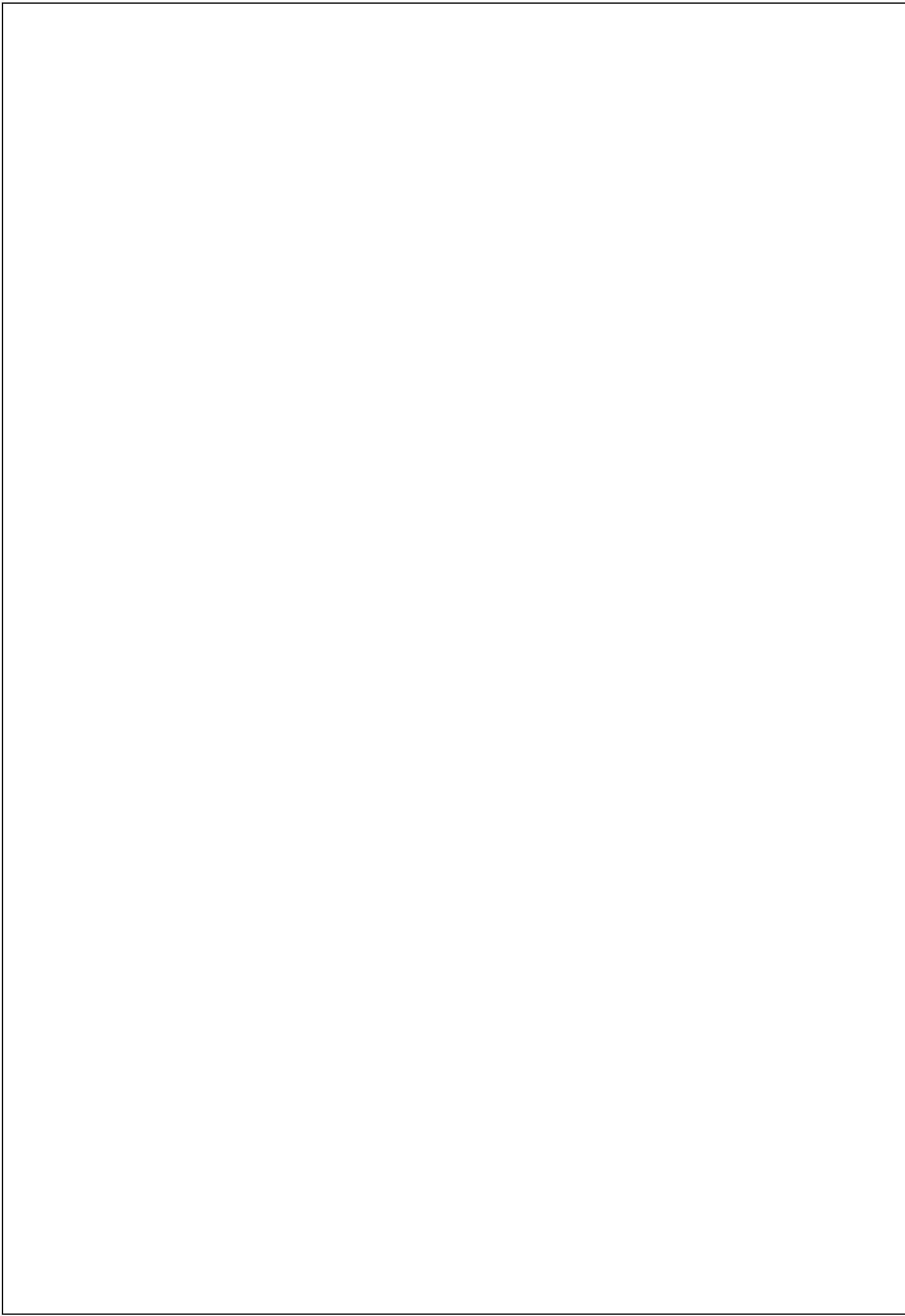




AMRITA
VISHWA VIDYAPEETHAM

SYLLABUS

B.Sc. (Hons.) Agriculture - 2026



CURRICULUM

B.Sc. (Hons.) Agriculture – 2026

Table explaining different components of Course Code

26HOR101	26	HOR	1	0	1
Course code	Year to indicate curriculum in operation (here 2026)	abbreviation indicating department/ discipline (here it is Horticulture)	Year of study (First year)	Odd semester (1 st /3 rd /5 th /7 th)	Serial number of course in a particular discipline in a particular year (here it is first course in first year)

26AGR212	26	AGR	2	1	2
Course code	Year to indicate curriculum in operation (here 2026)	abbreviation indicating department/ discipline (here it is Agronomy)	Year of study (Second year)	Even semester (2 nd /4 th /6 th /8 th)	Serial number of course in a particular discipline in a particular year (here it is second course in second year)

The general rule as listed above is typically followed for course codes, but for university-level courses and elective courses, the specific pattern followed at the university level applies.

Explanation of the letter code in Course Code

Sl. No.	Letter code	Department / Discipline
1.	ADM	Indian culture/Heritage
2.	AEC	Agricultural Economics
3.	AEN	Agricultural Entomology
4.	AEX	Agricultural Extension Education and Communication
5.	AGM	Agricultural Microbiology
6.	AGR	Agronomy
7.	AMP	Animal Husbandry
8.	AVP	Amrita Values Programme
9.	BIC	Biochemistry and Biotechnology
10.	CRP	Crop Physiology
11.	CUL	Cultural Education
12.	ENG	Language (English)
13.	ENR	Agricultural Engineering
14.	ENV	Environmental Sciences
15.	FOR	Forestry
16.	FSN	Food Science and Nutrition
17.	GPB	Genetics and Plant Breeding
18.	HOR	Horticulture
19.	INF	Agri Informatics
20.	INT	Internship
21.	LSK	Life Skills
22.	MAT	Mathematics
23.	PAT	Plant Pathology
24.	PED	Physical Education and Yoga Practices
25.	SAC	Soil Science and Agricultural Chemistry
26.	STA	Agricultural Statistics
27.		Students Welfare (NSS/NCC)

ACADEMIC PROGRAMME

Semester Wise Course and Credits Allocation

First Year

Semester I

S. no.	Course Code	Course Title	Lecture Hrs/w	Practical Hrs/w	Credits
1.	26AEX101	Deeksharambh (Induction-cum-Foundation Course)*	0	4	2
2.		Skill Enhancement Course-I (anyone SEC from the list)	0	4	2
3.		Skill Enhancement Course-II (anyone SEC from the list)	0	4	2
4.	26AEX102	Rural Sociology and Educational Psychology	2	0	2
5.	26AGR101	Fundamentals of Agronomy	2	2	3
6.	26AEX103	Communication Skills	1	2	2
7.	26AGR102	Farming based Livelihood Systems	2	2	3
8.	26SAC101	Fundamentals of Soil Science	2	2	3
9.	26HOR101	Fundamentals of Horticulture	2	2	3
10.	26NSS101/26NCC101	NSS I/ NCC I	0	2	1
11.	26MAT107/26BIO101 **	Introductory Mathematics/Introductory Biology**(need based)	1/1	0/2	1/2
12.	22AVP103	Mastery over mind	1	2	2
13.	22ADM101	Foundation of Indian Heritage	2	1	2
		Total	15	26/27	28 /29

* Non-gradual course

Semester II

S. no.	Course Code	Course Title	Lecture Hrs/w	Practical Hrs/w	Credits
1		Skill Enhancement Course-III (anyone SEC from the list)	0	4	2
2		Skill Enhancement Course-IV (anyone SEC from the list)	0	4	2
3	26SAC112	Soil Fertility Management	2	2	3
4	26ENV111	Environmental Studies and Disaster Management	2	2	3
5	26AEN111	Fundamentals of Entomology	2	2	3
6	26AMP111	Livestock and Poultry Management	1	2	2
7	26PAT111	Fundamentals of Plant Pathology	2	2	3

8	26NSS111/26NCC111	NSS II/ NCC II	0	2	1
9	26AEX114	Personality Development	1	2	2
1	22ADM111	Glimpses of Glorious India	2	1	2
	Total		12	22	23
Post-Semester II (Only for exit option for award of UG-Certificate in Agriculture)					
1	26AGR190	Internship (10 weeks)	10		10

Second Year
Semester III

S. no.	Course Code	Course Title	Lecture Hrs/w	Practical Hrs/w	Credits
1.		Skill Enhancement Course-V (anyone SEC from the list)	0	4	2
2.	26AEC201	Entrepreneurship Development and Business Management	2	2	3
3.	26PED201	Physical Education, First Aid, Yoga Practices and Meditation	0	4	2
4.	26GPB201	Principles of Genetics	2	2	3
5.	26AGR201	Crop Production Technology-I (Kharif Crops)	1	4	3
6.	26HOR201	Production Technology of Fruit and Plantation Crops	1	2	2
7.	26AEX201	Fundamentals of Extension Education	1	2	2
8.	26AEN201	Fundamentals of Nematology	1	2	2
9.	26AGR202	Principles and Practices of Natural Farming	1	2	2
10.	26CUL200	Integrated Amrita Meditation Technique	0	2	1
	Total		9	26	22

Semester IV

S. no.	Course Code	Course Title	Lecture Hrs/w	Practical Hrs/w	Credits
1.		Skill Enhancement Course-VI* (SEC – VI) anyone SEC from the list	0	4	2
2.	26INF211	Agricultural Informatics and Artificial Intelligence	2	2	3
3.	26HOR212	Production Technology of Vegetables and Spices	1	2	2
4.	26AEC212	Principles of Agricultural Economics and Farm Management	2	0	2
5.	26AGR213	Crop Production Technology-II (Rabi Crops)	1	4	3
6.	26ENR211	Farm Machinery and Power	1	2	2
7.	26AGR214	Water Management	1	2	2
8.	26SAC211	Problematic Soils and their Management	1	2	2

9.	26GPB212	Basics of Plant Breeding	2	2	3
10.	26CRS201	Career Readiness Skills I	1	2	2
	Total		12	22	23
Post-Semester IV* (Only For exit option for UG-Diploma in Agriculture)					
1.	26AGR190	Internship (10 weeks)			10

Third Year

Semester V

S. no.	Course Code	Course Title	Lecture Hrs/w	Practical Hrs/w	Credits
1.	26AEC301	Agricultural Marketing and Trade	2	2	3
2.	26AGR301	Introduction to Agro-meteorology	1	2	2
3.	26CRP301	Fundamentals of Crop Physiology	2	2	3
4.	26AEN301	Pest Management in Crops and Stored Grains	2	2	3
5.	26PAT301	Diseases of Field & Horticultural Crops & their Management	2	2	3
6.	26GPB301	Crop Improvement (kharif Crops) – I	1	2	2
7.	26AGR302	Weed Management	1	2	2
8.	26HOR301	Ornamental Crops, MAPs and Landscaping	1	2	2
9.	26FOR301	Introductory Agroforestry	1	2	2
10.	26AEX301	Study tour*	0	4	2
11.	26CRS211	Career Readiness Skills II	1	2	2
	Total		14	24	26

*** Non-gradual course**

Semester VI

S. no.	Course Code	Course Title	Lecture Hrs/w	Practical Hrs/w	Credits
1.	26GPB312	Fundamentals of Agri Biotechnology	2	2	3
2.	26STA311	Basic and Applied Agricultural Statistics	2	2	3
3.	26GPB313	Crop Improvement (Rabi Crops) – II	1	2	2
4.	26ENR311	Renewable Energy in Agriculture and Allied Sector	1	2	2
5.	26AGR313	Dryland Agriculture/Rainfed Agriculture and Watershed Management	1	2	2
6.	26AGM311	Agricultural Microbiology and Phyto -remediation	1	2	2
7.	26AEC312	Agricultural Finance & Cooperation	1	2	2
8.	26BIC311	Essentials of Plant Biochemistry	2	2	3

9.	26GPB314	Fundamentals of Seed Science & Technology	1	2	2
10.	26CRS301	Career Readiness Skills III	1	2	2
	Total		13	20	23

Fourth Year
Semester VII

S. no.	Course Code	Course Title	Lecture Hrs/w	Practical Hrs/w	Credits
1.		5 Elective Courses (major or minor) each of 4 (3+1) credits for B.Sc. (Hons.) Agriculture degree	3	2	4 × 5 = 20

List of Elective Courses

Course Code	Course Title	Lecture Hrs/w	Practical Hrs/w	Credits
26AEC431	Agri-business Management	3	2	4
26AEX431	Agricultural Journalism	3	2	4
26AGM431	Bio pesticides & Bio fertilizers	3	2	4
26AGR431	Basic Coding and System Simulation for Agro advisory	3	2	4
26AGR432	Management of Natural Resources	3	2	4
26AGR433	Climate Resilient Agriculture	3	2	4
26AGR434	Geoinformatics and Remote sensing, Precision farming	3	2	4
26AGR435	Principles and practices of organic farming/Conservation Agriculture	3	2	4
26AGR436	Fundamentals of Digital Agriculture, IoT, Sensors, Drones, Robotics and Automation	3	2	4
26SAC431	Agrochemicals	3	2	4
26SAC432	Bioformulation and Nano formulation	3	2	4
26FSN431	Food science and Nutrition	3	2	4
26FSN432	Post harvest Technology and Value addition	3	2	4
26GPB431	Commercial Plant Breeding	3	2	4
26GPB432	Micro propagation Technologies	3	2	4
26GPB433	Biotechnology of crop improvement	3	2	4

26GPB434	Commercial Seed Production	3	2	4
26HOR431	Landscaping	3	2	4
26HOR432	Protected Cultivation	3	2	4
26HOR433	Hi-tech Horticulture	3	2	4

Semester VIII

S. no.	Course Code	Course Title	Lecture Hrs/w	Practical Hrs/w	Credits
1.	26AEX499	Student READY (RAWE/ Experiential learning/ Hands on training/ Industrial Attachment/ Project Work/ Internship)***	0	40	20

*** The module to be undertaken under the student READY programme shall be decided by the Class Committee. The evaluation pattern and assessment criteria for the RAWE programme shall also be recommended by the Class Committee and approved by the Dean.

Skill Enhancement Courses (indicative)

Course Code	Course Title	Lecture Hrs/w	Practical Hrs/w	Credits
26AEC181	Farm Economics, Agribusiness, Value Chain, Supply Chain and Producer Organization Management	0	4	2
26AEN181	Beneficial Insect farming	0	4	2
26AEX181	Digital Farm Communications, Advisory Systems, and Agricultural Media Production	0	4	2
26AGM181	Production Technology for Bio agents, Biofertilizer and Biopesticide	0	4	2
26AGR181	Organic Production Technology and Agriculture Waste Management	0	4	2
26AGR182	Application of Artificial Intelligence, IoT, Sensor Technologies, Drones and Robotics in Agriculture	0	4	2
26AMP181	Poultry Production Technology	0	4	2
26ENR181	Farm Mechanization, Irrigation Systems, design, Water Harvesting, Soil and Water Conservation, and Farm Infrastructure Development	0	4	2
26FSN181	Food Processing, Post harvest Processing Technology, and Commercial Agrifood Enterprises	0	4	2

26GPB181	Seed Production and Seed Testing Technology	0	4	2
26HOR181	Commercial Horticulture: Floriculture and Landscaping	0	4	2
26HOR182	Plantation Crops Production, Processing, Commercialisation, and Supply chain Management	0	4	2
26PAT181	Mushroom Cultivation Technology	0	4	2
26SAC181	Soil, Plant, and Water Testing and Farm Mapping	0	4	2

Online courses

The students will take a minimum of 10 credits of online courses during four years as a partial requirement for the B.Sc. (Hons.) Agriculture program. These online courses shall be non gradial. The Class Committee shall identify and recommend the indicative list of online courses that may be undertaken by the students. The evaluation pattern, eligibility for successful completion and method of credit recognition shall also be recommended by the Class Committee by the approval of Dean. The University shall maintain a record of all such online courses registered and successfully completed by each student. The titles of successfully completed online courses shall be reflected in final transcript certificate issued to the students.

Annexure III

Syllabus

Agronomy

26AGR101

Fundamentals of Agronomy

2 0 2 3

Course objectives

- i. To impart the basic and fundamental knowledge of agronomy and its role in crop production.
- ii. To develop practical skills in crop establishment, nutrient, water, weed management, and sustainable crop production practices

Course outcomes

Any student who has undergone the course shall be able to:

Sl. No	Course outcome	CO	Blooms level
1	Explain the fundamental concepts, principles, scope, and importance of agronomy in crop production.	CO1	Understand
2	Describe crop establishment techniques, tillage practices, planting geometry, and cropping systems for improving crop productivity.	CO2	Understand
3	Apply the principles of nutrient management, integrated nutrient management (INM), green manuring, and water management in crop production.	CO3	Apply
4	Identify major weeds, understand their management practices, and explain the concepts of sustainable agriculture and natural resource conservation.	CO4	Understand

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, 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 /uncombined 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, Soil moisture constants. Weeds: Definition, importance and basics of classification of weeds and their control. Agroclimatic zones of India and the state, cropping systems: Factors affecting cropping systems, major cropping patterns and systems in the country. Sustainable crop production: Definition, importance and practices, natural resources

and conservation pollution and pollutants, Allelopathy: Meaning and importance in crop production, Growth and development of crops: Definition, Meaning and factors affecting growth and development.

Practical

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.

Suggested Readings

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

26AGR102

Farming based Livelihood Systems

2 0 2 3

Course objectives

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

Course outcomes

Any student who has undergone the course shall be able to:

Sl.No	Course outcome	CO	Blooms level
1	Understand the concepts, objectives, and importance of farming-based livelihood systems.	CO1	Understand
2	Identify different farming systems and livelihood enterprises suitable for different agro-climatic regions.	CO2	Understand
3	Analyse the productivity, profitability, and sustainability of various farming-based livelihood models.	CO3	Analyze

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, Duckery 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.

Suggested Readings

1. Ashley C and Carney D. 1999. *Sustainable Livelihoods: Lessons from Early Experience*. Department for International Development: London, UK; Volume 7. [Google Scholar]
2. Agarwal A and Narain S. 1989. *Towards Green Villages: A strategy for Environmentally, Sound and Participatory Rural Development*. Center for Science and Environment, New Delhi, India
3. Carloni A. 2001. *Global Farming Systems Study: Challenges and Priorities to 2030 – Regional Analysis: Sub-Saharan Africa*. Consultation Document, FAO, Rome, Italy
4. Dixon J, Gulliver A and Gibbon D. 2001. *Farming Systems and Poverty: Improving Farmers' Livelihoods in a Changing World*. FAO & World Bank, Rome, Italy & Washington, DC, USA
5. Evenson R E. 2000. *Agricultural Productivity and Production in Developing Countries*. In FAO, The State of Food and Agriculture, FAO, Rome, Italy
6. Reddy S R. 2016. *Farming System and Sustainable Agriculture*. Kalyani Publishers, New Delhi.
7. Walia S S and Walia U S. 2020. *Farming System and Sustainable Agriculture*. Scientific Publishers, Jodhpur, Rajasthan.

26AGR201

Crop Production Technology-I (Kharif Crops)

1 0 4 3

Course objective

- i. To impart basic and fundamental knowledge on principles and practices of kharif crop production
- ii. To impart knowledge and skill on scientific crop production and management

Course outcomes

Any student who has undergone the course shall be able to:

Sl. No	Course outcome	CO	Blooms level
1	Explain the origin, distribution, economic importance, and agro-climatic requirements of major kharif crops.	CO1	Understand
2	Describe the recommended scientific production technologies, crop varieties, and agronomic practices for major cereals, pulses, oilseeds, fibre, and forage crops grown during the kharif season.	CO2	Understand
3	Apply appropriate crop production and management practices, including nursery raising, sowing, nutrient management, and weed management for kharif crops.	CO3	Apply
4	Evaluate crop growth, yield attributes, and productivity through biometric observations, yield estimation, and agronomic experiments.	CO4	Analyze
5	Demonstrate practical skills in cultivation, crop identification, forage conservation (silage and hay making), and field-based crop production technologies through experiential learning.	CO5	Analyze

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 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.

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

Suggested Readings

1. Chidda Singh.1997. *Modern Techniques of Raising Field Crops*. Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi.
2. Gurarajan B, Balasubramanian R and Swaminathan V. 2018. *Recent Strategies on Crop Production*. (2nd Edn.). Kalyani Publishers, New Delhi.
3. Rajendra Prasad. 2017. *Textbook of Field Crops Production - Commercial Crops (Volume II)*. ICAR Publication.
4. Reddy S R. 2009. *Agronomy of Field Crops*. Kalyani Publishers, New Delhi.
5. Singh S S. 2005. *Crop Management*. Kalyani Publishers, New Delhi.
6. Subhash Chandra Bose M and Balakrishnan V. 2001. *Forage Production*. South Asian Publishers, New Delhi.

26AGR202

Principles and Practices of Natural Farming

1 0 2 2

Objectives

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

Course outcomes

Any student who has undergone the course shall be able to:

Sl.No	Course outcome	CO	Blooms level
1	Explain the concepts, principles, importance, and different approaches of natural farming in relation to sustainable agriculture and climate resilience.	CO1	Understand
2	Describe the ecological principles, biodiversity conservation, nutrient cycling, water conservation, and integrated farming practices involved in natural farming.	CO2	Understand
3	Apply natural farming techniques, including indigenous technical knowledge (ITK), on-farm input preparation, green manuring, and natural methods of nutrient, pest, disease, and weed management.	CO3	Apply

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).

Suggested Readings

1. Ayachit S M. 2002. *Kashyapi Krishi Sukti (A Treatise on Agriculture by Kashyapa)*. Agri-History Bulletin No.4. Asian Agri-History Foundation.
2. Boeringa R. (Ed.). 1980. *Alternative Methods of Agriculture*. Elsevier, Amsterdam.
3. Dabholkar Shripad A and Prayog Pariwar. 2021. *Plenty for All: Natural Farming A to Z*. Prayog Pariwar Methodology. Mehta Publishing House, 1941, Sadashiv Peth, Madiwale Colony, Pune.
5. Faires Nicole. 2016. *The Ultimate Guide to Natural Farming and Sustainable Living: Permaculture for Beginners (Ultimate Guides)*. Skyhorse Pub Co Inc.
6. FAO. 2018. *The 10 elements of agro-ecology: Guiding the transition to sustainable food and agricultural system*. FAO. <https://www.fao.org/3/i9037en/i9037en.pdf>
7. Khurana A and Kumar V. 2020. *State of Organic and Natural Farming: Challenges and Possibilities*. Centre for Science and Environment, New Delhi.
8. Lindenmayer David B, Macbeth Suzannah M, et al. 2022. *Natural Asset Farming: Creating Productive and Biodiverse Farms*. CSIRO Publishing.
9. Malhotra R and Babaji S D. 2020. *Sanskrit Non-Translatable- The importance of Sanskritizing English*. Amaryllis, New Delhi India.
10. Nalini S. 1999. *Krishi-Parashara (Agriculture by Parashara)*. Parashara, Brig Sayeed Road, Secunderabad, Telangana: AAHF Classic Bulletin, Asian Agri-History Foundation.
11. 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.
12. Tirado Reyes. 2015. *Ecological Farming – The Seven principles of a food system that has people at its heart*. Baker, M., Kramb, D. [Eds]. Publ. Greenpeace International.
13. Behera U K. 2013. *A Textbook of Farming System*. Agrotech Publishing House, Udaipur.

26AGR213

Crop Production Technology-II (Rabi Crops)

1 0 4 2

Objectives

- i. To impart basic and fundamental knowledge on principles and practices of *rabi* crop production.
- ii. To impart knowledge and skill on scientific crop production and management.

