pt-III, Semester – VI

S. No.	Course No.	Course Title	Discipline	Credit Hours
1	AGECON 321	Agricultural Finance and Cooperation	Agril. Economics	2 (1+1)
2	AGRON 321	Dry Land Agriculture and Watershed Management	Agronomy	2 (1+1)
3	HORT 321	Ornamental Crops, MAPs and Landscaping	Horticulture	2 (1+1)
4	GPB 321	Crop Improvement (Rabi Crops)- II	GPB	2 (1+1)
5	GPB 322	Fundamentals of Seed Science & Technology	GPB	2 (1+1)
6	BIOTECH 321	Fundamentals of Agri Biotechnology	Plant Biotechnology	3 (2+1)
7	BIOCHEM 321	Essentials of Plant Biochemistry	Biochemistry	3 (2+1)
8	PPATH 321	Agricultural Microbiology and Phyto - Remediation	Plant pathology	2 (1+1)
9	STAT 321	Basic and Applied Agrilcultural Statistics	Agril. Statistics	3 (2+1)
10	NCC 321/ NSS 321	NCC /NSS (to be continued)	NCC/NSS	1 (0+1) NG
			Total	**21 (12+9)**

AGECON 321 Agricultural Finance & Cooperation 2 (1+1)

Objectives

To impart knowledge on issues related to lending to priority sector credit management and financial risk management

Theory

Agricultural Finance-meaning, scope and significance, credit needs and its role in Indian agriculture. Agricultural credit: meaning, definition, need, classification. Credit analysis: 3 R's, 5C's and 7 P's of credits. Sources of agricultural finance: institutional and non-institutional sources, commercial banks, social control and nationalization of commercial banks. Micro financing including KCC. Lead bank scheme, RRBs, Scale of finance and unit cost. An introduction to higher financing institutions – RBI, NABARD, ADB, IMF, world bank, Insurance and Credit Guarantee Corporation of India. Cost of credit. Recent development in agricultural credit. Preparation and analysis of financial statements – Balance Sheet and Income Statement. Basic guidelines for preparation of project reports. Bank norms – SWOT analysis. Agricultural Cooperation – Meaning, brief history of cooperative development in India, objectives, principles of cooperation, significance of cooperatives in Indian agriculture. Agricultural Cooperation in India- credit, marketing, consumer and multi-purpose cooperatives, farmers' service cooperative societies, processing cooperatives, farming cooperatives, cooperative warehousing; role of ICA, NCUI, NCDC, NAFED. Crop insurance: its scope, significance and limitations and the potential of the newly launched 'Pradhan Mantri Fasal Bima Yojana' (Prime Minister's Crop Insurance Scheme). Successful cooperative systems in Gujarat (AMUL), Tamil Nadu (Aavin), Karnataka (Nandini), Maharashtra and Punjab.

Practical

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

Lecture Schedule- Theory

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

Lecture Schedule – Practical

S. No.	Topic	Cr. Hrs.
1.	Analysis of progress and performance of cooperatives using published data.	1
2.	To study the progress and performance of commercial banks and RRBs using published data.	1
3.	Visit to a commercial bank, cooperative bank and cooperative society to acquire first-hand knowledge of their management, schemes and procedures.	2

4.	Estimation of credit requirement of farm business – A case study.	1
5.	Preparation and analysis of balance sheet – A case study.	1
6.	Preparation and analysis of income statement–A case study.	1
7.	Different types of repayment plans.	1
8.	Techno-economic parameters for preparation of projects.	2
9.	Appraisal of a loan proposal –A case study.	2
10.	Preparation of Bankable projects for various agricultural products and its value-added products	1
11.	Seminar on selected topics	2
	Total Credit Hours	**15**

Suggested Readings:

1. Gittinger, J. P. 1982. Economic Analysis of Agricultural Projects. The Johns Hopkins Univ. Press.
2. Reddy, S. S. and Ram, P. R. 1996. Agricultural Finance and Management. Oxford & IBH.
3. प्रसाद, कृषि वित्त एवं सहकारिता.
4. एन. एल. अगरवाल, १९७७, भारतीय कृषि का अर्थतंत्र, राजस्थान हिंदी ग्रन्थ अकादमी, जयपुर

AGRON 321 Dryland Agriculture and Watershed Management 2 (1+1)

Objectives

1. To learn about characteristics and conditions of dryland agriculture
2. To gain knowledge about drought and its mitigation
3. To impart knowledge on water harvesting and watershed management

Theory

Dryland agriculture: Introduction, types and characteristics; History of dryland agriculture in India; Problems and prospects of dryland agriculture in India; Soil and climatic conditions prevalent in dryland areas; Length of growing period (LGP) and soil moisture availability (SMA) and its impact on crop and cropping system; Soil and water conservation techniques; Drought: types, effect of water deficit on physio- morphological characteristics of the plants; Crop adaptation and mitigation to drought; Water harvesting: importance, its techniques, Efficient utilization of water through soil and crop management practices; Crops and cropping systems in dryland areas; Management of crops in dryland areas; Contingent crop planning for aberrant weather conditions; Concept, history, objective, principles and components of watershed management, factors affecting watershed management. Log term rainfall analysis in relation to simple mathematical models and forecasting the weather abnormalities; Alternate land use system location; regional and crop specific dryland principles and practices for profitable and sustainable dry land farming and allied enterprises.

Practical

Studies on climate classification, studies on rainfall pattern in rainfed areas of the country and pattern of onset and withdrawal of monsoons. Calculation of length of growing period (LGP) and soil moisture availability (SMA). Studies on cropping pattern of different rainfed areas in the country and demarcation of rainfed area on map of India. Interpretation of meteorological data and scheduling of supplemental irrigation on the basis of evapo-transpiration demand of crops. Critical analysis of rainfall and possible drought period in the country. Effective rainfall and its calculation. Studies on cultural practices for mitigating moisture stress including mechanical and agronomic measure. Soil moisture determination under different land situations, Importance of seed priming to mitigate drought. Assessment of meteorological drought. Characterization and delineation of model watershed. Seed treatment, viz., seed hardening and seed priming techniques for all the agricultural crops Field demonstration on soil and moisture conservation measures. Field demonstration on construction of water harvesting structures. Visit to rainfed research station/watershed.

Lecture Schedule- Theory

S.No.	Topic	Cr. Hrs.
1.	Dryland agriculture- Definition, types, characteristics, history and its importance in India with particular to references Rajasthan	1
2.	Problems and prospects of dryland agriculture in India	1
3.	Length of growing period (LGP) and soil moisture availability (SMA) and its impact on crop and cropping system	1
4.	Soil and water conservation techniques	1
5.	Drought: Types, effect of water deficit on physio-morphological characteristics of the plants	1
6.	Crop adaptation and mitigation to drought	1
7.	Water harvesting: Importance and its techniques	1
8.	Efficient utilization of water through soil and crop management practices in dry farming areas	1
9.	Concept, history, objective, principles and components of watershed management	1
10.	Factors affecting watershed management	1
11.	Log term rainfall analysis in relation to simple mathematical models and forecasting the weather abnormalities	1
12.	Crops and cropping systems and management of crops in dryland areas	1
13.	Contingent crop planning for aberrant weather conditions	1
14.	Alternate cropping and land use strategies for dryland agriculture	1
15.	Regional and crop specific dry land principles and practices for profitable and sustainable dryland farming and allied enterprises	1
	Total Credit Hours	**15**

Lecture Schedule – Practical

S.No.	Topic	Cr. Hrs.
1.	Studies on climate classification	1
2.	Studies on rainfall pattern in rainfed areas of the country and pattern of onset and withdrawal of monsoons	1
3.	Calculation of length of growing period (LGP) and soil moisture availability (SMA)	1
4.	Studies on cropping pattern of different rainfed areas in the country and demarcation of rainfed area on map of India	1
5.	Interpretation of meteorological data and scheduling of supplemental irrigation on the basis of evapo-transpiration demand of crops	1
6.	Critical analysis of rainfall and estimation of moisture index, aridity	1

	index and possible drought period in the country	
7.	Effective rainfall and its calculation	1
8.	Studies on cultural practices for mitigating moisture stress including mechanical and agronomic measure	1
9.	Soil moisture determination under different land situations	1
10.	Importance of seed priming to mitigate drought	1
11.	Characterization and delineation of model watershed	1
12.	Mulching and its effects on soil moistures conservation	1
13.	Seed treatment, viz., seed hardening and seed priming techniques for all the agricultural crops	1
14.	Field demonstration on soil and moisture conservation measures and construction of water harvesting structures	1
15.	Visit to dryland research station/watershed.	1
	Total Credit Hours	**15**

Suggested Readings:

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

HORT 321 Ornamental Crops, MAPs and Landscaping 2 (1+1)

Objectives

1. To educate in detail about origin, area, climate, soil, improved varieties production technology of flowers and MAPs
2. To educate about concept, designing principles and components of landscaping
3. To educate about the physiological disorders of commercial flowers
4. To educate about the post-harvest management and value addition in flower crops and MAP

Theory

Importance and scope of ornamental crops, medicinal & aromatic plants and landscaping. Production technology of ashwagandha, isabgol, aloe, periwinkle, glory lily, costus, etc. Production technology of plants like lemongrass, citronella, vetiver and palmarosa etc., Brief concept of home landscaping, Carpet bedding, Topiary, Bonsai, Lawn, flower arrangement, Herbaceous Border, Hedge, Edge etc.; Principles of landscaping; Landscape uses of trees, shrubs and climbers, Production technology of important cut flowers like rose, gerbera and orchids; Production technology of gladiolus, tuberose, lilium chrysanthemum and carnation; Package of practices for loose flowers like marigold and jasmine under open conditions; Processing and value addition important ornamental crops; Processing and value addition of MAPs produce.

Practical

Identification MAPs and Ornamental plants (trees, shrubs, climbers, seasonal flower and house plants). Propagation of MAP, Bed preparation and planting of MAP; Nursery bed preparation and sowing of seasonal flower seeds; Propagation of ornamental plants by terminal/herbaceous cuttings; Propagation of Anthurium and orchids; Propagation of bougainvillea; Planting of gerbera suckers; Gladiolus corms; Establishment and maintenance of lawn; Preparation of flower preservatives and their use in extending the vase life of cut flowers; Training and pruning of ornamental plants and raising of hedge and edge; Planning and layout of garden.

Lecture Schedule- Theory

S. No.	Topic	Cr. Hrs.
1.	Importance and scope of ornamental crops, medicinal & aromatic plants and landscaping.	1
2.	Production technology of ashwagandha, isabgol, aloe, periwinkle, glory lily, costus, etc.	2
3.	Production technology of plants like lemongrass, citronella, vetiver	1

	and palmarosa etc.	
4.	Brief concept of home landscaping, Carpet bedding, Topiary, Bonsai.	1
5.	Lawn, flower arrangement, Herbaceous Border, Hedge, Edge etc.	1
6.	Principles of landscaping; Landscape uses of trees, shrubs and climbers.	1
7.	Production technology of important cut flowers like rose, gerbera and orchids.	2
8.	Production technology of gladiolus, tuberose, lilium chrysanthemum and carnation.	2
9.	Package of practices for loose flowers like marigold and jasmine under open conditions.	2
10.	Processing and value addition important ornamental crops.	1
11.	Processing and value addition of MAPs produce.	1
	Total Credit Hours	**15**

Lecture Schedule – Practical

S. No.	Topic	Cr. Hrs.
1.	Identification MAPs and Ornamental plants (trees, shrubs, climbers, seasonal flower and house plants).	2
2.	Propagation of MAP.	1
3.	Bed preparation and planting of MAP.	2
4.	Nursery bed preparation and sowing of seasonal flower seeds.	1
5.	Propagation of ornamental plants by terminal/herbaceous cuttings.	1
6.	Propagation of Anthurium and orchids.	1
7.	Propagation of bougainvillea.	1
8.	Planting of gerbera suckers and Gladiolus corms.	1
9.	Establishment and maintenance of lawn.	1
10.	Preparation of flower preservatives and their use in extending the vase life of cut flowers.	1
11.	Training and pruning of ornamental plants.	1
12.	Raising of hedge and edge.	1
13.	Planning and layout of garden.	1
	Total Credit Hours	**15**

Suggested Readings:

1. A. K. Tiwari and R. Kumar, Fundamentals of ornamental horticulture and landscape gardening (2012) New India
2. Arora, J.S., Introductory Ornamental Horticulture (2006) Kalyani Publishers

3. Atal, E. K. and Kapur, B., Cultivation and Utilization of Medicinal and Aromatic plants (1982) CSIR, New Delhi
4. Azhar Ali Farooqui and Sreeramu, B.S., Cultivation of medicinal and aromatic plants (2001) United Press Limited
5. Bimaldas Chowdhury and Balai Lal Jana Flowering Garden trees (2014) Pointer publishers, Jaipur
6. Bose, T.K. Malti, R.G. Dhua, R.S. & Das, P., Floriculture and Landscaping (2004) Nayaprakash
7. Bose, T.K. and Mukherjee, D., Gardening in India (2004) Oxford & IBH Publishers
8. Chadha, K.L. and Chaudhary, B., Ornamental Horticulture in India (1986) ICAR
9. H.S. Grewal and Parminder Singh, Landscape designing and ornamental plants (2014)
10. K.V. Peter, Ornamental plants (2009) New India publishing agency
11. R.K. Roy, Fundamentals of Garden designing (2013) New India publishing agency
12. Rajesh Srivastava, Fundamentals of Garden designing (2014) Agrotech press, Jaipur
13. Randhawa, G.S. Amitabha Mukhopadhyay, Floriculture in India (2004) Allied Publishers Pvt. Ltd., New Delhi
14. Gupta, R.D., Agrotechniques and Uses of Medicinal Plants Astral
15. Vermeulin, N., Complete Encyclopedia of House Plants: A comprehensive cross reference guide to popular house plant Rebo
16. G.S. Randhawa and Mukopadhyay., Floriculture in India by ICAR
17. N. Kumar, Abdul Khadder, P. Rangaswamy, I. Irulappam. , Introduction to spices, plantation crops, medicinal and aromatic plants.
18. Anil K. Singh and Anjana Sisodia., Textbook of floriculture and landscaping.
19. T.K. Bose, Commercial flowers (Vol 1 and 2)

GPB 321 Crop Improvement-II (Rabi Crops) 2 (1+1)

Objectives:

1. To provide knowledge about self-pollinated and cross-pollinated rabi crops
2. To learn about origin and distribution of rabi crops
3. To design breeding objectives of major rabi crops
4. To impart information on different crop varieties for rabi season

Theory

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

Practical

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

Lecture Schedule- Theory

S. No.	Topic	Cr. Hrs.
1.	Crop improvement aspects in Wheat, Barley and Oat as mentioned in the syllabus such as centers of origin, distribution of species, wild relatives, floral biology, breeding objectives and procedures etc	1
2.	Crop improvement aspects in Fenugreek and Fennel, as mentioned in the syllabus such as centers of origin, distribution of species, wild relatives, floral biology, breeding objectives and procedures etc	1
3.	Crop improvement aspects in Coriander and Cumin as mentioned in the syllabus such as centers of origin, distribution of species, wild relatives, floral biology, breeding objectives and procedures etc	1
4.	Crop improvement aspects in Chickpea as mentioned in the syllabus such as centers of origin, distribution of species, wild relatives, floral	1

	biology, breeding objectives and procedures etc	
5.	Crop improvement aspects in Lentil and field pea as mentioned in the syllabus such as centers of origin, distribution of species, wild relatives, floral biology, breeding objectives and procedures etc	1
6.	Crop improvement aspects in Rapeseed and mustard as mentioned in the syllabus such as centers of origin, distribution of species, wild relatives, floral biology, breeding objectives and procedures etc	1
7.	Crop improvement aspects in Sunflower as mentioned in the syllabus such as centers of origin, distribution of species, wild relatives, floral biology, breeding objectives and procedures etc	1
8.	Crop improvement aspects in Berseem and potato as mentioned in the syllabus such as centers of origin, distribution of species, wild relatives, floral biology, breeding objectives and procedures etc	1
9.	Crop improvement aspects in Sugarcane as mentioned in the syllabus such as centers of origin, distribution of species, wild relatives, floral biology, breeding objectives and procedures etc	1
10.	Crop improvement aspects in Chilli, tomato and onion as mentioned in the syllabus such as centers of origin, distribution of species, wild relatives, floral biology, breeding objectives and procedures etc	1
11.	Modern innovative approaches for development of hybrids and varieties for yield, adaptability, stability, biotic and abiotic stress tolerance and quality (physical, chemical, nutritional) in Rabi crops.	1
12.	Seed production technology in self pollinated, cross pollinated and vegetatively propagated crops of Rabi.	1
13.	Hybrid seed production technology in wheat, rapeseed and mustard etc.	1
14.	Ideotype concept with example of Rabi crops	1
15.	Biofortified and climate resilient Rabi crop varieties for future.	1
	Total Credit Hours	**15**

Lecture Schedule – Practical

S. No.	Topic	Cr. Hrs.
1.	Botany, floral biology, emasculation and hybridization techniques in Wheat, Oat and Barley.	1
2.	Botany, floral biology, emasculation and hybridization techniques in Fenugreek, Fennel, Coriander and Cumin.	1
3.	Botany, floral biology, emasculation and hybridization techniques in Coriander and Cumin.	1
4.	Botany, floral biology, emasculation and hybridization techniques in Chickpea, Lentil and Field pea.	1
5.	Botany, floral biology, emasculation and hybridization techniques in Rapeseed and mustard.	1

6.	Botany, floral biology, emasculation and hybridization techniques in Sunflower and Potato.	1
7.	Botany, floral biology, emasculation and hybridization techniques in Berseem and Sugarcane.	1
8.	Botany, floral biology, emasculation and hybridization techniques in Tomato, Chilli and Onion.	1
9.	Maintenance breeding of different Rabi crops.	1
10.	Handling of germplasm and segregating populations by different methods like pedigree, bulk and single seed decent methods.	1
11.	Study of field techniques for seed production and hybrid seeds production in Rabi crops.	1
12.	Estimation of heterosis, inbreeding depression and heritability.	1
13.	Study of quality characters in Rabi crops.	1
14.	Donor parents for different characters in Rabi crops.	1
15.	Visit to AICRP breeding/seed production plots of Rabi crops in National Agricultural Institutes.	1
	Total Credit Hours	**15**

Suggested Readings:

1. Breeding Field Crops -I by V.L. Chopra
2. Genetic Improvement of Field Crops by C.B. Singh and D. Khare
3. Genetics and Breeding of Pulse crops by D.P. Singh
4. Vegetable Breeding – Principles and Practices by Hari Har Ram
5. Breeding Field Crops by D.A. Sleper and J.M. Poehlman
6. Plant Breeding –Theory and practice by S.K. Gupta
7. Breeding Asian field Crops by J.M. Poehlman and D.N. Barthakur
8. Practical Manuals on Crop Improvement I (Rabi crops) by Rajendra Kumar Yadav
9. फसल उन्नयन - II (रबी फसलें), ओंकार सिंह, रामा पब्लिशिंग हाउस

GPB 322 Fundamentals of Seed Science and Technology 2 (1+1)

Objectives

1. To impart basic and fundamental knowledge on principles and practices seed science and technology
2. To impart practical skills on scientific seed production and post-harvest quality management

Theory

Introduction to seed technology, definition and importance; Seed quality- definition, characteristics of good quality seed; Causes of deterioration of varietal purity and assessment of genetic purity, different classes of seed. Foundation and certified seed production of important cereals, millets, pulses, fibre crops, seed spices and oilseed crops, field inspection- importance and procedures; Post-harvest seed quality management; seed processing procedures, seed drying; Seed treatment, its importance, method of application and seed packing; seed storage - general principles, stages and factors affecting seed longevity during storage; Seed health management during storage. Seed Certification and legislation; Seed Act and Seed Act enforcement, duties and powers of seed inspector, offences and penalties. Seeds Control Order 1983, basics of seed quality testing; New Seed Bill 2019; Seed quality enhancement techniques.