Course outcomes

Any student who has undergone the course shall be able to:

Sl.No	Course outcome	CO	Blooms level
1	Explain the origin, distribution, economic importance, and agro-climatic requirements of major rabi crops.	CO1	Understand
2	Describe the recommended scientific production technologies, crop varieties, and agronomic practices for major cereals, pulses, oilseeds, sugar crops, medicinal and aromatic crops, forage crops, and other important rabi crops.	CO2	Understand
3	Apply appropriate crop production and management practices, including sowing methods, nutrient management, and weed management for rabi crops.	CO3	Apply
4	Analyze crop growth, yield attributes, productivity, and quality parameters through biometric observations, yield estimation, and agronomic experiments.	CO4	Analyze
5	Demonstrate practical skills in crop identification, cultivation, quality analysis, forage production, oil extraction, and field-based crop production technologies through experiential learning and research station visits.	CO5	Analyze

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, peas. *Rabi* redgram and, rajmash. Oilseed- rapeseed, mustard, 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 weeds in *rabi* season crops; study of morphological characteristics of *rabi* crops; study of yield contributing characters of *rabi* season crops; yield and juice quality analysis of sugarcane; study of important agronomic experiments of *rabi* crops at experimental farms; study of *rabi* forage experiments; oil extraction of medicinal crops; visit to research stations of related crops.

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

Suggested Readings

1. Gurarajan B, Balasubramanian R and Swaminathan V. 2008. *Recent Strategies on Crop Production*. Kalyani Publishers, New Delhi.
2. Prasad Rajendra. 2002. *Textbook of Field Crops Production*. ICAR, New Delhi.
3. Prasad Rajendra. 2012. *Textbook of Field Crops Production - Foodgrain Crops (Volume I)*. ICAR Publication.
4. Prasad Rajendra. 2017. *Textbook of Field Crops Production - Commercial Crops. (Volume II)*. ICAR Publication.
5. Reddy S R. 2004. *Agronomy of Field Crops*. Kalyani Publishers, Ludhiana.
6. Reddy S R. 2009. *Agronomy of Field Crops*. Kalyani Publishers, New Delhi.
7. Singh Chidida, Singh Rajbir and Singh Prem. 2025. *Modern Techniques of Raising Field Crops*. (4th Edn.). Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi.
8. Singh S S. 2005. *Crop Management*. Kalyani Publishers, New Delhi.
9. Subhash Chandra Bose M and Balakrishnan V. 2001. *Forage Production*. South Asian Publishers, New Delhi.
10. UAS Bangalore. 2011. *Package of Practice*. UAS, Bengaluru.

26AGR214

Water Management

1 0 2 2

Objectives

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

Course outcomes

Any student who has undergone the course shall be able to:

Sl.No	Course outcome	CO	Blooms level
1	Explain the principles of soil–plant–water relationships, crop water requirements, and the importance of efficient water management in agriculture.	CO1	Understand

2	Describe different irrigation methods, irrigation scheduling approaches, irrigation water quality, and water management practices for field and horticultural crops.	CO2	Understand
3	Apply appropriate irrigation techniques, soil moisture conservation practices, fertigation, and water use efficiency measures for sustainable crop production.	CO3	Apply
4	Analyze irrigation system performance, water requirement, irrigation efficiency, and the role of modern technologies such as automation and climate-based irrigation in water management.	CO4	Analyze

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.

Suggested Readings

1. Carr M K V and Fereres Elias. 2014. *Advances in Irrigation Agronomy*. Cambridge University Press.
2. Michael A M. 2009. *Irrigation Theory and Practice*. (2nd Edn.). Vikas Publishing House Pvt. Ltd.
3. Majumdar Dilip Kumar. 2010. *Irrigation Water Management: Principles and Practice*. Prentice Hall of India Pvt. Ltd.
4. Patil S V and Rajakumar G R. 2016. *Water Management in Agriculture and Horticultural Crops*. Satish Serial Publishing House, Delhi.
5. Rao Y P and Bhaskar S R. 2008. *Irrigation Technology. Theory and Practice*. Agrotech Publishing Academy, Udaipur.

26AGR301

Introduction to Agro-meteorology

1 0 2 2

Objectives

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

Course Outcome:

Any student who has undergone the course shall be able to:

Sl.No	Course outcome	CO	Blooms level
1	Explain the concepts of weather, climate, atmospheric processes, weather hazards, and climate change in agriculture.	CO1	Understand
2	Apply agrometeorological instruments and techniques to measure weather variables and compute radiation, temperature, humidity, and evapotranspiration.	CO2	Apply

3	Analyze weather data, synoptic charts, and crop weather calendars for weather forecasting and climate change impact assessment.	CO3	Analyze
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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, longwave 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 heat-wave 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 Agrometeorological 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 windrose, 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.

Suggested Readings

1. Mahi G S and Kingra P K. 2018. Fundamentals of Agrometeorology and Climate Change. Kalyani Publishers.
2. Mavi H S. 1986. Introduction to Agrometeorology. Oxford & IBH Pub.
3. Varshneya M C and Pillai P B. 2004. Textbook of Agricultural Meteorology. Indian Council of Agricultural Research.
4. Patra Alok Kumar. 2020. Introduction to Agrometeorology and Climate Change. New India Publishing Agency.
5. Prasada Rao G S L H V. 2008. Agricultural Meteorology. PHI Learning Pvt. Ltd.

26AGR302

Weed Management

2 0 2 3

Course objectives

- i. To teach students about principles of weed science.
- ii. To impart practical knowledge of weed management in field and horticultural crops.

Course outcomes

Any student who has undergone the course shall be able to:

Sl.No	Course outcome	CO	Blooms level
1	Understand the principles, classification, and biology of weeds and their interaction with crops.	CO1	Understand
2	Identify major weed species and their characteristics in different field and horticultural crops.	CO2	Understand
3	Analyze the losses caused by weeds and the factors affecting crop-weed competition.	CO3	Analyze
4	Explain various methods of weed management	CO4	Understand

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.

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. 1984. *Scientific Weed Management*. Today and Tomorrow Printers and Publishers, New Delhi.
3. Gupta O P. 2015. *Modern Weed Management*. Agro Bios (India), Jodhpur.
4. Naidu V S G R. 2012. *Handbook of Weed Identification*. Directorate of Weed Research, Jabalpur.
5. Rajagopal A, Aravindan R and Shanmugavelu K G. 2015. *Weed management of Horticultural Crops*. Agrobios (India), Jodhpur.
6. Ramamoorthy K and Subbian P. 2013. *Predominant Weed Flora in Hill Ecosystems*. Agrobios (India), Jodhpur.

7. Rao V S. 2000. *Principles of Weed Science*. Oxford & IBH Publishing Co., New Delhi.
8. Subramanian S, Mohammed Ali A and Jayakumar R. 1991. *All About Weed Control*. Kalyani Publishers, Ludhiana.
9. Tadulingam C and Venkatnarayana D. 1955. *A Handbook of Some South Indian Weeds*. Government Press, Madras.
10. Thakur C. 1977. *Weed Science*. Metropolitan Book Co. Pvt. Ltd., New Delhi.

26AGR313 Dryland Agriculture/ Rainfed Agriculture and Watershed Management 1 0 2

2

Course objectives

- i. To learn about characteristics and conditions of dryland/rainfed agriculture.
- ii. To gain knowledge about drought and its mitigation.
- iii. To impart knowledge on water harvesting and watershed management.

Course outcomes

Any student who has undergone the course shall be able to:

Sl. No	Course outcome	CO	Blooms level
1	Understand the characteristics, constraints, and agro-climatic conditions of dryland/rainfed agriculture	CO1	Understand
2	Identify different types, causes, and indices of drought affecting crop production in rainfed areas.	CO2	Understand
3	Analyze various drought mitigation strategies including crop planning, soil moisture conservation, and contingency measures	CO3	Analyze
4	Explain the principles and techniques of water harvesting and their role in sustainable rainfed farming	CO4	Understand

Theory

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

and crop specific dryland principles and practices for profitable and sustainable dryland farming and allied enterprises.

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.

Suggested Readings

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

Soil Science

Objectives

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

Course Outcome:

Any student who has undergone the course shall be able to:

Sl.No	Course outcome	CO	Blooms level
1	Outline elementary aspects of soil-forming rocks and minerals, weathering, and composition and soil formation	CO1	Understand
2	Recognise the soil's physical parameters and characteristics of the soil	CO2	Remember
3	Explain the chemistry of soil with nutrient availability	CO3	Understand
4	Discuss the role of soil organisms in the soil and soil pollution and its environment	CO4	Analyse
5	Determine the soils for basic physical, physico-chemical & chemical properties	CO5	Evaluate

Theory

Soil: Pedological and edaphological 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 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.

Suggested Readings

1. Das Dilip Kumar. 2022. Introductory Soil Science. Kalyani Publishers.

2. Harry O Buckman and Nyle C. 1996. The Nature and Properties of Soils. (11th Edn.). Prentice Hall.
3. Singh S S. 2016. Soil Fertility and Nutrient Management. (3rd Edn.). Kalyani Publishers.
4. Tisdale Samuel L, Nelson Werner L and Beaton James D. 2016. Soil Fertility and Fertilizers. (8th Edn.). Pearson Education

26SAC112

Soil Fertility Management

2 0 2 3

Objectives

- To expose the basic concepts of soil fertility and different manures and fertilizers.
- In-depth understanding of the essential plant nutrients and the role, functions, and deficiency of nutrients in plants.
- Understanding the importance of plant/soil/nutrient interactions and how these components dynamically interact to influence soil fertility and nutrient management through various approaches.
- Acquire practical knowledge on nutrient analysis in soil, plants, and manures.

Course Outcome:

Any student who has undergone the course shall be able to:

Sl.No	Course outcome	CO	Blooms level
1	Memorize different manures and fertilizers as sources of plant nutrients and their properties	CO1	Remember
2	Explain the functions, deficiency, toxicity, and dynamics of different nutrients and the working principle of analytical instruments	CO2	Understand
3	Describe the nutrient behaviour in soil ecosystem services with a view to plant requirements across a range of crops	CO3	Understand
4	Illustrate the modern concepts of soil fertility evaluation and its management	CO4	Understand
5	Estimate and interpret the nutrient content in soil, plants, and manures to overcome nutrient use efficiency	CO5	Analyze

Theory

History of soil fertility and plant nutrition. Criteria of essentiality. Role, deficiency and toxicity symptoms of essential plant nutrients, Mechanisms of nutrient transport to plants, factors affecting nutrient availability to plants. Chemistry of macro and micronutrients. Soil fertility evaluation, Soil testing. Critical levels of different nutrients in soil. Forms of nutrients in soil, plant analysis, rapid plant tissue tests. Indicator plants. Introduction and importance of manures and fertilizers.

Fertilizer recommendation approaches. Integrated nutrient management. Chemical fertilizers: classification, composition and properties of major fertilizers, secondary and micronutrient fertilizers, Complex fertilizers, Customised fertilisers, water soluble fertilizers, nano fertilizers Soil amendments, Fertilizer Storage, Fertilizer Control Order. Methods of fertilizer recommendations to crops. Factor influencing nutrient use efficiency (NUE), methods of application under rainfed and irrigated conditions. STCR/RTNM/ IPNS, Carbon sequestration and Carbon Trading, Preparation and properties of major manures (FYM, Compost, Vermicompost, Green manuring, Oilcakes).

Practical

Introduction of analytical instruments and their principles, calibration and applications of Colouremetry and flame photometry; Estimation of alkaline hydrolysable 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.

Suggested Readings

1. Buckman Harry O and Brady Nyle C. 2018. The Nature and Properties of Soils. Franklin Classics.
2. Das Dilip Kumar. 2022. Introductory Soil Science. Kalyani Publishers, New Delhi.
3. Singh S S. 2011. Soil Fertility and Nutrient Management. Kalyani Publishers, New Delhi
4. Tisdale Samuel L, Nelson Werner L and Beaton James D. 2016. Soil Fertility and Fertilizers. (8th Edn.). Pearson Education India.

Objectives

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

Course Outcome:

Any student who has undergone the course shall be able to:

Sl.No	Course outcome	CO	Blooms level
1	Attain knowledge about soil health, quality, wasteland and problem soils with their characteristics and management	CO1	Understand
2	Able to identify problems of soil, how to reclaim the problem soil and their post- reclamation management	CO2	Apply
3	Explain about the land management to improve the soil physical and chemical health	CO3	Understand
4	Assess the irrigation water quality and suggest the recommendation for better crop production	CO4	Apply
5	Acquire advanced knowledge regarding the remote sensing and GIS	CO5	Understand
6	Define clear vision about different types of soil pollution and their management along with ecosystem management and carbon sequestration methodologies	CO6	Remember

Theory

Soil quality and health, Distribution of wasteland 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, utilisation 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, bioremediation through MPTs of soils, land capability and classification, land suitability classification.

Practical

Determination of pH 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 characterisation 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, CO₃, HCO₃, Cl, SAR and RSC), Determination of nitrate (NO₃⁻) from irrigation water, Determination of dissolved oxygen and free carbon dioxide levels in water samples.

Suggested Readings

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

Horticulture

26HOR101

Fundamentals of Horticulture

2 0 2 3

Objectives

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

Course Outcome

Sl. No	Course outcome	CO	Blooms level
1.	Basics of horticulture and classification of crops learned	CO-1	Understanding
2.	Students can able to demonstrate the different types of plant propagation techniques and propagating structures	CO-2	Execution & Evaluation

3.	Can able to apply and evaluate the special horticultural practices	CO-3	Theory
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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 Stock-scion relationship. 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.

Practical

Identification and nomenclature of fruit, 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 PGR, Layout of different irrigation systems, Maturity studies, harvesting, grading, packaging and storage.

Objectives

- i. To educate about the different forms of classification of fruit crops
- ii. To educate about the origin, area, climate, soil, improved varieties and cultivation practices of fruit and plantation crops
- iii. To educate about the physiological disorders of fruit crops, palms and plantation crops

Course outcomes:

At the end of the course the student shall be able to

Sl. No	Course outcome	CO	Blooms level
1.	Explain The scientific cultivation methods of different fruit and plantation crops	CO1	Understanding
2.	Apply the techniques of nursery management, HDP and special horticultural practices followed for important fruit and plantation crops.	CO2	Applying
3.	Practice the techniques of propagation and canopy management for important fruit and plantation crops	CO3	Applying

Theory

Production status of fruit and plantation crops: Importance and scope of fruit and plantation crop industry in India; nutritional value of fruit crops; classification of fruit crops; area, production, productivity and export potential of fruit and plantation crops. 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, apple, plantation crops-coconut, arecanut, cashew, tea, coffee and rubber. Crop production techniques in palms and plantation crops: Climate and soil requirements, varieties, propagation, nursery management, planting and planting systems, cropping systems, after care, training and pruning for plantation crops, water, nutrient and weed management, intercropping, multi-tier cropping system, mulching, special horticultural practices, maturity indices, harvest and yield, pests and

diseases, processing- value addition Palms: Coconut, Arecanut, Oil palm and Palmyrah, Plantation crops: Tea, Coffee, Cocoa, Cashewnut, Rubber.

Practical

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.

Suggested Readings

1. Banday F A and Sharma M K. 2010. Advances in temperate fruit production. Kalyani Publishers, Ludhiana.
2. Bose T K, Mitra S K and Sanyal D. 2001. Fruits: Tropical and Subtropical (2 volumes) Naya Udyog, Calcutta.
3. Bose T K, Mitra S K, Farooqi A A and Sadhu M K. (Eds). 1999. Tropical Horticulture Vol.1. Naya Prokash, Calcutta.
4. Chadha T R. 2001. Textbook of temperate fruits. ICAR, New Delhi
5. Chattopadhyay T K. 2001. A Text Book on Pomology (4 volumes). Kalyani Publishers, Ludhiana.
6. Chattopadhyay T K. 1998. A Textbook on Pomology (sub-tropical fruits) vol.III. Kalyani Publishers, Ludhiana.
7. Das B C and Das S N. 2003. Cultivation of minor fruits. Kalyani Publishers, Ludhiana.
8. Dhillon W S. 2013. Fruit production in India. Narendra Publishing House, New Delhi.
9. Kavino M, Jegadeeswari V, Vijayakumar R M and Balkrishnan S. 2018. Production Technology of Fruits and Plantation Crops. Narendra Publishing House.
10. Ponnuswami V, Kumar M, Kumar S Ramesh and Krishnamoorthy C. 2015. Fruit and Plantation Crops. Narendra Publishing House.
11. Radha T and Mathew L. 2007. Fruit crops. New India Publishing Agency.
12. Sadhu M K and Chattopadhyay P K. 2001. Introductory Fruit Crops. Naya Prokash, Calcutta.

13. Sharma A, Kumar P, Tripathi V K. 2024. Production Technology of Fruits and Plantation Crops. Elite Publishing House.
14. Singh H P and Mustafa M M. 2009. Banana – New Innovations. Westville Publishing House, New Delhi.
15. Singh S P. 2004. Commercial Fruits. Kalyani Publishers, Ludhiana.
16. Veeraragavathatham D, Jawaharlal M, Jeeva S, Rabindran R and Umapathy G. 2004. Scientific fruit culture. (2nd Edn.). Suri Associates, 1362/4, Velraj Vihar Complex, Thadagam Road, Coimbatore-2.

26HOR212

Production Technology of Vegetables and Spices

1 0 2 2

Objectives

- i. To educate about the different forms of classification of vegetables
- ii. To educate about the origin, area, climate, soil, improved varieties and cultivation practices of vegetables and spices
- iii. To educate about the physiological disorders of vegetables and spices

Course Outcome:

By the end of the semester, the student shall be able to

Sl. No	Course outcome	CO	Blooms level
1.	Explain the scientific cultivation methods of different vegetable and spice crops	CO1	Understanding
2.	Apply the techniques of nursery management, nutrient management and special horticultural practices followed for important vegetable and spice crops	CO2	Application

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, French bean, peas; cole crops such as cabbage, cauliflower, knolkhol; 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, spice crops like turmeric, zinger, garlic, coriander, cumin, black pepper, cardamom, fenugreek, fennel, clove, nutmeg, cinnamon, curry leaf, 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.

Suggested Readings

1. Anant Bahadur and Singh K P. 2014. Olericulture, Fundamentals of Vegetable Production (Vol.1). Kalyani Publishers, Chennai.
2. Fagaria M S, Choudhury B R and Dhaka R S. 2016. Vegetable Crops Production Technology (Vol. II). Kalyani Publishers.
3. Kabir J, Bose T K and Som M G. 2021. Vegetable crops. (4th Edn.). Astral Publishing Authors Across the Globe.

26HOR301

Ornamental Crops, MAPs and Landscaping

1 0 2 2

Objectives

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

Course Outcome

Sl. No	Course outcome	CO	Blooms level
1.	Understand the basics of ornamental crops, Medicinal and Aromatic plants and Landscaping	CO-1	Understand
2.	Understand the production techniques of flower crops, medicinal crops, aromatic plants and Design and layout of landscape garden	CO-2	Understand
3.	Gain practical knowledge on production technology of flower crops, MAP and Landscaping	CO-3	Apply

Theory

Production technology of ashwagandha, costus, isabgol and geranium; Production technology of mint, aloe and ocimum, Coleus, Glory lily, Periwinkle etc.; Production technology of plants like lemongrass, citronella, vetiver and palmarosa etc., Importance and scope of ornamental crops; Importance and scope of medicinal and aromatic plants and landscaping; 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 and lily; Production technology of chrysanthemum and carnation; Package of practices for loose flowers like marigold and jasmine under open conditions; Brief concept of Home landscaping, Carpet bedding, Topiary, Bonsai, Lawn, flower arrangement, Herbaceous Border, Hedge, Edge etc.; Processing and value addition in 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.

Suggested Readings

1. Bose T K, Aswath C, Yadav LP, Pal P, Dutta K, Kumar Rajiv and Das P. 2021 (3rd Edn.) Commercial flowers (Vol-1). Astral Publishing Authors Across the Globe.
2. Bose T K, Aswath C, Dutta K, Bhatia Reeta and Shah TN. 2021 (3rd Edn.) Commercial flowers (Vol-2). Astral Publishing Authors Across the Globe.
3. Kumar N, Khader A, Rangaswami P and Irulappan I. 1997. Introduction to Spices, Plantation Crops, Medicinal and Aromatic Plants. Rajalakshmi Publications.
4. Randhawa G S and Mukhopadhyay A. 1998. Floriculture in India. Allied Publishers Pvt Ltd.
5. Singh Anil K and Sisodia Anjana. 2017. Textbook of floriculture and landscaping. New India Publishing Agency.

Genetics and Plant Breeding

26BIO101

Introductory Biology

1 0 2 2

(need based) Non-gradual

Course objectives

The objective of this course is to

1. **Establish a strong foundation in biological principles**, including evolution, cell biology and classification, tailored to agricultural contexts.
2. **Develop a clear understanding of economically important plant families** and the integral role of animals in sustainable agriculture.

3. **Build essential practical skills** in plant morphology, microscopy, and systematics for students without prior exposure to biology.

Course outcomes

By the end of the course, the students will be able to

Sl.No	Course outcome	CO	Blooms level
1	Remember fundamental concepts of the living world, evolution, eugenics, and classification.	CO1	Remember
2	Understand basic plant biology, including morphology, seed germination and the role of animals in agriculture	CO2	Understand
3	Apply knowledge to interpret the stages of cell division, and analyze the diagnostic characteristics of agriculturally important plant families such as Brassicaceae, Fabaceae, and Poaceae.	CO3	Apply

(**Bloom's taxonomy:** Anderson, L. W., & Krathwohl, D. R. (2001). A taxonomy for learning, teaching, and assessing, Abridged Edition. Boston, MA: Allyn and Bacon)

Syllabus

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 flowering plants. Seed and seed germination. Plant systematic- viz, Brassicaceae, Fabaceae and Poaceae. Role of animals in agriculture.

Practical

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

Objectives

To acquaint students with both principles and practices in classical genetics, modern genetics, quantitative genetics, and cytogenetics.

Course Outcome:

Any student who has undergone the course shall be able to:

Sl.No	Course outcome	CO	Blooms level
1	Illustrate the key concepts that underpin cell, gene and chromosome and Mendelian Genetics	CO1	Understand
2	Explain the fundamental concepts of Genetics and Cytogenetics using classical examples and the principles of Mendelian and Non-Mendelian inheritance	CO2	Understand
3	Demonstrate the use of microscopes and perform mitotic and meiotic cell division studies to identify cellular and chromosomal structures	CO3	Apply
4	Exemplify about Modern concepts of Genetics	CO4	Understand
5	Analyze the quantitative and qualitative data from classical to modern genetics	CO5	Apply

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. Probabilit and Chi-square. Types of DNA and RNA, 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, Methods of inducing mutations, mutagenic agents and induction of mutation. Qualitative and quantitative traits, Polygenes and continuous variations, multiple factor hypothesis, Cytoplasmic inheritance, Nature, structure and replication of genetic material, Protein synthesis, Transcription and translational mechanism of genetic material, Gene concept: Gene structure, function and regulation.

Practical

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

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

26GPB212

Basics of Plant Breeding

2 0 2 3

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.

Course Outcome:

Any student who has undergone the course shall be able to:

Sl.No	Course outcome	CO	Blooms level
1	Describe the breeding procedures of self- and cross-pollinated crops for varietal and hybrid development.	CO1	Remember
2	Practice different methods of emasculation and hybridization techniques in self- and cross-pollinated crops.	CO2	Apply
3	Explain the fundamentals of mutation, polyploidy, wide hybridization, biotechnological tools, and their role in crop improvement.	CO3	Understand

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. 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, heritability, Designs used in plant breeding experiments, analysis of Randomized Block Design, To work out the mode of pollination in a given crop and extent of natural out-crossing, Prediction of performance of double cross hybrids, Maintenance of breeding records and data collection, Screening tests for biotic and abiotic stresses.

Suggested Readings

1. Principles of Plant Breeding (1st & 2nd Edition) by RW Allard.
2. Plant Breeding: Principles & Practices by JR Sharma.
3. Plant Breeding- B.D. Singh.
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.

26GPB301

Crop Improvement (kharif crops) – I

1 0 2 2

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

Course Outcome:

Any student who has undergone the course shall be able to:

Sl.No	Course outcome	CO	Blooms level
1	Summarize the origin, distribution, plant genetic resources, and centres of diversity of kharif crops.	CO1	Understand
2	Apply different breeding methods for the development of varieties and hybrids in field and horticultural crops.	CO2	Apply
3	Explain the procedures of varietal development and hybrid seed production techniques in field and horticultural crops.	CO3	Apply

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 pigeonpea etc. Ideotype concept, climate resilient 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, ragi, pigeonpea, urdbean, mungbean, soybean, groundnut, sesame, castor, cotton, cowpea, tobacco, brinjal, okra and cucurbitaceous crops. Maintenance breeding of different kharif crops. Handling of germplasm and segregating populations by different methods like pedigree, bulk and single seed decent methods; Study of field techniques for seed production and hybrid seed production in kharif crops; Estimation of heterosis, inbreeding depression and heritability; Layout of field experiments; Study of quality characters, donor parents for different characters; Visit to seed production plots; Visit to AICRP breeding plots of different crops.

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

26GPB312

Fundamentals of Agricultural Biotechnology

2 0 2 3

Objectives

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

Course Outcome:

Any student who has undergone the course shall be able to:

Sl.No	Course outcome	CO	Blooms level
1	Utilize the plant tissue culture techniques for in-vitro regeneration of plants	CO1	Apply

2	Explain the structure and function of DNA, RNA, genes and the molecular mechanisms of DNA replication, transcription, translation, protein synthesis and gene regulation including lac operon concepts in prokaryotes, principles and applications of nucleic acid hybridization, PCR and sequencing	CO 2	Understand
3	Explain the principles and methods of recombinant DNA technology and the development and significance of transgenic crops	CO3	Understand
4	Analyse DNA samples through Agarose gel electrophoresis and restriction digestion	CO4	Analyse
5	Apply the principles of molecular markers to explain their use in marker-assisted breeding for crop improvement	CO5	Apply

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; DNA replication, transcription and translation, RNA, types and function; Structure of prokaryotic and eukaryotic gene; Central dogma of life - DNA replication, transcription, genetic codes translation and protein synthesis; Lac Operon concept - Nucleic acid hybridization; Polymerase chain reaction- DNA sequencing – Sanger method; PCR and its applications. Introduction to recombinant DNA technology: DNA modifying enzymes and vectors; plant genetic transformation – physical (Gene gun method), chemical (PEG mediated) and Agrobacterium-mediated gene transfer methods; Transgenic and its importance in crop improvement with successful stories; biosafety. Introduction to various molecular markers: RFLP, RAPD, SSR, SNP etc.; Marker-assisted breeding in crop improvement.

Practical

Introduction to Plant Tissue Culture Laboratory; Good Laboratory Practices; Media Preparation and sterilization; Glassware sterilization; Micropropagation; Callus induction and culture; Anther culture;

Apical meristem culture; Preparation of synthetic seeds; Isolation of plasmid DNA; Quantification of DNA; Agarose Gel Electrophoresis and visualization of plasmid DNA; Restriction digestion of plasmid DNA and agarose gel electrophoresis; Isolation of Plant genomic DNA; PCR amplification of DNA; Gel electrophoresis of amplified DNA; Visit to tissue culture units /biotech labs.

Suggested Readings

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

26GPB313

Crop Improvement (Rabi crops) - II

1 0 2 2

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

Course Outcome:

Any student who has undergone the course shall be able to:

S.No.	Course outcomes	COs	Blooms level
1	Summarize the origin, distribution, plant genetic resources, centers of diversity and floral biology of major crop species	CO1	Understand
2	Analyse the appropriate breeding methods for the development of varieties and hybrids in field and horticultural crops	CO2	Apply
3	Demonstrate and perform techniques of emasculation, pollination and hybrid seed production in different crop species	CO3	Apply

Theory

Centres of origin, distribution of species, wild relatives in different cereals; pulses; oilseeds; fibres; fodders and cash crops; vegetable and other horticultural crops; Plant genetic resources, its utilization and conservation, study of genetics of qualitative and quantitative characters;

Important concepts of breeding self-pollinated, cross-pollinated and vegetatively propagated crops. Major breeding objectives and procedures including conventional and modern innovative approaches for development of hybrids and varieties for yield, adaptability, stability, abiotic and biotic stress tolerance and quality (physical, chemical, nutritional); Hybrid seed production technology in wheat, oat, chickpea, rapeseed and mustard etc. Ideotype concept, climate resilient crop varieties for future.

Practical

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

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

26GPB314

Fundamentals of Seed Science and Technology

1 0 2 2

Objectives

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

Course Outcome:

Any student who has undergone the course shall be able to:

Sl. No	Course outcome	CO	Blooms level
1	Explain seed structure, different classes of seed, germination tests, seed enhancement techniques, and seed certification.	CO1	Understand
2	Analyze seed quality through physical purity and genetic purity tests.	CO2	Analyze
3	Explore seed production farms, seed processing plants, and seed testing laboratories through field visits.	CO3	Explore

Theory

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

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

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.

Entomology

Objectives

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

Course Outcome:

Any student who has undergone the course shall be able to:

Sl. No	Course outcome	CO	Blooms level
1	Define identification of commonly occurring insects with other groups of arthropods	CO1	Remember
2	Recall the morphology, physiology and systematic classification of insects which may facilitate them in their higher studies and research field.	CO 2	Remember
3	Extend practical knowledge on collection, curation and preservation of insects, dissection of various physiological systems of insects	CO3	Understand
4	Build knowledge on the characteristics of commonly observed economically important insect families and orders	CO4	Apply

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 Insects with other classes of Arthropoda. Morphology: Structure and functions of insect cuticle and molting. Body segmentation. Structure of head, thorax and abdomen. Structure and modifications of insect antennae, mouth parts, legs, Wing venation, modifications and wing coupling apparatus. 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, Subspecies, 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, Papilionidae, Noctuidae, Sphingidae, Pyralidae, Gelechiidae, Arctiidae, Saturnidae, Bombycidae; Coleoptera: Coccinellidae, Chrysomelidae, Cerambycidae, Curculionidae, Bruchidae, Scarabaeidae; Hymenoptera: Tenthredinidae, Apidae. Trichogrammatidae, Ichneumonidae, Braconidae, Chalcididae; Diptera: Cecidomyiidae, Tachinidae, Agromyziidae, Culicidae, Muscidae, Tephritidae.

Practical

Methods of collection and preservation of insects including immature stages; External features of Grasshopper/Blister beetle; Types of insect antennae, mouthparts and legs; Wing venation, types of wings and wing coupling apparatus. Types of insect larvae and pupae; Dissection of digestive system in insects (Grasshopper); 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

Suggested Readings

1. Richards O.W. and R.G. Davies. 1977. *Imm's General Text Book of Entomology*. Vol.I and II. Chapman and Hall Publication, London. 1354p. {ISBN 0412 15220 7}
2. Johnson Norman and Triplehorn Charles. 2004. *Borror and DeLong's Introduction to the study of Insects*. (7th Edn.). Brooks/Cole.
3. Odum Eugene P and Barrett Gray W. 2020. *Fundamentals of Ecology*. (5th Edn.). Cengage Learning India.
4. Chapman, R.F. 1998. *The Insects: Structure and Function*. Fourth Edition. Cambridge University Press. 770p. {ISBN 0 521 78732 7}
5. Snodgrass, R.E. 1994. *Principles of Insect Morphology*. CBS publishers and distributors, New Delhi. 667p.
6. Pedigo, L.P. and M.E.Rice.1996. *Entomology and Pest Management*. Prentice-Hall of India Pvt Ltd, New Delhi. 812p. {ISBN-978-8120338869}

Objectives

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

Course Outcome:

Any student who has undergone the course shall be able to:

Sl. No	Course outcome	CO	Blooms level
1	Define phytonematology concepts, history, economic importance, and general characteristics of plant parasitic nematodes	CO1	Remember
2	Explain nematode morphology, biology, classification (up to family level), and feeding/parasitic habits.	CO2	Understand
3	Apply appropriate sampling, extraction (Cobb's sieving, Baermann funnel), and counting techniques for nematodes from soil and plant tissues.	CO2	Apply
4	Perform identification of economically important nematodes. Interpret crop symptoms caused by nematode infections and relate them to specific nematode genera.	CO3	Analyse
5	Evaluate the impact of nematode pests across major crops suitable management strategies. And design integrated nematode management (INM) strategies.	CO5	Evaluate

Theory

Introduction: History of phytonematology, 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, tea, coffee and coconut. 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, plantation crops etc. Methods of application of nematicides and organic amendments.

Suggested readings

1. Economic Nematology - Edited by J.M. Webster
2. Plant Parasitic Nematodes (Vol-1) by Zukerman, Mai, Rohde
3. Plant Parasitic Nematodes of India: Problems and Progress by - Gopal Swarup, D. R. Dasgupta, P. K. Koshy.
4. Text book on Introductory Plant Nematology -R.K. Walia and H.K. Bajaj.

Objectives

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

Course Outcome:

Any student who has undergone the course shall be able to:

Sl.No	Course outcome	CO	Blooms level
1	Examine the major insect and non- insect pests of crops in field and storage	CO1	Analyze
2	Adapt appropriate management tactics to manage insect and non-insect pests of crops in field and storage	CO 2	Create

Theory

General description on nature and type of damage by different arthropod pests; Scientific name, order, family, host range, distribution, biology and bionomics; Nature of damage and management of major insect pests of various field crops, vegetable crops, fruit crops, plantation crops, ornamental crops, spices and condiments. Structural entomology and important household pests, their nature of damage and management. Factors affecting loss of stored grains. Insect pests, mites, rodents, birds and microorganisms associated with stored grains and their management. Storage structures and methods of grain storage and fundamental principles of stored grains management. Management of non insect pest of mites, snails and slugs, Concept of IPM, Practices, scope and limitations of IPM. Classification of insecticides, toxicity of insecticides and formulations of insecticides, Biorational pesticides including insect repellents, antifeedants, Use of drones and AI in pest management.

Practical

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. Study on structural entomology and household pests. Storage structures and methods of grain storage. Spraying techniques for selected field and horticultural crops. Vertebrate pest management, Mass multiplication of NPV and entomopathogenic nematodes

Suggested Readings

1. Athwal A S. 1986. Agricultural Pests of India and South-East Asia. Kalyani Publishers.

2. Dhaliwal G S and Arora Ramesh. 2022. Integrated pest Management Concept and Approaches. (3rd Edn.). Kalyani Publishers.
3. Prakash Rambhat Thalya and Ravi Chandra. 2022. Essentials of Pest Management: Key Information on Pest Identification and its Management. Wings Publication.
4. Sen Somnath and Mohd. Sameer. 2021. A Textbook of Insect Pest and Disease Management. S. Kataria & Sons publish.
5. Srivastava K P and Dhaliwal G S. 2010. A Textbook of Applied Entomology. Kalyani Publishers.
6. Tarique Hassan Askary. 2022. Pest Management: Methods, Applications and Challenges. Nova Science Publishers.
7. Manisegaran, S. and R.P. Soundararajan. 2010. *Pest Management in Field Crops- Principles and Practices*. Agrobios, Jodhpur, India. 316p. {ISBN(10):81-7754-321-0}
8. David, B.V. and V.V. Ramamurthy. 2011. *Elements of Economic Entomology*, Namrutha Publications, Chennai. 386 p. {ISBN: 978-81-921477-0-3}
9. Regupathy, A. and R. Ayyasamy. 2016. *A Guide on Crop Pests*. Namrutha Publications, Chennai. 368p. {ISBN: 978-81-921477-1-0}

Plant Pathology

26PAT111

Fundamentals of Plant Pathology

2 0 2 3

Objectives

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

Course Outcome:

Any student who has undergone the course shall be able to:

Sl.No	Course outcome	CO	Blooms level
1	Conceptualize the causes responsible for disease development and assess the importance of different plant pathogens and their classification.	CO1	Understand
2	Identify the plant pathogens based on morphological characteristics and evaluate the host-pathogen interaction	CO 2	Understand
3	Relate the survival, reproduction and transmission of different plant pathogens with disease development and analyze the cultural, biological, host resistance and chemical based disease management.	CO3	Apply

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; Bacteria: Morphology, reproduction classification of phytopathogenic bacteria; Other plant pathogens: Mollicutes; Flagellant 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, bacteria and viruses; Purification of plant pathogens; Study on plant disease diagnosis: Koch's Postulates, Characteristics, formulation, methods of application and calculation on fungicides.

Suggested Readings

1. Agrios G N. 2010. *Plant Pathology*. Acad. Press.
2. Alexopoulos Constantine J, Mims Charles W and Blackwell Meredith M. 2007. *Introductory Mycology*. (4th Edn.). Wiley India Pvt. Ltd.
3. Dhingra O D and Sinclair J B. 2019. *Basic Plant Pathology Methods*. (2nd Edn.). CRC Press, London.
4. Goto M. 1990. *Fundamentals of Plant Bacteriology*. Academic Press, New York.
5. Hull R. 2002. *Mathew's Plant Virology*. (4th Edn.). Academic Press, New York.
6. Mehrotra R S and Aggarwal A. 2007. *Plant Pathology*. (7th Edn.). Tata Mc Graw Hill Publ. Co. Ltd.
7. Nene Y L and Thapliyal P N. 1993. *Fungicides in Plant Disease Control*. (3rd Edn.). Oxford & IBH, New Delhi.
8. Rajeev K and Mukherjee R C. 1996. *Role of Plant Quarantine in IPM*. Aditya Books.
9. Singh R S. 2008. *Plant Diseases*. (8th Edn.). Oxford & IBH. Pub. Co.
10. Singh R S. 2013. *Introduction to Principles of Plant Pathology*. Oxford and IBH Pub. Co.

26PAT301 Diseases of Field and Horticultural Crops and their Management 2 0 2 3

Objectives

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

Course Outcome:

Any student who has undergone the course shall be able to:

Sl. No	Course outcome	CO	Blooms level
1	Identify the symptoms of diseases of field and horticultural crops and determine the etiology of various plant pathogens.	CO1	Understand
2	Examine the host pathogen interaction on disease development in crops and illustrate the disease cycle of plant pathogens during pathogenesis.	CO 2	Understand
3	Evaluate the prevalence, epidemiology and factors affecting disease development and recommend integrated disease management practices in crops.	CO3	Apply

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, false smut, bacterial leaf blight, bacterial leaf streak, tungro, khaira); Wheat (rusts, loose smut, Karnal bunt); Maize (banded leaf and sheath blight, southern and northern blight, downy mildew); Sorghum (smuts, grain mold, anthracnose); Bajra (downy mildew, ergot) and Finger millet (blast, leaf spot); Groundnut (early and late leaf spots, rust, wilt); Soybean (Rhizoctonia blight, bacterial spot, seed and seedling rot, mosaic); Grams (Ascochyta blight, wilt, grey mold); Pea (downy mildew, powdery mildew, rust); Black gram and Green gram (web blight, Cercospora leaf spot, anthracnose, yellow mosaic); Sugarcane (red rot, smut, grassy shoot, ratoon stunting, PokahBoeng); Mustard (Alternaria blight, white rust, downy mildew, sclerotinia stem rot) and Sunflower (sclerotinia stem rot, Alternaria blight); Cotton (anthracnose, vascular wilts, black arm). Horticultural crops: Citrus (canker, gummosis) and Guava (wilt, anthracnose); Banana (sigatoka, Panama wilt, bacterial wilt, bunchy top); Papaya (foot rot, leaf curl, mosaic) and Pomegranate (bacterial blight); Apple (scab, powdery mildew, fire blight, crown gall) and Peach (leaf curl); Grapevine (downy mildew, powdery mildew, anthracnose) and Strawberry (leaf spot); Coconut (bud rot, Ganoderma wilt), Tea (blister blight) and Coffee (rust); Mango (anthracnose, malformation, bacterial blight, powdery mildew); Potato (early and late blight, black scurf, leaf roll, mosaic) and Tomato (damping off, wilt, early and late blight, leaf curl, mosaic); Brinjal (phomopsis blight and fruit rot, sclerotinia blight) and Chilli (anthracnose and fruit rot, wilt, leaf curl); Cucurbits (powdery and downy mildew, wilts) and Cruciferous vegetables (Alternaria leaf spot, black rot, cauliflower mosaic); Beans (anthracnose, bacterial blight) and Okra (yellow vein mosaic); Ginger (soft rot), Turmeric (leaf Spot) and Coriander (stem gall); Rose (dieback, powdery mildew, black leaf spot) and Marigold (botrytis blight, leaf spots).

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 of cucurbits, Rhizoctonia and Cercospora leaf spot of green gram / black gram, Alternaria blight and downy mildew of mustard, early blight of 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, Taphrina leaf spot of turmeric, 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.

Suggested Readings

1. Agrios George N. 2005. *Plant Pathology*. (5th Edn.). Academic Press.

2. Chaube Hriday and Singh Uma S. 2017. *Plant Disease Management: Principles and Practices*. CRC Press, Taylor and Francis Group.
3. Sharma R C and Sharma J N. 2011. *Integrated Plant Disease Management*. Scientific Publishers (India)
4. Singh R S. 2024. *Plant Diseases*. (11th Edn.). Medtec

26AGM311 Agricultural Microbiology and Phyto -remediation 1 0 2 2

Objectives

- To introduce microbiology with specific focus on its significance in agriculture science
- To acquaint with the bacterial structure and the function of the different bacterial components
- To highlight different fields of microbiology
- To highlight the bioremediation of polluted soils using microbial mediators and phytoremediation
- To introduce the concept of biological control and the role of biopesticides in plant disease management.

Course Outcome:

Any student who has undergone the course shall be able to:

Sl. No	Course outcome	CO	Blooms level
1	Define different types of microorganisms and microscopy techniques.	CO1	Understand
2	Relate classification, functional cell biology, reproduction and genetics of prokaryotic and eukaryotic microorganisms	CO 2	Understand
3	Explain the role of beneficial microorganisms in bio-geo chemical cycling, soil fertility, crop production and Phytoremediation	CO3	Apply

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, photo autotrophy, 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. Food Microbiology: Microbial spoilage and principles of food preservations, Food poisoning. Water Microbiology: Types of water, water microorganisms, and microbial analysis of water e.g. coliform test, Purification of water. Industrial Microbiology: Microbial products, Biodegradation, Biogas production, Biodegradable plastics etc. 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.

Suggested Readings

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

Extension Education

26AEX102

Rural Sociology and Educational Psychology

2 0 0 2

Objectives

- i. To provide knowledge on concept and importance of sociology and rural sociology as well as the relationship with Extension Education

Course Outcome:

Any student who has undergone the course shall be able to:

Sl.No	Course outcome	CO	Blooms level
1.	Remember rural systems and people's behavior in rural areas.	CO1	Remembering
2.	Identify suitable groups and leaders for conducting meetings and training programmes.	CO2	Evaluating
3.	Test the people's psychology, personality, intelligence, and attitude in teaching-learning situations.	CO3	Analysing

Theory

Extension Education and Agricultural Extension: Meaning, definition, scope, and importance. Sociology and rural sociology: Meaning, definition, scope, importance of rural sociology in Agricultural Extension, and interrelationship between rural sociology and Agricultural Extension. Indian Rural Society: important characteristics, differences and relationship between rural and urban societies. Social Groups: Meaning, definition, classification, factors considered information and organization of groups, motivation in group formation and role of social groups in Agricultural Extension. 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 Control: Meaning, definition, need of social control and means of social control. Social change: Meaning, definition, nature of social change, dimensions of social change and factors of social change. Leadership: Meaning, definition, classification, roles of leader, different methods of selection of professional and lay leaders. Training of Leaders: Meaning, definition, methods of training, Advantages and limitations in use of local leaders in Agricultural Extension, Psychology and educational psychology: Meaning, definition, scope, and importance of educational psychology in Agricultural Extension. Intelligence: Meaning,

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

Suggested Readings

1. Desai, A. R. 1997. Rural Sociology in India. Mumbai: Popular Prakashan.
2. Dahama, O. P., & Bhatnagar, O. P. 1980. Education and Communication for Development. New Delhi: Oxford and IBH Publishing Co. Pvt. Ltd.
3. Chitambar, J. B. 1997. Introductory Rural Sociology. New Delhi: New Age International Publishers.
4. Ghorpade, M. B. 1990. Essentials of Psychology. Nagpur: Vidya Prakashan.
5. Velusamy, R. Textbook on Rural Sociology and Educational Psychology. Coimbatore: Tamil Nadu Agricultural University.
6. Ray, G. L. 1999. Extension Communication and Management. Kolkata: Naya Prokash.
7. Sandhu, A. S. 1993. Textbook on Agricultural Communication: Process and Methods. New Delhi: Oxford and IBH Publishing Co. Pvt. Ltd.

26AEX103

Communication Skills

1 0 2 2

Objectives

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

Course Outcome:

Any student who has undergone the course shall be able to:

Sl.No	Course outcome	CO	Blooms level
1.	Develop their personality through effective communication skills.	CO1	Create
2.	Determine field diaries and lab records effectively.	CO2	Evaluate
3.	Summarize scientific and technical papers, proposals, reports, etc.	CO3	Understanding
4.	Plan scientific forums such as seminars, conferences etc.,	CO4	Remember

Theory

Communication Process: The magic of effective communication; Building self-esteem and overcoming fears; Concept, nature and significance of communication process; Meaning, types and models of communication; Verbal and non-verbal 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 and verbals; phrases and clauses; Case: subjective case, possessive case; objective case; Correct usage of nouns, pronouns and antecedents, adjectives, adverbs and articles; Agreement of verb with the subject: tense, mood, voice; Writing effective sentences; Basic sentence faults.

Practical

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.

Suggested Readings

1. Allport, G. W. 1937. Personality: A Psychological Interpretation. Holt, New York.
2. Brown Michele and Gyles Brandreth. 1994. How to Interview and be Interviewed. Sheldon Press, London.
3. Dale, Carnegie. 1997. The Quick and Easy Way to Effective Speaking. Pocket Books, New York.
4. Francis Peter, S. J. 2012. Soft Skills and Professional Communication. Tata McGraw Hill, New Delhi.
5. Kumar, S and Pushpa Lata. 2011. Communication Skills. Oxford University Press.
6. Neuliep James, W. 2003. Intercultural Communication A Contextual Approach. Houghton Mifflin Co Boston.
7. Pease, Allan. 1998, Body Language. Sudha Publications, Delhi.
8. Raman, M. and Singh, P. 2000. Business Communication. Oxford University Press.
9. Seely, J. 2013. Oxford Guide to Effective Writing and Speaking. Oxford University Press.
10. Thomson, A. J. and Martinet, A. V. 1977. A Practical English Grammar. Oxford University

Objectives

- i. To make students realize their potential strengths
- ii. To cultivate their inter-personal skills and improve employability
- iii. To equip students with practical tools to enhance personal effectiveness, teamwork, and decision-making within organizational settings.

Course Outcome:

Any student who has undergone the course shall be able to:

Sl. No	Course outcome	CO	Blooms level
1.	Understand and explain the key concepts of personality	CO1	Understand
2.	Analyze the foundations of individual behavior	CO2	Analyze
3.	Evaluate learning theories and principles and apply them to improve employee training, development, and performance in organizations.	CO3	Evaluate
4.	Assess the roles of attitudes, values, intelligence, and motivation in determining individual and group behavior in an organizational context.	CO4	Assess
5.	Understanding of group dynamics, teamwork, and the interaction between personality	CO5	Demonstrate

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

Practical

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.