Practical

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

Lecture Schedule- Theory

S. No.	Topic	Cr. Hrs.
1.	Introduction to seed technology, definition and importance. Seed quality: Definition and characteristics of good quality seeds.	1
2.	Causes of deterioration in varietal purity and assessment of genetic purity	1
3.	Overview of different seed classes: Breeder, Foundation, Certified, and Truthfully Labeled Seeds	1
4.	Foundation and certified seed production of wheat, barley, maize and pearl millet: Procedures and standards	1
5.	Foundation and certified seed production of greengram, blackgram, chickpea, groundnut, sesame, mustard: Procedures and standards	1

6.	Foundation and certified seed production of cotton, jute, fenugreek and fennel: Procedures and standards	1
7.	Field inspection: Importance and procedures for maintaining seed quality	1
8.	Seed processing procedures: Cleaning, grading, and conditioning	1
9.	Seed drying: Principles, methods, and equipment used	1
10.	Seed treatment: Importance, methods of application, and packaging techniques.	1
11.	General principles of seed storage, stages and factors affecting seed longevity.	1
12.	Seed health issues and management techniques during storage	1
13.	Seed Certification process and its importance	1
14.	Seed Act and Seed Act enforcement: Duties and powers of seed inspectors, Offences and penalties under the Seed Act, Seeds Control Order, 1983, Overview of the New Seed Bill, 2019	1
15.	Basics of seed quality testing and seed quality enhancement techniques	1
	Total Credit Hours	**15**

Lecture Schedule – Practical

S. No.	Topic	Cr. Hrs.
1.	Study the external and internal structure of seeds of monocot and dicot plants	1
2.	Seed Sampling Techniques	1
3.	Physical Purity Analysis	1
4.	Measure seed moisture using different methods	1
5.	Germination Test	1
6.	Seed and seedling vigour test	1
7.	Seed Viability Test	1
8.	Verify genetic purity through grow-out tests	1
9.	Criteria for Field Inspection for seed certification	1
10.	Seed health testing using blotter and agar plate methods	1
11.	Visit to Seed Production Farm	1
12.	Visit to Seed Testing Laboratory	1
13.	Visit to Seed Processing Plant	1
14.	Seed production technologies in important crops of the region.	2
	Total Credit Hours	**15**

Suggested Readings:

1. Agarwal, R.L. 1995. Seed Technology (2nd edition). Oxford & IBH Publishing Co. Pvt. Ltd. New Delhi, India.
2. Khare, D. and Bhale, M.S. 2019. Seed Technology (2nd revised & enlarged edn), Scientific Publishers, ISBN: 978-81-72338-84-8, New Pali Road, P.O. Box 91, Jodhpur, India
3. Vanangamudi, K. 2014. Seed Technology (An illustrated book), New India Publishing Agency, New Delhi, India.
4. Bhojwani, S.S. and Bhatnagar, S.P. 1999. The Embryology of Angiosperm. Vikas Publ
5. McDonald, M.B. Jr and Copeland, L.O. 1997. Seed Production: Principles and Practices. Chapman & Hall.
6. Tunwar, N.S. and Singh, S.N. 1988. Indian Minimum Seed Certification Standards. CSCB, Ministry of Agriculture, New Delhi.
7. हरवेन्द्र सिंह तौमर 2016 बीज प्रोद्योगिकी, अमन पब्लिशिंग हाउस, मेरठ (उ.प्र.)
8. आर.के. सिंह 2018 बीज प्रोद्योगिकी, कल्याणी प्रकाशन, न्यू दिल्ली
9. फूलचंद गुप्ता और रतन लाल अग्रवाल 2014 बीज कार्यिकी एवम बीज परीक्षण, प्रकाशन निदेशालय, गो. ब. पन्त कृषि एवम प्रोद्योगिकी, उतराखंड

BIOTECH-321 Fundamentals of Agri Biotechnology 3 (2+1)

Objectives

To familiarize the students with the fundamental principles of biotechnology, various developments in biotechnology and its potential applications

Theory

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

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

Introduction to recombinant DNA technology: DNA modifying enzymes and vectors; plant genetic transformation – physical (Gene gun method), chemical (PEG mediated) and Agrobacterium-mediated gene transfer methods; Importance of transgenics and genome editing; biosafety. Introduction to various molecular markers: RFLP, RAPD, SSR, SNP etc.; Marker-assisted breeding in crop improvement.

Practical

Introduction to Plant Tissue Culture Laboratory; Good Laboratory Practices; Media Preparation and sterilization; Glassware sterilization; Micropropagation; Isolation of Plant genomic DNA; PCR amplification of DNA; Gel electrophoresis of amplified DNA; Visit to tissue culture units /biotech labs.

Lecture Schedule- Theory

S. No.	Topic	Cr. Hrs.
1	Introduction to Plant Tissue Culture and Genetic Engineering: History; Cellular totipotency and cytodifferentiation	1
2	Callus culture, Single-cell/suspension culture and their applications; Organogenesis and somatic embryogenesis	1
3	Somaclonal variation and its use in crop improvement	1
4	Embryo rescue technique and its significance in hybrid development; In vitro fertilization, ovule culture and its significance in hybrid development	2
5	Protoplast isolation, culture and regeneration; Somatic hybridization (somatic hybrids and cybrids) and its application in crop improvement	2
6	Anther and pollen culture for haploid production; Development of disease-free (virus free) plants through apical meristem culture	1
7	Micropropagation technique for the generation of quality planting material	2
9	Synthetic seeds and its applications	1
10	National certification and Quality management of TC plants	1
11	Secondary metabolite production, in-vitro germplasm conservation	1
12	Introduction to Molecular Biology: DNA structure, structure and function; RNA, types and function	1
13	Central Dogma- DNA replication, transcription and translation	3
14	Structure of prokaryotic and eukaryotic gene; Genetic code	2
15	Lac Operon concept	1
16	Nucleic acid hybridization; Polymerase chain reactionand its applications	1
17	DNA sequencing – Sanger method	1
18	Introduction to recombinant DNA technology: DNA modifying enzymes and vectors	1
19	Plant genetic transformation – physical (Gene gun method), chemical (PEG mediated) and Agrobacterium-mediated gene transfer methods	1
20	Importance of transgenics and genome editing	2
21	Biosafety	1
22	Introduction to various molecular markers: RFLP, RAPD, SSR, SNP etc.; Marker-assisted breeding in crop improvement	3
	Total Credit Hours	**30**

Lecture Schedule – Practical

S. No.	Topic	Cr. Hrs.
1	Introduction to Plant Tissue Culture Laboratory	1
2	Good Laboratory Practices	1
3	Glassware sterilization	1
4	Media Preparation and sterilization	2
5	Micropropagation	4
6	Restriction digestion of plasmid DNA and agarose gel electrophoresis	2
7	Isolation of Plant genomic DNA and Quantification of DNA	2
8	PCR amplification of DNA and Gel electrophoresis of amplified DNA	1
9	Visit to tissue culture units /biotech labs	1
	Total Credit Hours	**15**

Suggested Readings:

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

BIOCHEM 321 Essentials of Plant Biochemistry 3 (2+1)

Objective

To impart the fundamental knowledge on structure and function of cellular components, Bimolecular and the biological processes in plants.

Theory

Biochemistry – Introduction and importance, Properties of water, pH and buffer, plant cell and its components. Bio-molecules – Structure, classification, properties and function of carbohydrates, amino acids, proteins, lipids and nucleic acids. Vitamins – physiological and metabolic role. Enzymes: General properties; Classification; Mechanism of action; Michaelis and Menten and Line Weaver Burk equation and plots; Introduction to allosteric enzymes, use of enzymes. Metabolic energy and its generation – Metabolism – Basic concepts, Glycolysis, Citric acid Cycle, Glyoxylate pathway, Pentose phosphate pathway, oxidative phosphorylation, Fatty acid oxidation. Biosynthetic Pathways –Photosynthesis, Gluconeogenesis, nitrogen fixation, nitrate assimilation, fatty acid and starch formation. Regulation of metabolic pathways. Introduction to secondary metabolites and their significance.

Practical

Preparation of standard solutions and reagents, Preparation of buffers and determination of pH, Qualitative tests of carbohydrates and amino acids, Quantitative estimation of soluble sugars / starch, Estimation of protein by Kjeldhal method and Lowry's method, Preparation of mineral solution from ash, Estimation of fat by Soxhlet method, Determination of acid value/peroxide value, Estimation of ascorbic acid, Estimation of total phenolics.

Lecture Schedule: Theory

S. No.	Topic	Cr. Hrs.
1	Biochemistry – Introduction and importance	1
2	Properties of water, pH and buffer	1
3	Plant cell and its components.	1
4	Carbohydrates; Structure, classification, properties and function.	1
5	Amino acids; Structure, classification, properties and function.	1
6	Proteins; Structure, classification, properties and function.	1
7	Lipids; Structure, classification, properties and function.	1
8	Nucleic acids; Structure, classification, properties and function.	1
9	Vitamins – General properties and Classification	1
10	Vitamins -Physiological and metabolic role.	1
11	Enzymes: General properties; Classification	1

12	Enzymes: Mechanism of action; Michaelis and Menten and Line Weaver Burk equation and plots	1
13	Introduction to allosteric enzymes.	1
14	Use of enzymes.	1
15	Metabolic energy and its generation – Metabolism – Basic concepts	1
16	Glycolysis	1
17	Citric acid Cycle, Glyoxylate pathway	2
18	Pentose phosphate pathway	1
19	Oxidative phosphorylation	1
20	Fatty acid oxidation.	1
21	Biosynthetic Pathways –Photosynthesis	1
22	Gluconeogenesis.	1
23	Nitrogen fixation, nitrate assimilation	2
24	Fatty acid and starch formation.	1
25	Regulation of metabolic pathways.	2
26	Introduction to secondary metabolites and their significance.	2
	Total Credit Hours	**30**

Lecture Schedule – Practical

S. No.	Topic	Cr. Hrs.
1	Preparation of standard solutions and reagents.	1
2	Preparation of buffers and determination of pH	1
3	Qualitative tests of carbohydrates.	1
4	Qualitative tests of amino acids.	1
5	Quantitative estimation of soluble sugars/starch	1
6	Estimation of protein by Kjeldhal method.	2
7	Estimation of protein by Lowry's method.	2
8	Preparation of mineral solution from ash.	1
9	Estimation of fat by Soxhlet method.	1
10	Determination of acid value/peroxide value	1
11	Estimation of ascorbic acid.	1
12	Estimation of total phenolics	2
	Total Credit Hours	**30**

Suggested reading:

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

PPATH 321 Agricultural Microbiology and Phyto-remediation 2(1+1)

Objectives

1. To get an introduction to microbiology with specific focus on its significance in agriculture science
2. To get acquainted with the bacterial structure and the function of the different bacterial components
3. To get highlights on different fields of microbiology
4. To get highlights on the bioremediation of polluted soils using microbial mediators and phytoremediation
5. To get a concept of biological control and the role of biopesticides in plant disease management.

Theory

Introduction to Microbiology: Definition, applied areas of Microbiology and Importance of Microbiology. History of Microbiology: Discovery of microorganisms, Spontaneous generation theory, Germ theory of diseases, Immunization, fermentation and origin of life. Bacteria: cell structure, chemoautotrophy, photoautotrophy, growth. Bacterial genetics: Genetic recombination- transformation, conjugation and transduction, genetic engineering. Soil Microbiology: Nutrient mineralization and transformation, Air Microbiology: Phyllosphere microflora, Phylloplane microflora, microflora of floral parts etc. Biological control: Microbial biopesticides for plant disease management. Concepts of rhizosphere microbiology- Rhizodeposits -biochemical nature, release mechanism in rhizosphere, function, Carbon flow in rhizosphere, Rhizosphere microbiome- residents and their roles. Potential of plant growth promoting rhizobacteria (PGPR) and endophytes on soil health and sustainability. Bioremediation of polluted soils using microbial mediators. Phytoremediation of polluted soils

Practical

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

Lecture Schedule: Theory

S.No.	Topic	Cr. Hrs.
1	Introduction to Microbiology: Definition, applied areas of Microbiology and Importance of Microbiology. History of Microbiology: Discovery of microorganisms, Spontaneous generation theory, Germ theory of diseases, Immunization, fermentation, and origin of life.	3
2	Bacteria: cell structure, chemoautotrophy, photo autotrophy, growth. Bacterial genetics: Genetic recombination- transformation, conjugation and transduction, genetic engineering.	2
3	Soil Microbiology: Nutrient mineralization and transformation, Air Microbiology: Phyllosphere microflora, Phylloplane microflora, microflora of floral parts etc.	2
4	Biological control: Microbial biopesticides for plant disease management	2
5	Concepts of rhizosphere microbiology- Rhizodeposits -biochemical nature, release mechanism in rhizosphere, function, Carbon flow in rhizosphere, Rhizosphere microbiome- residents and their roles.	2
6	Potential of plant growth promoting rhizobacteria (PGPR) and endophytes on soil health and sustainability.	2
7	Bioremediation of polluted soils using microbial mediators. Phytoremediation of polluted soils	2
	Total Credit Hours	**15**

Lecture Schedule – Practical

S.No.	Topic	Cr. Hrs.
1	Study of the microscope; Acquaintance with laboratory material and equipment; Microscopic observation of different groups of microorganisms: moulds (Fungi)	3
2	Direct staining of bacteria by crystal violet; Negative or indirect staining of bacteria by nigrosin; Gram staining of bacteria	2
3	Study of phyllosphere and rhizosphere microflora	2
4	Measurement of microorganisms	2
5	Preparation of culture media; Isolation and purification of rhizospheric microbes	2
6	Isolation and purification of N-fixers; Isolation and purification of Nutrient solubilizers;	2
7	Isolation and purification of Endophytes.	2
	Total Credit Hours	**15**

Suggested Readings:

1. Avdesh Partap Singh. 2020. Introductory Microbiology. Kalyani Publishers.
2. Dubey, H.C. 2007. A Textbook of Fungi, Bacteria and Viruses. Vikas Publishing House Ltd., New Delhi – 10014
3. Mukherjee, N. and Ghosh, T. 2004. Agricultural Microbiology. Kalyani Publishers, Calcutta
4. Pareek. R.P and Navneet Pareek. 2019. Agriculture Microbiology. Scientific Publishers.
5. Pelczar, M.J., Chan, E.C.S. and Kreig, N.R. 2002. Microbiology. 5th Edition, Tata McGraw- Hill, New Delhi.
6. Prescott, L. M. 2002. Microbiology 5th Edition. McGraw-Hill Inc, US
7. Rangaswami, G. and Bagyaraj, D. J. 2005. Agricultural Microbiology. Prentice-Hall of India Pvt. Ltd., New Delhi.
8. Salyers, A. A. and Whitt, D. D. 2001. Microbiology: diversity, disease, and the environment. Fitzgerald Science Press, Inc.
9. Singh R.S. 2013. Introduction to Principles of Plant Pathology. Oxford and IBH Pub. Co.
10. Verma, J.P. 1998. The Bacteria. Malhotra Publ. House, New Delhi.

STAT 321 Basic and Applied Agricultural Statistics 3 (2+1)

Objective:

To provide an idea on statistical concepts of both descriptive and inference Statistics which will be useful to do statistical analysis.

Theory

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

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

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

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

Probability Theory & Distibutions. Introduction to Probability. Basic Terminologies. Classical Probability-Definition and Limitations. Empirical Probability- Definition and Limitations. Axiomatic Probability. Addition and Multiplication Theorem (without proof). Conditional Probability. Independent Events. Simple Problems based on Probability. Definition of Random Variable. Discrete and Continuous Random Variable. Binomial and Poisson distribution, Normal Distribution- Definition, Prob. Distribution, Mean and Variance. Assumptions of Normal Distribution. Normal Probability Curve.

Correlation and Regression. Definition of Correlation. Scatter Diagram. Karl Pearson's Coefficient of Correlation. Types of Correlation Coefficient. Properties of Correlation Coefficient. Definition of Linear Regression. Regression Equations. Regression Coefficients. Properties of Regression Coefficients. Tests of Significance. Definition. Null and Alternative Hypothesis. Type I and Type II Error. Critical Region and Level of Significance. One Tailed and Two Tailed Tests. Test Statistic. One Sample, Two Sample and Paired t-test with Examples. F-test for Variance. ANOVA and Experimental Designs. Definition of ANOVA. Assignable and Non-assignable Factors. Analysis of One-way and Two-way Classified Data. Sampling Theory. Introduction. Definition of Population, Sample, Parameter and Statistic. Sampling Vs Complete Enumeration. Sampling Methods. Simple Random Sampling with Replacement and without Replacement. Use of Random Number Table.