Suggested Readings

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

26AEX201

Fundamentals of Extension Education

1 0 2

Objectives

- i. To state the importance of extension education in agriculture
- ii. To familiarize with the different types of agriculture and rural development programs launched by govt. of India
- iii. To classify the types of extension teaching methods
- iv. To elaborate the importance and different models of communication
- v. To explain the process and stages of adoption along with adopters' categories

Course Outcome:

Any student who has undergone the course shall be able to:

Sl.No	Course outcome	CO	Blooms level
1.	Understand the concept of agriculture extension, principles and philosophy of Extension.	CO1	Understand
2.	Learn extension systems in India: Extension efforts in pre- and post- independence eras.	CO2	Remember
3.	Analyze new trends in agriculture extension.	CO3	Analyze
4.	Gain knowledge on monitoring, evaluation and Transfer of Technology in agriculture.	CO4	Apply

5.	Describe the communication, adoption and diffusion of innovation concepts in agricultural extension.	CO5	Evaluate
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Theory

Education: Meaning, definition and Types; Extension Education: meaning, definition, scope and process; objectives and principles of Extension Education; Extension Programme planning: Meaning, Process, Principles and Steps in Programme Development. 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.); Reorganised 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, DW CRA, 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. Rural Leadership: concept and definition, types of leaders in rural context; Method of identification of Rural Leader. Extension administration: meaning and concept, principles and functions. Monitoring and evaluation: concept and definition, monitoring and evaluation of extension programs; transfer of technology: concept and models, capacity building of extension personnel; extension teaching methods: meaning, classification, individual, group and mass contact methods, ICT Applications in TOT (New and Social Media), media mix strategies; communication: meaning and definition; Principles and Functions of Communication, models and barriers to communication. Agriculture journalism; diffusion and adoption of innovation: concept and meaning, process and stages of adoption, adopter categories.

Practical

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.

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. Jaliha, K. A. and Veerabhadraiah, V. 2007. Fundamentals of Extension Education and Management in Extension, Concept publishing company, New Delhi.
4. Muthaiah Manoraharan, P. and Arunachalam, R., Agricultural Extension, Himalaya Publishing House (Mumbai).
5. Sagar Mondal and Ray, G. L., Text Book on Rural Development, Entrepreneurship and Communication Skills, Kalyani Publications.
6. Rathore, O. S. et al. 2012. Handbook of Extension Education, Agrotech Publishing Academy, Udaipur.
7. Dudhani, C.M., Hirevenkatgoudar, L.V., Manjunath, L. Hanchinal, S.N. and Patil, S.L. 2004. Extension Teaching Methods and Communication Technology, UAS, Dharwad.
8. Sandhu, A.S. 1993. Text book on Agricultural Communication: Process and Methods. Oxford and IBH Publishing Pvt. Ltd, New Delhi.
9. Singh, A.K., Lakhan Singh, R. and Roy Burman. 2006. Dimensions of Agricultural Extension. Aman Publishing House, Meerut

26AEX499 Student READY ((RAWE / Experiential Learning / Hands on Training

/Industrial Attachment /Project Work / Internship etc.

0 0 40 20

Objectives

- i. To acquire knowledge about rural setup and farming practices
- ii. To understand the farmer's problem
- iii. To expose the role of various institutions in farm development
- iv. To obtain knowledge about various agricultural systems and rural development programmes and their impacts on agriculture and community development.
- v. To acquire knowledge about ICT on the transfer of technology.
- vi. To diagnose and make recommendations on all aspects of crop health through field visits and queries received from growers.
- vii. To understand the functional mechanism of an industry

Course Outcome:

Any student who has undergone the course shall be able to:

Sl.No	Course outcome	CO	Blooms level
1.	Describe the various agricultural problems encountered by the farmers	CO 1	Understand
2.	Select the appropriate technology demonstration based on the farm situation.	CO2	Apply
3.	Examine the roles of various rural development institutions.	CO3	Apply
4.	Examine the crop health	CO 1	Apply
5.	Advise farmers to undergo soil and water testing and apply the recommended dose of fertilizers and grow suitable crops based on their farm's soil and water health	CO2	Apply
6.	Describe the various functions of an industry	CO 1	Understand
7.	Develop a business proposal and report	CO2	Apply

Agricultural Economics

26AEC201 Entrepreneurship Development and Business Management 2023

Objectives

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

Course Outcome:

Any student who has undergone the course shall be able to:

Sl.No	Course outcome	CO	Blooms level
1	Explain the concepts, characteristics, functions, types, and entrepreneurial competencies, and identify business opportunities through environmental scanning.	CO1	Understand
2	Describe the procedures for establishing and managing an enterprise, including legal formalities, production, marketing, financial, human resource, and crisis management aspects.	CO 2	Understand
3	Prepare a financially viable agribusiness project proposal by applying principles of entrepreneurship, enterprise planning, and business management.	CO3	Apply

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.

Suggested Readings

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

Objectives

- I. To make students aware of broad areas covered under agricultural economics and farm management
- II. To impart knowledge on judicious use of resources for optimum production

Course Outcome:

Any student who has undergone the course shall be able to:

Sl.No	Course outcome	CO	Blooms level
1	Explain the theories of demand, supply, consumption, exchange, and distribution in economics.	CO1	Understand
2	Explain the basic macroeconomic concepts and their relevance to the agricultural sector and the Indian economy.	CO 2	Understand
3	Apply the principles of production economics, including input-output relationships, laws of returns, and cost concepts, for efficient resource use and optimum production.	CO3	Apply

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, input output relationship. Laws of returns: Law of variable proportions and law of returns to scale. Cost: Cost concepts, short run and long run cost curves. Supply: Stock v/s supply, law of supply, supply schedule, supply curve, determinants of supply, elasticity of supply. Distribution theory: meaning, factor market and pricing of factors of production.

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

Suggested Readings

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

26AEC301

Agriculture Marketing and Trade

1 0 2 2

Objectives

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

Course Outcome:

Any student who has undergone the course shall be able to:

Sl.No	Course outcome	CO	Blooms level
1	Explain the concepts, functions, institutions, and strategies involved in agricultural marketing and trade.	CO1	Understand
2	Apply the principles of agricultural marketing to analyze demand and supply, marketing channels, marketing costs, price spread, and market efficiency.	CO 2	Apply
3	Explain the role of government policies, agricultural price policy, WTO, Agreement on Agriculture (AoA), IPR, and	CO3	Understand

	trade regulations in agricultural marketing and international trade.		
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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 labelling (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 and DMI – their objectives and functions; cooperative marketing in India; Risk in marketing: Types of risk in marketing; speculation and hedging; an overview of futures trading; Agricultural prices and policy: Meaning and functions of price; administered prices; need for innovations in agricultural price policy; Trade: Concept of International Trade and its need, theories of absolute and comparative advantage. Present status and prospects of international trade in agri-commodities; WTO; Agreement on Agriculture (AoA) and its implications on Indian agriculture; IPR; Role of government in agricultural marketing; Role of APMC and its relevance in the present day context.

Practical

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.

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 Publications, New Delhi.
3. Kohls Richard L and Uhl Josheph N. 2002. Marketing of Agricultural Products. Prentice-Hall of India Private Ltd., New Delhi.
4. Kotler and Armstrong. 2005. Principles of Marketing. Pearson Prentice-Hall.
5. Lekhi R K and Singh Joginder. 2006. Agricultural Economics. Kalyani Publishers, Delhi.
6. Memoria C B, Joshi R L and Mulla N I. 2003. Principles and Practice of Marketing in India. Kitab Mahal, New Delhi.
7. Pandey Mukesh and Tewari Deepali. 2004. Rural and Agricultural Marketing. International Book Distributing Co. Ltd, New Delhi.
8. Salvatore Dominic. 2003. Microeconomics: Theory and Application. OUP USA.
9. Sharma R. 2005. Export Management. Laxmi Narain Agarwal, Agra.

26AEC312

Agricultural Finance and Cooperation

2 0 2 3

Objectives

1. To impart knowledge on agricultural finance and financial risk management

Course Outcome:

Any student who has undergone the course shall be able to:

Sl.No	Course outcome	CO	Blooms level

1	Explain the concepts, sources, institutions, and mechanisms of agricultural finance, credit, and financial risk management.	CO1	Understand
2	Apply the principles of agricultural finance to estimate credit requirements, prepare financial statements, appraise loan proposals, and develop bankable agricultural projects.	CO 2	Apply
3	Explain the principles, structure, and role of agricultural cooperatives, crop insurance, and cooperative institutions in agricultural development.	CO3	Understand

Theory

Agricultural Finance- meaning, scope and significance, credit needs and its role in Indian agriculture. Agricultural credit: meaning, definition, need, classification. Credit analysis: 4 R's, and 3C's of credits. Sources of agricultural finance: institutional and non-institutional sources, commercial banks, social control and nationalization of commercial banks. Micro financing including KCC. Lead bank scheme, RRBs, Scale of finance and unit cost. An introduction to higher financing institutions – RBI, NABARD, ADB, IMF, world bank, Insurance and Credit Guarantee Corporation of India. 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. 3 R's, 5 C's and 7 P's of credit. Crop insurance: its scope, significance and limitations and the potential of the newly launched 'Pradhan Mantri Fasal Bima Yojana' (Prime Minister's Crop Insurance Scheme). Successful cooperative systems in Gujarat (AMUL), Tamil Nadu (Aavin), Karnataka (Nandini), Maharashtra and Punjab.

Practical

Optimum allocation of limited amount of capital among different enterprise. Analysis of progress and performance of cooperatives using published data. Analysis of progress and performance of commercial banks and RRBs using published data. Visit to a commercial bank, cooperative bank and cooperative society to acquire first-hand knowledge of their

management, schemes and procedures. Estimation of credit requirement of farm business – A case study. Preparation and analysis of balance sheet – A case study. Preparation and analysis of income statement – A case study. Appraisal of a loan proposal – A case study. Techno-economic parameters for preparation of projects. Preparation of Bankable projects for various agricultural products and its value-added products. Seminar on selected topics. Different types of repayment plans.

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 and IBH Publishing Co. Pvt. Ltd., New Delhi.

Agricultural Statistics

26MAT107

Introductory Mathematics

1 0 0 1

(need based) Non-gradual

Objectives

- i. To provide students with a fundamental understanding of algebra, matrices, differential and integral calculus, and mathematical modelling relevant to agricultural sciences.
- ii. To enable students to apply mathematical concepts and techniques for solving agricultural problems, analysing experimental data and developing suitable mathematical models.

Course Outcome:

Any student who has undergone the course shall be able to:

Sl.No	Course outcome	CO	Blooms level
1	Explain the concepts of arithmetic, geometric and harmonic progressions, and perform matrix operations including addition, subtraction, multiplication, transpose, inverse and evaluation of determinants.	CO1	Understand
2	Apply the principles of differential and partial differentiation to analyze functions, solve optimization problems, and evaluate growth rate, average cost, marginal cost, and marginal revenue in agricultural applications	CO 2	Apply

3	Apply techniques of definite and indefinite integration, including substitution and integration by parts, to solve mathematical problems and determine the area under simple curves	CO3	Apply
4	Develop and interpret linear, quadratic and exponential mathematical models by fitting them to agricultural experimental data for problem-solving and decision-making.	CO4	Create

Theory

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

Differential Calculus: Definition - Differentiation of function using first principle, Derivatives of sum, difference, product and quotient of two functions, Methods, Increasing and Decreasing Functions. Application of Differentiation- Growth rate, Average Cost, and Marginal cost, Marginal Cost, Marginal Revenue. Partial differentiation: Homogeneous function, Euler's theorem, Maxima and Minima of the functions of the form $y = f(x)$ and $y = f(x_1, x_2)$.

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

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

Suggested Readings

1. Introductory Agricultural Mathematics , Y.B. Singh, Neeraj Singh, Kalyani Publishers, 2025.
2. Higher Engineering Mathematics, B. S. Grewal, 1965, 45th edition, Khanna Publishers
3. Advanced Engineering Mathematics, Erwin Kreyszig, 2020, 10th Edition, Wiley Plus
4. Differential Calculus, P K Mittal & Shanti Narayan, 1942, S. Chand, New Delhi
5. A textbook of Matrices, P K Mittal & Shanti Narayan, 1953, S. Chand, New Delhi
6. An Introduction to Mathematical Modeling, Edward A. Bender, 1978, John Wiley & Sons
7. Integral Calculus, Shanti Narayan & P K Mittal, S. Chand & Company Ltd., New Delhi
8. Mathematical Modeling in Agriculture, John H M Thornley and John France, Wiley Plus.

Objectives

- i. To acquaint student 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 computer with applications in agriculture.
- iii. To make the students familiar with agricultural informatics, it's components and applications in agriculture.

Course Outcome:

Any student who has undergone the course shall be able to:

Sl. No	Course outcome	CO	Blooms level
1	Explain the fundamentals of computer systems, databases, and artificial intelligence concepts relevant to agriculture.	CO1	Understand
2	Apply computer applications, database management systems, and AI-enabled technologies to solve agricultural information management and decision-making problems.	CO2	Apply
3	Analyze agricultural datasets and evaluate the suitability of informatics based solutions for improving agricultural productivity, precision farming, and resource management.	CO3	Analyze

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, Database, concepts and types, creating data base, Uses of DBMS in Agriculture. Internet and World Wide Web (WWW): Concepts and components.

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

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

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

Practical

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 documents, MS-EXCEL-Creating a spreadsheet, Use of statistical tools, Writing expressions, Creating graphs, Analysis of scientific data, MS-ACCESS: Creating Database, preparing queries and reports, Demonstration of Agri- information system, Introduction to World Wide Web (WWW) and its components, Introduction of programming languages such as Visual Basic, Java, Fortran, C, C++, Hands on practice on Crop Simulation Models (CSM), DSSAT/InfoCrop/Crop Syst/ Wofost, Preparation of inputs file for CSM and study of model outputs, computation of water and nutrient requirements of crop using CSM and IT tools, Use of smartphones and other devices in agro-advisory and dissemination of market information, Introduction of Geospatial technology, AR/ VR demonstration, Preparation of contingent crop planning, India Digital Ecosystem of Agriculture (IDEA).

Suggested Readings

1. Concepts and Techniques of Programming in C by Dhabal Prasad Sethi and Manoranjan, Wiley India.

2. Fundamentals of Computer by V. Rajaroman.
3. Introduction to Information Technology by Pearson.
4. Introduction to Database Management System by C. J. Date.
5. Introductory Agri-Informatics by Mahapatra, Subrat K et al, Jain Brothers Publication.

26STA311 Basic and Applied Agricultural Statistics

2 0 2 3

Objectives

- i. To provide students with a sound understanding of the concepts and methods of descriptive and inferential statistics.
- ii. To enable students to apply statistical techniques for data analysis, interpretation and decision-making in agricultural research

Course Outcome:

Any student who has undergone the course shall be able to:

Sl. No	Course outcome	CO	Blooms level
1	Explain the fundamental concepts of statistics, types and scales of data, methods of data classification, frequency distributions and diagrammatic and graphical presentation of data	CO1	Understand
2	Compute and interpret measures of central tendency and dispersion, including arithmetic mean, median, mode, standard deviation, variance and coefficient of variation for grouped and ungrouped data.	CO 2	Apply
3	Apply the principles of probability, normal distribution, correlation, and linear regression to analyze relationships among variables and solve statistical problems	CO3	Apply
4	Apply hypothesis testing, analysis of variance (ANOVA), completely randomized design (CRD), and sampling techniques to analyze agricultural experimental data and draw valid statistical conclusions.	CO4	Apply

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. Coefficient of Variation

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

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

Addition and Multiplication Theorem (without proof). Conditional Probability. Independent Events. Simple Problems based on Probability. Definition of Random Variable. Discrete and Continuous Random Variable. Normal Distribution- Definition, Prob. Distribution, Mean and Variance. Assumptions of Normal Distribution. Normal Probability Curve. Correlation and Regression. Definition of Correlation. Scatter Diagram. Karl Pearson's Coefficient of Correlation. Types of Correlation Coefficient. Properties of Correlation Coefficient. Definition of Linear Regression. Regression Equations. Regression Coefficients. Properties of Regression Coefficients. Tests of Significance. Definition. Null and Alternative Hypothesis. Type I and Type II Error. Critical Region and Level of Significance. One Tailed and Two Tailed Tests. Test Statistic. One Sample, Two Sample and Paired t-test with Examples. F-test for Variance. ANOVA and Experimental Designs. Definition of ANOVA. Assignable and Non assignable

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

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). Correlation and Regression analysis. Application of t-test (one sample, two sample independent and dependent). Analysis of variance one-way classification. CRD. Selection of random sample using simple random sampling.

Suggested Readings

1. Agarwal B L. 2006. Basic Statistics. New Age International Publishers.
2. Elhance D N, Elhance Veena and Aggarwal B M. 2018. Fundamentals of Statistics. Kitab Mahal Publishers.
3. Gupta S C and Kapoor V K. 2021. Fundamentals of Applied Statistics. (6th Edn.). Sultan Chand and Sons.
4. Sahu P K. 2010. Agriculture and Applied Statistics-I. Kalyani Publishers.
5. Sahu P K and Das A K. 2009. Agriculture and Applied Statistics-II. Kalyani Publishers.
6. Singh S P and Verma R P S. Agricultural Statistics. Rama Publishing House, Meerut.

Agricultural Engineering

26ENR211

Farm Machinery and Power

1 0 2 2

Objectives

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

Course Outcome:

Any student who has undergone the course shall be able to:

Sl. No	Course outcome	CO	Blooms level
1	Explain the working of different systems in IC engines and tractors	CO1	Understand

2	Demonstrate the working of different tillage equipment, intercultural implements, sowing and planting equipment, plant protection, harvesting and threshing equipment	CO2	Understand
3	Compute the power requirement and cost of operation of farm machineries and calibrate the sowing equipment	CO3	Apply
4	Operate tractors, power tillers with farm implements and plant protection equipment	CO4	Apply

Theory

Status of Farm Power in India; Sources of Farm Power, I.C. engines, working principles of I C engines; comparison of two stroke and four stroke cycle engines, Study of different components of I.C. engine, I.C. engine terminology and solved problems; Familiarization with different systems of I.C. engines: Air cleaning, cooling, lubrication, fuel supply and hydraulic control system of a tractor; Familiarization with Power transmission system : clutch; gear box, differential and final drive of a tractor; Tractor types; Cost analysis of tractor power and attached implement; Criteria for selection of tractor and machine implements. Familiarization with Primary and Secondary Tillage implement; Implement for hill agriculture; implement for intercultural operations; Familiarization with sowing and planting equipment; calibration of a seed drill and solved examples; Familiarization with Plant Protection equipment; Familiarization with harvesting and threshing equipment.

Practical

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

Suggested Readings

1. Jain S C and Rai C R. 2019. Farm Tractor Maintenance and Repair. Standard Publishers, 1705-B, Nai Sarak. Delhi- 110006

2. Ojha T P and Michael A M. 2023. Principles of Agricultural Engineering (Vol. I). (15th Edn.). Jain brothers, 16/893, East Park Road, Karol Bagh, New Delhi -110005.
3. Singh Surendra. 2007. Farm machinery–Principles and Applications. ICAR, New Delhi
4. Sahay Jagdiswar. 2020. Elements of Agricultural Engineering. Standard Publishers and Distributors Pvt Ltd.

26ENR311

Renewable Energy in Agriculture and Allied sector

1 0 2 2

Objectives

- i. To gain the knowledge on different types of materials used in renewable energy
- ii. To understand the importance of renewable energy technology and its applications
- iii. To train the students on the applications of solar thermal technology

Course Outcome:

Any student who has undergone the course shall be able to:

Sl. No	Course outcome	CO	Blooms level
1	Explain the classification, principles, and applications of renewable energy sources in agriculture and allied sectors	CO1	Understand
2	Explain the production processes and utilization of biomass-based biofuels, solar energy technologies, wind energy systems, and their agricultural applications	CO2	Understand
3	Demonstrate the operation and applications of biogas plants, gasifiers, solar thermal devices, and biomass processing equipment	CO3	Apply

Theory

Classification of energy sources, contribution of these sources in agricultural sector; Familiarization with biomass utilization for biofuel production and their application; Familiarization with types of biogas plants and gasifiers, biogas, bioalcohol, biodiesel and biooil production and their utilization as bioenergy resource; introduction of solar energy, collection and their application; Familiarization with solar energy gadgets: solar cooker, solar water heater, application of solar energy: solar drying, solar pond, solar distillation, solar photovoltaic system and their application; Introduction of wind energy and their application. Availability of biomass and their application in different places.

Practical

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

Suggested Readings

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

Biochemistry

26BIC311

Essentials of Plant Biochemistry

2 0 2 3

Objectives

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

Course Outcome:

Any student who has undergone the course shall be able to:

Sl.No	Course outcome	CO	Blooms level
1	Elucidate the different plant organic molecules their structure, properties and functions	CO1	Understand
2	Explain the major metabolic and biosynthetic pathways and their regulation.	CO 2	Understand
3	Elucidate the role of secondary metabolites and their application	CO 3	Understand
4	Prepare standard solutions and reagents and determine the pH of the samples and chemical qualities of oils and fats	CO 4	Apply
5	Demonstrate the qualitative and quantitative estimates of macromolecules and secondary metabolites	CO 5	Analyse

Theory

Biochemistry – Introduction and importance, Properties of water, pH and buffer, plant cell and its components. Biomolecules – 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, Pentose phosphate pathway, oxidative phosphorylation, Fatty acid oxidation. Biosynthetic Pathways – Photosynthesis, Gluconeogenesis, nitrogen fixation, fatty acid and starch formation. Regulation of metabolic pathways. Secondary metabolites, Terpenoids, Alkaloids, Phenolic and their applications in food and pharmaceutical industries.

Practical

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

Suggested Readings

1. Conn Erice, Stumpf Paul, Bruening George and Doi Roy H. 2009. Outlines of Biochemistry. (5th Edn.). John Wiley & Sons
2. Goodwin T W and Mercer E I. 2005. Introduction to Plant Biochemistry. (2nd Edn.). CBS..
3. Horton Robert, Moran Laurence, Scrimgeour Gray, Perry Marc. 2011. Principles of Biochemistry. (5th Edn.). Pearson/Prentice Hall
4. Heldt Hans-Walter and Heldt Fiona. 2005. Plant Biochemistry. Elsevier
5. Nelson David L, Cox Michael. 2008. Lehninger Principles of Biochemistry. (4th & 5th Edn.). Freeman

Crop Physiology

26CRP301

Fundamentals of Crop Physiology

2023

Objectives

- i. 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

Course Outcome:

Any student who has undergone the course shall be able to:

Sl.No	Course outcome	CO	Blooms level
1	Understand the functions of cellular organelles inside the plant system	CO1	Remember
2	Infer the role of nutrients, water, lipids and hormones inside the plant	CO2	Understand
3	Analyze the processes that takes place inside the plant	CO3	Analyse
4	Identify the symptoms of nutrient deficiency, Physiological disorder and solve the problem by recommending the nutrients/hormones to farmers	CO4	Apply
5	Physiological consequences of abiotic stress in plants and its Adaptation and management	CO5	Evaluate

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 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 photophosphorylation: 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, Krebs 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 Abscissic acid) and their major physiological roles, Agricultural uses of PGRs (IBA, NAA, 2, 4 –D, GAs, Kinetin etc).

Practical

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

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

Course objectives

- i. To study Agro forestry as an alternate system of land use.
- ii. To study different types of Agro forestry for soil and water conservation.
- iii. To study the characteristics of Agro forestry in terms its potential for soil moisture conservation practices.

Course outcomes

Any student who has undergone the course shall be able to:

Sl.No	Course outcome	CO	Blooms level
1	Understand the concept, principles, and importance of agroforestry as an alternate land use system.	CO1	Understand
2	Identify different agroforestry systems and their components suited for various agro-climatic regions.	CO2	Understand
3	Analyze the role of different agroforestry systems in soil and water conservation.	CO3	Analyze
4	Explain the characteristics and mechanisms of agroforestry practices in soil moisture conservation.	CO4	Apply

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, 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 agro- forestry 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.