Practical

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

Lecture Schedule - Theory

S.No.	Topic	Cr. Hrs.
1	Introduction to Statistics and its Applications in Agriculture, Types of Data. Scales of measurements of Data. Summarization of Data	1
2	Classification of Data, Methods of Classification, Frequency Distribution, Definition of Grouped and Ungrouped Data. Definition of Class Interval Width of CI, Types of Frequency Distribution.	1
3	Diagrammatic Presentation of Data. Bar Diagrams – Simple, Multiple, Sub-divided and Percentage Bar Diagrams. Pie-diagram. Graphical Presentation of Data – Histogram, Frequency Polygon and Ogives.	2
4	Measures of Central Tendency. Requisites for an Ideal Measure of Central Tendency. Different Types of Measure. Arithmetic Mean– Definition, Properties, Merits, Demerits and Uses. A.M. (examples) for Grouped and Ungrouped Data. Step-deviation Method.	2
5	Weighted Mean. Definition of Geometric Mean and Harmonic Mean. Relationship between A.M., G.M. and H.M. Median- Definition, Merits, Demerits and Uses. Graphical Location of Median.	1
6	Mode- Definition, Merits, Demerits and Uses. Graphical Location of	1

	Mode. Relationship between Mean, Median and Mode.	
7	Measures of Dispersion. Characteristics for an Ideal Measure of Dispersion. Different Types of Measures of Dispersions. Definition of Range, Interquartile Range, Quartile Deviation and Mean Deviation.	1
8	Standard Deviation- Definition, Properties. S.D. and Variance for Grouped and Ungrouped Data. Variance of Combined Series. Coefficients of Dispersions. Co-efficient of Variation.	1
9	Measures of Skewness and Kurtosis. Definition of Symmetrical Distribution. Definition of Skewness, Measures of Skewness. Definition of Kurtosis. Measure of Kurtosis. Relationship between Mean, Median and Mode for Symmetrical and Skewed Distribution.	1
10	Probability Theory and Introduction to Probability. Basic Terminologies. Classical Probability-Definition and Limitations. Empirical Probability- Definition and Limitations. Axiomatic Probability.	2
11	Addition and Multiplication Theorem (without proof). Conditional Probability. Independent Events. Simple Problems based on Probability.	1
12	Definition of Random Variable. Discrete and Continuous Random Variable.	1
13	Binomial, Poisson and Normal Distribution - Definition, Prob. Distribution, Mean and Variance. Normal Probability Curve.	2
14	Correlation and Regression. Definition of Correlation. Scatter Diagram. Karl Pearson's Coefficient of Correlation. Types of Correlation Coefficient. Properties of Correlation Coefficient	2
15	Definition of Linear Regression. Regression Equations. Regression Coefficients. Properties of Regression Coefficients.	2
16	Tests of Significance. Definition. Null and Alternative Hypothesis. Type I and Type II Error. Critical Region and Level of Significance.	1
17	One Tailed and Two Tailed Tests. Test Statistic. One Sample, Two Sample and Paired t-test with Examples.	2
18	F-test for Variance. ANOVA and Experimental Designs. Definition of ANOVA. Assignable and Non-assignable Factors.	2
19	Analysis of One-way and Two-way classified data	2
20	Sampling Theory. Introduction. Definition of Population, Sample, Parameter and Statistic. Sampling Vs Complete Enumeration.	1
21	Sampling Methods. Simple Random Sampling with Replacement and without Replacement. Use of Random Number Table.	1
	Total Credit Hours	**30**

Lecture Schedule – Practical

S.No.	Topic	Cr. Hrs.
1	Diagrammatic and Graphical representation of data.	2
2	Calculation of A.M., Median and Mode (Ungrouped and Grouped data).	2
3	Calculation of S.D. and C.V. (Ungrouped and Grouped data).	1
4	Fitting of Binomial and Poisson distribution	1
5	Correlation and Regression analysis.	2
6	Application of t-test (one sample, two sample independent and dependent).	2
7	Analysis of variance one-way and two-way classification.	2
8	Completely Randomized Design	1
9	Randomized Block Design	1
10	Selection of random sample using simple random sampling	1
	Total Credit Hours	**15**

Suggested Readings:

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

Courses for B.Sc. (Hons.) Pt-IV, Agriculture

As Per VI Deans Report

B.Sc. (Hons.) Agriculture Pt-IV, Semester – VII

(Only Elective Courses of 20 credit hours)

Initially the following elective courses are suggested:

S. No.	Course No.	Course Title	Discipline	Credit Hours
1	SOIL 411	Management of Natural Resources	Soil Science	4 (3+1)
2	HORT 411	Landscape Gardening	Horticulture	3 (2+1)
3	HORT 412	Post Harvest Management & Value Addition of Horticultural Crops	Horticulture	2 (1+1)
4	ENT 411	Bio-Pesticides & Biofertilizers	Entomology/ Plant Pathology	4 (3+1)
5	ENT 412	Insect Ecology & Principles of Integrated Pest Management	Entomology	2 (1+1)
6	PPATH 411	Epidemiology & Integrated Disease Management	Plant Pathology	2 (1+1)
7	BIOTECH 411	Techniques in Plant Biotechnology	Plant Biotech. / GPB	3 (2+1)
			Total	**20 (13+07)**

Note: A list of elective courses is also mentioned below option courses, which can be run as per the feasibility or availability of the resource person or facilities, but in no case should they exceed 20 credit hours. If any elective course other than the above is run at the college level, then it has to be informed to the COE and the Dean & Faculty at the initiation of the VII semester.

SOIL 411 Management of Natural Resources 4 (3+1)

(Elective Course)

Objectives

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

Theory

Introduction to Natural Resource Bases: Concept of resource, classification of natural resources. Factors influencing resource availability, distribution and uses. Inter-relationships among different types of natural resources. Concern on productivity issues. Ecological, social and economic dimension of resource management. Land resources: Land as a resource. Dry land, land use classification, land degradation, man induced landslides, soil erosion and desertification. Landscape impact analysis, wetland ecology and management. Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems. Water ecology and management. Energy resources: Growing energy needs, renewable and non- renewable energy sources, use of alternate energy sources. Resource Management Paradigms: Resource management the evolution and history of resource management paradigms. Resource conflicts: Resource extraction, access and control system. Approaches in Resource Management: Ecological approach; economic approach; ethnological approach; implications of the approaches; integrated resource management strategies. Introduction to soil and water conservation and causes of soil erosion., Definition and agents of soil erosion, water erosion - Forms of water erosion, gully classification and control measures. Soil loss estimation by universal soil loss equation-Soil loss measurement techniques. Principles of erosion control - Introduction to contouring, strip cropping. Contour bund – Graded bund and bench terracing. Wind erosion - Mechanics of wind erosion, types of soil movement -Principles of wind erosion control and its control measures, Water harvesting techniques – Lining of ponds, tanks and canal systems.

Practical

Identifying natural resources and their utility. Practicing survey - Principles and educating to use pacing technique for measurement. Area calculations through chain survey - GPS demo fort racking and area measurement. Estimation of soil loss and calculation of erosion index. Leveling concepts and practical utility in agriculture. Preparation of contour maps. Concept of vegetative water ways and design of grassed water ways. Wind erosion and estimation process. Different irrigation pumps and their constructional differences. Farm

pond construction and its design aspects. Visit to nearby farm pond. Visit to an erosion site. Exposure to strip cropping/contour bunding.

Lecture schedule: Theory

S. No.	Topic	Cr. Hrs.
1.	Introduction to Natural Resources: Concept of resources, classification of natural resources, factors influencing resource availability, distribution, and uses.	3
2.	Interrelationships of Natural Resources: Interrelationships among different types of natural resources, concerns on productivity issues, ecological, social, and economic dimensions.	3
3.	Land Resources: Land as a resource, dry land, land use classification, land degradation, man-induced landslides, soil erosion, desertification.	3
4.	Landscape Impact Analysis & Wetland Ecology: Landscape impact analysis, wetland ecology, and management.	2
5.	Water Resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams—benefits and problems.	3
6.	Water Ecology and Management: Water ecology and management.	1
7.	Energy Resources: Growing energy needs, renewable and non-renewable energy sources, use of alternate energy sources.	3
8.	Resource Management Paradigms: Resource Management Paradigms.	3
9.	Resource Conflicts: Resource extraction, access, and control systems	3
10.	Approaches in Resource Management: Ecological approach, economic approach, ethnological approach, implications of these approaches.	3
11.	Integrated Resource Management Strategies: Integrated resource management strategies.	1
12.	Introduction to Soil and Water Conservation: Introduction to soil and water conservation, causes of soil erosion, definition and agents of soil erosion.	3
13.	Forms of Water Erosion: Water erosion, types of water erosion, gully classification, and control measures.	3
14.	Soil Loss Estimation and Measurement: Soil loss estimation by universal soil loss equation, soil loss measurement techniques.	3
15.	Principles of Erosion Control: Principles of erosion control, contouring, strip cropping, contour bunds, graded bunds, bench terracing.	3
16.	Wind Erosion and Control Measures: Mechanics of wind erosion, types of soil movement, principles of wind erosion control, and control measures.	3

17.	Water Harvesting Techniques: Water harvesting techniques, lining of ponds, tanks, and canal systems.	2
	Total Credit Hours	**45**

Lecture Schedule – Practical

S.No.	Topic	Cr. Hrs.
1	Overview of natural resources, types, and their importance in agriculture.	1
2	Introduction to survey principles and techniques for measurement.	1
3	Techniques for using a chain survey for accurate area measurement.	1
4	Demonstration of GPS technology for tracking and area measurements.	1
5	Understanding soil erosion, and calculating the erosion index using different methods.	1
6	Introduction to leveling in agriculture, and its use in land preparation.	1
7	Understanding and preparing contour maps for land use planning.	1
8	Concept of vegetative waterways and how to design grassed waterways for erosion control.	1
9	Understanding the impact of wind erosion and how to estimate its effect.	1
10	Study of different types of irrigation pumps, their uses, and construction differences.	2
11	Design aspects, construction, and management of farm ponds for water conservation.	1
12	Farm Pond Site Visit-Practical exposure to an existing farm pond and its design features.	1
13	Visit to an erosion-prone site for hands-on understanding of erosion management.	1
14	Practical exposure to land use classification, techniques like strip cropping and contour bunding for erosion control.	1
	Total Credit Hours	**15**

Suggested Readings:

1. Sustainable Natural Resource Management by Danill R.Lynch.
2. Management of Natural Resource for Sustainable Development, by Vijay Singh Rathor and BS. Rathor, Daya Publishing House.
3. Managing Natural Resources: Focuson Land and Water.Ed.Harikesh N.Mishra.PHI, Learning,496p.
4. Management of Resources for Sustainable Development: Sushma Goel. The Orient Blackswan 284p.
5. Natural Resources: Their Conservation and Management by Arvind Rai Upadhyay. Aspiration Academy, 320p.
6. Natural Resource Management for Growth Development and Sustainability by Vasudeva Srishti Pal.Today & Tomorrows Printers and Publishers, 336p.

HORT 411 Landscape Gardening 3(2+1)

(Elective Course)

Objectives

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

Theory

Importance and scope of landscaping. Principles of landscaping, garden styles, Terrace gardening, vertical gardening, garden components, adornments, rockery water garden, walk-paths, bridges, other constructed features etc. Ornamental trees: selection, propagation, planting schemes, canopy management. Hedges, shrubbery border and herbaceous border: selection, propagation, planting schemes, architecture; Climber importance, selection, propagation, planting. Annuals: selection, propagation, planting scheme. Other garden plants: palms, ferns, grasses and cacti succulents. Pot plants: selection, arrangement, management. Bio- aesthetic planning: definition, need, planning. Landscaping of urban and rural areas, Peri-urban landscaping, Landscaping of schools, public places like bus station, railway station, townships, river banks, hospitals, play grounds, airports, industries, institutions, Bonsai principles and management. Lawn: establishment and maintenance. CAD application.

Practical

Identification of trees, shrubs, annuals, pot plants; Identification of tools and implements used in landscape design. Propagation of trees, shrubs and annuals; Care and maintenance of plants, potting and repotting; 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).; Designing of conservatory and lathe house. Use of computer software. Visit to important gardens /parks /institutes.

Lecture Schedule-Theory

S. No.	Topic	Cr. Hrs.
1.	Importance and scope of landscaping.	2
2.	Principles of landscaping and garden styles.	2
3.	Terrace gardening and vertical gardening.	2
4.	garden components, adornments, rockery water garden, walk-paths, bridges, other constructed features etc.	2

5.	Ornamental trees: selection, propagation, planting schemes, canopy management.	2
6.	Hedges, shrubbery border and herbaceous border: selection, propagation, planting schemes, architecture.	2
7.	Climber importance, selection, propagation, planting.	2
8.	Annuals: selection, propagation, planting scheme.	2
9.	Other garden plants: palms, ferns, grasses and cacti succulents.	2
10.	Pot plants: selection, arrangement, management.	2
11.	Bio- aesthetic planning: definition, need, planning.	2
12.	Landscaping of urban and rural areas, Peri-urban landscaping.	2
13.	Landscaping of schools, public places like bus station, railway station, townships, river banks, hospitals, play grounds, airports, industries, institutions.	2
14.	Bonsai principles and management.	2
15.	Lawn: establishment and maintenance.	1
16.	CAD application.	1
	Total Credit Hours	**30**

Lecture Schedule – Practical

S. No.	Topic	Cr. Hrs.
1.	Identification of trees, shrubs, annuals and pot plants.	2
2.	Identification of tools and implements used in landscape design.	2
3.	Propagation of trees, shrubs and annuals.	1
4.	Care and maintenance of plants, potting and repotting.	1
5.	Training and pruning of plants for special effects.	2
6.	Lawn establishment and maintenance.	1
7.	Layout of formal gardens, informal gardens.	2
8.	Special type of gardens (sunken garden, terrace garden, rock garden) and designing of conservatory and lathe house.	2
9.	Use of computer software.	1
10.	Visit to important gardens /parks /institutes.	1
	Total Credit Hours	**15**

Suggested Readings:

1. Anil K. Singh and Anjana Sisodia, Textbook of floriculture and landscaping
2. Y. Chandrasekhar and Hemla Naik B., 2020. Principles of Landscape Gardening: ICAR.
3. Rajaneesh Singh and Brijendra Kumar Singh. 2020, Introductory Ornamental Horticulture and Landscape Gardening: Bio-Green Books.

4. Pragnyashree Mishra and Bhimasen Naik. 2022. Principles of Landscape Architecture: New India Publishing Agency.
5. Sudhir Pradhan. 2018. Landscape Gardening: Scientific Publishers India.
6. A. K. Tiwari and R. Kumar, Fundamentals of ornamental horticulture and landscape gardening (2012) New India
7. Arora, J.S. Introductory Ornamental Horticulture (2006) Kalyani Publishers
8. Bose, T. K. Malti, R. G. Dhua, R.S. & Das, P. Floriculture and Landscaping (2004) Nayaprakash
9. Bose, T. K. and Mukherjee, D. Gardening in India (2004) Oxford & IBH Publishers
10. Chadha, K. L. and Chaudhary, B. Ornamental Horticulture in India (1986) ICAR
11. H. S. Grewal and Parminder Singh, Landscape designing and ornamental plants (2014)
12. K. V. Peter. Ornamental plants (2009) New India publishing agency
13. R. K. Roy, Fundamentals of Garden designing (2013) New India publishing agency
14. Rajesh Srivastava, Fundamentals of Garden designing (2014) Agrotech press, Jaipur

HORT 412 Post Harvest Management & Value Addition of Horticultural Crop 2 (1+1)

Theory

Importance of post-harvest processing of fruits and vegetables, extent and possible causes of post harvest losses; Pre- harvest factors affecting postharvest quality, maturity, ripening and changes occurring during ripening; Respiration and factors affecting respiration rate; Harvesting and field handling; Storage (ZECC, cold storage, CA, MA, and hypobaric); Value addition concept; Principles and methods of preservation; Intermediate moisture food- Jam, jelly, marmalade, preserve, candy - Concepts and Standards; Fermented and non-fermented beverages. Tomato products- Concepts and Standards; Drying/ Dehydration offruits and vegetables - Concept and methods, osmotic drying. Canning -- Concepts and Standards, packaging of products. FSSAI, FPO, HACCP.

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.

Lecture Schedule-Theory

S. No.	Topic	Cr. Hrs.
1.	Importance of post-harvest processing of fruits and vegetables.	1
2.	Extent and possible causes of post harvest losses.	1
3.	Pre- harvest factors affecting postharvest quality, maturity, ripening and changes occurring during ripening.	2
4.	Respiration and factors affecting respiration rate.	1
5.	Harvesting and field handling; Storage (ZECC, cold storage, CA, MA, and hypobaric).	2
6.	Value addition concept; Principles and methods of preservation.	1
7.	Intermediate moisture food- Jam, jelly, marmalade, preserve, candy - Concepts and Standards.	2
8.	Fermented and non-fermented beverages.	1
9.	Tomato products- Concepts and Standards.	1
10.	Drying/ Dehydration of fruits and vegetables - Concept and methods, osmotic drying.	1
11.	Canning -- Concepts and Standards, packaging of products.	1

12.	FSSAI, FPO, HACCP.	1
	Total Credit Hours	**15**

Lecture Schedule – Practical

S. No.	Topic	Cr. Hrs.
1.	Applications of different types of packaging, containers for shelf life extension.	2
2.	Effect of temperature on shelf life and quality of produce.	1
3.	Demonstration of chilling and freezing injury in vegetables and fruits.	2
4.	Extraction and preservation of pulps and juices.	2
5.	Preparation of jam and jelly.	1
6.	RTS, nectar, squash, osmotically dried products.	2
7.	Fruit bar and candy.	1
8.	Tomato products.	1
9.	Canned products.	1
10.	Quality evaluation of products - physico-chemical and sensory.	1
11.	Visit to processing unit/ industry.	1
	Total Credit Hours	**15**

Suggested Readings:

1. Battacharjee, S. K. and De, L. C., Post Harvest Technology of Flowers and Ornamentals Plants (2005) by Pointer Publisher.
2. Jacob John, P, A., Handbook on Post Harvest management of Fruits and vegetables (2008) by Daya Publishing House, Delhi.
3. Manoranjan, K and Sangita, S, Food Preservation & Processing (1996) by Kalyani Publishers.
4. Mitra, S.K, Post Harvest Physiology and Storage of Tropical and Sub- tropical Fruits (1997) by CAB International.
5. Saraswathy, S. et al., Post harvest Management of Horticultural Crops (2008) by Agribios.
6. Battacharjee, S. K. and De, L. C., Post Harvest Technology of Flowers and Ornamentals Plants (2005) Pointer Publisher
7. Jacob John, P. A., Handbook on Post Harvest management of Fruits and vegetables (2008) Daya Publishing House, Delhi
8. Manoranjan, K and Sangita, S. Food Preservation & Processing (1996) Kalyani Publishers
9. Mitra, S. K. Post Harvest Physiology and Storage of Tropical and Sub-tropical Fruits (1997) CAB International
10. Morris, T. N. Principles of Fruit Preservation (2006) Biotech Books, Delhi

11. Saraswathy, S. et. al. Post harvest Management of Horticultural Crops (2008) Agribios
12. Srivastava, R. P. & Sanjeev Kumar. Fruits and vegetable Preservation – Principles and Practice (2002) International Book Distributing Co., Lucknow140
13. Verma, L. R. and Joshi, V. K. Post Harvest Technology of Fruits and Vegetables Vol. I & II. (2000) Indus Publishing Co., New Delhi
14. Vijay, K. Text Book of Food Sciences and Technology (2001) ICAR
15. Mayani, Desai, Vagadia, Post Harvest Management of Horticultural crops Jaya Publishing House,
16. Ed. M.K. Jatav, et al. Good management Practices for Horticultural Crops NIPA
17. Sharma, Satish Post Harvest management & Processing of fruits & vegetables- Instant notes NIPA
18. Sharma, Satish, Post Harvest of Horticultural Crops- Practical manual Series Vol.2 NIPA
19. Rosa L.A. Fruit and Vegetable Phytochemicals: Chemistry, Nutritional Value and Stability BioGreen
20. Ryall, A. Handling, transportation and Storage of Fruits & Vegetables Vol.1 2nd Ed (Vegetables & Melons) Sci Int
21. Saini, R. Laboratory Manual of Analytical Techniques in Horticulture Agro Bot
22. Chavan, U. Nutritional Value and Health benefits from fruits, vegetable, nuts & spices. Daya Publishing House
23. Lal, S. Olive: Improvement, Production and Processing Astral
24. Bose, T. Ornamental Plants and Garden Design in Tropics and subtropics, Vol-2 sets Daya Publishing House
25. Sasikaumar, R. Post Harvest Technology of fruits and Vegetables Biotech

ENT 411 Bio-pesticides and Biofertilizers 4 (3+1)

Objective

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

Theory

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

Biofertilizers - Introduction, status and scope. Structure and characteristics feature of bacterial biofertilizers – Azospirillum, Azotobacter, Bacillus, Pseudomonas, Rhizobium and Frankia; Cynobacterial bio fertilizers- Anabaena, Nostoc, Hapalosiphon and fungal biofertilizers – AM mycorrhiza and ectomycorhiza. Nitrogen fixation –Free living and symbiotic nitrogen fixation. Mechanism of phosphate solubilisation and phosphate mobilization, K solubilisation. Production Technology: Strain selection, sterilization, growth and fermentation, mass production of carrier based and liquid biofertilizers. FCO specifications and quality control of biofertilizers. Application technology for seeds, seedlings, tubers, sets etc. Biofertilizers- Storage, shelf life, quality control and marketing. Factors influencing the efficiency of biofertilizers.

Practical

To study about mass production technology of important biopesticides: NPV, Metarahyzium, Beauveria, Bt. Etc. Identification of important botanicals. Visit to biopesticide lab. working 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 Trichoderma, 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.

Lecture Schedule – Theory

S.No.	Topic	Cr. Hrs.
1	History and concept of biopesticides.	2
2	Importance, scope and potential of biopesticide.	2
3	Definitions, concepts and classification of biopesticides viz. pathogen, botanical pesticides, and bio-rationales.	4
4	Botanicals and their uses.	2
5	Mass production technology of bio-pesticides.	5
6	Virulence, pathogenicity and symptoms of entomopathogenic pathogens and nematodes.	2
7	Methods of application of biopesticides.	1
8	Methods of quality control and Techniques of biopesticides.	3
9	Impediments and limitation in production and use of biopesticide.	1
10	Biofertilizers - Introduction, status and scope.	1
11	Structure and characteristic features of bacterial biofertilizers- Azospirillum, Azotobacter, Bacillus, Pseudomonas, Rhizobium and Frankia	4
12	Structure and characteristic features of Cynobacterial biofertilizers- Anabaena, Nostoc	1
13	Structure and characteristic features of Hapalosiphon and fungal biofertilizers- AM mycorrhiza and ectomycorhiza.	3
14	Nitrogen fixation- Free living and symbiotic nitrogen fixation.	2
15	Mechanism of phosphate solubilization and phosphate mobilization, K solubilization.	4
16	Production technology: Strain selection, sterilization, growth and fermentation, mass production of carrier based and liquid biofertiizers.	4
17	FCO specifications and quality control of biofertilizers.	1
18	Application technology for seeds, seedlings, tubers, sets etc.	1
19	Biofertilizers- Storage, shelf life, quality control and marketing.	1
20	Factors influencing the efficacy of biofertilizers.	1
	Total Credit Hours	**45**

Lecture Schedule – Practical

S.No.	Topic	Cr. Hrs.
1	To study about mass production technology of important biopesticides: NPV, Metarahyzium, Beauveria, Bt. Etc.	2
2	Identification of important botanicals. Preparation of plant extract: neem, karanj, etc.	2

3	Visit to biopesticide laboratory nearby area.	1
4	Field visit to explore naturally infected cadavers.	1
5	Identification of entomopathogenic entities in field condition.	1
6	Quality control of biopesticides.	1
7	Isolation and purification of important biopesticides Trichoderma, Azospirillum, Azotobacter, Rhizobium P-solubilizers and cyanobacteria and its production.	3
8	Mass multiplication and inoculums production of biofertilizers	2
9	Isolation of AM fungi -Wet sieving method and sucrose gradient method.	1
10	Mass production of AM inoculants.	1
	Total Credit Hours	**15**

Suggested Reading:

1. Baker, E.F. and James, R.C. 1982. Biological Control of Plant Pathogens. American Phytopathological Society
2. Boland, G.J. and David, L.1998. Plant Microbe Interactions and Biological Control. Kuykendall Marel Dekker, INC.
3. Borkar, S.G. 2015. Beneficial Microbes as Biofertilizers and its Production Technology.
4. Cincholkar, S.B. and Mukherji, K.G. 2007. Biological Control of Plant Diseases. Hawarth Food and Agricultural Products.
5. Gnanamanickam, S.S. 2002. Biological Control of Crop Disease. Kuykendall Marel Dekker, INC.
6. Nehra, Sampat. Biofertilizers for Sustainable Agriculture. Aavishkar Publishers, Jaipur, India.
7. Singh, Awani Kr. Handbook of Microbial Biofertilizers. Agrotech Press, Jaipur, India.
8. Singh, S.P. and Hussanini, S.S. 1998. Biological Suppression of Plant Disease, Phytoparasitic Nematodes and Weeds. Precision Fototype Services, Bengaluru.
9. Trivedi, P.C. Fungal Biopesticides and VAM applications. Pointer Publishers, Jaipur, India.
10. Dhaliwal, GS & Koul O. 2007. Biopesticides and Pest Management. Kalyani Publ., New Delhi.
11. Mukherjee, N. and Ghosh T. 1998. Agricultural Microbiology, Kalyani Publishers, New Delhi

ENT 412 Insect Ecology & Principles of Integrated Pest Management 2 (1+1)

Objective

1. To provide knowledge on insect ecology, environment and its component, agroecosystem.
2. To provide knowledge on history, importance, concept and principles of IPM.

Theory

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. Agroecosystem. Categories of insect pests. IPM: Introduction, history, importance, concept, principles and limitations of IPM. Economic decision levels. Survey, surveillance and forecasting of insect pests. Assessment of insect pest population. Tools/ methods of IPM: Cultural, mechanical, physical, legislative, host plant resistance, biological, and chemical control. Importance, hazards and limitations of chemical control. Classification, toxicity and formulations of insecticides. Insecticides Act 1968-Important provisions. Symptoms of poisoning, first aid and antidotes. Recent methods of pest control- repellents, antifeedants, hormones and pheromones, attractants, gamma radiation and genetic control.

Practical

Sampling techniques for estimation of insect population and damage. Monitoring of insect population through light and pheromone traps. Insecticides and their formulations. Pesticide appliances and their maintenance. Calculations on the doses of insecticides and application techniques. Safe use of pesticides. Identification of biocontrol agents. Mass production of NPV and fungi.

Lecture Schedule – Theory

S.No.	Topic	Cr. Hrs.
1	Insect Ecology: Introduction, Environment and its components.	1
2	Effect of abiotic factors–temperature, moisture, humidity, rainfall, light, atmospheric pressure and air currents.	1
3	Effect of biotic factors – food competition, natural and environmental resistance. Agroecosystem.	1
4	IPM: Categories of pests. Introduction, history, importance, concept, principles and limitations of IPM.	1
5	Economic decision levels.	1
6	Survey, surveillance and forecasting of insect pests. Assessment of insect pest population.	1

7	Tools/ methods of IPM: Cultural, mechanical, physical, legislative, host plant resistance, biological.	3
8	Chemical control: Importance, hazards and limitations. Classification, toxicity and formulations of insecticides.	2
9	Insecticides Act 1968-Important provisions.	1
10	Application techniques of insecticides, symptoms of poisoning, first aid and antidotes.	1
11	Recent methods of pest control- repellents, antifeedants, hormones and pheromones, attractants, gamma radiation and genetic control.	2
	Total Credit Hours	**15**

Lecture Schedule – Practical

S.No.	Topic	Cr. Hrs.
1	Sampling techniques for estimation of insect population and damage.	2
2	Monitoring of insect population through light and pheromone traps	1
3	Insecticides and their formulations.	2
4	Pesticide appliances: Handling and their maintenance of small kitchen garden sprayer, hand compression sprayer, knapsack sprayer, foot sprayer, power sprayer, hand rotary duster, power duster	4
5	Calculations on the doses of insecticides	1
6	Application techniques of insecticides.	1
7	Safe use of pesticides	1
8	Identification of biocontrol agents	1
9	Mass production of NPV and fungi	2
	Total Credit Hours	**15**

Suggested Reading:

1. Yazdani G.S. and Agarwal M.L. 1979. Elements of Insect Ecology. Naroji publishing house, New Delhi.
2. Atwal, A.S. and Dhaliwal, G.S. 2002. Agricultural Pests of South Asia and Their Management, Kalyani Publishers, New Delhi.
3. David, B.V. and Ramamurthy, V.V. 2016. Elements of Economic Entomology, 8th Ed. Popular Book Depot, Chennai.
4. Dhaliwal, G.S. and Ramesh Arora 2001. Integrated Pest Management. Concepts and Approaches. Kalyani publishers, New Delhi.
5. Mathur and Upadhyay, 2005. A Text Book of Entomology, Aman Publishing House, Meerut.
6. Srivastava, K.P. 2004. A Text Book of Entomology, Vol.I, Kalyani Publishers, New Delhi.
7. Dhawan, A.K. Integrated Pest Management, Scientic Publishers, Jodhpur.

PPATH 411 Epidemiology & Integrated Disease Management 2(1+1)

Theory

Epidemiology and factors affecting disease development. Diagnosis of plant diseases. Disease triangle and tetrahedron. Forecasting of plant diseases.

Principles of plant disease management. Methods of integrated disease management: Host plant resistance, cultural, physical, legislative, biological and chemical control. IDM modules for wheat, rice, sugarcane, cotton, groundnut, mustard, potato, cumin, citrus and chickpea. Integrated disease management in protected cultivation. Nature, chemical combination, general classification of fungicides and antibiotics. Safety issues in fungicidal uses. Pest risk analysis.

Practical

Diagnosis of plant diseases. Methods of plant disease measurement. Assessment of crop yield losses. Identification of bio-control agents. Mass multiplication of Trichoderma, Pseudomonas and Bacillus. Methods of pesticide application and their safe use. Study of structural details of sprayers, dusters and seed dressers. Awareness campaign at farmer's fields.

Lecture Schedule: Theory

S.No.	Topic	Cr. Hrs.
1	Epidemiology and factors affecting disease development	2
2	Diagnosis of plant diseases	1
3	Disease triangle and tetrahedron	1
4	Forecasting of plant diseases	1
5	Principles of plant disease management	1
6	Methods of integrated disease management	1
7	Host plant resistance, cultural, physical, legislative, biological and chemical control.	2
8	IDM modules for wheat, rice, sugarcane, cotton, groundnut, mustard, potato, cumin, citrus and chickpea	2
9	Integrated disease management in protected cultivation.	1
10	Nature, chemical combination, general classification of fungicides and antibiotics	2
11	Safety issues in fungicidal uses. Pest risk analysis	1
	Total Credit Hours	**15**

Lecture Schedule – Practical

S.No.	Topic	Cr. Hrs.
1	Diagnosis of plant diseases	2
2	Methods of plant disease measurement. Assessment of crop yield losses	2
3	Identification of bio-control agents	2
4	Mass multiplication of Trichoderma, Pseudomonas and Bacillus.	3
5	Methods of pesticide application and their safe use	2
6	Study of structural details of sprayers, dusters and seed dressers.	2
7	Awareness campaign at farmer's fields	2
	Total Credit Hours	**15**

Suggested Readings:

1. G.N. Agrios Plant Pathology. 5th Edition. 2020. Acad. Press. ISBN: 9780128224298 Page Count: 898
2. H.C. Dube. (2014). Modern Plant Pathology. 3rd Edition. AGROBIOS (INDIA), Jodhpur, ISBN: (10): 81-7754-353-9, 978-817754-3537.
3. H.C. Dube. (2016). A Text Book of Fungi Bacteria and Virus. 3rd Edition.Student Edition Jodhpur ISBN (10): 81-88826-38-3, 978-81-88826-38-4 Page count:270.
4. Mehrotra, R.S. and Aggarwal, A. 2007. Plant Pathology. 7th edn. Tata Mc Graw Hill Publ. Co. Ltd.
5. Nene, Y.L. and Thapliyal, P.N. 1993. Fungicides in Plant Disease Control. 3rd Ed. Oxford & IBH, New Delhi.
6. R. S. Singh. 2024. An introduction to principles of plant pathology. 11th Edition. India: CBS Publishers & Distributors. ISBN: 9788120417465, 8120417461. Page count:458
7. Singh R.S. 2013. Introduction to Principles of Plant Pathology. Oxford and IBH Pub. Co.

BIOTECH-411 Techniques in Plant Biotechnology 3 (2+1)

Objectives

To familiarize the students with the techniques of tissue culture and other biotechnological tools, various developments in biotechnology and its potential applications

Theory

Concepts of Plant Biotechnology: History of Plant Tissue Culture and Plant Genetic Engineering; Scope and importance in Crop Improvement. Totipotency and Morphogenesis, Nutritional requirements of in-vitro cultures; Techniques of In-vitro cultures, Micropropagation, Anther culture, Pollen culture, Ovule culture, Embryo culture, Test tube fertilization, Endosperm culture, Factors affecting above in-vitro culture. Applications and Achievements; Somatic embryogenesis and synthetic seed production technology. Protoplast isolation, Culture, and Fusion; Products of somatic hybrids and cybrids, Applications in crop improvement. Genetic engineering; Restriction enzymes; Vectors for gene transfer, DNA amplification, Gene cloning, Direct and indirect method of gene transfer. Transgenic plants and their applications. Blotting techniques, DNA finger printing, DNA based markers: RFLP, AFLP, RAPD, SSR and DNA Probes, Mapping QTL: Future prospects. MAS, and its application in crop improvement.

Practical

Requirements for Plant Tissue Culture Laboratory; Techniques in Plant Tissue Culture; Media components and preparations; Sterilization techniques and Inoculation of various explants; Aseptic manipulation of various explants; Callus induction and Plant Regeneration; Micro propagation of important crops; Anther, Embryo and Endosperm culture; Hardening / Acclimatization of regenerated plants; Somatic embryogenesis and synthetic seed production; Isolation of protoplast; Demonstration of Culturing of protoplast; Demonstration of Isolation of DNA; Demonstration of Gene transfer techniques, Demonstration of Confirmation of Genetic transformation; Demonstration of gel-electrophoresis techniques & PCR.

Lecture Schedule – Theory

S. No.	Topic	Cr Hrs
1	Concepts of Plant Biotechnology: History of Plant Tissue Culture and Plant Genetic Engineering, Scope and importance in Crop Improvement	1
2	Totipotency and Morphogenesis; Nutritional requirements of *in-vitro* cultures	1
3	Techniques of *In-vitro* cultures- Anther culture, Pollen culture, Ovule culture, Embryo culture, Test tube fertilization, Endosperm culture, Factors affecting above *in-vitro* cultures. Applications and Achievements	4
4	Micropropagation	3
5	Protoplast isolation, culture and regeneration; Somatic hybridization (somatic hybrids and cybrids) and its application in crop improvement	2
6	Somatic embryogenesis	1
7	Micropropagation technique for the generation of quality planting material	2
9	Protoplast isolation, Culture, and Fusion; Products of somatic hybrids and cybrids, Applications in crop improvement.	2
10	Synthetic seed production technology	1
11	Genetic engineering; Restriction enzymes	1
12	Direct and indirect method of gene transfer	1
13	Vectors for gene transfer	2
14	Gene cloning	1
15	Transgenic plants and their applications	1
16	Blotting techniques DNA finger printing, ,.	1
17	DNA finger printing	1
18	DNA based markers: RFLP, AFLP, RAPD, SSR and DNA Probes	2
19	Mapping QTL: Future prospects	1
20	MAS, and its application in crop improvement	2
Total		**30**

Lecture Schedule – Practical

S. No.	Topic	Cr. Hrs.
1	Requirements for Plant Tissue Culture Laboratory	1
2	Techniques in Plant Tissue Culture	1
3	Media components and preparations	1
4	Sterilization techniques and Inoculation of various explants	1
5	Aseptic manipulation of various explants	2
6	Callus induction and Plant Regeneration	1

7	Micro propagation of important crops	2
8	Anther, Embryo and Endosperm culture	1
9	Hardening / Acclimatization of regenerated plants	1
10	Somatic embryogenesis and synthetic seed production	1
11	Demonstration of Isolation and Culturing of protoplast	1
12	Demonstration of Isolation of DNA	1
13	Demonstration of gel-electrophoresis techniques & PCR	1
	Total Credit Hours	**15**

Suggested Readings:

1. Singh, B D, 2004. Biotechnology Expanding Horizons 2nd Edn. Kalyani Publishers, New Delhi. Gupta, P.K., 2015. Elements of Biotechnology 2nd Edn. Rastogi and Co., Meerut.
2. Razdan M K, 2014. Introduction to plant Tissue Culture 2nd Edn. Science Publishers, inc. USA. Gautam V K, 2005. Agricultural Biotechnology. Sublime Publications
3. Thomar, R.S., Parakhia, M.V., Patel, S.V. and Golakia, B.A., 2010. Molecular markers and Plant biotechnology, New Publishers, New Delhi.
4. Purohit, S.S., 2004. A Laboratory Manual of Plant Biotechnology 2nd Edn. Agribios, India. Singh, B.D. 2012. Plant biotechnology. Kalyani publishers, Ludhiana
5. Bilgrami, K.S. and Pandey, A.K.1992. Introduction to biotechnology. CBS Pub. New Delhi Gupta, P.K. 1994. Elements of biotechnology. Rastogi Pub. Meerut.
6. Chahal, G.S. and Gosal, S.S.2003. Principles and procedures of plant approaches breeding Biotechnological and conventional. Narosa Publishing House, New Delhi

Other Elective Courses (Options)

S. No.	Course No.	Course Title	Discipline	Credit Hours
1	AGECON 411	Agri-Business Management	Agril. Economics	4 (3+1)
2	SOIL 412	Agrochemicals	Soil Science	4 (3+1)
3	EXT 411	Agricultural Journalism	Agril Extension	4 (3+1)
4	GPB 411	Commercial Plant Breeding	GPB	4 (3+1)
5	GPB 412	Micro-propagation Technologies	GPB/ Plant Biotechnology	4 (3+1)
6	GPB 413	Commercial Seed Production	GPB	4 (3+1)
7	PPATH 412	Bioformulation and Nanoformulation	Pl. Pathology	4 (3+1)
8	AGRON 411	Principles and Practices of Organic Farming and Conservation Agriculture	Agronomy	4 (3+1)
9	AGMET 411	System Simulation and Agroadvisory	Agril. Meteorology	4 (3+1)
10	AGMET 412	Climate Resilient Agriculture	Agril. Meteorology	4 (3+1)
11	HORT 413	Hi-tech Horticulture	Horticulture	4 (3+1)
12	HORT 414	Landscaping	Horticulture	4 (3+1)
13	HORT 415	Post Harvest Technology and Value Addition	Horticulture	4 (3+1)
14	HORT 416	Food Safety and Standards	Horticulture	4 (3+1)
15	AGENGG 411	Protected Cultivation	Agril. Engineering	4 (3+1)
16	AGENGG 412	Geoinformatics and Remote Sensing, Precision Farming	Agril. Engineering	4 (3+1)
17	BIOCHEM 411	Food Science and Nutrition	Biochemistry	4 (3+1)
18	BIOTECH 412	Biotechnology of Crop Improvement	GPB/Pl. Biotech.	4 (3+1)
19	LPM 411	Entrepreneurship Development Through Cattle, Buffalo and Goat Farming	LPM	3 (2+1)

AGECON 411, Agri-Business Management 4 (3+1)

Objectives

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

Theory

Transformation of agriculture into agribusiness, various stakeholders and components of agribusiness systems. Importance of agribusiness in the Indian economy and New Agricultural Policy. Distinctive features of Agribusiness Management: Importance and needs of agro-based industries. Classification of industries and types of agro based industries. Institutional arrangement, procedures to set up agro based industries. Constraints in establishing agro-based industries. Agri-value chain: Understanding primary and support activities and their linkages. Business environment: PEST and SWOT analysis. Management functions: Roles and activities, Organization culture. Planning, meaning, definition, types of plans. Purpose or mission, goals or objectives, Strategies, polices procedures, rules, programs and budget. Components of a business plan, Steps in planning and implementation. Organization staffing, directing and motivation. Ordering, leading, supervision, communications, control. Capital management and Financial management of Agribusiness. Financial statements and their importance. Marketing Management: Segmentation, targeting and positioning. Marketing mix and marketing strategies. Consumer behaviour analysis, Product Life Cycle (PLC). Sales and Distribution Management. Pricing policy, various pricing methods. Project Management definition, project cycle, identification, formulation, appraisal, implementation, monitoring and evaluation. Project Appraisal and evaluation techniques.