Suggested Readings

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

26ENV111 Environmental Studies and Disaster Management 2 0 2 3

Objectives

- v. To acquire knowledge on environment, ecosystems, natural resources, biodiversity, and pollution.
- vi. To develop practical skills in environmental quality assessment and analytical techniques.
- vii. To gain expertise in disaster management frameworks, mechanisms, and sustainable strategies.

Course Outcome:

Any student who has undergone the course shall be able to:

Sl.No	Course outcome	CO	Blooms level
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1	Explain the concepts of environment, ecosystems, biodiversity, pollution, social issues, and disaster management frameworks.	CO1	Understand
2	Apply analytical techniques for water quality assessment, SPM estimation, and biodiversity documentation through field visits.	CO2	Apply
3	Analyze environmental problems and disaster scenarios to evaluate control measures, legal frameworks, and sustainable management strategies.	CO3	Analyze

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. 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.

Suggested Readings

1. Bharucha Erach. 2004. Textbook for Environmental studies. University Grants Commission, New Delhi
2. De A K. 2010. Environmental chemistry. New Age International Publishers, New Delhi. ISBN:13-978 81 224 2617 5.
3. Dhar Chakrabarti P G. 2011. Disaster management - India's risk management policy frameworks and key challenges. Centre for Social Markets (India), Bangalore.
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 textbook 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.
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.

Animal Husbandry

26AMP111

Livestock and Poultry Management

1 0 2 2

Objectives

- i. To provide basic knowledge to the students about scientific livestock and poultry rearing practices
- ii. Entrepreneurship development through Livestock/Poultry and Agriculture Integrated Farming System

Course Outcome

Any student who has undergone the course shall be able to:

S. No	Course outcome	CO	Blooms level
1	Explain the role of livestock and poultry in the national economy and rural livelihoods.	CO1	Understand
2	Identify important Indian and exotic breeds of livestock and poultry and their utility.	CO2	Remember
3	Describe basic principles of reproduction, housing, and management of livestock and poultry.	CO3	Apply
4	Classify feedstuffs and explain digestion, nutrients, and feeding practices.	CO4	Understand
5	Outline common diseases of livestock and poultry and appropriate preventive measures.	CO5	Understand

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, goat and swine. Incubation, hatching and brooding. Management of growers and layers. Important Indian and exotic breeds of cattle, buffalo, sheep, goat, swine and poultry. Improvement of farm animals and poultry. Digestion in livestock and poultry. Classification of feedstuffs. Proximate principles of feed. Nutrients and their functions. Feed ingredients for ration for livestock and poultry. Feed supplements and feed additives. Feeding of livestock and poultry. Introduction of livestock and poultry diseases. Prevention (including vaccination schedule) and control of important diseases of livestock and poultry.

Practical

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

Suggested Readings

1. **Banerjee, G.C.** 2019. *A Textbook of Animal Husbandry*. 8th Edn. Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi.
2. **Verma, D.N.** 1999. *A Textbook of Livestock Production Management in Tropic*. Kalyani Publishers, New Delhi.

26PED201 Physical Education, First Aid, Yoga Practices and Meditation 0 0 4 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

Course Outcome:

Any student who has undergone the course shall be able to:

Sl. No	Course outcome	CO	Blooms level
1.	Explain the history of sports and national sporting events; and the rules, measurements, skill techniques, and specific equipment involved in different sports and games; and the concept of training and coaching	CO1	Understand
2.	Understand the methods of different fitness trainings and aerobic and anaerobic exercises	CO2	Understand
3.	Illustrate the role of sports in personality development and the effects of exercise on biological systems and balanced diet and its effects, aging process	CO3	Understand
4.	Demonstrate their skills in Cricket, football, table Tennis, Badminton, Volleyball, Basketball, Kabaddi and Kho-Kho and Athletics	CO4	Apply
5.	Utilize the asanas and Meditation in their day today life to gain emotional balance and moral values.	CO5	Apply
6.	Apply appropriate first aid measures based on the need	CO6	Apply
7.	Understand the sporting injuries and its treatments	CO7	Understand

Practical**Unit I:**

Physical education; Training and Coaching - Meaning and Concept; Methods of Training; aerobic and anaerobic exercises; Calisthenics, weight training, circuit training, interval training, Fartlek training; Effects of Exercise on Muscular, Respiratory, Circulatory and Digestive systems; Balanced Diet and Nutrition: Effects of Diet on Performance; Physiological changes due to ageing and role of regular exercise on ageing process; Personality, its dimensions and types; Role of sports in personality development; Motivation and Achievements in Sports; Learning and Theories of learning; Adolescent Problems and its Management; Posture; Postural Deformities; Exercises for good posture.

Unit II: Yogs Asanas and Meditation

Yoga; History of Yoga, Types of Yoga, Introduction to Yoga:

- Asanas (Definition and Importance): Padmasan, Gaumukhasan, Bhadrasan, Vajrajan, Shashankasan, Pashchimotasan, Ushtrasan, Tadasan, Padhastasan, Ardhchandrasan, Bhujangasan, Utanpadasan, Sarvangasan, Parvatasan, Patangasan, Shishupalanasan (left leg and right leg), Pavanmuktasan, Halasan, Sarpasan, Ardhdhanurasan, and Shavasan.
- Surya Namaskar & Pranayama (Definition and Importance): Omkar, Suryabhedan, Chandrabhedan, Anulom Vilom, Shitali, Shitkari, Bhastrika, and Bhramari.
- Meditation (Definition and Importance): Yogic Kriyas (Kapalbhati), Tratak, Jalneti, and Tribandh.
- Mudras (Definition and Importance): Gyanmudra, Dhyanmudra, Vayumudra, Akashmudra, Pruthvimudra, Shunyamudra, Suryamudra, Varunmudra, Pranmudra, Apanmudra, Vyanmudra, and Uddanmudra.
- Instructional Methods: Role of yoga in sports; Teaching of Asanas – demonstration, practice, correction, and practice.

Unit III: History, Governance and Major Games

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

Unit IV: First Aid and Emergency Techniques

Need and requirement of first aid. First Aid equipment and upkeep. First aid Techniques, First aid related with Respiratory system. First aid related with Heart, Blood and Circulation. First aid related with Wounds and Injuries. First aid related with Bones, Joints Muscle related injuries. First aid related with Nervous system and Unconsciousness. First aid related with Gastrointestinal Tract. First aid related with Skin, Burns. First aid related with Poisoning. First aid related with Bites and Stings. First aid related with Sense organs, Handling and transport of injured traumatized persons. Sports injuries and their treatments.

Suggested Readings

1. Bansode, Ramakant D. 2023. Physical Education, First Aid and Yoga Practices. Khel Sahitya Kendra, New Delhi.
2. Iyengar, B.K.S. 2005. Light on Yoga. Schocken Books, New York.
3. Kumar, Varinder. 2025. Physical Education, First Aid, Yoga Practices and Meditation. Kalyani Publishers, New Delhi.
4. Singh, Ajmer. 2016. Essentials of Physical Education. Kalyani Publishers, New Delhi.

5. St. John Ambulance Association. 2011. First Aid and Emergency Care. St. John Ambulance, New Delhi.
6. Swami Vivekananda. 2009. Raja Yoga. Advaita Ashrama, Kolkata.
7. Sharma, Vivek. 2013. First Aid and Management of Sports Injuries. Khel Sahitya Kendra, New Delhi.
8. National Council of Educational Research and Training (NCERT). 2015. Health and Physical Education. NCERT, New Delhi.
9. Saraswati, Swami Satyananda. 2002. Asana Pranayama Mudra Bandha. Yoga Publications Trust, Munger, Bihar.
10. Posture, Dr. 2018. A Textbook on Physical Education & Health Education: Posture, Athletic Care and First Aid. Khel Sahitya Kendra, New Delhi.

Course Code:

NCC /NSS I

1(0+1)

National Service Scheme (NSS) 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 communitybased organizations) and society.

Course Code:

NCC /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.

22AVP103 Mastery Over Mind (MAOM) 1-0-2 2

1. Course Overview

Master Over the Mind (MAOM) is an Amrita initiative to implement schemes and organise university-wide programs to enhance health and wellbeing of all faculty, staff, and students (UN SDG -3). This program as part of our efforts for sustainable stress reduction gives an introduction to immediate and long-term benefits and equips every attendee to manage stressful emotions and anxiety facilitating inner peace and harmony. With a meditation technique offered by Amrita Chancellor and world-renowned humanitarian and spiritual leader, Sri Mata Amritanandamayi Devi (Amma), this course has been planned to be offered to all students of all campuses of AMRITA, starting off with all first years, wherein one hour per week is completely dedicated for guided practical meditation session and one hour on the theory aspects of MAOM. The theory section comprises lecture hours within a structured syllabus and will include invited guest lecture series from eminent personalities from diverse fields of excellence. This course will enhance the understanding of experiential learning based on university's mission: "Education for Life along with Education for Living", and is aimed to allow learners to realize and rediscover the infinite potential of one's true Being and the fulfilment of life's goals.

2. Course Syllabus

Unit 1 (4 hours)

Causes of Stress: The problem of not being relaxed. Need for meditation -basics of stress management at home and workplace. Traditions and Culture. Principles of meditation—promote a sense of control and autonomy in the Universal Human Value System. Different stages of Meditation. Various Meditation Models. Various practices of Meditation techniques in different schools of philosophy and Indian Knowledge System.

Unit 2 (4 hours)

Improving work and study performance. Meditation in daily life. Cultivating compassion and good mental health with an attitude of openness and acceptance. Research and Science of Meditation: Significance of practising meditation and perspectives from diverse fields like science, medicine, technology. philosophy, culture, arts, management, sports, economics, healthcare, environment etc. The role of meditation for stress and anxiety reduction in one's life with insights based on recent cutting-edge technology. The effect of practicing meditation for the wholesome wellbeing of an individual.

Unit 3 (4 hours)

Communications: principles of conscious communication. Relationships and empathy: meditative approach in managing and maintaining better relationships in life during the interactions in the world, role of MAOM in developing compassion, empathy and responsibility, instilling interest, and orientation to humanitarian projects as a key to harness intelligence and compassion in youth. Methodologies to evaluate effective awareness and relaxation gained from meditation. Evaluating the global transformation through meditation by instilling human values which leads to service learning and compassion driven research.

TEXT BOOKS:

1. Mata Amritanandamayi Devi, “Cultivating Strength and vitality,” published by Mata Amritanandamayi Math, Dec 2019
2. Swami Amritaswarupananda Puri ,”The Color of Rainbow “ published by MAM, Amritapuri.

REFERENCES:

1. Craig Groeschel, “Winning the War in Your Mind: Change Your Thinking, Change Your Life” Zondervan Publishers, February 2019
2. R Nagarathna et al, “New Perspectives in Stress Management “Swami Vivekananda Yoga Prakashana publications, Jan 1986
3. Swami Amritaswarupananda Puri “Awaken Children Vol 1, 5 and 7 - Dialogues with Amma on Meditation”, August 2019
4. Swami Amritaswarupananda Puri “From Amma’s Heart - Amma’s answer to questions raised during world tours” March 2018
5. Secret of Inner Peace- Swami Ramakrishnananda Puri, Amrita Books, Jan 2018.
6. Mata Amritanandamayi Devi “Compassion :The only way to Peace:Paris Speech”, MA Center, April 2016.
7. Mata Amritanandamayi Devi “Understanding and collaboration between Religions”, MA Center, April 2016.
8. Mata Amritanandamayi Devi “Awakening of Universal Motherhood: Geneva Speech” M A center, April 2016.

3. Evaluation and Grading

Internal			External	Total
Components	Weightage		Practical (attendance and class participation) 60%	100 %
Quiz (based on the reading material)	20 %	40%		
Assignments (Based on webinars and lecture series)	20%			

Course Outcomes (CO)

CO1: Relate to the causes of stress in one's life.

CO2: Experiment with a range of relaxation techniques

CO3: Model a meditative approach to work, study, and life.

CO4: Develop appropriate practice of MA-OM technique that is effective in one's life

CO5: Inculcate a higher level of awareness and focus.

CO6: Evaluate the impact of a meditation technique

***Programme Outcomes(PO) (As given by NBA and ABET)**

PO1: Engineering Knowledge

PO2: Problem Analysis

PO3: Design/Development of Solutions

PO4: Conduct Investigations of complex problems

PO5: Modern tools usage

PO6: Engineer and Society

PO7: Environment and Sustainability

PO8: Ethics

PO9: Individual & Team work

PO10: Communication

PO11: Project management & Finance

PO12: Lifelong learning

CO – PO Affinity Map

PO	PO	P	P	P	P	P	P	P	P	P	P	P	PS	PS	PS
CO	1	O2	O3	O4	O5	O6	O7	O8	O9	O10	O11	O12	O1	O2	O3
CO1	3	3	3	2			2	3		3		3			
CO2	3	3	3	2	2		2	3	3	3		3			
CO3	3	3	2	2	2	2	2	3	3	3		3			
CO4	3	3	3	2	-	2	3	3	3	3		3			
CO5	3	2	2	2	-	2		3	2	2		2			
CO6	3	2	2	2	3	2		3	2	2		2			

Course Objectives

- To introduce students to the depths and richness of the Indian heritage and knowledge traditions, and to enable them to obtain a synoptic view of the grandiose achievements of India in diverse fields.
- To equip students with a knowledge of their country and its eternal values.

Course Outcomes

After completing this course, students will be able to:

Sl. No	Course outcome	CO	Blooms level
1.	Be able to enhance the understanding of true essence of India's cultural and spiritual heritage through learning analytically what it amounts to living a happy life, and about the richness of India's education system, while pondering on the serious damage caused by colonialism in India alongside learning about the means of decolonization and knowing about the early timeline of Indian subcontinent.	CO1	Understand
2.	Learn about the sublime value of selflessness and final freedom alongside understanding the concept of circle of life and Indian approach toward it while delving into the means of celebrating life.	CO2	Apply
3.	Familiarize on the topic of what true love is, by way of understanding the immense compassion of mahātmas, and Mātā Amṛtānandamayī's Amma's gospel on compassion, the role of metaphors and tropes whereafter focussing personality development through Yoga both theoretically and Practically	CO3	Analyze
4.	Appreciate the discussion on what it takes to be a strategic thinker, how India was glorified by various scholars and travellers and how strong a human being's association with nature should be alongside getting introduced to the glimpses of Indian traditions like Advaita Vedanta: the theory of oneness.	CO4	Understand

Module 1

Chapters 1-4 Decolonisation, Windows to the Universe: Indian Darśanas, Ancient Wisdom for Modern Challenges: Pañcamahāyajña, Epistemology of Indian Philosophies

Module 2

Chapters 5- 8 A Vedantic Modelling of Human Personality, The Wake-Up Call from Upaniṣads, Goals of Life, The Six Ingredients of Success.

Module 3

Chapters 9 -11 Making Sense of Dharma, Ancestral Anchors: The Indian Family, Decoding the Idea of India.

Module 4

Chapters 12 -14 Nation Builders of Bhāratavarṣa, Civilisational Bridges: India and the World, Kindness

Reading Material

1. Amrita University. (n.d.). Foundations of Indian Heritage. In-house publication.
2. Dharampal. (1983). The Beautiful Tree: Indigenous Indian Education in the Eighteenth Century. Other India Press.
3. William Pinch. (1996). Peasants and Monks in British India. University of California Press.
4. J. Sai Deepak. (2021). India, That Is Bharat: Coloniality, Civilisation, Constitution. Bloomsbury India.
5. Mata Amritanandamayi. (2018). Awaken, Children: Dialogues with Mata Amritanandamayi. MAM Publications.
6. Mata Amritanandamayi Devi. (1995). Man and Nature. MAM Publications.
7. Divine Life Society. (n.d.). What Becomes of the Soul After Death. The Divine Life Society.

Evaluation Pattern

Assessment	Internal/External	Weightage
Continuous Assessment	Internal	30%
Mid-term jury	Internal	30%
End-semester jury	External	40%

Course Objectives

- To offer a comprehensive introduction to Bhārath in a nutshell, with special emphasis on the foundational sources of Indian thought and the eminent personalities who significantly shaped philosophical, cultural, scientific, and social disciplines.
- To explore India's major contributions to humankind, highlighting its enduring impact in areas such as knowledge traditions, science, technology, ethics, and civilizational values that continue to influence the world.
- To critically understand India's present position in global geopolitics, along with its unique and holistic approach to science and ecology, rooted in sustainability, harmony with nature, and long-term civilizational wisdom.

Course Outcomes

After completing this course, students will be able to:

Sl. No	Course outcome	CO	Blooms level
1	Will be able to recognise the call of Upanishads and outstanding personalities for confronting the wicked in the real world while admiring the valour, pursuit and divinity in both classical and historical female characters of India	CO1	Understand
2	Will get introduced to Acharya Chanakya, his works, and his views on polity and nation to find synchrony between public and personal life, alongside understanding India's cultural nuances and uniqueness concerning the comprehension of God across major global communities	CO2	Apply
3	Will be able to appreciate Bhagavad Gita as the source of the Indian worldview through the various Yogic lessons enshrined in it, making it one of India's numerous soft powers, and also understand the faith-oriented mechanism of preserving nature.	CO3	Analyze
4	Will be informed about the enormous contribution of Indian civilisation over two and a half millennia to humanity and develop awareness about India's approach toward science, devoid of dogmas and rooted in humanism.	CO4	Understand

Theory Schedule**Module 1**

Vision and Mission of IKS, Unveiling the Roots of Fear: Pathways to Fearlessness, Chanakya – Architect of a Greater India, Bhagavadgita – From Soldier to Samsarin to Sadhaka.

Module 2 Lessons in Yoga from Bhagavadgita, Ultimate Reality: Different Perspectives, Weaving a New Future Using Ancient Threads, Legacy of Knowledge & Learning in India,

Ayurveda: Evolution and Relevance for Health & Well-Being, Indian Calendar Systems.
Module 3 In the Mirror of Culture: Understanding Gender in India, Revisiting Indian Historiography, A Glimpse into Yoga, Ashtanga Yoga, Illuminating Innovations: India's Contributions to Science & Technology, Science and Spirituality

References:

1. Amrita University. (n.d.). Glimpses of Glorious India. In-house publication.
2. Swami Tathagatananda. (2003). Fear Not: Be Strong. Advaita Ashrama.
3. Sri Aurobindo. (1997). Essays on the Gita. Sri Aurobindo Ashram.
4. Vijnana Bharati. (n.d.). Indian Contribution to Science. Vijnana Bharati Publication.
5. D. D. Kosambi. (1965). The Culture and Civilisation of Ancient India in Historical Outline. Vikas Publishing House.
6. Chanakya. (1972). The Kautilya Arthaśāstra (R. P. Kangle, Trans. with critical and explanatory notes). Motilal Banarsidass.
7. Radhakrishnan Pillai. (2020). Chanakya Neeti: Strategies for Success. Jaico Publishing House.
8. Swami Ranganathananda. (2000). Universal Message of the Bhagavad Gita: An Exposition of the Gita in the Light of Modern Thought and Modern Needs. Advaita Ashrama.
9. D. M. Bose, S. N. Sen, & B. V. Subbarayappa. (1971). A Concise History of Science in India. The Indian National Science Academy.
10. Michel Danino. (2011). Indian Culture and India's Future. D. K. Printworld (P) Ltd.

Evaluation Pattern

Assessment	Internal/External	Weightage
Continuous Assessment	Internal	30%
Mid-term jury	Internal	30%
End-semester jury	External	40%

A. Nature of Course: Lab/Practical

B. Course Description:

The course introduces students to the Integrated Amrita Meditation Technique (IAM 20), a structured practice that combines yogic stretches, regulated breathing (pranayama), and guided meditation. The course integrates both theoretical understanding and experiential practice to enhance emotional balance, stress resilience, concentration, and overall holistic development.

Aligned with United Nations Sustainable Development Goal 3 (SDG 3): Good Health and Well-Being, the course promotes preventive mental health care, emotional well-being, and sustainable lifestyle practices among students. By fostering inner stability, self-awareness, and self-regulation, the programme supports academic excellence and contributes to the development of healthy individuals and communities.

The course is expected to improve student well-being, enhance academic focus and cognitive clarity, reduce stress-related indicators, and promote compassionate and emotionally supportive culture.

C. Course Objectives:

- To promote overall health and well-being of students.
- To train students in the structured practice of IAM 20.
- To develop emotional regulation and stress management skills.
- To encourage reflective awareness and compassionate living.

D. Course Outcomes:

After successful completion of the course, students will be able to:

CO	Course Outcomes	Knowledge Level (Bloom's Taxonomy)
CO1	Explain principles and components of IAM 20	Understand (L2)
CO2	Demonstrate and correct meditation practice independently	Apply (L3)
CO3	Analyze personal stress patterns using meditation insights	Analyse (L4)
CO4	Evaluate personal growth through daily practice	Evaluate (L5)

E. CO-PO Mapping: [affinity: 3 – high; 2- moderate; 1- slightly]

CO's	Program Outcomes (PO's)											Program Specific Outcomes (PSF's)		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2	PSO 3
CO 1	-	-	-	-	-	1	-	2	-	-	1	-	-	-
CO 2	-	-	-	-	-	2	2	1	1	-	1	-	-	-
CO 3	-	-	-	-	-	1	1	2	-	-	1	-	-	-
CO 4	-	-	-	-	-	1	1	1	1	-	1	-	-	-

F. Syllabus

Unit 1: Foundations of Meditation (CO1)

- Meaning and purpose of meditation
- Demonstration and supervised training
- Overview of structure of IAM
- Guidance for safe and effective practice
- Importance of mental health

Unit 2: Theoretical Foundations (CO2)

- Structure and components of IAM: yogic stretches, regulated breathing, and guided meditation
- Breath–mind connection
- Integration of IAM practice into daily routine and academic life
- Application of IAM for stress management, concentration, and holistic student development

Unit 3: IAM Practical Training (CO3)

- Preparatory stretches
- Pranayama components
- Guided meditation sequence
- Corrections and common challenges

Unit 4: Integration and Transformation (CO4)

- Building daily discipline
- Research evidence in higher education
- Compassion and mindful communication

G. Evaluation Pattern:

Assessment	Internal (60)	External (40)
Attendance	20 Marks	
Class Participation	20 Marks	
Activity	20 Marks	
Practical Demonstration		30 Marks
Viva		10 Marks

CIR Course**23LSK201****LIFE SKILLS I****L-T-P-C: 1-0-2-2**

Pre-requisite: An open mind and the urge for self-development, basic English language skills, knowledge of high school level mathematics.

Course Objective: To assist students in inculcating soft skills, developing a strong personality, empowering them to face life's challenges, improving their communication skills and problem solving skills.

Course Outcomes CO1: Soft Skills - To develop greater morale and positive attitude to face, analyze, and manage emotions in real life situations, like placement process.

CO2: Soft Skills - To empower students to create better impact on a target audience through content creation, effective delivery, appropriate body language and overcoming nervousness, in situations like presentations, Group Discussions and interviews.

CO3: Aptitude – To analyze, understand and solve questions in arithmetic and algebra by employing the most suitable methods.

CO4: Aptitude - To investigate and apply suitable techniques to solve questions on logical reasoning.

CO5: Verbal – To infer the meaning of words & use them in the right context. To have a better understanding of the nuances of English grammar and become capable of applying them effectively.

CO6: Verbal - To identify the relationship between words using reasoning skills. To develop the capacity to communicate ideas effectively.

Skills: Communication, self-confidence, emotional intelligence, presentation skills and problem solving skills.

CO-PO Mapping

PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO												
CO1								2	3	3		3
CO2								3	2	3		3
CO3		3										3
CO4		3										3
CO5										3		3
CO6									3	3		3

Syllabus

Soft Skills and its importance: Pleasure and pains of transition from an academic environment to work-environment. New-age challenges and distractions. Learning to benefit from constructive criticisms and feedback. Need for change in mindset and up-skilling to keep oneself competent in the professional world.