Practical

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

Lecture Schedule- Theory

S. No.	Topic	Cr. Hrs.
1.	Transformation of agriculture into agribusiness: Introduction	1
2.	Various stakeholders and components of agribusiness systems	2
3.	Importance of agribusiness in the Indian economy and New Agricultural Policy	2
4.	Distinctive features of Agribusiness Management: Importance and needs of agro-based industries	2
5.	Classification of industries and types of agro-based industries	2
6.	Institutional arrangement and procedures to set up agro-based industries	2
7.	Constraints in establishing agro-based industries	1
8.	Agri-value chain: Understanding primary and support activities and their linkages	3
9.	Business environment: Introduction to PEST analysis and application	1
10.	Business environment: SWOT analysis	1
11.	Management functions: Roles and activities overview	1
12.	Organization culture: Importance and impact	1
13.	Planning: Meaning and definition, Types of plans: Short-term and long-term plans,	2
14.	Purpose or mission, goals or objectives Strategies, policies, procedures, rules, programs, and budgets	2
15.	Components of a business plan, Steps in planning and implementation	1
16.	Organization staffing, directing and motivation, Ordering, leading, supervision, communications, control.	2
17.	Capital management and financial management in agribusiness	1
18.	Financial statements and their importance	2
19.	Marketing management: Segmentation, targeting, and positioning	2
20.	Marketing mix: Concept and components	1
21.	Marketing strategies: Overview and importance	1
22.	Consumer behaviour analysis: Factors and models	1
23.	Product Life Cycle (PLC): Stages and implications	1
24.	Sales and distribution management in agribusiness	1
25.	Pricing policy: Overview	2
26.	Various pricing methods: Analysis and application	1
27.	Project management: Definition and importance	2

28.	Project cycle: Stages and overview	1
29.	Project Appraisal and evaluation techniques.	3
	Total Credit Hours	**45**

Lecture Schedule – Practical

S. No.	Topic	Cr. Hrs.
1.	Study of agri-input markets: Overview of seed market	1
2.	Study of agri-input markets: Fertilizers and Pesticides	1
3.	Study of output markets: Grains market analysis, Flower markets and their potential	1
4.	Study of output markets: Fruits and vegetables markets	1
5.	Study of product market, retails trade, Commodity trading: Mechanisms and platforms	1
6.	Value-added products: Market opportunities and challenges	1
7.	Study of financing institutions: Cooperative structures, Commercial Banks and RRBs	2
8.	Agribusiness Finance Limited and NABARD	1
9.	Preparation of agribusiness projects and Feasibility reports	1
10.	Appraisal and evaluation techniques: Introduction to project analysis	2
11.	Case study of successful agro-based industries: Analysis Part 1	1
12.	Case study of successful agro-based industries: Analysis Part 2	1
13.	Trend and growth rate of price of agricultural commodities	1
	Total Credit Hours	**15**

Suggested Readings:

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

SOIL 412 Agrochemicals 4 (3+1)

Objectives

To impart knowledge on different classes of agrochemicals

Theory

An introduction to agrochemicals, their type and role in agriculture, effect on environment, soil, human and animal health, merits and demerits of their uses in agriculture, management of agrochemicals for sustainable agriculture. Herbicides -Major classes and important herbicides. Fate of herbicides. Fungicides- classification –Inorganic fungicides- 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 use. Introduction and classification and insecticides: inorganic and organic insecticides organochorine, Ogranophosphates, Carbamates, Synthetic pyrethriods Neonicotinoids, Biorationals. Insecticide Act and rules, Insecticides banned, with drawn and restricted use. Fate of insecticides in soil and plant. IGR Biopesticides, Reduced risk insecticides, Botanical, Plant and animal systemic insecticides their characteristics and uses. Fertilizers and their importance. Nitrogenous Fertilizers: Feed stocks and properties of ammonium sulfate, ammonium nitrate, calcium ammonium nitrate, ammonium sulphate nitrate, ammonium chloride, urea, sodium nitrate. Slow-release nitrogen fertilizers. Phosphatic Fertilizers: Feedstock and properties of single superphosphate, concentrated superphosphate, enriched superphosphate, nitric (or nitro) phosphate, ammonium phosphate, urea ammonium phosphate, ammonium phosphate sulphate, ammonium phosphate nitrate, ammonium polyphosphate, ammonium metaphosphate, preparation of bone meal and basic slag. Potassic Fertilizers: Natural sources of potash and properties of potassium chloride, potassium sulfate, and potassium nitrate. Mixed and Complex Fertilizers: Sources and compatibility of mixed and complex fertilizers. Preparation of major, secondary, and micronutrient mixtures. Properties of ammonium phosphates, nitro-phosphates, and NPK complexes, customized and speciality fertilizers. Fertilizer control order. Fertilizer logistic and marketing. Plant bio-pesticides for ecological agriculture, Bio-insect repellent.

Practical

Sampling of fertilizers and pesticides. Pesticides application technology to study about various pesticides appliances. Quick tests for identification of common fertilizers. Identification of anion and cation in fertilizer. Calculation of doses of insecticides to be used. To study and identify various formulations of insecticide available k in market. Estimation of nitrogen in Urea. Estimation of water soluble P2O5 and citrate soluble P_2O_5

in single super phosphate. Estimation of potassium in Muraite of Potash/ Sulphate of Potash by flame photometer. Estimation of sulphur content in sulphur fungicides. Visit of manufacturing factory/industry of fertilizer/ pesticide/ insecticide/ herbicide etc.

Lecture Schedule- Theory

S. No.	Topic	Cr. Hrs.
1.	Introduction to Agrochemicals: Introduction to agrochemicals, types, and roles in agriculture, effects on the environment, soil, human and animal health. Merits and demerits of agrochemicals in agriculture, Management of agrochemicals for sustainable agriculture.	3
2.	Herbicides: Major classes of herbicides and important herbicides. Fate of herbicides.	2
3.	Fungicides (Inorganic): Classification of fungicides. Mode of action of Bordeaux mixture and copper oxychloride.	2
4.	Fungicides (Organic and Systemic): Organic fungicides - Mode of action of Dithiocarbamates (Zineb and Maneb), and systemic fungicides (Benomyl, Carboxin, Oxycarboxin, Metalaxyl, Carbendazim) and their use.	4
5.	Insecticides: Introduction and classification of insecticides: Inorganic and organic (Organochlorine, Organophosphates, Carbamates, Synthetic Pyrethroids, Neonicotinoids, Biorationals).	4
6.	Insecticides - Regulations and Fate: Insecticide Act and Rules, banned and restricted insecticides. Fate of insecticides in soil and plant.	3
7.	Biopesticides and Reduced Risk Insecticides: IGR, biopesticides, reduced-risk insecticides, botanical, plant, and animal systemic insecticides—characteristics and uses.	4
8.	Fertilizers (Introduction): Importance of fertilizers in agriculture. Types of fertilizers.	1
9.	Nitrogenous Fertilizers: Feedstock and properties of ammonium sulfate, ammonium nitrate, calcium ammonium nitrate, ammonium sulphate nitrate, ammonium chloride, urea, sodium nitrate. Slow-release nitrogen fertilizers.	4
10.	Phosphatic Fertilizers: Feedstock and properties of single superphosphate, concentrated superphosphate, enriched superphosphate, nitric (or nitro) phosphate, ammonium phosphate, urea ammonium phosphate, ammonium phosphate sulphate, ammonium phosphate nitrate, ammonium polyphosphate, ammonium metaphosphate, preparation of bone meal and basic slag.	5
11.	Potassic Fertilizers: Natural sources of potash and properties of potassium chloride, potassium sulfate, and potassium nitrate.	2
12.	Mixed and Complex Fertilizers Sources and compatibility of mixed and complex fertilizers. Preparation of major, secondary and	5

	micronutrient mixtures. Properties of ammonium phosphates, nitrophosphates, and NPK complexes, customized and speciality fertilizers.	
13.	Fertilizer Control and Marketing: Fertilizer control order, logistics, and marketing of fertilizers.	3
14.	Plant Bio-pesticides for Ecological Agriculture: Plant bio-pesticides for ecological agriculture, bio-insect repellents.	3
	Total Credit Hours	**45**

Lecture Schedule – Practical

S. No.	Topic	Cr. Hrs.
1	Overview of fertilizers and pesticides. Introduction to their role and importance in agriculture.	1
2	Techniques and methods of sampling fertilizers and pesticides for analysis.	1
3	Study of various pesticide application appliances (sprayers, spreaders, etc.).	2
4	Methods for identifying common fertilizers using quick field tests.	1
5	Techniques for identifying anions and cations in fertilizers.	1
6	Calculation of correct insecticide doses based on application rates and crop area.	1
7	Identification and analysis of various insecticide formulations available in the market.	1
8	Laboratory estimation of nitrogen content in urea using standard methods.	1
9	Methodology for estimating water-soluble and citrate soluble P2O5 in single super phosphate.	2
10	Estimation of potassium content in Muriate of Potash (MOP) and Sulphate of Potash (SOP) using flame photometry.	2
11	Estimation of sulphur content in sulphur fungicides	1
12	Visit of manufacturing factory of fertilizer/ pesticide/ insecticide/ weedicide/ herbicide	1
	Total Credit Hours	**15**

Suggested Readings:

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

EXT 411 Agriculture Journalism 4 (3+1)

Objectives

To impart knowledge and skill in agricultural journalism

Theory

Journalism – Meaning, nature, importance, and types of journalism. Agricultural Journalism – Meaning, definition, principle, objectives, types, and scope. Similarities and difference between agricultural journalism and other types of journalism. Role of agricultural journalist, Training of agricultural journalist. Qualities of journalist, Role of journalist /journalism in agricultural development and development of newspaper and magazines readers. Newspaper and magazines as communication media: Characteristics, kinds and functions of newspaper and magazines, Characteristics of newspaper and magazines readers. Form, content, style and language of newspaper and magazines, Standard part of newspaper and magazines. The agricultural story: Types of Agriculture stories, subject matter of the agricultural story, structure of the agricultural story. Gathering farm information -Sources of farm information: abstracting from research and scientific materials, interviews, coverage of events. Other sources: electronic media, field study. Success stories- definition, nature, components, guidelines of writing a success story. Writing a news story difference between news and feature story, the principle of writing a news story, Inverted pyramid structure. Organizing the material, treatment of the story, writing the news lead and the body. Readability measure-readability ease score, automated readability index, gunning fog index, How to improve readability of articles and stories. Use of photograph in agricultural journalism- Basic principles of photography – composition, exposure, lens, light. Use of artwork (Graphs, charts maps, etc.). Writing the captions. Editorial mechanism: Copy reading, headline

and title writing. Proofreading: definition, signs and symbols of proofreading, level of proofreading, duties of a proof-reader. Layout – meaning, principles of layout and design.

Practical

Practice in writing an agricultural news story. Practice in writing an agricultural feature story. Covering agricultural events for the information collection. Practice in interviewing for the information collection. Abstracting stories from research and scientific materials and wire services. Selecting pictures and artwork for the agricultural story. Practice in editing, copy reading. Practice in headline and title writing. Practicing proof reading. Practice in lay outing of newspaper. Testing copy with a readability formula. Visit a publishing office.

Lecture Schedule- Theory

S.No.	Topic	Cr. Hrs.
1.	Journalism – Meaning, nature, importance, and types of journalism	3
2.	Agricultural Journalism – Meaning, definition, principle, objectives, types, and scope. Similarities and difference between agricultural journalism and other types of journalism. Role of agricultural journalist.	5
3.	Training of agricultural journalist. Qualities of journalist, Role of journalist /journalism in agricultural development and development of newspaper and magazines readers.	4
4.	Newspaper and magazines as communication media: Characteristics, kinds and functions of newspaper and magazines.	3
5.	Characteristics of newspaper and magazines readers. Form, content, style and language of newspaper and magazines, Standard part of newspaper and magazines	3
6.	The agricultural story: Types of Agriculture stories, subject matter of the agricultural story, structure of the agricultural story.	3
7.	Gathering farm information -Sources of farm information: abstracting from research and scientific materials, interviews, coverage of events. Other sources: electronic media, field study.	3
8.	Success stories- definition, nature, components, guidelines of writing a success story.	3
9.	Writing a news story difference between news and feature story, the principle of writing a news story, Inverted pyramid structure.	3
10	Organizing the material, treatment of the story, writing the news lead and the body.	3
11	Readability measure-readability ease score, automated readability index, gunning fog index, how to improve readability of articles and stories.	3
12	Use of photograph in agricultural journalism- Basic principles of photography – composition, exposure, lens, light. Use of artwork (Graphs, charts maps, etc.). Writing the captions. Editorial mechanism: Copy reading, headline and title writing.	5
13	Proofreading: definition, signs and symbols of proofreading, level of proofreading, duties of a proof-reader. Layout – meaning, principles of layout and design.	4
	Total Credit Hours	**45**

Lecture Schedule – Practical

S.No.	Topic	Cr. Hrs.
1	Practice in writing an agricultural news story.	1
2	Practice in writing an agricultural feature story.	1
3	Covering agricultural events for the information collection. Practice in interviewing for the information collection.	2
4	Abstracting stories from research and scientific materials and wire services.	2
5	Selecting pictures and artwork for the agricultural story.	2
6	Practice in editing, copy reading.	2
7	Practice in headline and title writing. Practicing proof reading.	2
8	Practice in lay outing of newspaper.	1
9	Testing copy with a readability formula. Visit a publishing office.	2
	Total Credit Hours	**15**

Suggested Readings:

1. Agricultural Journalism in the digital age by Panda Shubonam, Scientific Publisher 2024.
2. Agricultural Extension and farm Journalism – A K Singh.
3. Introduction to Journalism by Carole Fleming, Emma Hemmingway, and Gillian Moore.
4. Basic Journalism by Rangaswami Parthasarathy.
5. News Reporting and Editing by K. M. Shrivastava.
6. Professional Journalism by M.V. Kamath.
7. The Journalist's Handbook Book by M.V. Kamath.
8. Farm Journalism and Media Management – Bhaskaran et al.
9. Farm Journalism – Jana and Mitra.
10. Web Materials.
11. Prepared You Tube videos.

GPB 411 Commercial Plant Breeding 4 (3+1)

Objectives

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

Theory

Types of crops and modes of plant reproduction. Line development and maintenance breeding in self- and cross-pollinated crops (A/B/R and two-line system) for development of hybrids and seed production. Genetic testing of commercial hybrids. Advances in hybrid seed production of maize, rice, sorghum, pearl millet, castor, sunflower, cotton, pigeon pea and brassica etc. Speed breeding, Shuttle breeding and Organic breeding, Breeding management systems, High-throughput phenotyping and genotyping platforms, Quality seed production of vegetable crops under open and protected environment. Alternative strategies for the development of the line cultivars: haploid inducers, tissue culture techniques and biotechnological tools. IPR issues in commercial plant breeding: NDUS testing and registration of varieties under PPV&FR Act. Variety testing, release and notification systems in India. Principles and techniques of seed production, types of seeds, quality testing in self- and cross- pollinated crops.

Practical

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

Lecture Schedule- Theory

S. No.	Topic	Cr. Hrs.
1.	Introduction to commercial plant breeding: importance and scope	1
2.	Types of crops and Modes of plant reproduction: sexual and asexual	1
3.	Self-pollination: mechanisms and significance	1
4.	Cross-pollination: mechanisms and significance	1
5.	Line development in self-pollinated crops	1
6.	Line development in cross-pollinated crops	2
7.	Maintenance breeding: concepts and applications	2
8.	A/B/R system in hybrid development	1
9.	Two-line system for hybrid development	1
10.	Genetic testing of commercial hybrids	1
11.	Principles of hybrid seed production	1
12.	Advances in hybrid seed production of maize	1
13.	Advances in hybrid seed production of rice	1
14.	Advances in hybrid seed production of sorghum and pearl millet	1
15.	Advances in hybrid seed production of castor and sunflower	1
16.	Advances in hybrid seed production of cotton	1
17	Advances in hybrid seed production of pigeon pea	1
18.	Advances in hybrid seed production of brassica	1
19.	Techniques for genetic purity testing	1
20.	Speed breeding, shuttle breeding & organic breeding	1
21.	Breeding management systems	1
22.	High-Throughput phenotyping platforms	1
23.	Quality seed production in vegetable crops: open field	1
24.	Quality seed production in vegetable crops: protected environments	1
25.	Haploid inducers in line development	1
26.	Tissue culture techniques: micropropagation and somatic hybridization	1
27.	Biotechnological tools in plant breeding	1
28.	Intellectual Property Rights (IPR) in Plant Breeding	1
29.	NDUS Testing: Principles and Applications	1
30.	Registration of Varieties under the PPV & FR Act	1
31.	Variety Testing: Concepts and Methods	1
32.	Variety Release Systems in India	1

33.	Notification of Varieties: Procedure and Guidelines	1
34.	Principles of Seed Production	1
35.	Types of seeds: breeder, foundation, certified, and hybrid	1
36.	Seed quality testing: physical and genetic purity	1
37.	Seed quality testing: moisture content and germination	1
38.	Certification standards for seed production	1
39.	Seed Production in self-pollinated crops	1
40.	Seed Production in cross-pollinated crops	2
41.	Role of protected cultivation in seed production	1
42	Synthetic and Composite Varieties	1
	Total Credit Hours	**45**

Lecture Schedule – Practical

S. No.	Topic	Cr. Hrs.
1.	Floral Biology in Self- and Cross-Pollinated Species	1
2.	Selfing and Crossing Techniques in Self- and Cross-Pollinated Species	1
3.	Seed production methods using A/B/R and two-line systems	1
4.	Hybrid Seed Production Using Male-Sterility System	1
5.	Challenges in Hybrid Seed Production	1
6.	Tools and techniques for optimizing hybrid seed production and difficulties in hybrid seed production	1
7.	Concept of rouging in seed production plot	1
8.	Concept of line multiplication and purification in hybrid seed production.	1
9.	Role of pollinators in hybrid seed production.	1
10.	Hybrid seed production techniques in major crops and vegetables	2
11.	Sampling and analytical procedures for purity testing and detection of spurious seed	1
12.	Seed drying and storage structure in quality seed management	1
13.	Screening techniques during seed processing, viz. grading and packaging	1
14.	Visit to public private seed production and processing plants	1
	Total Credit Hours	**15**

Suggested Readings:

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

GPB 412 Micro-propagation Technologies 4 (3+1)

Objectives

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

Theory

Introduction, History, Advantages and limitations. Totipotency, differentiation, dedifferentiation and redifferentiation, Tissue culture methodology, Types of cultures (seed, embryo, organ, callus, cell); Stages of micro propagation; Axillary bud proliferation (Shoot tip and meristem culture, bud culture); Organogenesis (callus and direct organ formation);Environmental requirement and Genetic control of regeneration, Plant regeneration pathways, Somatic embryogenesis; Synthetic seed-Concepts, necessity and procedure, Requirements for production of synthetic seeds,Cell suspension cultures; production of secondary metabolites; Somaclonal variation; Cryopreservation, Successful examples viz., Banana, Sugarcane, Potato, Strawberry etc.