Managing Self: Knowing oneself, Self-perception, Importance of positive attitude, Building and displaying confidence, Avoiding being overconfident, Managing emotions, stress, fear. Developing Resilience and handling failures. Self-motivation, Self-learning, and continuous knowledge up-gradation / Life-long learning. Personal productivity - Goal setting and its importance in career planning, Self-discipline, Importance of values, ethics and integrity, Universal Human Values.

Communication: Process, Language Fluency, Non-verbal, Active listening. Assertiveness vs. aggressiveness. Barriers in communication. Digital communication

Aptitude

Numbers: Types, Power Cycles, Divisibility, Prime, Factors & Multiples, HCF & LCM, Surds, Indices, Square roots, Cube Roots and Simplification.

Percentage: Basics, Profit, Loss & Discount, and Simple & Compound Interest.

Ratio, Proportion & Variation: Basics, Alligations, Mixtures, and Partnership.

Averages: Basics, and Weighted Average.

Equations: Basics, Linear, Quadratic, Equations of Higher Degree and Problems on ages

Logical Reasoning I: Blood Relations, Direction Test, Syllogisms, Series, Odd man out, Coding \& Decoding, Cryptarithmic Problems and Input - Output Reasoning

Verbal Skills

Vocabulary: Familiarize students with the etymology of words, help them realize the relevance of word analysis and enable them to answer synonym and antonym questions. Create an awareness about the frequently misused words, commonly confused words and wrong form of words in English.

Grammar (Basics): To learn the usage of grammar and facilitate students to identify errors and correct them.

Reasoning: Stress the importance of understanding the relationship between words through analogy questions. Emphasize the importance of avoiding the gap (assumption) in the argument/ statements/ communication.

Speaking Skills: Make students conscious of the relevance of effective communication in today's world through individual speaking activities.

Writing Skills: Introduce formal written communication and keep the students informed about the etiquette of email writing.

References:

1. Gulati. S., (1006) "Corporate Soft Skills", New Delhi, India: Rupa & Co.
2. The hard truth about Soft Skills, by Amazon Publication.
3. Verbal Skills Activity Book, CIR, AVVP
4. Nova's GRE Prep Course, Jeff Kolby, Scott Thornburg & Kathleen Pierce
5. The BBC and British Council online resources
6. Owl Purdue University online teaching resources
7. www.thegrammarbook.com online teaching resources
8. www.englishpage.com online teaching resources and other useful websites
9. Student Workbook: Quantitative Aptitude & Reasoning, Corporate & Industry Relations, Amrita Vishwa Vidyapeetham.
10. Quantitative Aptitude for All Competitive Examinations, Abhijit Guha.
11. How to Prepare for Quantitative Aptitude for the CAT, Arun Sharma.
12. How to Prepare for Data Interpretation for the CAT, Arun Sharma.
13. How to Prepare for Logical Reasoning for the CAT, Arun Sharma.
14. Quantitative Aptitude for Competitive Examinations, R S Aggarwal.
15. A Modern Approach to Logical Reasoning, R S Aggarwal.
16. A Modern Approach to Verbal & Non-Verbal Reasoning, R S Aggarwal.

Evaluation pattern

Assessment	Internal	External
Continuous Assessment (CA)* – Soft Skills	30	-
Continuous Assessment (CA)* – Aptitude	10	25
Continuous Assessment (CA)* – Verbal	10	25
Total	50	50

***CA – can be presentations, speaking activities and tests**

Pre-requisite: Willingness to learn, communication skills, basic English language skills, knowledge of high school level mathematics.

Course Objective: To help students understand the corporate culture and assist them in improving their group discussion skills, communication skills, listening skills and problem solving skills.

Course Outcomes

CO1: Soft Skills - To improve the inter-personal skills, professional etiquette and leadership skills, vital for arriving at win-win situations in Group Discussions and other team activities.

CO2: Soft Skills - To develop the ability to create better impact in a Group Discussions through examination, participation, perspective-sharing, ideation, listening, brainstorming and consensus.

CO3: Aptitude - To interpret, critically analyze and solve questions in arithmetic and algebra by employing the most suitable methods.

CO4: Aptitude - To analyze, understand and apply suitable methods to solve questions on logical reasoning.

CO5: Verbal - To be able to use vocabulary in the right context and to be competent in spotting grammatical errors and correcting them.

CO6: Verbal - To be able to logically connect words, phrases, sentences and thereby communicate their perspectives/ideas convincingly.

Skills: Communication, etiquette and grooming, inter-personal skills, listening skills, convincing skills, problem-solving skill.

CO-PO Mapping

PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO												
CO1								2	3	3	2	3
CO2								2	3	3	2	3
CO3		3										3
CO4		4										3
CO5										3		3
CO6									3	3		3

Syllabus

Soft Skills

Professional Grooming and Practices: Basics of corporate culture, key pillars of business etiquette – online and offline: socially acceptable ways of behavior, body language, personal hygiene, professional attire and cultural adaptability and managing diversity. Handling pressure, multi-tasking. Being enterprising. Adapting to corporate life: Emotional Management (EQ), Adversity Management, Health consciousness. People skills, Critical Thinking and Problem solving.

Group Discussions: Advantages of group discussions, Types of group discussion and Roles played in a group discussion. Personality traits evaluated in a group discussion. Initiation techniques and maintaining the flow of the discussion, how to perform well in a group discussion. Summarization/conclusion.

Aptitude

Logarithms, Inequalities and Modulus: Basics

Sequence and Series: Basics, AP, GP, HP, and Special Series.

Time and Work: Basics, Pipes & Cistern, and Work Equivalence.

Time, Speed and Distance: Basics, Average Speed, Relative Speed, Boats & Streams, Races and Circular tracks.

Logical Reasoning II: Arrangements, Sequencing, Scheduling, Venn Diagram, Network Diagrams, Binary Logic, and Logical Connectives, Clocks, Calendars, Cubes, Non-Verbal reasoning and Symbol based reasoning.

Verbal Skills

Vocabulary: Help students understand the usage of words in different contexts. **Grammar (Medium Level):** Train Students to comprehend the nuances of Grammar and empower them to spot errors in sentences and correct them.

Reading Comprehension (Basics): Introduce students to smart reading techniques and help them understand different tones in comprehension passages.

Reasoning: Enable students to connect words, phrases and sentences logically.

Oral Communication Skills: Aid students in using the gift of the gab to interpret images, do a video synthesis, try a song interpretation or elaborate on a literary quote.

References:

1. Adair. J., (1.986), "Effective Team Building: How to make a winning team", London, U.K: Pan Books.
2. Gulati. S., (2006) "Corporate Soft Skills", New Delhi, India: Rupa & Co.
3. The Hard Truth about Soft Skills, by Amazone Publication.

4. Verbal Skills Activity Book, CIR, AVVP
5. Nova's GRE Prep Course, Jeff Kolby, Scott Thornburg & Kathleen Pierce
6. The BBC and British Council online resources
7. Owl Purdue University online teaching resources
8. www.thegrammarbook.com online teaching resources
9. www.englishpage.com online teaching resources and other useful websites
10. Student Workbook: Quantitative Aptitude & Reasoning, Corporate & Industry Relations, Amrita Vishwa Vidyapeetham.
11. Quantitative Aptitude for All Competitive Examinations, Abhijit Guha. 66
12. How to Prepare for Quantitative Aptitude for the CAT, Arun Sharma.
13. How to Prepare for Data Interpretation for the CAT, Arun Sharma.
14. How to Prepare for Logical Reasoning for the CAT, Arun Sharma.
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17. A Modern Approach to Verbal & Non-Verbal Reasoning, R S Aggarwal.

Evaluation pattern

Assessment	Internal	External
Continuous Assessment (CA)* – Soft Skills	30	-
Continuous Assessment (CA)* – Aptitude	10	25
Continuous Assessment (CA)* – Verbal	10	25
Total	50	50

***CA – can be presentations, speaking activities and tests**

Pre-requisite: Team Spirit, self-confidence and required knowledge, basic English language skills, knowledge of high school level mathematics.

Course Objective: To help students understand the nuances of leadership, know the importance of working in teams, face challenging situations, crack interviews, improve communication skills and problem-solving skills.

Course Outcomes

CO1: Soft Skills - To acquire the ability to work in teams, present themselves confidently and showcase their knowledge, skills, abilities, interests, practical exposure, strengths and achievements to potential recruiters through a resume, video resume, and personal interview.

CO2: Soft Skills - To have better ability to prepare for facing interviews, analyse interview questions, articulate correct responses and respond appropriately to convince the interviewer of one's right candidature through displaying etiquette, positive attitude and courteous communication.

CO3: Aptitude - To manage time while arriving at appropriate strategies to solve questions in geometry, statistics, probability and combinatorics.

CO4: Aptitude - To analyze, understand and apply suitable methods to solve questions on data analysis and data sufficiency.

CO5: Verbal - To use diction that is less verbose and more refined and to use prior knowledge of grammar to correct/improve sentences.

CO6: Verbal - To understand arguments, analyze arguments and use inductive/deductive reasoning to arrive at conclusions. To be able to generate ideas, structure them logically and express them in a style that is comprehensible to the audience/recipient.

Skills: Communication, teamwork, leadership, facing interviews and problem-solving.

CO-PO Mapping

PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO												
CO1								2	3	3		3
CO2								2	3	3		3
CO3												3
CO4		3										3
CO5		3								3		3
CO6									3	3		3

Syllabus

Soft Skills

Team Work: Value of teamwork in organizations, Definition of a team. Why team? Effective team building. Parameters for a good team, roles, empowerment and need for transparent communication, Factors affecting team effectiveness, Personal characteristics of members and its influence on team. Project Management Skills, Collaboration skills

Leadership: Initiating and managing change, Internal problem solving, Evaluation and coordination, Growth and productivity, Importance of Professional Networking.

Facing an interview: Importance of verbal & aptitude competencies, strong foundation in core competencies, industry orientation / knowledge about the organization, resume writing (including cover letter, digital profile and video resume), being professional. Importance of good communication skills, etiquette to be maintained during an interview, appropriate grooming and mannerism.

Aptitude

Geometry: 2D, 3D, Coordinate Geometry, and Heights & Distance.

Permutations & Combinations: Basics, Fundamental Counting Principle, Circular Arrangements, and Derangements.

Probability: Basics, Addition & Multiplication Theorems, Conditional Probability and Bayes' Theorem.

Statistics: Mean, Median, Mode, Range, Variance, Quartile Deviation and Standard Deviation.

Data Interpretation: Tables, Bar Diagrams, Line Graphs, Pie Charts, Caselets, Mixed Varieties, and other forms of data representation.

Data Sufficiency: Introduction, 5 Options Data Sufficiency and 4 Options Data Sufficiency.

Campus recruitment papers: Discussion of previous year question papers of all major recruiters of Amrita Vishwa Vidyapeetham.

Miscellaneous: Interview Puzzles, Calculation Techniques and Time Management Strategies.

Verbal Skills

Vocabulary: Create an awareness of using refined language through idioms and phrasal verbs. Grammar (Advanced Level): Enable students to improve sentences through a clear understanding of the rules of grammar.

Reasoning Skills: Facilitate the student to tap his reasoning skills through Syllogisms, and critical reasoning arguments.

Reading Comprehension (Advanced): Enlighten students on the different strategies involved in tackling reading comprehension questions.

Public Speaking Skills: Empower students to overcome glossophobia and speak effectively and confidently before an audience.

Writing Skills: Practice closet tests that assess basic knowledge and skills in usage and mechanics of writing such as punctuation, basic grammar and usage, sentence structure and rhetorical skills such as writing strategy, organization, and style. Practice formal written communication through writing emails especially composing job application emails.

References:

1. Adair. J., (1.986), "Effective Team Building: How to make a winning team", London, U.K: Pan Books.
2. Gulati. S., (2006) "Corporate Soft Skills", New Delhi, India: Rupa & Co.
3. The Hard Truth about Soft Skills, by Amazone Publication.
4. Verbal Skills Activity Book, CIR, AVVP
5. Nova's GRE Prep Course, Jeff Kolby, Scott Thornburg & Kathleen Pierce
6. The BBC and British Council online resources
7. Owl Purdue University online teaching resources
8. www.thegrammarbook.com online teaching resources
9. www.englishpage.com online teaching resources and other useful websites
10. Student Workbook: Quantitative Aptitude & Reasoning, Corporate & Industry Relations, Amrita Vishwa Vidyapeetham.
11. Quantitative Aptitude for All Competitive Examinations, Abhijit Guha.
12. How to Prepare for Quantitative Aptitude for the CAT, Arun Sharma.
13. How to Prepare for Data Interpretation for the CAT, Arun Sharma.
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17. A Modern Approach to Verbal & Non-Verbal Reasoning, R S Aggarwal.

Evaluation pattern

Assessment	Internal	External
Continuous Assessment (CA)* – Soft Skills	30	-
Continuous Assessment (CA)* – Aptitude	10	25
Continuous Assessment (CA)* – Verbal	10	25
Total	50	50

***CA – can be presentations, speaking activities and tests**

Electives

26AEC431

Agri-Business Management

3 0 2 4

Objective

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

Course Outcome:

Any student who has undergone the course shall be able to:

Sl.No	Course outcome	CO	Blooms level
1	Explain the concepts, functions, and processes of agribusiness management, organizational behaviour, value chains, and business environment.	CO1	Understand
2	Explain the principles of financial, marketing, and project management and their role in the successful management of agribusiness enterprises	CO 2	Understand
3	Apply the principles of agribusiness management to prepare, appraise, and evaluate agribusiness projects and business plans.	CO3	Apply

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, policies 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 agribusiness entrepreneur. Appraisal /evaluation techniques of identifying viable project- Non discounting techniques. Case study of agro- based industries. Trend and growth rate of price of agricultural commodities. Net present worth technique for selection of viable project. Internal rate of return.

Suggested Readings

1. Bairwa S L. 2016. Objective on Fundamentals of Agri-business Management. Kalyani Publishers
2. Bairwa Shoji Lal, Sen Chandra, Meena L K and Kumari Meera. 2018. Agribusiness Management Theory and Practices. Write and Print Publications.
3. Broadway A C and Arif A. 2002. A textbook of Agri-Business Management. Kalyani Publishers
4. Kamalvanshi Virender. 2015. Agribusiness Management. Random Publications.
5. Nishra Anjan, Biswas Debasish and Giri Arunangshu. 2019. Agribusiness Management. Himalaya Publishing House, 220p.

Objective

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

Course Outcome:

Any student who has undergone the course shall be able to:

Sl.No	Course outcome	CO	Blooms level
1.	Recognize agricultural journalism concepts and print publication.	CO1	Remembering
2.	Produce news stories, TV, and radio programmes.	CO2	Understanding
3.	Analyze the ideological issues and concepts related to layout, design, and editorial mechanics.	CO3	Analyzing
4.	Practice the skills of writing popular/review/research articles.	CO4	Applying
5.	Create extension teaching print material for the ToT process.	CO5	Creating

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 storiesdefinition, 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. Practising proof reading. Practice in lay outting of newspaper. Testing copy with a readability formula. Visit a publishing office.

Suggested Readings

1. Fleming, C., Hemmingway, E., Moore, G., & Welford, D. (2006). An Introduction to Journalism. London: Sage Publications.
2. Parthasarathy, R. (2009). Basic Journalism (2nd ed.). New Delhi: Macmillan India Ltd.
3. Shrivastava, K. M. (2003). News Reporting and Editing. New Delhi: Sterling Publishers Pvt. Ltd.
4. Kamath, M. V. (2005). Professional Journalism. New Delhi: Vikas Publishing House Pvt. Ltd.
5. Kamath, M. V. (2009). The Journalist's Handbook. New Delhi: Vikas Publishing House Pvt. Ltd.
6. Bhaskaran, S., Balasubramaniam, R., Swaminathan, R., & Leelavathi, M. (Year not specified). Farm Journalism and Media Management. Coimbatore: Tamil Nadu Agricultural University.
7. Singh, A. K. (2008). Agricultural Extension and Farm Journalism. New Delhi: Agrotech Publishing Academy.
8. Jana, H., & Mitra, A. 2013. Farm Journalism. New Delhi: Kalyani Publishers.
9. Web Materials.
10. Prepared You Tube videos.

26AGM431

Biopesticides and Biofertilizers

3 0 2 4

Objectives

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

Course Outcome:

Any student who has undergone the course shall be able to:

Sl.No	Course outcome	CO	Blooms level
1	List the bio fertilizer, bio pesticide producing microorganisms and important botanicals.	CO1	Remember
2	Compare the role of bio pesticides, biorationals and bio fertilizers in crop protection and soil fertility, respectively	CO 2	Understand
3	Explain different method of applications of biorationals and bio fertilizer	CO3	Understand
4	Demonstrate mass production technology and quality control of bio pesticide and bio fertilizers at lab scale	CO4	Apply
5	Solve problems in identification, characterization and commercial production of bio fertilizer, biorationals	CO5	Apply

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 entomopathogenic pathogens and nematodes, Methods of application of bio pesticides. Methods of quality control and Techniques of bio pesticides. Impediments and limitation in production and use of bio pesticides. Biofertilizers - Introduction, status and scope. Structure and characteristics features of bacterial biofertilizers – Azospirillum, Azotobacter, Bacillus, Pseudomonas, Rhizobium and Frankia; Cyanobacterial bio fertilizers- Anabaena, Nostoc, Hapalosiphon and fungal biofertilizers – AM mycorrhiza and ectomycorrhiza. 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

Isolation and purification of important biopesticides: Trichoderma Pseudomonas, Bacillus, Metarhizium etc. and its production. Identification of important botanicals. Visit to biopesticide laboratory in nearby area. Field visit to explore naturally infected cadavers. Identification of entomopathogenic entities in field condition. Quality control of biopesticides. Isolation and purification of Azospirillum, Azotobacter, Rhizobium, P-solubilizers and cyanobacteria. Mass multiplication and inoculums production of biofertilizers. Isolation of AM fungi- Wet sieving method and sucrose gradient method. Mass production of AM inoculants.

Suggested Readings

1. Boland G J and David L.1998. Plant Microbe Interactions and Biological Control. Kuykendall Marel Dekker, INC.
2. Borkar S G. 2015. Microbes as Biofertilizers and its Production Technology. WPI India. Ciancia A and Mukerji K J. 2007.
- 3.General Concepts of Integrated Pest and Disease Management. Edited Published by Springer. Cincholkar S B and Mukherji K G. 2007.
4. Biological Control of Plant Diseases. Hawarth Food and Agricultural Products. Gehlot Dushyant. 2005.
5. Organic Farming: Standards, Accreditation, Certification and Inspection. Agrobios (India). Gnanamanickam S S. 2002.
6. Biological Control of Crop Disease. Kuykendall Marel Dekker, INC. Ramanujam B and Rabindra R J. 2006.
7. Current Status of Biological Control of Plant Disease using Antagonistic Organisms in India. Precision Fototype Services, Bengaluru.
8. Singh Awani Kr. 2018. Handbook of Microbial Biofertilizers. Agrotech Press, Jaipur, India.
9. Singh A K. 2015. Organic Farming. New India Publishing Agency, New Delhi.

26AGR431 Basic Coding and System Simulation for Agro advisory 3 0 2 4

Objectives

- i. To impart basic knowledge of computer programming and coding concepts for agricultural applications.
- ii. To familiarize students with system simulation techniques and their application in crop growth, yield prediction, and agro-advisory services.
- iii. To develop skills in integrating weather, crop, and field data using coding tools for preparation and dissemination of agro-advisory bulletins.

Course Outcome:

Any student who has undergone the course shall be able to:

Sl.No	Course outcome	CO	Blooms level
1	Explain the fundamentals of computer programming, coding logic, and data handling for agricultural applications.	CO1	Understand
2	Apply basic coding techniques and system simulation models to analyze crop growth, weather, and yield under different agro-climatic conditions.	CO2	Analyze

3	Develop simple decision-support tools and scientifically sound agro-advisory bulletins by integrating coded data analysis, weather forecasts, and crop simulation outputs.	CO3	Create
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Theory

Introduction to computers and programming concepts; algorithms, flowcharts, variables, operators, input/output statements, conditional and looping statements; basic programming using R for agricultural applications; functions, lists, dictionaries, arrays, file handling, and data visualization.

Introduction to system approach and system boundaries in agriculture; soil–plant–atmosphere continuum; principles of system simulation; crop models, concepts and types; data requirements and relational diagrams; introduction to crop simulation models and decision support systems.

Weather and climate data handling using coding tools; data preprocessing, visualization, and statistical analysis; evaluation of crop responses to weather elements; elementary crop growth models; calibration, validation, verification, and sensitivity analysis.

Concepts of potential and achievable crop production; simulation under water- and nutrient-limited conditions; soil water and nutrient balance; weather forecasting methods, forecast verification, value-added weather forecasts, Indigenous Technical Knowledge (ITK) in weather forecasting; crop-weather calendars; preparation and dissemination of agro-advisory bulletins using coding tools, weather forecasts, and crop simulation model outputs.

Practical

Introduction to R programming and R-Studio; writing simple programs using variables, operators, conditional statements, loops, and functions; reading and processing agricultural datasets; importing and exporting CSV/Excel files; graphical visualization of weather and crop data.

Preparation of crop-weather calendars using coding tools; statistical analysis of meteorological data; simulation of crop growth using AquaCrop models; simulation under varying weather, irrigation, and nutrient management scenarios; sensitivity analysis using simulation models; yield forecasting using statistical and simulation approaches; introduction to pest and disease forecasting models; preparation of agro-advisory bulletins based on weather forecasts and simulation outputs; collection and analysis of farmers' feedback on agro-advisories.

Suggested Readings

1. R for Data Science: <https://r4ds.hadley.nz>
2. R Manuals (R Project): <https://cran.r-project.org/manuals.html>
3. Wallach, D., Makowski, D., Jones, J. W., & Brun, F. (2018). Working with dynamic crop models: methods, tools, and examples for agriculture and environment. Academic Press.
4. AquaCrop model: <https://www.fao.org/aquacrop/en>

5. Prasada Rao, G.S.L.H.V. (2008). Agricultural Meteorology. PHI Publisher, Delhi
6. Santanu K.B., Rao, K.V. Sarath Chandran, M.A., Subodh, Sasml and Singh, V.K. (2021). Weather forecast, agriculture contingency plan and agromet-advisory services for climate resilient agriculture. Indian Journal of Agronomy 66 (5th IAC Special issue): S1-S14
7. ICAR Agro advisory: <https://ccari.icar.gov.in/agroadvisory.html>

26AGR432

Management of Natural Resources

3 0 2 4

Objectives

- i. To enlighten about available natural resources and their relationship with crop production
- ii. To impart the knowledge of principles and practices of natural resource management

Course outcomes

Any student who has undergone the course shall be able to:

Sl.No	Course outcome	CO	Blooms level
1	Explain the concepts, classification, distribution, and sustainable management of natural resources, including land, water, and energy resources, and their ecological, social, and economic significance.	CO1	Understand
2	Apply principles of soil and water conservation to identify different forms of soil erosion, estimate soil loss, and recommend suitable erosion control and water harvesting measures under various field conditions.	CO2	Apply
3	Analyze resource management approaches, resource conflicts, land degradation issues, watershed management practices, and conservation strategies for sustainable agricultural production.	CO3	Analyze

Theory

Introduction to Natural Resource Bases: Concept of resource, classification of natural resources. Factors influencing resource availability, distribution and uses. Interrelationships among different types of natural resources. Concern on Productivity issues. Ecological, social and economic dimension of resource management. Land resources: Land as a resource. Dry land, land use classification, land degradation, man induced landslides, soil erosion and desertification. Landscape impact analysis, wetland ecology and management. Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems. 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 for tracking and area measurement. Estimation of soil loss and calculation of erosion index. Leveling concepts and practical utility in agriculture. Preparation of contour maps. Concept of vegetative water ways and design of grassed water ways. Wind erosion and estimation process. Different irrigation pumps and their constructional differences. Farm pond construction and its design aspects. Visit to nearby farm pond. Visit to an erosion site. Exposure to strip cropping/contour bunding.

Suggested Readings

1. Misra Harikesh N. (Ed.). 2014. Managing Natural Resources: Focus on Land and Water. Prentice Hall India Learning Private Limited, 496p
2. Goel Sushma. 2016. Management of Resources for Sustainable Development. The Orient Blackswan.,284p.
3. Lynch Danill R. 2009. Sustainable Natural Resource Management. Cambridge University Press.
4. Rathor Vijay Singh and Rathor B S. 2020. Management of Natural Resource for Sustainable Development. Daya Publishing House.
5. Upadhyay Arvindrai. 2021. Natural Resources: Their Conservation and Management. Aspiration Academy, 320p.
6. Vasudeva Srishti Pal. 2023. Natural Resource Management for Growth, Development and Sustainability. Today & Tomorrows Printers and Publishers, 336p.

26AGR433

Climate Resilient Agriculture

3 0 2 4

Objectives

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

Course outcomes

Any student who has undergone the course shall be able to:

Sl.No	Course outcome	CO	Blooms level

1	Explain the concepts of climate change, climate-resilient agriculture, and their impacts on agricultural production, food security, and natural resources.	CO1	Understand
2	Apply climate-resilient agronomic practices, water and nutrient management strategies, conservation agriculture, and integrated farming systems to enhance agricultural productivity and sustainability.	CO2	Apply
3	Analyze climate vulnerability, weather and climate risks, and the effectiveness of adaptation and mitigation strategies for sustainable agriculture.	CO3	Analyze

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.

Suggested Readings

1. Bhan Manish, Tomar Vijay Singh, Agarwal Kamal Kishore, Tomar Sahib Singh and Upadhyaya Sunil Dutta. 2018. Climate Resilient Agriculture: Adaptation and Mitigation Strategies. New India Publishing Agency.
2. FAO. 2013. Climate-Smart Agriculture Sourcebook. FAO.
3. Prasada Rao G S L H V, Girish Varma G and Beena V. 2017. Climate Resilient Animal Agriculture. New India Publishing Agency.
4. Prasada Rao G S L H V, Rao G G S N and Rao V U M. 2010. Climate Change and Agriculture Over India. PHI Learning, 352p.
5. Prakash M. 2022. Climate Smart Agriculture for Sustaining Crop Productivity and Improving Livelihood Security. Satish Serial Publishing House, 178p.
6. Wahid Hasan, Sachin G. Mundhe, Abdul Majid Ansari and Shivani Kumari. 2022. Implications for Climate Smart Agriculture. Bio-Green Books, 357p.

26AGR434 Geo informatics and Remote Sensing, precision farming 3 0 2 4

Objectives

- i. Enabling students acquire knowledge on basics of remote sensing technique for precision farming applications
- ii. To provide a comprehensive knowledge of remote sensing, precision farming and its benefits in improving crop production and soil health management

Course Outcome:

Any student who has undergone the course shall be able to:

Sl.No	Course outcome	CO	Blooms level
1	Explain the fundamental principles of remote sensing, and GIS, and their role in precision farming applications.	CO1	Understand
2	Apply remote sensing data, GIS tools, and geospatial technologies to assess crop health, soil variability, and other components of site-specific crop management.	CO2	Apply
3	Analyze geospatial datasets and evaluate precision farming strategies to support decision-making for improving crop productivity, resource-use efficiency.	CO3	Analyze

Theory:

Introduction and history of remote sensing; sources, Principles of remote sensing, propagation of radiations in atmosphere; Interaction with matter; Application of remote sensing techniques

land use soil surveys; crop stress and yield forecasting; Advantages and disadvantages of remote sensing; Remote sensing institutes in India; Basic Concepts about geoinformatics.

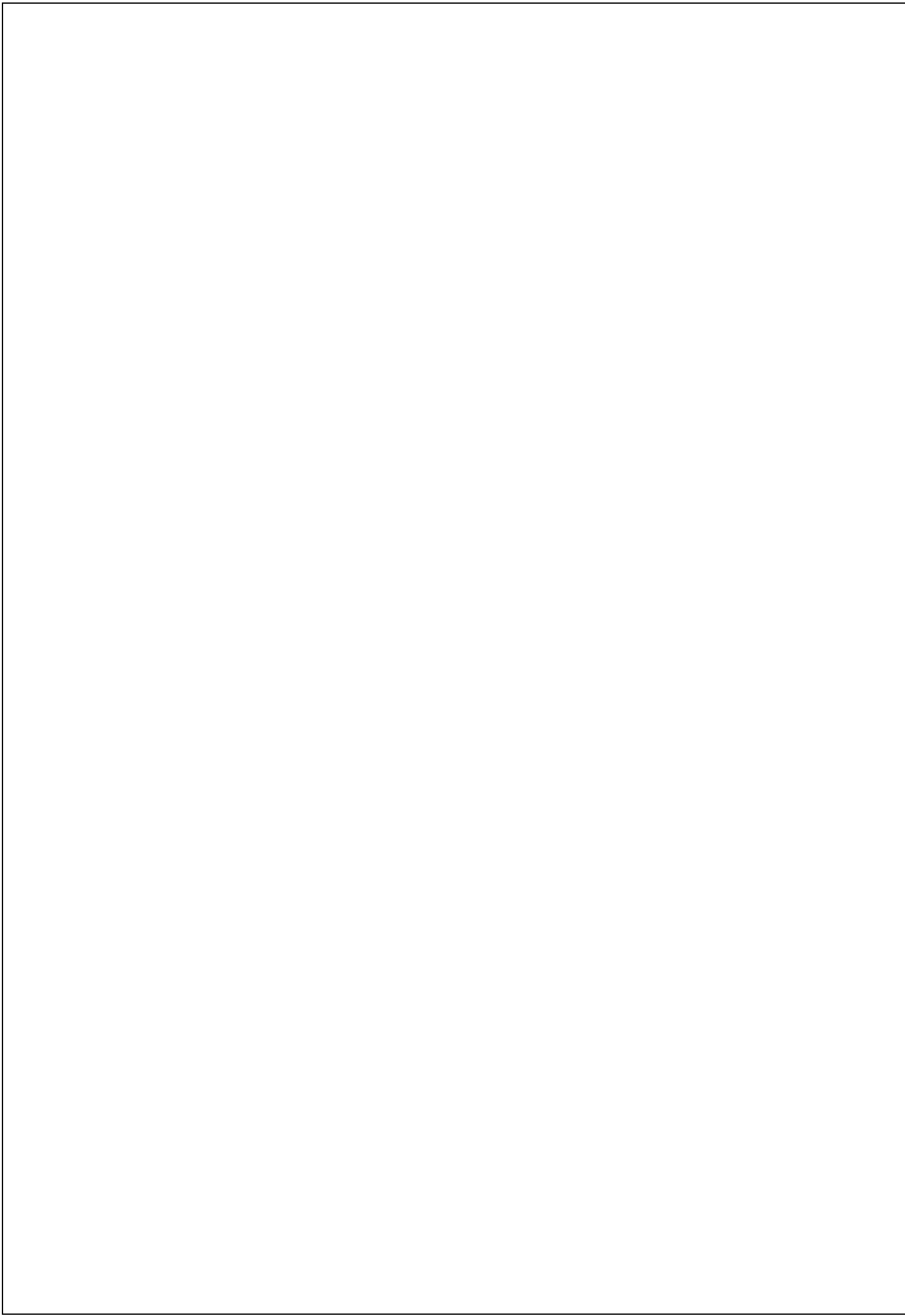
Data sharing; Expert System: Introduction to expert system, Characteristics and features of expert system, Applications of Expert System, Importance of Expert system, Rule based system architecture; Software Agents; Impact of Block chain and its concepts; Probability and Statistics: Bayes Theorem, correlation and Covariance, Continuous Random variables and probability distribution function, various forms of distributions, central limit theorem; Basics of Machine Learning: Random forest, SVM, ensemble methods; Basics of Deep learning: various model architectures and its training aspects; Hyperspectral and Thermal Remote Sensing; Proximal Soil and Crop Sensors.

Practical:

Familiarization with different remote sensing equipment and data products, Interpretation of aerial photographs and satellite data for mapping of land resources, Global positioning system (GPS), Basics of Geographic Information System (GIS), Georeferencing of toposheets, Digital soil mapping with different variables, Basics of multivariate data analytics, Principal component analysis and regression applications, clustering methods and geostatistics are essential in agricultural studies.

Suggested Readings

1. Data Analytics in Bioinformatics: A Machine Learning Perspective. Editor(s):.Rabinarayan Satpathy, Tanupriya Choudhury, Suneeta Satpathy, Sachi Nandan.
2. Machine Learning Approaches to Bioinformatics by Zheng Rong Yang
3. Text Book of Remote Sensing and Geographical Information Systems by M. Anji Reddy
4. Precision Agriculture Technologies for Food Security and Sustainability by A El-Kader, M Sherine, M El-Basioni, M Basma.
5. Principles and Theory of Geoinformatics by P.K. Garg. Khanna Publishers. 296p
6. Advances in Geoinformatics Remote Sensing and GIS by Bhunia, Gouri Sankar & Uday Chatterjee & Gopal Krishna Panda, BIO GREEN
7. Artificial Intelligence: Machine Learning, Deep Learning, and Automation Processes, John Adamssen, Efaon Acies
8. Remote Sensing and Image Interpretation, Willey Student Edition
9. Remote Sensing and Geographic Information: A.M.Chandra and S.K.Ghosh, Narosa



Agriculture**Objectives**

- i. To teach the principles of crop production under organic and conservation agriculture situation
- ii. To impart practical knowledge of organic and conservation agriculture practices

Course outcomes

Any student who has undergone the course shall be able to:

Sl.No	Course outcome	CO	Blooms level
1	Explain the principles, concepts, scope, certification procedures, and standards of organic farming and conservation agriculture.	CO1	Understand
2	Apply organic farming practices, including nutrient, pest, disease, and weed management, composting, biofertilizer application, and indigenous technical knowledge for sustainable crop production.	CO2	Apply
3	Analyze the principles, practices, advantages, and challenges of conservation agriculture and evaluate their role in sustainable and climate-resilient farming systems.	CO3	Analyze

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.

Suggested Readings

1. Acharya Sankar Kumar, Bera Sreemoyee, Saha Cornea, Kumar Prabhat, Haque Monirul, Chatterjee Riti and Mandal Anwasha. 2022. Conservation Agriculture Approach and Application. Scholars World, 292p.
2. Dahama A K. 2003. Organic Farming for Sustainable Agriculture. Agrobios (India), Jodhpur.
3. Gaur A C. 2024. Handbook of Organic farming and biofertilizers. New India Publishing Agency – NIPA.
4. Palaniappan S P and Annadurai K. 2018. Organic Farming – Theory and Practice. Scientific Publishers, Jodhpur.
5. Purohit S S. 2006. Trends in Organic Farming in India. AgrosBios (India), Jodhpur.
6. Sathe T V. 2004. Vermiculture and Organic Farming. Daya Publishing House, New Delhi.
7. Sharma Arun K. 2001. Handbook of Organic Farming. Agrobios (India), Jodhpur.
8. Singh Abhinandan, Ojha Pankaj Kumar and Kumar Rahul. 2018. Conservation Agriculture Technologies. Biotech Books.
9. Thampan P K. 1995. Organic Agriculture. Peekay Tree Crops Development Foundation, Cochin, Kerala. 10.
10. Thapa U and Tripathy P. 2018. Organic Farming in India- Problems and Prospects. Agrotech publishing agency, Udaipur. 11.
11. Veeresh G K. 2006. Organic Farming. Foundation Books. New Delhi.

26AGR436 Fundamentals of Digital Agriculture, IoT, Sensors, Drones, 3 0 2 4

Robotics and Automation

Objectives

- iv. To impart fundamental knowledge of digital agriculture concepts, precision farming technologies, and smart agricultural systems.
- v. To familiarize students with Internet of Things (IoT), sensors, drones, robotics, automation, and data acquisition techniques for agricultural applications.
- vi. To develop skills in integrating digital technologies for crop monitoring, resource management, decision support, and sustainable agricultural production.

Course Outcome:

Any student who has undergone the course shall be able to:

Sl.No	Course outcome	CO	Blooms level
1	Explain the principles of digital agriculture, IoT, sensors, drones, robotics, and automation used in modern agricultural systems.	CO1	Understand

2	Apply digital tools, sensor technologies, UAVs, and automation systems for precision farming, crop monitoring, and resource management.	CO2	Analyze
3	Design and evaluate simple digital agriculture solutions by integrating IoT devices, sensor data, drones, and automation technologies for agricultural decision-making.	CO3	Create

Theory

Introduction to digital agriculture; digital transformation in agriculture - Agriculture 4.0 and Agriculture 5.0. Fundamentals of Internet of Things (IoT); IoT architecture and communication protocols; sensors and actuators; types of agricultural sensors for soil moisture, temperature, humidity, rainfall, pH, electrical conductivity, nutrient status, leaf wetness, light intensity, and weather monitoring; wireless sensor networks; cloud computing, edge computing, and data acquisition systems for agriculture.

Fundamentals of Unmanned Aerial Vehicle (UAV); UAV components and classifications; remote sensing principles; RGB, multispectral, hyperspectral, and thermal sensors; image acquisition, processing, and interpretation; drone applications in crop monitoring, nutrient management, irrigation scheduling, pest and disease detection, yield estimation, and crop health assessment; DGCA guidelines and safety regulations.

Introduction to agricultural robotics and automation; autonomous field machinery; robotic systems for seeding, transplanting, weeding, harvesting, spraying, and post-harvest operations; automation in protected cultivation and irrigation systems; Artificial Intelligence (AI), Machine Learning (ML), Computer Vision, Digital Twins, and Internet-enabled farm management systems; opportunities, challenges, ethics, data security, and future trends in digital agriculture.

Practical

Introduction to digital agriculture platforms and smart farming technologies; identification and calibration of agricultural sensors; installation and operation of IoT-based weather stations and soil monitoring systems; interfacing sensors with Arduino/Raspberry Pi; collection, storage, and visualization of sensor data.

Demonstration of wireless communication modules for IoT applications; operation and mission planning of agricultural drones; acquisition and processing of UAV images; vegetation indices (NDVI and related indices) for crop health assessment; GIS-based visualization of drone data. Demonstration of robotic and automated agricultural equipment; automation of irrigation systems using sensors and controllers; monitoring crop and environmental parameters using IoT dashboards; case studies on digital agriculture technologies; preparation of precision farming recommendations based on sensor and drone data; field visit to digital farms, precision agriculture facilities, or drone service providers.

Suggested Readings

8. Castrignanò, A., Buttafuoco, G., Khosla, R., Mouazen, A., Moshou, D., & Naud, O. (Eds.). (2020). Agricultural internet of things and decision support for precision smart farming. Academic Press.
9. Karkee, M., & Zhang, Q. (Eds.). (2021). Fundamentals of Agricultural and Field Robotics. Springer Nature, <https://doi.org/10.1007/978-3-030-70400-1>
10. Kateris, D., Benos, L., Bochtis, D., et al. (2023). *Unmanned Aerial Systems in Agriculture: Eyes Above Fields*. Academic Press (Elsevier). DOI: 10.1016/C2020-0-04638-4
11. DGCA Digital Sky Platform (Drone Regulations) – <https://digitalsky.dgca.gov.in>
12. Pix4D Documentation – <https://support.pix4d.com>
13. Arduino Documentation – <https://docs.arduino.cc>
14. Raspberry Pi Documentation – <https://www.raspberrypi.com/documentation>

26SAC431

Agrochemicals

3 0 2 4

Objective

The course on agrochemicals to understand the basic concepts of agrochemicals, their applications in agriculture and the impact of agrochemicals on environmental, animal, and human health. This course helps to distinguish types of pesticides based on their properties, effects and their role in sustainable agriculture. Knowledge of fertilizers, types of fertilizers, their nutrient contents, and method of manufacturing and their reaction in soil, FCO and fertilizer storage will be of much useful both at the field level as well as in the industry.

Course Outcome:

Any student who has undergone the course shall be able to:

Sl.No	Course outcome	CO	Blooms level
1	Summarize the basic knowledge of agrochemicals (pesticides and fertilizers)	CO1	Understand
2	Distinguish various pesticides concerning characteristics, properties, formulation, use and their fate in soil and plants.	CO2	Analyze
3	Explain the Act, rules, marketing and usage of pesticides and fertilizers	CO3	Understand
4	Describe the manufacturing process of all major and micronutrients in available form of fertilizers	CO4	Understand
5	Estimate the active ingredient and nutrient in the pesticides and fertilizers	CO5	Evaluate

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, properties and important herbicides. Fate of herbicides. Fungicides- classification –Inorganic fungicides-characteristics, preparation and use of sulphur and copper. Mode of action- Bordeaux mixture and copper oxychloride. Organic fungicides –Mode of action –Dithiocarbamates- characteristics, preparation and use of Zineb and maneb. Systemic fungicides- Benomyl, carboxin, oxycarboxin, Metalaxyl, Carbendazim, characteristics and use. Introduction and classification and insecticides: inorganic and organic insecticides organochlorine, Organophosphates, Carbamates, Synthetic pyrethroids Neonicotinoids, Biorationals. Insecticide Act and rules, Insecticides banned, withdrawn and restricted use. Fate of insecticides in soil and plant. IGR Biopesticides, Reduced risk insecticides, Botanical, Plant and animal systemic insecticides their characteristics and uses. Fertilizers and their importance. Nitrogenous fertilizers: Feedstocks and Manufacturing of ammonium sulphate, ammonium nitrate, ammonium chloride, urea. Slow release N-fertilizers. Phosphatic fertilizers: feedstock and manufacturing of single superphosphate. Preparation of bone meal and basic slag. Potassic fertilizers: Natural sources of potash, manufacturing of potassium chloride, potassium sulphate and potassium nitrate. Mixed and complex fertilizers: Sources and compatibility preparation of major, secondary and micronutrient mixtures. Complex fertilizers: Manufacturing of ammonium phosphates, nitrophosphates and NPK complexes. Fertilizer control order. Fertilizer logistic and marketing. Plant bio-pesticides for ecological agriculture, Bio-insect repellent.

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 in market. Estimation of nitrogen in Urea. Estimation of water soluble P₂ O₅ and citrate soluble P₂ O₅ in single super phosphate. Estimation of potassium in Murate of Potash/ Sulphate of Potash by flame photometer. Determination of copper content in copper oxychloride. Determination of sulphur content in sulphur fungicide.

Suggested Readings

1. Biswas D R. 2021. A Textbook of Fertilizers. New India Publishing Agency
2. Buchel K H (Ed.). 1992. Chemistry of pesticides. John Wiley & Sons

3. Larramendy M L. 2017. Toxicity and Hazard of Agrochemicals. INTECH.
4. Panda H. 2022. The Complete Technology Book on Pesticides, Insecticides, Fungicides and Herbicides (Agrochemicals) with Formulae, Manufacturing Process, Machinery & Equipment Details. (2nd Revised Edn.). NPCS.
5. Singh A. 2022. Basics of Agrochemical Formulations. Brillion Publishing.

26SAC432

Bioformulation and Nanoformulation

3 0 2 4

Objective

- To enable students to acquire expertise and skills to develop bioformulation and nanoformulation
- To know the importance of biopesticides and biofertilizers
- To acquaint students about various techniques involved in biofertilizers and biopesticides production
- To impart knowledge on essential oils, botanicals, predators, parasitoids, pheromones, and parapheromone and their application in insect pest management
- To provide concepts on agrochemical formulations with nanoparticles and acquaint them with nanotechnology.

Sl.No	Course outcome	CO	Blooms level
1	Explain the concepts, importance, and regulatory aspects of bioformulations, nano-formulations, biopesticides, biofertilizers, and biological control in sustainable agriculture.	CO1	Understand
2	Distinguish different microbial biocontrol agents, biofertilizers, botanicals, nano-formulations, etc., based on their characteristics, mode of action, and agricultural applications.	CO2	Analyze
3	Apply laboratory techniques for isolation, purification, mass multiplication, quality assessment, formulation, compatibility testing, and efficacy evaluation of biopesticides and biofertilizers.	CO3	Apply
4	Analyze the production methods, formulation technologies, and application strategies of nano-biopesticides and nano-fertilizers, including green synthesis approaches, for crop protection and nutrient management.	CO4	Analyze
5	Evaluate the effectiveness of bioformulations and nano-formulations for integrated pest, disease, and nutrient management based on laboratory observations and experimental results.	CO5	Evaluate

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, pheromone, and

parapheromone and their application in insect pest management; Use of predators and parasitoids for insect pest management; Nanotechnology: its applications in pest and disease diagnosis and management; Nano biopesticides: Concept and importance, different techniques of producing nano biopesticides; Nano Fertilizers: Concept and importance, Types of nano fertilizers; Different techniques of producing nano fertilizers; Green synthesis of nano fertilizers; green slow-release fertilizer composition based on urea-modified hydroxyapatite nanoparticles

Practical

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

Suggested Readings

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

Objective

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

Course Outcome:

Any student who has undergone the course shall be able to:

Sl.No	Course outcome	CO	Blooms level
1	Retrieve the composition of foods and nutrient metabolism and its interaction.	CO1	Remember
2	Interpret the food additives for improving the food safety and quality.	CO2	Understand
3	Differentiate the various food processing and preservation techniques in their regular activities.	CO3	Analyze
4	Hypothesize the role of specific nutrients in maintaining wellness of health.	CO4	Understand

Theory

Introduction on fundamentals of foods and human nutrition; Basic food groups; Concept of balanced diets; Recommended Daily Allowances (RDA) for various age groups; Biochemical composition, energy and food value of various food grains, fruits and vegetables; Carbohydrates, proteins, fats as nutrients and their interactions; Physio-chemical, functional and nutritional characteristics of essential nutrients- sources and functions, Nutritional requirements, malnutrition, inborn errors of metabolism, deficiency diseases; Digestion, absorption, transport and metabolism of nutrients in human system; Protein quality evaluation. Biochemical and nutritional aspects of vitamins, minerals, nutraceuticals, antioxidant, antinutritional factors and biochemistry of post-harvest storage, losses during processing. Effect of cooking, processing and preservation on nutrients of different food products, biochemical aspects of food spoilage; Food fads, food safety and quality standards. Enzymes in food industry, food additives, nutritional quality of plant, animal, dairy, marine and fermented products.

Practical

Proximate analysis of foods; calorific value of foods; Estimation of vitamins, mineral, phenols and flavonoids, carotenoids, antinutrients like Phytate/ Oxallate, Trypsin and Chymotrypsin inhibitor activities, microbial quality in foodstuff.

Suggested Readings

1. Damodaran S and Parkin K L (Eds.). 2017. Fennema's Food Chemistry. CRC Press
2. Dharmesh Kumar. 2019. Food Science and Nutrition. Random Publications.
3. Gibney M J, Lanham-New S A, Cassidy A and Voster H H (Eds.). 2009. Introduction to Human Nutrition. Wiley-Blackwell.

4. Rekhi Tejmeet and Yadav Heena. 2014. Fundamentals of Food and Nutrition. Elite Publishing House, 257p.
5. Trueman P. 2007. Nutritional Biochemistry. MJP Publishers.

26FSN432 Post Harvest Technology and Value Addition

**3 0 2
4**

Objective

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

Course Outcome:

Any student who has undergone the course shall be able to:

Sl.No	Course outcome	CO	Blooms level
1	Explain the principles of post-harvest processing, physiological changes during ripening, storage methods, and preservation techniques for fruits and vegetables.	CO1	Remember
2	Apply appropriate post-harvest handling, processing, preservation, packaging, and storage techniques to prepare quality value-added fruit and vegetable products.	CO 2	Understand
3	Analyze the effects of post-harvest factors, processing methods, storage conditions, and packaging on the quality, shelf life, and sensory characteristics of processed products.	CO3	Analyze
4	Evaluate the quality and commercial potential of processed fruit and vegetable products using physicochemical, sensory, and economic parameters, and recommend suitable processing technologies.	CO4	Evaluate

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.