Practical

Identification and use of equipment in tissue culture Laboratory; Nutritional 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.

Lecture Schedule- Theory

S. No.	Topic	Cr. Hrs.
1.	Introduction	1
2.	History	1
3.	Advantages and limitations	1
4.	Totipotency, differentiation, dedifferentiation and redifferentiation	1
5.	Tissue culture methodology	2
6.	Types of cultures (seed)	2
7.	Types of cultures (embryo)	2
8.	Types of cultures (organ)	2
9.	Types of cultures (callus)	2
10.	Types of cultures (cell)	2
11.	Stages of micro propagation	2

12.	Axillary bud proliferation (shoot tip culture)	2
13.	Axillary bud proliferation (meristem culture)	2
14.	Axillary bud proliferation (bud culture)	2
15.	Organogenesis (callus formation)	2
16.	Organogenesis (direct organ formation)	2
17.	Environmental requirement and Genetic control of regeneration	1
18.	Plant regeneration pathways	1
19.	Somatic embryogenesis	2
20.	Synthetic seed-Concepts, necessity and procedure	2
21.	Requirements for production of synthetic seeds	1
22.	Cell suspension cultures	2
23.	Production of secondary metabolites	2
24.	Somaclonal variation	2
25.	Cryopreservation	1
26.	Successful examplesviz., Banana, Sugarcane, Potato, Strawberryetc	3
	Total Credit Hours	**45**

Lecture Schedule – Practical

S. No.	Topic	Cr. Hrs.
1.	Identification and use of equipment in tissue culture Laboratory	1
2.	Nutritional media composition	1
3.	Sterilization techniques for media, containers and small instruments	2
4.	Sterilization techniques for explants	1
5.	Preparation of stocks and working solution	2
6.	Preparation of working medium	2
7.	Culturing of explants: Seeds, shoot tip and single node	2
8.	Callus induction	1
9.	Induction of somatic embryos regeneration of whole plants from different explants	2
10.	Hardening procedures	1
	Total Credit Hours	**15**

Suggested Readings:

1. Basics of Horticulture by Jitendra Singh
2. Introduction to Horticulture by N. Kumar
3. Handbook of Horticulture by ICAR.
4. Plant Tissue Culture: Basic and Applied by Timir Baran Jha and Biswajit Ghosh. Platinum Publishers. 439p.
5. Chawla, H.S. 2008. Introduction to Plant Biotechnology.2nd edn. Oxford &IBH publishing Co. Ltd. 113-B ShahpurJat, New Delhi-110049.
6. बायोटेक्नोलॉजी, बी डी सिंह, कल्याणी प्रकाशक

GPB 413 Commercial Seed Production 4 (3+1)

Objectives

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

Theory

General Principles of Seed Production: Raising the seed crop, Introduction, Procurement of a class of Improved seeds, Reporting to Monitoring or certification Agency, Principles and practices of selection of area and agronomic requirement of seed production of field crops, Importance of isolation distance and Rouging, Principles of hybrid seed production in field crops, Principles and practices of selection of area and agronomic requirement of seed production of horticultural crops, Concept of apomixes, male sterility and self-incompatibility and its application in hybrid seed production of field and horticultural crops, Farmers participatory seed production.

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

General Principles of Seed Testing: Seed Testing-Introduction, Procedure of Seed testing, components of seed quality testing- genetic, physical, physiological and seed health testing, Seed sampling, Types of seed sampling, Requirements of sampling, Concept of seed viability and vigour; dormancy, types and principles of seed dormancy, Physiological quality of seed, Principles of seed Germination, types of germination, biochemical and genetic basis.

Seed Certification: History, concept and objectives of seed certification; seed certification agency/organization and staff requirement, Indian Minimum Seed Certification Standards (I.M.S.C.S.)- general and specific crop standards including GM varieties, field and seed standards.

Seed Industry and Seed Marketing: Introduction, Evolution of the seed industry, Development of the vegetable and flower seed industry, Seed marketing – concept, definition and purpose, importance and promotion of quality seed, formal and informal seed supply systems, Seed marketing intelligence and product mix, sales promotion, distribution channels, marketing costs and margins; packaging and labeling, Seed Associations, Factors influencing seed marketing, Seed marketing programs, Seed industry organizations,

Marketing of public versus private players, Demand and supply of seed; role of seed replacement rate (SRR), seed multiplication ratio (SMR), economics of seed production; determining seed needs, Seed pricing and price policy, seed processing and packaging, demand forecasting and factors affecting demand for seeds, effect of price and farm income on seed demand, Role of WTO in seed marketing.

Biotechnology in Seed Technology: History of plant tissue culture, Laboratory organization, Composition of nutrient medium, Micro-propagation, Axillary bud proliferation approach, Meristem and shoot tip culture, Bud culture, Advantages of Micro-propagation, Problems associated with micro-propagation, Synthetic seed production, Types of synthetic seeds, methods of development of synthetic seeds, Components of nutrient media for synthetic seed development, Storage of synthetic seeds, Advantages and limitations of synthetic seed production.

Practical

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

Lecture Schedule- Theory

S. No.	Topic	Cr. Hrs.
1.	General Principles of Seed Production: Introduction and objectives	02
2.	Procurement of a Class of Improved Seeds	01
3.	Reporting standards and role of certification agencies	02
4.	Principles and practices of selection of area and agronomic requirement of seed production of field crops	02
5.	Importance of Isolation Distance and Rouging	01
6.	Principles of Hybrid Seed Production in Field Crops	02
7.	Principles and practices of selection of area and agronomic requirement of seed production of horticultural crops	02
8.	Concept of Apomixis: Role and application in seed production	01
9.	Male sterility and self-incompatibility and its application in hybrid seed production of field horticultural crops	02
10.	Farmers participatory seed production	01
11.	General Principles of Seed Processing: Introduction, Objectives of Seed Processing	01
12.	Seed Drying, Principles of Drying, Water vapour equilibrium, Methods of drying seeds	02
13.	Cleaning and grading: Air and screen machines, Dimensional separators, Density separators, Surface texture separators, Colour separators, Spiral separators, Electric separators, Vibrator separators, Separation based on Affinity to liquids,	02
14.	Seed treatment, Temperature treatment, Chemical treatment,	01
15.	Bagging and Labelling	01
16.	Seed testing-Introduction, Procedure of Seed testing, components of seed quality testing genetic, physical, physiological and seed health testing	03
17.	Seed sampling, Types of seed sampling, Requirements of sampling	01
18.	Concept of seed viability and vigour	02
19.	Seed Dormancy: Types, principles, and overcoming dormancy	01
20.	Principles of seed Germination, types of germination, biochemical and genetic basis	01
21.	Seed Certification: History, concept and objectives of seed certification, seed certification agency/organization and staff requirement	02
22.	Indian Minimum Seed Certification Standards (I.M.S.C.S.) - general and specific crop standards including GM varieties, field and seed standards	02
23.	Evolution of the seed industry, Development of the vegetable and	01

	Flower seed industry	
24.	Seed marketing – concept, definition and purpose, importance and promotion of quality seed, formal and informal seed supply systems	01
25.	Seed marketing intelligence and product mix, sales promotion, distribution channels, marketing costs and margins;	01
26.	Packaging and labeling, Seed Associations, Factors influencing seed marketing, Seed marketing programs, Seed industry organizations, Marketing of public versus private players, Demand and supply of seed	01
27.	Role of seed replacement rate (SRR), seed multiplication ratio (SMR), economics of seed production; determining seed needs, Seed pricing and price policy, seed processing and / packaging, demand forecasting and factors affecting demand for seeds, effect of price and farm income on seed demand	01
28.	WTO and Seed Marketing	01
29.	Laboratory organization, Composition of nutrient medium	01
30.	Micro-propagation, Axillary bud proliferation approach, Meristem and shoot tip culture, Bud culture, Advantages of Micro-propagation, Problems associated with micro-propagation	02
31.	Synthetic seed production, Types of synthetic seeds, methods of development of synthetic seeds, Components of nutrient media for synthetic seed development, Storage of synthetic seeds, Advantages and limitations of synthetic seed production	01
	Total Credit Hours	**45**

Lecture Schedule – Practical

S. No.	Topic	Cr. Hrs.
1.	Planning of Seed Production, Estimation of seed requirements for different classes in field crops (unit area and rate)	01
2.	Operation and Handling of Mechanical Drying Equipment	01
3.	Seed Processing Equipment: Demonstration of cleaning, grading, and separating seeds using various machines	01
4.	Seed Treating Equipment	01
5.	Seed production in cross pollinated crops with special reference to land, isolation, Planting ratio of male and female lines	01
6.	Synchronization of Parental Lines and methods to achieve synchrony	01
7.	Supplementary Pollination: Practical methods of pollen storage, viability testing, and artificial pollination	01
8.	Hand Emasculation and Pollination in Tomato	01
9.	Hybrid Seed Production in Maize: Detasseling, identification of rogues, pollen shedders, pollen viability and stigma receptivity	01
10.	Visits to Seed Production Plots, seed processing plant and	01

	commercial controlled and uncontrolled Seed Stores, Seed industries and local entrepreneurships visit to nearby areas	
11.	Seed Health Testing: detection of seed-borne fungi, bacteria and viruses, identification of storage fungi, control of seed- borne diseases, seed treatment methods	01
12.	Maintenance of aseptic conditions and sterilization techniques	01
13.	Preparation of Nutrient Media for Callus Induction: Formulation of MS medium, selection of explants, and inoculation for micro-propagation	01
14.	Micro-Propagation Techniques: Preparation of MS medium for micro-propagation and Callus induction, Inoculation of explants for micro-propagation, Inoculation of explants for callus induction and subsequently regeneration of plantlets from matured seeds of field and horticultural crops	01
15	Synthetic Seed Preparation	01
	Total Credit Hours	**15**

Suggested Readings:

1. Agarwal, R.L. 1997. Seed Technology. 2nd edn. Oxford & IBH.
2. McDonald, M.B. Jr and Copeland, L.O. 1997. Seed Production: Principles and Practices. Chapman & Hall
3. Thompson, J.R. 1979. An Introduction to Seed Technology. Leonard Hill.
4. Singhal, N.C. 2003. Hybrid Seed Production in Field Crops. Kalyani.
5. Justice, O.L. and Bass, L.N. 1978. Principles and Practices of Seed Storage. Castle House Publ. Ltd.
6. Tunwar, N.S. and Singh S.N. 1988. Indian Minimum Seed Certification Standards. CSCB, Ministry of Agriculture, New Delhi.
7. Chawla, H.S. 2008. Introduction to Plant Biotechnology. 2nd edn. Oxford & IBH publishing Co. Ltd. 113-B Shahpur Jat, New Delhi-110049.
8. आर.के. सिंह 2018 बीज प्रोद्योगिकी, कल्याणी प्रकाशन, न्यू दिल्ली
9. हरवेन्द्र सिंह तौमर 2016 बीज प्रोद्योगिकी, अमन पब्लिशिंग हाउस, मेरठ (उ.प्र.)
10. पादप प्रजानन सिद्धांत एवं विधियां, बी डी सिंह, कल्याणी प्रकाशक
11. बायोटेक्नोलॉजी, बी डी सिंह, कल्याणी प्रकाशक

PPATH 412 Bioformulation and Nano formulation 4 (3+1)

Objectives

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

Theory

Introduction and history of biological control of pests and diseases; Microbial biopesticides: the global and Indian market scenario; biopesticides for organic agriculture; Different phytopathogenic biocontrol agents: Mode of action; Different entomopathogenic biocontrol agents: Mode of action; Microbial inoculants as biofertilizer candidates, Production, quality assessment and methods of application of biopesticides and biofertilizers.

Regulatory system of biopesticides in India; Formulations of plant essential oils, botanicals. Nanotechnology: its applications in pest and disease diagnosis and management; Nano biopesticides: Concept and importance, different techniques of producing nano biopesticides; Nano Fertilizers: Concept and importance, Types of nano fertilizers; Different techniques of producing nano fertilizers; Green synthesis of nano fertilizers; green slow-release fertilizer composition based on urea-modified hydroxyapatite nanoparticles.

Practical

Introduction and acquaintance with biopesticide laboratory; Preparation of culture media; Isolation and purification of bioagent from soil and infected insects; Microscopic study of different microbial bioagents; In vitro assay of microbial bioagents against plant pathogens. In vitro compatibility study among different microbial bioagents; Mass multiplication of biopesticides; Population enumeration of biocontrol agents in different biopesticides; Preparation of plant extracts and their efficacy test against insect pests; Bioassay of Entomopathogenic biocontrol agents on insect pests; Preparation of microbial inoculants of biofertilizer microbes; Compatibility of biofertilizer microbes; Preparation of solid and liquid consortia of biofertilizer microbes.

Lecture Schedule- Theory

S.No.	Topic	Cr. Hrs.
1	Introduction and history of biological control of pests and diseases	3
2	Microbial biopesticides: the global and Indian market scenario; biopesticides for organic agriculture	3
3	Different phytopathogenic biocontrol agents: Mode of action	4
4	Different entomopathogenic biocontrol agents: Mode of action	3
5	Microbial inoculants as biofertilizer candidates	4
6	Production, quality assessment and methods of application of biopesticides and biofertilizers.	4
7	Regulatory system of biopesticides in India; Formulations of plant essential oils, botanicals	4
8	Nanotechnology: its applications in pest and disease diagnosis and management	4
9	Nano biopesticides: Concept and importance, different techniques of producing nano biopesticides	4
10	Nano Fertilizers: Concept and importance, Types of nano fertilizers	4
11	Different techniques of producing nano fertilizers;	4
12	Green synthesis of nano fertilizers; green slow-release fertilizer composition based on urea-modified hydroxyapatite nanoparticles	4
	Total Credit Hours	**45**

Lecture Schedule – Practical

S.No.	Topic	Cr. Hrs.
1	Introduction and acquaintance with biopesticide laboratory	1
2	Preparation of culture media	2
3	Isolation and purification of bioagent from soil and infected insects	3
4	Microscopic study of different microbial bioagents	3
5	In vitro assay of microbial bioagents against plant pathogens.	3
6	In vitro compatibility study among different microbial bioagents	3
	Total Credit Hours	**15**

Suggested Readings:

1. Baker, E.F. and James, R.C. 1982. Biological Control of Plant Pathogens. American Phytopathological Society.
2. Borkar, S.G. 2015. Beneficial Microbes as Biofertilizers and its Production Technology.
3. Boland, G.J. and David, L.1998. Plant microbe interactions and Biological Control. Kuykendall Marel Dekker, INC.

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

AGRON 411 Principles and Practices of Organic Farming and Conservation Agriculture 4(3+1)

Objectives

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

Theory

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

Practical

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

Lecture Schedule- Theory

S. No.	Topic	Cr. Hrs.
1.	Concept of organic farming, principles and its scope in India	4
2.	Choice of crops and varieties in organic farming	3
3.	Nutrient management in organic farming and their sources	4
4.	Fundamentals of insect, pest and disease under organic mode of production	4
5.	Weed management under organic mode of production	2
6.	Operational structure of NPOP	3

7.	Certification process and crop standards of organic farming	4
8.	Processing, labelling, economic considerations and viability, marketing and export potential of organic products	4
9.	Initiatives taken by Government (central/state), NGOs and other organizations for promotion of organic agriculture	4
10.	Conservation agriculture: Definition, origin, principles, advantages and challenges	4
11.	Primary practices in conservation agriculture: Minimum soil disturbance, crop residue retention, crop diversification and complementary practices	3
12.	Conservation agriculture vis a vis climate smart agriculture	2
13.	Organic manures: Recommended doses and application in comparison to inorganic fertilizers for major crops	4
	Total Credit Hours	**15**

Lecture Schedule – Practical

S. No.	Topic	Cr. Hrs.
1.	Visit of organic farms to study the various components and their utilization	1
2.	Preparation of enrich compost, vermicompost and their quality analysis	3
3.	Method of application of bio-fertilizers	1
4.	Indigenous technology knowledge (ITK) for nutrient, insect-pest and disease management	2
5.	Studies in green manuring in-situ and green leaf manuring	1
6.	Studies on different type of botanicals for insect- pest management	2
7.	Weed management in organic farming	2
8.	Cost of organic production system	1
9.	Practices of conservation agriculture	2
	Total Credit Hours	**15**

Suggested Readings:

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

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

AGMET 411 System Simulation and Agroadvisory 4 (3+1)

Objectives

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

Theory

System approach for representing soil-plant-atmospheric continuum, system boundaries. Crop models, concepts and techniques, types of crop models, data requirements, relational diagrams. Evaluation of crop responses to weather elements; Elementary crop growth models; calibration, validation, verification and sensitivity analysis. Potential and achievable crop production- concept and modeling, techniques for their estimation. Crop production in moisture and nutrients limited conditions; components of soil water and nutrients balance. Weather forecasting, types methods, tools and techniques, forecast verification; Value added weather forecast, ITK for weather forecast and its validity; 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.

Practical

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

Lecture Schedule- Theory

S. No.	Topic	Cr. Hrs.
1.	System approach for representing soil-plant-atmospheric continuum and system boundaries	4
2.	Crop models: Concepts and techniques, types of crop models, data requirements and relational diagrams	4
3.	Evaluation of crop responses to weather elements	3
4.	Elementary crop growth models: Calibration, validation, verification and sensitivity analysis	4

5.	Potential and achievable crop production: Concept and modeling, techniques for their estimation	4
6.	Crop production in moisture and nutrients limited conditions	3
7.	Components of soil water and nutrients balance	2
8.	Weather forecasting: Types, methods, tools and techniques, forecast verification	4
9.	Value added weather forecast	3
10.	ITK for weather forecast and its validity	3
11.	Crop- weather calendars	3
12.	Preparation of agro-advisory bulletin based on weather forecast	4
13.	Use of crop simulation model for preparation of agro- advisory and its effective dissemination	4
	Total Credit Hours	**45**

Lecture Schedule – Practical

S. No.	Topic	Cr. Hrs.
1.	Preparation of crop weather calendars	2
2.	Preparation of agro-advisories based on weather forecast using various approaches and synoptic charts	2
3.	Statistical and simulation models for crop growth	2
4.	Potential and achievable production; Yield forecasting, insect and disease forecasting models	2
5.	Simulation with limitations of water and nutrient management options	2
6.	Sensitivity analysis of varying weather and crop management practices	2
7.	Use of statistical approaches in data analysis and preparation of historical, past and present meteorological data for medium range weather forecast	2
8.	Feedback from farmers about the agro- advisory	1
	Total Credit Hours	**15**

Suggested Readings:

1. Introduction to Agrometeorology by H. S. Mavi.
2. Agricultural Meteorology by G.S.L.H.V. Prasado Rao.
3. Advances in Plant Atmospheric Interactions (Eds. Rao, V.U.M., Rao, A.V.M.S., Rao, G.G.S.N., Ramana Rao, B.V., Vijaya Kumar, P. and Venkateswarlu, B), Central Research Institute for Dryland Agriculture (CRIDA), Santoshnagar, Hyderabad.
4. Text Book of Agricultural Meteorology by M.C. Varshneya and P.B. Pillai. ICAR.
5. Principles of Agricultural Meteorology by OP Bishnoi.

AGMET 412 Climate Resilient Agriculture 4 (3+1)

Objectives

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

Theory

Climate change and impacts of climate change on agriculture and food security; crop productivity under different climate change scenarios including extreme events such as drought, flood, pest and disease outbreak etc. Basics of adaption and mitigation in the agricultural sectors; analyzing and assessing climate vulnerability to identify vulnerable sectors and possible adaptation options in agriculture; assessing biophysical and socio-economic impacts on agricultural sector; risk assessment strategies, preparedness for weather and climate risks in agriculture; application of geospatial tools and techniques for sustainable agriculture. Climate resilient agriculture (CRA)– concept, scope and importance with special reference to India, climate resilient technologies for enhancing crop productivity and sustainability – role of weather and climatic information, agro- advisories, ICTs and simulation models; climate resilient agronomic practices – crop/cultivar selection, crop diversification/ crop mixtures; water management practices – rain water harvesting, micro-irrigation, deficit irrigation and drainage management, organic/natural farming, integrated farming systems (IFS); site specific nutrient management (SSNM), conservation agriculture technologies to build soil organic carbon, harnessing microbial biodiversity, biomass recycling; use of renewable sources of energy; climate resilient pest-disease management strategies. Breeding strategies for development of climate change resilient crops and varieties, development of biotic and abiotic stress tolerant/resistant cultivars under changed climatic scenarios including extreme weather events.

Practical

Acquaintance with meteorological instruments including AWS, Statistical techniques to study trend of climatic parameters, Analysis of extreme weather events using non-parametric tests, Building climate change scenarios under different futuristic emission of GHGs, Designing strategies to mitigate the effect of climate change using climate resilient crops/cultivars, Climate resilient technologies and manipulation of cropping patterns, Acquaintance with ICTs for effective dissemination of local weather information and agro-advisories, Analysing carbon sequestration potential of different agro-ecosystems;

Designing climate smart village model considering the availability of resources. Awareness programme on climate change and climate resilient agriculture among farming community.

Lecture Schedule- Theory

S. No.	Topic	Cr. Hrs.
1.	Climate change and impacts of climate change on agriculture and food security	2
2.	Crop productivity under different climate change scenarios including extreme events such as drought, flood, pest and disease outbreak etc.	3
3.	Basics of adaption and mitigation in the agricultural sectors	2
4.	Analyzing and assessing climate vulnerability to identify vulnerable sectors and possible adaptation options in agriculture	2
5.	Assessing biophysical and socio-economic impacts on agricultural sector	2
6.	Risk assessment strategies; Preparedness for weather and climate risks in agriculture	2
7.	Application of geospatial tools and techniques for sustainable agriculture	2
8.	Climate resilient agriculture (CRA): Concept, scope and importance with special reference to India	3
9.	Climate resilient technologies for enhancing crop productivity and sustainability	2
10.	Role of weather and climatic information, agro- advisories, ICTs and simulation models	3
11.	Climate resilient agronomic practices: Crop/cultivar selection, crop diversification/ crop mixtures	3
12.	Water management practices: Rain water harvesting, micro-irrigation, deficit irrigation and drainage management	3
13.	Organic/natural farming; Integrated farming systems (IFS)	3
14.	Site specific nutrient management (SSNM)	2
15.	Conservation agriculture technologies to build soil organic carbon, harnessing microbial biodiversity and biomass recycling	3
16.	Use of renewable sources of energy	2
17.	Climate resilient pest-disease management strategies	2
18.	Breeding strategies for development of climate change resilient crops and varieties	2
19.	Development of biotic and abiotic stress tolerant/resistant cultivars under changed climatic scenarios including extreme weather events	2
	Total Credit Hours	**45**

Lecture Schedule – Practical

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

Suggested Readings:

1. Climate Resilient Animal Agriculture by GSLHV Prasada Rao. New India Publishing Agency.
2. Climate Resilient Agriculture Adaptation and Mitigation Strategies by Bhan Manish. New India Publishing Agency
3. Climate-Smart Agriculture Sourcebook. FAO (2013). Implications for Climate Smart Agriculture by Wahid Hasan, Sachin G. Mundhe, Abdul Majid Ansari and Shivani Kumari. Biotech Books, 357p.
4. Climate Resilient Agriculture, Adaptation and Mitigation Strategies by Manish Bhan. New India Publishing Agency, 294p.
5. Climate Change and Agriculture Over India by Prasad Rao. PHI Learning, 352p.
6. Climate Smart Agriculture for Sustaining Crop Productivity and Improving Livelihood Security by Prakash M. Satish Serial Publishing House.178p.
7. New Horizon in Climate Smart Agriculture Singh S., Singh A., Sharma, J. and Checham, S. 2024. Vital Biotech Publisher, Kota. 184p.

HORT 413 Hi-tech Horticulture 4 (3+1)

Objectives

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

Theory

Introduction and importance of Hi-tech horticulture and protected cultivation; Protray nursery management and mechanization; micro propagation of horticultural crops; Introduction to vegetable grafting, Modern field preparation and planting methods; Protected cultivation: advantages, controlled conditions, method and techniques; Micro irrigation systems and its components; EC, pH based fertilizer scheduling; canopy management; high density orcharding; Components of precision farming: Remote sensing; Geographical Information System (GIS); Differential Geo-positioning System (DGPS); Variable Rate Application (VRA); application of precision farming in horticultural crops (fruits, vegetables and ornamental crops); mechanized harvesting of produce.

Practical

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

Lecture Schedule- Theory

S. No.	Topic	Cr. Hrs.
1.	Introduction and importance of Hi-tech horticulture and protected cultivation.	3
2.	Protray nursery management and mechanization.	3
3.	Micro propagation of horticultural crops.	3
4.	Introduction to vegetable grafting.	2
5.	Modern field preparation and planting methods.	2
6.	Protected cultivation: advantages, controlled conditions, method and techniques.	3
7.	Micro irrigation systems and its components; EC, pH-based fertilizer scheduling.	4
8.	Canopy management; high density orcharding.	3
9.	Components of precision farming.	3
10.	Remote sensing.	3
11.	Geographical Information System (GIS).	3
12.	Differential Geo-positioning System (DGPS).	3

13.	Variable Rate Application (VRA).	3
14.	Application of precision farming in horticultural crops (fruits, vegetables and ornamental crops).	4
15.	Mechanized harvesting of produce.	3
	Total Credit Hours	**45**

Lecture Schedule – Practical

S. No.	Topic	Cr. Hrs.
1.	Types of polyhouses and shade net houses.	2
2.	Intercultural operations.	3
3.	Tools and equipment identification and application.	1
4.	Micro propagation and vegetable grafting.	2
5.	Nursery- portrays.	2
6.	Micro-irrigation.	1
7.	EC, pH-based fertilizer scheduling.	2
8.	Canopy management.	1
9.	Visit to hi-tech orchard/nursery.	1
	Total Credit Hours	**15**

Suggested Readings:

1. T.A. More, Hi-tech Horticulture.
2. Paul V. Nelson, Greenhouse Operation and Management.
3. S. Prasad, Dharam Singh and R.L. Bharadwaj, Hi Tech Horticulture (Pb) by. Agrobios
4. S.N. Gupta., Instant Horticulture by Jain Brothers. 488p.
5. Webb Eleanor, Tom Garden, Hydroponics for Beginners and Advanced: The Ultimate Hydroponic and Aquaponic Gardening Guide.
6. Hartman, HT and Kester, DE (1986). Plant propagation principles and practices. Prentice Hall of India Pvt. Ltd., Bombay
7. Gill, S. S. Bal, J. S. and Sadhu, A. S. (1985). Raising Fruit Nursery, Kalyani Publishers, New Delhi.
8. Chadha, K.L. Handbook of Horticulture (2002) ICAR, New Delhi
9. Chadda K.L. Advanced in Horticulture (2009) Malhotra Publishing House, New Delhi
10. Anonymous 2003. Proc. All India Seminar on Potential and Prospects for Protective
11. Cultivation. Organised by Institute of Engineers, Ahmednagar. Dec.12-13, 2003.
12. Chandra, S & Som, V. 2000. Cultivating Vegetables in Green House. Indian Horticulture 45: 17- 18.
13. Prasad S. & Kumar U. 2005. Greenhouse Management for Horticultural Crops. 2nd Ed. Agrobios.

HORT414 Landscaping 4 (3+1)

Objectives

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

Theory

Importance and scope of landscaping. Principles of landscaping, garden styles and types terrace gardening, vertical gardening, garden components, adornments, rockery water garden, walk-paths, bridges, other constructed features etc. Use of growing media and containers in landscape gardening. Ornamental trees: selection, propagation, planting schemes, canopy management. Hedges, shrubbery border and herbaceous border: selection, propagation, planting schemes, architecture. Climber importance, selection, propagation, planting. Annuals: selection, propagation, planting scheme. Other garden plants: palms, ferns, grasses and cacti succulents. Pot plants: selection, arrangement, management. Bio-aesthetic planning: definition, need, planning. Landscaping of urban and rural areas, Peri-urban landscaping, Landscaping of schools, public places like bus station, railway station, townships, river banks, hospitals, play grounds, airports, industries, institutions, Bonsai principles and management. Lawn: establishment and maintenance. CAD application.

Practical

Identification of trees, shrubs, annuals, pot plants; Identification of tools, implements and growing media and containers used in landscape gardening; Propagation of trees, shrubs and annuals; Care and maintenance of plants, potting and repotting; 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); Designing of conservatory and lathe house. Use of computer software. Visit to important gardens /parks /institutes.

Lecture Schedule- Theory

S. No.	Topic	Cr. Hrs.
1.	Importance and scope of landscaping.	3
2.	Principles of landscaping, garden styles and types terrace gardening.	3
3.	Vertical gardening, garden components, adornments, rockery water garden, walk-paths, bridges, other constructed features etc.	3
4.	Use of growing media and containers in landscape gardening.	3

5.	Ornamental trees: selection, propagation, planting schemes, canopy management.	3
6.	Hedges, shrubbery border and herbaceous border: selection, propagation, planting schemes, architecture.	3
7.	Climber importance, selection, propagation, planting.	3
8.	Annuals: selection, propagation, planting scheme.	3
9.	Other garden plants: palms, ferns, grasses and cacti succulents.	3
10.	Pot plants: selection, arrangement, management.	3
11.	Bio- aesthetic planning: definition, need, planning.	3
12.	Landscaping of urban and rural areas.	3
13.	Peri-urban landscaping, Landscaping of schools, public places like bus station, railway station, townships, river banks, hospitals, play grounds, airports, industries, institutions.	3
14.	Bonsai principles and management. Lawn: establishment and maintenance.	3
15.	CAD application.	3
	Total Credit Hours	**45**

Lecture Schedule – Practical

S. No.	Topic	Cr. Hrs.
1.	Identification of trees, shrubs, annuals, pot plants.	1
2.	Identification of tools, implements and growing media and containers used in landscape gardening.	2
3.	Propagation of trees, shrubs and annuals.	1
4.	Care and maintenance of plants, potting and repotting.	2
5.	Training and pruning of plants for special effects.	1
6.	Lawn establishment and maintenance.	2
7.	Layout of formal gardens, informal gardens.	1
8.	Special type of gardens (sunken garden, terrace garden, rock garden).	2
9.	Designing of conservatory and lathe house.	1
10.	Use of computer software.	1
11.	Visit to important gardens /parks /institutes.	1
	Total Credit Hours	**15**

Suggested Readings:

1. Bose, T. Ornamental Plants and Garden Design in Tropics and subtropics, Vol-2 sets Daya Publishing House.
2. Arora J. S. 2006. Introductory Ornamental Horticulture Kalyani Publishers, Ludhiana

3. Gopalaswamiengar, K.S. The Complete Gardening in India.The Hosali Press, Bangalore137
4. Bose, T.K. Malti, R.G. Dhua, R.S. & Das, P. Floriculture and Landscaping (2004) Nayaprakash
5. Bose, T.K. and Mukherjee, D. Gardening in India (2004) Oxford & IBH Publishers
6. Chadha, K.L. and Chaudhary, B. Ornamental Horticulture in India (1986) ICAR
7. H.S. Grewal and Parminder Singh, Landscape designing and ornamental plants (2014)
8. K.V. Peter. Ornamental plants (2009) New India publishing agency
9. R.K. Roy, Fundamentals of Garden designing (2013) New India publishing agency
10. Rajesh Srivastava, Fundamentals of Garden designing (2014) Agrotech press, Jaipur
11. Randhawa, G.S. Amitabha Mukhopadhyay Floriculture in India (2004) Allied Publishers Pvt. Ltd., New Delhi
12. Tiwari, A.K. Fundamentals of Ornamental Horticulture and Landscaping Gardening NIPA
13. Anil K. Singh and Anjana Sisodia, Textbook of floriculture and landscaping.
14. Y. Chandrasekhar and Hemla Naik B. 2020, Principles of Landscape Gardening by ICAR.
15. Rajaneesh Singh and Brijendra Kumar Singh. 2020, Introductory Ornamental Horticulture and Landscape Gardening: Rajaneesh Singh and Brijendra Kumar Singh. 2020, Bio-Green Books.
16. Pragnyashree Mishra and Bhimasen Naik. 2022., Principles of Landscape Architecture: Pragnyashree Mishra and Bhimasen Naik. 2022. New India Publishing Agency.
17. Sudhir Pradhan. 2018., Landscape Gardening: S Scientific Publishers India.

HORT 415 Post Harvest Technology and Value Addition 4 (3+1)

Objectives

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

Theory

Importance of post –harvest processing of fruits and vegetables, extent and possible causes of post-harvest losses: Pre-harvest factors affecting post-harvest quality, maturity, ripening and changes occurring during ripening; Respiration and factors affecting respiration rate; Harvesting and field handling; Storage (ZECC, cold storage, CA, MA and hypobaric); Value addition concept; Principles and methods of preservation; Intermediate moisture food (jam, jelly, marmalade, preserve, candy) - concepts and standards; Fermented and non-fermented beverages. Tomato products -concepts and standards; Drying /Dehydration of fruits and vegetables –concept and methods, osmotic drying. Canning – concepts and standards, packaging of products. FSSAI, FPO, HACCP, TQM, Non-Destructive Techniques of preservation.

Practical

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

Lecture Schedule- Theory

S. No.	Topic	Cr. Hrs.
1	Importance of post –harvest processing of fruits and vegetables.	3
2	extent and possible causes of post-harvest losses.	3
3	Pre-harvest factors affecting post-harvest quality, maturity, ripening and changes occurring during ripening.	3
4	Respiration and factors affecting respiration rate.	3
5	Harvesting and field handling; Storage (ZECC, cold storage, CA, MA and hypobaric).	3
6	Value addition concept.	3
7	Principles and methods of preservation.	3

8	Intermediate moisture food (jam, jelly, marmalade, preserve, candy) – concepts and standards.	3
9	Fermented and non-fermented beverages.	3
10	Tomato products –concepts and standards.	3
11	Drying /Dehydration of fruits and vegetables –concept.	3
12	methods, osmotic drying.	3
13	Canning – concepts and standards.	3
14	Packaging of products.	3
15	FSSAI, FPO, HACCP, TQM, Non-Destructive Techniques of preservation.	3
	Total Credit Hours	**45**

Lecture Schedule – Practical

S. No.	Topic	Cr. Hrs.
1	Applications of different types of packing.	1
2	containers for shelf-life extension.	1
3	Effect of temperature on shelf life and quality of produce.	2
4	Demonstration of chilling and freezing injury in vegetables and fruits.	2
5	Extraction and preservation of pulps and juices.	1
6	Preparation of jam, jelly, RTS, nectar.	2
7	squash, osmotically dried products, fruit bar candy.	1
8	Tomato products.	2
9	canned products.	1
10	Quality evaluation of products- Physico-chemical and sensory.	1
11	Visit to processing unit/industry.	1
	Total Credit Hours	**15**

Suggested Readings:

1. S. K. Sharma and M.C Nautiyal, Post-harvest technology of horticultural crops
2. Suja Nabi Qureshi, Kounser Javeed and Abhay Kumar Sinha, Post-Harvest Technology. Bioscientific Publishers.
3. K. P. Sudheer and V. Indira, Postharvest Technology of Horticultural Crops. New India Publishing Agency. 320p.
4. Aswini Kumar Goel, Rajender Kumar and Satwinder S. Mann, Postharvest Management and Value Addition. Daya Publishing House.
5. Kureel M.K. Biotech, Postharvest Management and Value Addition of Fruits and Vegetables.181p.
6. Battacharjee, S. K. and De, L. C Post Harvest Technology of Flowers and Ornamentals

Plants (2005) Pointer Publisher

7. Jacob John, P A., Handbook on Post Harvest management of Fruits and vegetables (2008) Daya Publishing House, Delhi
8. Manoranjan, K and Sangita, S., Food Preservation & Processing (1996) Kalyani Publishers
9. Mitra, S. K. Post Harvest Physiology and Storage of Tropical and Sub-tropical Fruits (1997) CAB International
10. Srivastava, R. P. & Sanjeev Kumar Fruits and vegetable Preservation – Principles and Practice (2002) International Book Distributing Co., Lucknow 140
11. Verma, L. R. and Joshi, V. K. Post Harvest Technology of Fruits and Vegetables Vol. I & II. (2000) Indus Publishing Co., New Delhi
12. Vijay, K. Text Book of Food Sciences and Technology (2001) ICAR
13. Mayani, Desai, Vagadia Post Harvest management of Horticultural crops Jaya Publishing House
14. Ed. M.K. Jatav, et al. Good management Practices for Horticultural Crops NIPA
15. Sharma, Satish, Post-Harvest management & Processing of fruits & vegetables- Instant notes NIPA
16. Sharma, Satish Post Harvest of Horticultural Crops- Practical manual Series Vol.2 NIPA
17. Rosa L.A. Fruit and Vegetable Phytochemicals: Chemistry, Nutritional Value and Stability BioGreen
18. Ryall, A. Handling, transportation and Storage of Fruits & Vegetables Vol.1 & 2nd Ed (Vegetables & Melons) Sci Int
19. Saini, R. Laboratory Manual of Analytical Techniques in Horticulture Agro Bot
20. Chavan, U. Nutritional Value and Health benefits from fruits, vegetable, nuts & spices Daya Publishing House.
21. Lal, S. Olive: Improvement, Production and Processing Astral
22. Sasikaumar, R. Post Harvest Technology of fruits and Vegetables Biotech

HORT 416 Food Safety and Standards 4 (3+1)

Objectives

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

Theory

Food safety –Definition, Importance, Scope and Factors affecting Food Safety. Hazards and Risks, Type of Hazards - Biological, Chemical Physical hazards. Management of hazards – Need. Control of Parameters. Temperature Control. Food Storage. Production Design. Hygiene and Sanitation in Food Service Establishments- Introduction. Sources of contamination and their control. Waste Disposal. Pest and Rodent Control. Personnel Hygiene. Food safety Measures. Food Safety Management Tool- Basic concepts. PRPs, GHPs, GMPs, SSOPs etc. HACCP.ISO series. TQM- concept and need for quality, components of TQM, Kaizen. Risk Analysis. Accreditation and Auditing, Water Analysis, Surface Sanitation and Personal Hygine. Food laws and Standards Indian Food Regulatory Regime, FSSA. Global Scenario CAC. Other laws and standards related to food. Recent concerns -New and Emerging Pathogens. Packaging, Product labelling and Nutritional labelling. Genetically modified food/transgenic. Organic foods. Newer approaches to food safety. Recent Outbreaks. Indian and International Standards for food products.

Practical

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

Lecture Schedule- Theory

S. No.	Topic	Cr. Hrs.
1	Food safety –Definition, Importance, Scope and Factors affecting Food Safety.	3
2	Hazards and Risks, Type of Hazards - Biological, Chemical Physical hazards. Management of hazards – Need. Control of Parameters. Temperature Control.	4
3	Food Storage. Production Design. Hygiene and Sanitation in Food Service Establishments- Introduction. Sources of contamination and their control.	4
4	Waste Disposal. Pest and Rodent Control. Personnel Hygiene. Food	4

	safety Measures. Food Safety Management Tool- Basic concepts.	
5	PRPs, GHPs, GMPs, SSOPs etc. HACCP.ISO series. TQM-concept and need for quality, components of TQM, Kaizen.	3
6	Risk Analysis. Accreditation and Auditing,	4
7	Water Analysis, Surface Sanitation and Personal Hygine.	3
8	Food laws and Standards Indian Food Regulatory Regime, FSSA. Global Scenario CAC.	3
9	Other laws and standards related to food.	3
10	Recent concerns -New and Emerging Pathogens. Packaging, Product labelling and Nutritional labelling.	3
11	Genetically modified food/transgenic. Organic foods.	4
12	Newer approaches to food safety.	3
13	Recent Outbreaks. Indian and International Standards for food products.	4
	Total Credit Hours	**45**

Lecture Schedule – Practical

S. No.	Topic	Cr. Hrs.
1	Water quality analysis physico – chemical and microbiological.	2
2	Preparation of different types of media.	2
3	Microbiological examination of different food samples.	2
4	Assessment of surface sanitation by swab/rinse method.	2
5	Assessment of personal hygiene.	2
6	Biochemical tests for identification of bacteria.	2
7	Scheme for the detection of food borne pathogens.	2
8	Preparation of plants for implementation of FSMS-HACCP, ISO:22000.	1
	Total Credit Hours	**15**

Suggested Readings:

1. Avantina Sharma, Text book of Food Science and Technology
2. D. S. L. Khatekar and N. Sarkate, Handbook of Food Safety: Step Up Academy, 576p.
3. Pulkit Mathur, Food safety and Quality Control: The Orient Blackswan.332p.
4. Cletus Fernandes, Safe Food Handling: HACCP booklet for Food Handlers. Notion Press.
5. Jacob John. P. A., Handbook on Post Harvest management of Fruits and vegetables (2008) by Daya Publishing House, Delhi.
6. Manoranjan, K and Sangita. S., Food Preservation & Processing (1996) by Kalyani Publishers.

7. Saraswathy, S. et al., Post Harvest Management of Horticultural Crops (2008) by Agribios.
8. Jacob John, P., A Handbook on Post Harvest Management of Fruits and Vegetables (2008)
9. Daya Publishing House, Delhi
10. Manoranjan, K and Sangita, S., Food Preservation & Processing (1996) Kalyani Publishers
11. Srivastava, R. P. & Sanjeev Kumar, Fruits and vegetable Preservation – Principles and
12. Practice (2002) International Book Distributing Co., Lucknow 140
13. Vijay, K., Text Book of Food Sciences and Technology (2001) ICAR
14. Rosa L. A., Fruit and Vegetable Phytochemicals: Chemistry, Nutritional Value and Stability BioGreen
15. Chavan, U., Nutritional Value and Health benefits from fruits, vegetable, nuts & spices
16. Yiu, H., and (2006). Hand Book of Food Science, Technology and Engineering
17. Swaminanthan, M., Hand Book of Food and Nutrition and Diet Therapy
18. Sumati R Mudamb, Fundamental of Food, Nutrition and Diet Therapy

BIOTECH-412 Biotechnology of Crop Improvement 4 (3+1)

Objectives

To acquaint with biotechnological tools of crop improvement, direct and indirect methods of gene transfer, gene editing in plants and to provide knowledge about marker assisted breeding and genomic selection

Theory

Impact of Biotechnology on crop improvement and the perspective of society; Various biotechnological techniques available for crop improvement – Plant Tissue Culture, Genetic Engineering, Marker Assisted breeding and Genomic Selection. Biosafety regulations and their application in Agricultural Biotechnology. Somaclonal variation and its use in crop improvement; embryo culture; anther/pollen culture; somatic embryogenesis; artificial seeds; techniques of protoplast culture, regeneration and somatic cell hybridization, achievements and limitations, utility in the improvement of crop plants. Direct and Indirect methods of gene transfer in plants - Agrobacterium-mediated gene transfer in dicots and monocots; Direct DNA delivery methods (microinjection, particle gun method, electroporation); gene targeting; Gene silencingtechniques; introduction to siRNA; siRNA technology; Micro RNA; construction of siRNA vectors; principle and application of gene silencing; creation of transgenic plants; debate over GM crops; Genome editing-concept, strategies and applications.

Practical

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

Lecture Schedule- Theory

S. No.	Topic	Cr. Hrs.
1	Impact of Biotechnology on crop improvement and the perspective of society	3
2	Various biotechnological techniques available for crop improvement – Plant Tissue Culture, Genetic Engineering, Marker Assisted breeding and Genomic Selection	5
3	Biosafety regulations and their application in Agricultural Biotechnology	3

4	Somaclonal variation and its use in crop improvement	4
5	Techniques of protoplast culture, regeneration and somatic cell hybridization, achievements and limitations, utility in the improvement of crop plants	4
6	Embryo culture; anther/pollen culture; artificial seeds	5
7	Direct and Indirect methods of gene transfer in plants - Agrobacterium-mediated gene transfer in dicots and monocots; Direct DNA delivery methods (microinjection, particle gun method, electroporation); gene targeting	6
9	Gene silencing techniques; introduction to siRNA; siRNA technology; Micro RNA; construction of siRNA vectors; principle and application of gene silencing	5
10	Creation of transgenic plants; debate over GM crops	5
11	Genome editing-concept, strategies and applications	5
	Total Credit Hours	**45**

Lecture Schedule – Practical

S. No.	Topics	Cr. Hrs.
1	Agrobacterium-mediated transformation in Tobacco – preparation of construct, transfer to binary vector	3
2	Transform Agrobacterium, prepare explant, Inoculation and Co-cultivation	2
3	Antibiotic based selection of putative transformants, validation using PCR	2
4	Genome editing- preparation of CRISPR/CAS construct	3
5	Direct transfer to plant, analysis of the targets	2
6	Planning of a MABB programme – selection of parents, crossing strategies, marker analysis	3
	Total Credit Hours	**15**

Suggested Readings:

1. Brown, T. A. 2006. Genomes (3rd edn). Garland Science Pub, New York.
2. Gene Cloning and DNA Analysis. 2010. Retrieved from http://biolab.szu.edu.cn/ otherweb/ lzc/genetic%20engineering/courseware/b1.pdf
3. Green, M. R. and Sambrook, J. 2012. Molecular Cloning: a Laboratory Manual. Cold Spring Harbor, NY: Cold Spring Harbor Laboratory Press.
4. Kumar, Pranav and Mina, Usha. 2015. Biotechnology: A Problem Approach. Pathfinder Publication.
5. Old, R. W., Primrose, S. B. and Twyman, R. M. 2001. Principles of Gene Manipulation and Genomics 7th Edition: Oxford: Blackwell Scientific Publications.
6. Ram, Hari Har. 2019. Crop Breeding and Biotechnology. Kalyani Publications.

7. Rastogi, S.C. 2020. Biotechnology: Principles and Applications. Narosa.
8. Sander, J.D. and Joung, J.K. 2014. CRISPR-Cas systems for Editing, Regulating and Targeting Genomes. Nat Biotechnol. 32:347-355.
9. Singh, K.H., Kumar, Ajay and Parmar, Nehanjali. 2019. Agricultural Biotechnology at a Glance, science technology.
10. Slater. 2008. Plant Biotechnology: The Genetic Manipulation of Plants. Oxford, 400p.

LPM 411 Entrepreneurship Development through Cattle, Buffalo and Goat Farming 3 (2+1)

Theory

Definition of entrepreneur, entrepreneurship, enterprise and manager. Concept of Entrepreneurship and Managerial Characteristics. Motivation and Entrepreneurship Development. Government Schemes and Incentives for Promotion of Entrepreneurship. Demographic distribution of livestock and role in state economy. Problems and prospects of livestock industry in Rajasthan. Introduction to integrated farming systems and its importance. Organic livestock production. Common farm management practices including disinfection, isolation, quarantine and disposal of carcass. Judging and BCS for body parts of livestock. Culling of animals. Selection and purchase of livestock. Housing systems, layout and design of different buildings for animals by utilization of local materials. Breeding schedule and management of bull (Cattle and Buffalo) and buck. Breeding strategies for the improvement of cattle, buffalo and goat. Current livestock breeding policies and programmes in the state and country. Important economic traits for milk production in cattle, buffaloes and goats. Draught ability of cattle, buffaloes and goats. Routine animal farm operations and labour management. Animal farm accounts and records. Merits and demerits of various methods of milking. Factors affecting quality and quantity of milk production and composition. Clean milk production. SWOT Analysis of Dairy Industry. Overview of Dairy Input Industry Opportunities for Entrepreneurs. Milk procurement and processing. Scope of milk processing industries.

Practical

Visit of various dairy and goat enterprises in surrounding areas. Components of entrepreneurship. Acquaintance with all dairy activities. Importance of housing and sanitation. General dairy farm practices such as identification, dehorning, castration, exercising, grooming, weighing etc. Housing systems, layout and design of different houses for dairy animals. General feeding and breeding management practices of dairy animals. Formulation of ration and feeding of dairy animals during different phases of growth and production. Systems of breeding and methods of selection of dairy animals. Demonstration of semen collection, processing and artificial insemination. General health management and vaccination schedule for dairy animals. Project preparation for commercial dairy farms. Biosecurity measures of dairy farm. Modern techniques used in the disposal of farm wastes. Value added products from farm wastes. Visits to different sized dairy farms and

assessment of routine management practices. Analysis of various farm records for economic evaluation. Visit modern integrated livestock farming units.

Lecture Schedule- Theory

S.No.	Topic	Cr. Hrs.
1	Definition of entrepreneur, entrepreneurship, enterprise and manager.	1
2	Concept of entrepreneurship and managerial characteristics.	1
3	Motivation and entrepreneurship development.	1
4	Government schemes and incentives for promotion of entrepreneurship.	1
5	Demographic distribution of livestock and role in state economy.	2
6	Problems and prospects of livestock industry in Rajasthan.	1
7	Introduction to integrated farming systems and its importance.	1
8	Organic livestock production.	1
9	Common farm management practices including disinfection, isolation, quarantine and disposal of carcass.	2
10	Judging and BCS for body parts of livestock.	1
11	Culling of animals.	1
12	Selection and purchase of livestock.	1
13	Housing systems, layout and design of different buildings for animals by utilization of local materials.	2
14	Breeding schedule and management of bull (cattle and buffalo) and buck.	1
15	Breeding strategies for the improvement of cattle, buffalo and goat.	1
16	Current livestock breeding policies and programmes in the state and country.	1
17	Important economic traits for milk production in cattle, buffaloes and goats.	1
18	Draught ability of cattle, buffaloes and goats.	1
19	Routine animal farm operations and labour management.	1
20	Animal farm accounts and records.	1
21	Merits and demerits of various methods of milking.	1
22	Factors affecting quality and quantity of milk production and composition.	1
23	Clean milk production.	1
24	SWOT analysis of dairy industry.	1
25	Overview of dairy input industry opportunities for entrepreneurs.	1
26	Milk procurement and processing.	1

27	Scope of milk processing industries.	1
	Total Credit Hours	**30**

Lecture Schedule – Practical

S. No.	Topic	Cr. Hrs.
1	Visit of various dairy and goat enterprises in surrounding areas.	1
2	Components of entrepreneurship. Acquaintance with all dairy activities.	1
3	Importance of housing and sanitation.	1
4	General dairy farm practices such as identification, dehorning, castration, exercising, grooming, weighing etc.	1
5	Housing systems, layout and design of different houses for dairy animals.	1
6	General feeding and breeding management practices of dairy animals.	1
7	Formulation of ration and feeding of dairy animals during different phases of growth and production.	1
8	Systems of breeding and methods of selection of dairy animals. Demonstration of semen collection, processing and artificial insemination.	1
9	General health management and vaccination schedule for dairy animals.	1
10	Project preparation for commercial dairy farms.	1
11	Biosecurity measures of dairy farm. Modern techniques used in the disposal of farm wastes.	1
12	Value added products from farm wastes.	1
13	Visits to different sized dairy farms and assessment of routine management practices.	1
14	Analysis of various farm records for economic evaluation.	1
15	Visit modern integrated livestock farming units.	1
	Total Credit Hours	**15**

Suggested Readings:

1. Pranav Kumar, Amandeep Singh and Devesh Thakur. 2019. A Handbook for Dairy Entrepreneurs. NIPA.
2. P.C. Chandran, R.K. Bharti, Reena Kamal, Shailendra Kumar Rajak, A. Dey and Kamal Sarma. 2023. Profitable Goat Farming Principles and Practices. Satish Serial Publishing Housing.
3. Das, B.C. et al. 2023. Livestock Entrepreneurship. Narendra Publishing House.
4. Banerjee, G.C. 2013. A Text Book of Animal Husbandry. 8th Ed. ICAR.
5. Sastry N.S.R. and Thomas, C.K. 2006. Livestock Production and Management. Kalyani
6. Thomas C.K. and Sastry, N.S.R. 1991. Dairy Bovine Production. Kalyani.

Courses for B.Sc. (Hons.) Pt-IV, Agriculture

As Per VI Deans Report

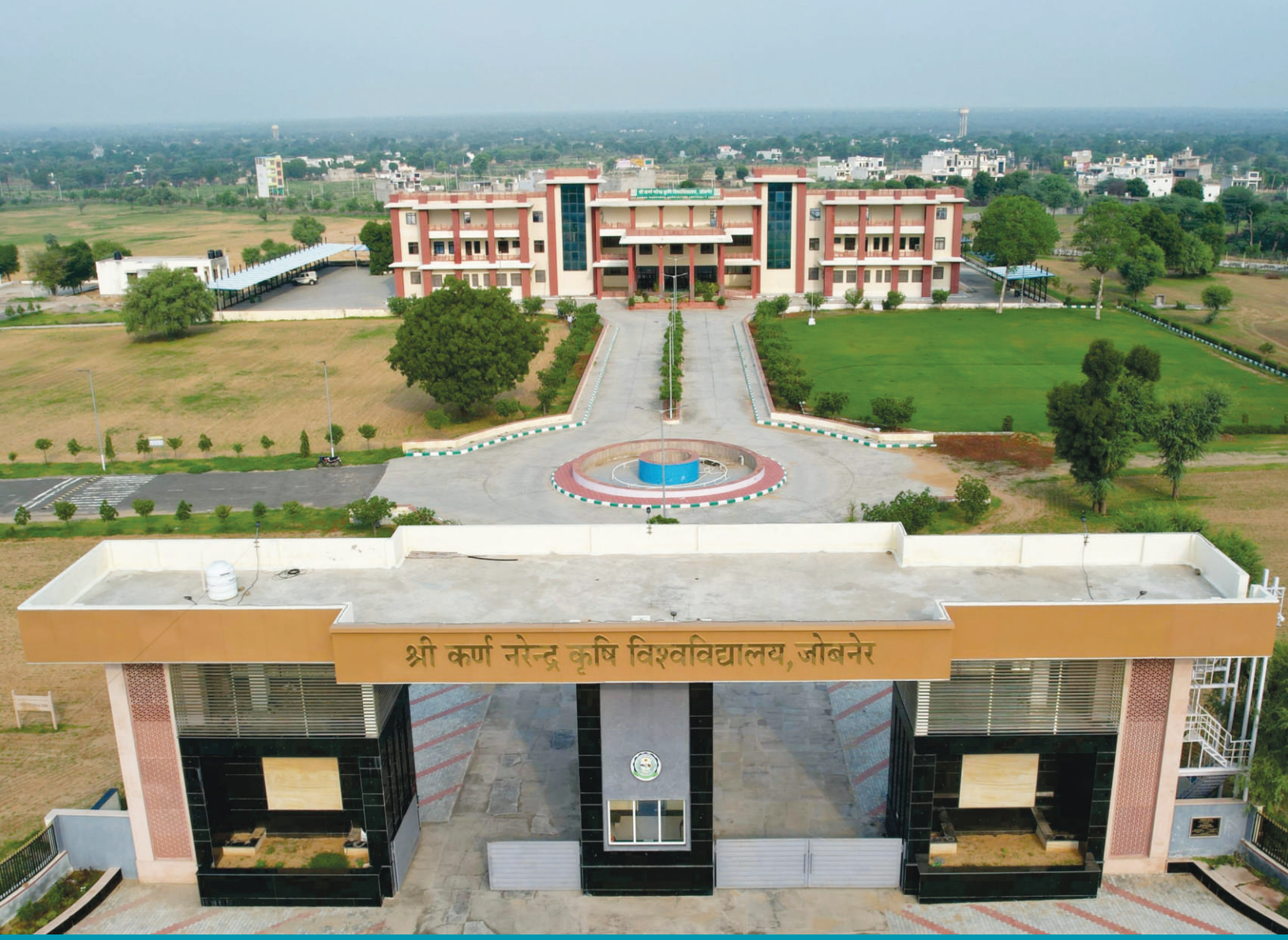
B.Sc. (Hons.) Agriculture Pt-IV, Semester – VIII

[For students opting 4-year B Sc. (Hons.) Agriculture degree]

S. No.	Course No.	Course title	Discipline	Total Credits
1	INTERN 421	Student READY (RAWE / Experiential Learning / Hands on Training / Industrial Attachment /Project Work / Internship	It will be a coordination programme between READY incharge preferably from concerned discipline of allotted module as per requirement and choice of student.	20
			Total Credit Hours	**20**

A student will have to be registered for 20 credits opting for two modules of (0+10) credits each (total 20 credits) from the package of modules in the VIII semester, to be decided later on from the modules decided by the Dean & FC or as per the sanction of EL units from ICAR and available existing facilities. One/two day's orientation programme will be organized by the READY incharge.

Student READY (RAWE / Experiential Learning / Hands on Training / Industrial Attachment /Project Work / Internship etc. will be a coordination programme between READY incharge preferably from concerned discipline of allotted module as per requirement and choice of student but the coordination, monitoring and evaluation will be done by a committee constituted by the Dean/Principal. The concerned READY incharge will be assigned a credit load of 05 credit hours for one batch of students of VIII semester. These 05 credits will not be reflected in students' transcript. It will be counted as credit load of concerned teachers/ incharge.



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