Practical

Applications of different types of packing, containers for shelf-life extension. Effect of temperature on shelf life and quality of produce. Demonstration of chilling and freezing injury in vegetables and fruits. Extraction and preservation of pulps and juices. Preparation of jam, jelly, RTS, nectar, squash, osmotically dried products, fruit bar candy and tomato products,

canned products. Quality evaluation of products- Physico-chemical and sensory. Visit to processing unit/industry.

Suggested Readings

1. Aswini Kumar Goel, Rajender Kumar and Satwinder S. Mann. 2007. Postharvest Management and Value Addition. Daya Publishing House.
2. Kureel M K, Mandloi D S, Singh K V and Lekhi Rajesh. 2020. Postharvest Management and Value Addition of Fruits and Vegetables. Biotech.
3. Qureshi Suja Nabi, Javeed Kounser and Sinha Abhay Kumar. 2018. Post-Harvest Technology. Bioscientific Publishers.
4. Sharma S K and Nautiyal M C. 2019. Post-harvest technology of horticultural crops. New India Publishing.
5. Sudheer K P and Indira V. 2007. Postharvest Technology of Horticultural Crops. New India Publishing Agency. 320p.

26GPB431

Commercial Plant Breeding

3 0 2 4

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.

Course Outcome:

Any student who has undergone the course shall be able to:

Sl.No	Course outcome	CO	Blooms level
1	Explain floral biology and breeding techniques in self- and cross-pollinated crops.	CO1	Remember
2	Demonstrate selfing and hybridization techniques in self- and cross-pollinated crops.	CO2	Apply
3	Explain the role of pollinators in hybrid seed production, male sterility breeding, seed production, hybridization, purity testing, and detection of spurious seed.	CO3	Remember

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 test of commercial hybrids. Advances in hybrid seed production

of maize, rice, sorghum, pearl millet, castor, sunflower, cotton, pigeon pea, *Brassica* etc. Speed Breeding, Breeding Management systems, High-throughput phenotyping and genotyping platforms, Quality seed production of vegetable crops under open and protected environment. Alternative strategies for the development of the line cultivators: haploid inducer, tissue culture techniques and biotechnological tools. IPR issues in commercial plant breeding: DUS testing and registration of varieties under PPV and FR Act. Variety testing, release and notification systems in India. Principles and techniques of seed production, types of seeds, quality testing in self- and cross-pollinated crops.

Practical

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

Suggested Readings

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

Objective

- i. To educate the students 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.

Course Outcome:

Any student who has undergone the course shall be able to:

Sl.No	Course outcome	CO	Blooms level
1	Explain the basic concepts of micropropagation	CO1	Understand
2	Summarize various plant tissue culture techniques and its applications	CO2	Understand
3	Apply the tissue culture techniques in in vitro plant regeneration	CO3	Apply
4	Analyse the problems that can occur in micropropagation technique and hardening procedures	CO4	Analyse

Theory

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

Practical

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

Suggested Readings

1. ICAR. 2001. *Handbook of Horticulture*. ICAR.
2. Jha Timir Baran and Ghosh Biswajit. 2016. *Plant Tissue Culture: Basic and Applied*. (2nd Edn.). Platinum Publishers, 439p.
3. Kumar N. 2020. *Introduction to Horticulture*. Oxford & IBH Publishing Company Pvt Ltd.
4. Singh Jitendra. 2008. *Basics of Horticulture*. Kalyani Publishers.

Objective

- i. To acquaint with biotechnological tools of crop improvement
- ii. To know about direct and indirect methods of gene transfer
- iii. To introduce about gene editing in plants
- iv. To provide knowledge about marker assisted breeding and genomic selection

Course Outcome:

Any student who has undergone the course shall be able to:

Sl. No	Course outcome	CO	Blooms level
1	Explain the concepts of various biotechnological techniques available for crop improvement and the biosafety regulations in agricultural biotechnology	CO1	Understand
2	Describe the principles, techniques and limitations of various plant tissue culture techniques and their applications in crop improvement	CO2	Understand
3	Illustrate the methods of gene transfer in plants and development of transgenic plants	CO3	Apply
4	Analyse the principles and applications of gene silencing and genome editing technologies and their use in crop improvement.	CO4	Analyse
5	Evaluate the use of DNA-based markers in marker assisted selection	CO5	Evaluate

Theory

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

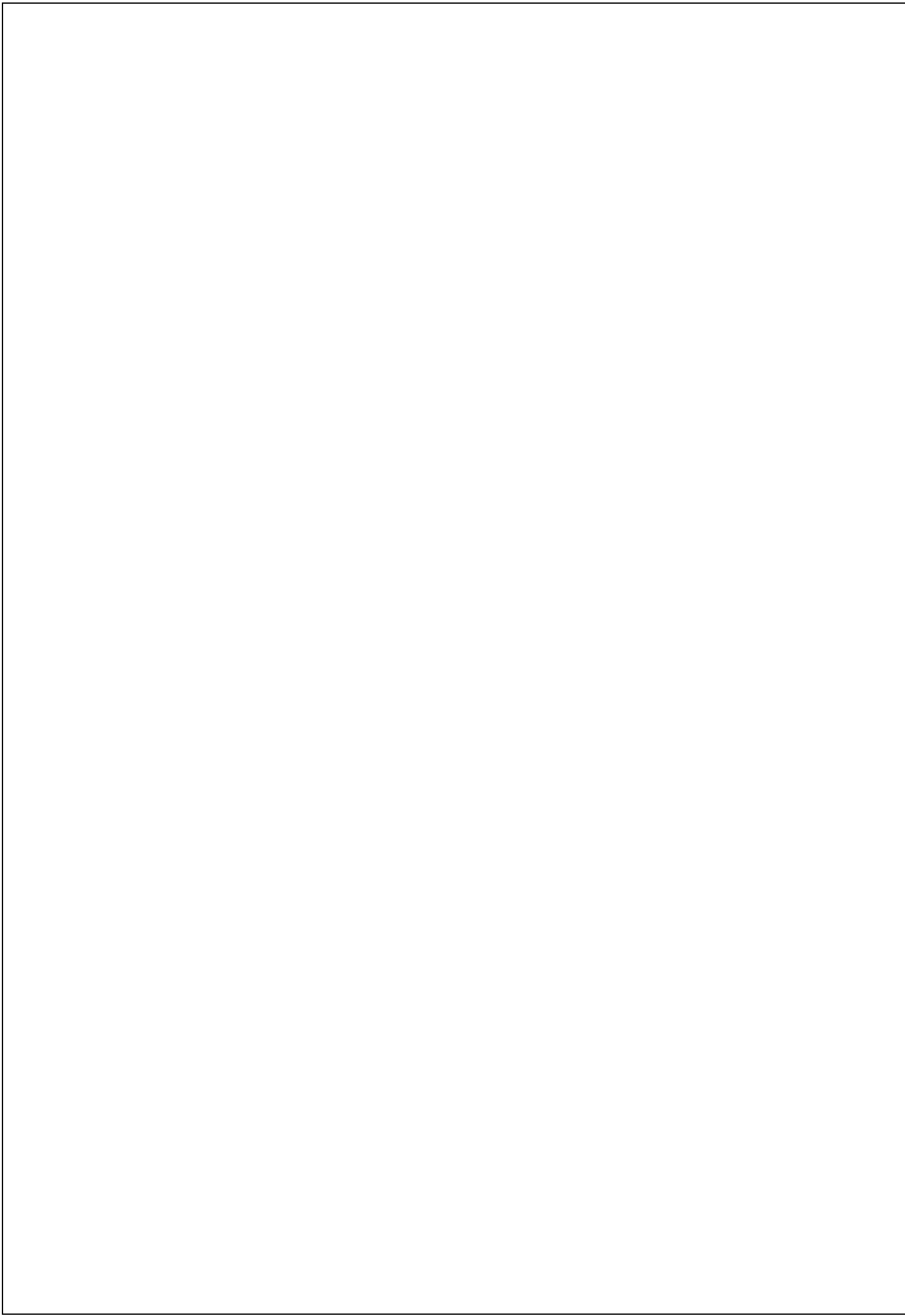
model systems. Introduction to genome editing – Various tools of genome editing; CRISPR-Cas9 with specific emphasis on Indian regulations; Cloning genomic targets into CRISPR/Cas9 plasmids; electroporation of Cas9 plasmids into cells; purification of DNA from Cas9 treated cells and evaluation of Cas9 gene editing; in vitro synthesis of single guide RNA (sgRNA); using Cas9/ sgRNA complexes to test for activity on DNA substrates; evaluate Cas9 activity by T7E1 assays and DNA sequence analysis; Applications of CRISPR/cas9 technology in crop plants. Marker Assisted Breeding and Genomic Selection: Introduction to various DNA-based markers and their use in marker-assisted breeding; Foreground Selection, Recombinant Selection and background Selection; Marker-assisted backcross breeding, marker-assisted selection – success stories; Introduction to Genomic Selection.

Practical

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

Suggested Readings

1. Brown, T A. 2006. *Genomes*. (3rd Edn.). Garland Science Pub, New York.
2. *Gene Cloning and DNA Analysis*. 2010. Retrieved from <http://biolab.szu.edu.cn/otherweb/lzc/genetic%20engineering/courseware/b1.pdf>
3. Green M R and Sambrook J. 2012. *Molecular Cloning: a Laboratory Manual*. Cold Spring Harbor, NY: Cold Spring Harbor Laboratory Press.
4. Kumar Pranav and Mina Usha. 2015. *Biotechnology: A Problem Approach*. Pathfinder Publication.
5. Old R W, Primrose S B and Twyman R M. 2001. *Principles of Gene Manipulation and Genomics*. (7th Edn.). 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*. Sharma Publishers & Distributers.
10. Slater. 2008. *Plant Biotechnology: The Genetic Manipulation of Plants*. Oxford, 400p.



Objectives

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

Course Outcome:

Any student who has undergone the course shall be able to:

Sl.No	Course outcome	CO	Blooms level
1.	Explain the principles, standards, and practices of commercial seed production for major field and horticultural crops	CO1	Apply
2.	Apply crop-specific seed production, hybridization, field inspection, and seed certification techniques to maintain genetic purity and seed quality	CO2	Analyse
3.	Analyze seed production systems and evaluate seed processing, storage, quality assurance, and marketing practices for commercial seed enterprises.	CO3	Evaluate

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 apomixis, male sterility and self-incompatibility

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

Practical

Planning of seed production, requirements for different classes of seeds in field crops – unit area and rate. Operation and handling of mechanical drying equipment; effect of drying temperature

and duration on seed germination and storability seed processing equipment; seed treating equipment. Seed production in cross pollinated crops with special reference to land, isolation, Planting ratio of male and female lines, synchronization of parental lines and methods to achieve synchrony; supplementary pollination, pollen storage, hand emasculation and pollination in tomato, Hybrid seed production in Maize, detasseling in maize, identification of rogues and pollen shedders, Pollen collection, storage, viability and stigma receptivity; gametocide application and visits to seed production plots etc., Visit to seed processing plant and commercial controlled and uncontrolled seed stores, Seed industries and local entrepreneurs 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.

Suggested Readings

1. Agarwal, R. L. (1997). *Seed Technology* (2nd Ed.). Oxford & IBH Publishing Co. Pvt. Ltd.
2. Chawla, H. S. (2008). *Introduction to Plant Biotechnology* (2nd Ed.). Oxford & IBH Publishing Co. Pvt. Ltd., 113-B Shahpur Jat, New Delhi.
3. Justice, O. L. and Bass, L. N. (1978). *Principles and Practices of Seed Storage*. Castle House Publications Ltd.
4. McDonald, M. B., Jr. and Copeland, L. O. (1997). *Seed Production: Principles and Practices*. Chapman & Hall.
5. Singhal, N. C. (2003). *Hybrid Seed Production in Field Crops*. Kalyani Publishers.
6. Thompson, J. R. (1979). *An Introduction to Seed Technology*. Leonard Hill.
7. Tunwar, N. S. and Singh, S. N. (1988). *Indian Minimum Seed Certification Standards*. Central Seed Certification Board (CSCB), Ministry of Agriculture, Government of India, New Delhi.

26HOR431

Landscaping

3 0 2 4

Objectives

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

Course Outcome

Any student who has undergone the course shall be able to:

Sl.No	Course outcome	CO	Blooms level
1	Understand the principles, basics of landscaping and garden components	CO1	Understand
2	Understand the styles and types of gardening	CO 2	Apply
3	Create landscape design and layout of landscape garden	CO3	Create

Theory

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

Practical

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

Suggested Readings

1. Singh Anil K. and Sisodia Anjana. 2017. Textbook of Floriculture and Landscaping. New India Publishing Agency.
2. Chandrasekhar Y and Hemla Naik B. 2020. Principles of Landscape Gardening. ICAR.
3. Mishra Pragnyashree and Naik Bhimasen. 2022. Principles of Landscape Architecture. New India Publishing Agency
4. Pradhan Sudhir. 2018. Landscape Gardening. Scientific Publishers India.
5. Singh Rajaneesh and Singh Brijendra Kumar. 2020. Introductory Ornamental Horticulture and Landscape Gardening. Bio-Green Books.

Objective

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

Course Outcome:

On completion of this course, the student will be able to:

Sl.No	Course outcome	CO	Blooms level
1	Describe the importance, scope, and status of protected cultivation and classify types of protected structures	CO1	Understand
2	Explain cladding materials, greenhouse design principles, environmental control systems, artificial lighting, and automation	CO2	Understand
3	Apply suitable management practices and operate irrigation and fertigation systems	CO3	Apply
4	Demonstrate propagation techniques and produce quality planting material	CO4	Apply
5	Analyze the specific cultivation requirements and management practices for greenhouse crops	CO5	Analyze

Theory

Protected cultivation- importance and scope, status of protected cultivation in India and World, types of protected structure based on site and climate. Cladding material involved in greenhouse/poly house. Greenhouse design, environment control, artificial lights, Automation. Soil preparation and management, Substrate management. Types of benches and containers, Irrigation and fertigation management. Propagation and production of quality planting material of horticultural crops. Greenhouse cultivation of important horticultural crops-rose, carnation, chrysanthemum, gerbera, orchid, anthurium, liliun, tulip, tomato, bell pepper, cucumber, strawberry, pot plants etc. Cultivation of economically important medicinal and aromatic plants. Off- season production of flowers and vegetables. Insect pest and disease management.

Practical

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

Suggested Readings

1. Ashok Kumar B, Eggadi Ramesh and Sindhu V. 2022. Textbook of Protected Cultivation and Precision Farming for Horticultural Crops. Jain Brothers.
2. Brahma Singh and Balraj Singh. 2014. Advances in Protected Cultivation. New India Publishing Agency, 252p.
3. Jha Madan Kumar, Paikra Sujan Singh and Sahu Manju Rani. 2019. Protected cultivation of Horticultural Crops. Educreation Publishing.
4. Manjunathaswetha B L, Prabhakar Itigi and Swetha B S. 2020. Protected Cultivation of Horticulture Crops. IBPSS.
5. Nelson Paul V. 1978. Greenhouse operation and management. Reston Publishing Company.
6. Sagar Maitra, Dinkar J. Gaikwad and Tanmoy Shankar (Eds.). 2021. Protected Cultivation and Smart Agriculture. New Delhi Publishers, 263p.

Objectives

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

Course outcome

Any student who has undergone the course shall be able to:

Sl.No	Course outcome	CO	Blooms level
1	Understand the basics of nursery and protected cultivation	CO1	Understand
2	Understand the controlled environmental conditions for protected cultivation	CO 2	Apply
3	Apply the methods and techniques precision farming in the protected cultivation	CO3	Create

Theory

Introduction and importance; Nursery management and mechanization; micro propagation of horticultural crops; Modern field preparation and planting methods; Protected cultivation: advantages, controlled conditions, method and techniques; 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 Applicator (VRA); application of precision farming in horticultural crops (fruits, vegetables and ornamental crops); mechanized harvesting of produce.

Practical

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

Suggested Readings

1. Garden Tom. 2021. Hydroponics for Beginners and Advanced: The Ultimate Hydroponic and Aquaponic Gardening Guide. Webb Eleanor.
2. Gupta S N. 2025. Instant Horticulture. (23rd Edn.). Jain Brothers, 488p
3. More TA. 2020. Hi-tech Horticulture. Agrobios
4. Nelson Paul V. 1978. Greenhouse Operation and Management. Reston Publishing Company.
5. Prasad S, Singh Dharam and Bharadwaj R L. 2019. Hi-Tech Horticulture. (Pb) Agrobios.

Skill Enhancement Courses

24AEC181 Farm Economics, Agribusiness, Value Chain, Supply Chain and Producer Organization Management 0042

Objectives

The course aims to enable students to:

- i. Understand farm business economics through practical applications.
- ii. Develop entrepreneurial thinking in agriculture and allied sectors.
- iii. Learn how successful agribusinesses operate.
- iv. Analyze agricultural value chains and supply chains using real-world cases.
- v. Gain practical exposure to Farmer Producer Organizations (FPOs), agribusiness firms, and startups.
- vi. Prepare business plans and marketing strategies.
- vii. Develop employability and self-employment skills.

Course Outcomes

After successful completion of the course, students will be able to

Sl. No.	Course Outcome	CO	Bloom's Level
1	Analyze farm enterprises by applying principles of farm economics, resource management, and enterprise profitability.	CO1	Analyze
2	Identify and evaluate viable agribusiness opportunities in agriculture and allied sectors for entrepreneurial development.	CO2	Analyze
3	Design agricultural value chains by identifying key stakeholders, value addition opportunities, and market linkages.	CO3	Create
4	Evaluate supply chain strategies for perishable and non-perishable agricultural commodities to improve operational efficiency.	CO4	Evaluate
5	Develop business models for Farmer Producer Organizations (FPOs) and agri-startups to promote sustainable agribusiness enterprises.	CO5	Create
6	Prepare bankable agribusiness business plans and effectively pitch business ideas to investors and financial institutions.	CO6	Create

Practical

The practical component of this course is designed using a Farm-to-Consumer (Farm-to-Fork) approach to provide experiential and skill-oriented learning in agribusiness. Students will gain hands-on experience in farm enterprise identification, farm resource inventory, production

technologies, cost and profitability analysis, enterprise budgeting, and business opportunity assessment. The course emphasizes agribusiness entrepreneurship through Business Model Canvas preparation, feasibility analysis, startup planning, funding opportunities, and exposure visits to Agri-Business Incubation Centres. Practical sessions focus on agricultural supply chain mapping, logistics, warehousing, cold chain management, value chain analysis, value addition, branding, packaging, digital marketing, market segmentation, consumer surveys, and marketing efficiency. Students will also participate in exposure visits to wholesale markets, APMC/e-NAM markets, warehouses, food processing industries, and Farmer Producer Organizations (FPOs) to understand real-world business operations and industry best practices. The course culminates in the development of an agribusiness or FPO business plan and its presentation before a panel of industry experts, incubator professionals, and FPO representatives, enabling students to develop entrepreneurial, managerial, analytical, and problem-solving skills for successful careers in agriculture and allied sectors.

Suggested Readings

1. Pandey M and Tewari D. 2010. The Agribusiness Book. IBDC Publishers, Lucknow.
2. Johl S S and Kapur T R. 2009. Fundamentals of Farm Business Management. Kalyani Publishers.
3. Lekhi R K and Singh Joginder. 2006. Agricultural Economics. Kalyani Publishers, Delhi.
4. Nishra Anjan, Biswas Debasish and Giri Arunangshu. 2019. Agribusiness Management. Himalaya Publishing House, 220p.
5. Bairwa S L. 2016. Objective on Fundamentals of Agri-business Management. Kalyani Publishers.
6. Gittinger J P. 1982. Economic Analysis of Agricultural Projects. The Johns Hopkins Univ. Press.
7. Jorge E. Hernandez, Janusz Kacprzyk. 2021. Agriculture Value Chain - Challenges and Trends in Academia and Industry. Studies in Systems, Decision and Control. Springer
8. Chandrasekar N. and G. Raghuram. 2025. Agribusiness Supply Chain Management. Taylor and Francis Group.
9. Benjamin Dent and Ray Collins. 2021. A manual for agribusiness value chain analysis in developing countries. CABI publisher

26AEN181

Beneficial Insect farming

0 0 4 2

Objectives

- i. To attain knowledge on importance of beneficial Insects, beekeeping and pollinators, and to study the bee biology which includes the commercial methods of rearing, equipment used, seasonal management, bee enemies and disease.
- ii. To gain a basic understanding of rearing, mounting and harvesting of cocoons. Pest and diseases of silkworm, management, rearing appliances of mulberry silkworm and methods of disinfection
- iii. To study the about the major predators and parasitoids used in pest management.

Course Outcome:

Any student who has undergone the course shall be able to:

Sl. No	Course outcome	CO	Blooms level
1.	Identify honeybee species and castes, mulberry varieties, silkworm breeds, host plants, and the life stages of honeybees and <i>Bombyx mori</i> .	CO1	Remember
2.	Demonstrate practical skills in honeybee colony management, mulberry cultivation, silkworm rearing, grainage operations, and honey and cocoon production.	CO3	Apply
3.	Analyse colony performance, bee pasturage, silkworm health, and pest and disease incidence to recommend appropriate management practices.	CO4	Analyse
4.	Evaluate and adopt improved apiculture and sericulture practices for enhancing the quality and productivity of honey, hive products, and silk cocoons.	CO5	Evaluate

Practical

Identification of honeybee species and castes. Hive and other apicultural appliances. Examination of honeybee colonies. Recording of colony performance. Bee pasturage. Migratory routes and migration of colonies. Seasonal management of honeybee colonies. Selection of honeybee colonies for improving bee health and colony productivity. Mass queen bee rearing techniques. Identification of bee enemies and diseases and their management. Foraging and communication behaviour in honeybees. Honey extraction, processing and packaging. Collection of other hive products.

Mulberry varieties, Host plants of non-mulberry silkworms, Preparation of land, planting material and planting of mulberry, Pruning, harvesting and storage of mulberry, Mulberry pests and diseases, Identification of cocoons of important breeds, External morphology of life stages egg, larva, pupa and moth of *Bombyx mori* L. Study of silk glands and digestive system of *Bombyx mori* L. Disinfectants- rearing bed and general disinfectants, Grainage techniques. Study of rearing house plan and equipment's for shoot feeding and shelf rearing. Methods of Incubation of silkworm eggs and brushing. Identification of silkworm settling for moult, at moult, out of moult, Feeding, bed cleaning and spacing, Identification and picking of ripe silkworms, mounting, types of mountages, cocoon harvesting and grading, Pests and diseases of mulberry silkworm, Single cocoon reeling, study of reeling equipment. Weed killers, pollinators, scavengers and soil builders. Identification of major predators and parasitoids commonly used in biological control.

Suggested Readings

1. Atwal A S. 2001. The World of the Honey Bee. Kalyani Publishers, New Delhi.
2. David V Alford. 2019. Beneficial Insects. CRC Press. 400p.

3. David V Alford. 2019. Beneficial Insects. CRC Press. 400p.
4. David, B.V. and V.V. Ramamurthy. 2011. Elements of Economic Entomology, Namrutha Publications, Chennai, 386 p. {ISBN: 978-81-921477-0-3}
5. Ganga G and Sulochanachetty J. 2019 Introduction to sericulture. 328p. Oxford and IBH Publishing
6. Graham J M. 2015. The Hive and Honey Bee. Dadant and Sons Publication, USA. New Delhi.
7. Ramakrishna Naika, Venkataravana P and Sunil kumar T. 2024. Sericulture cultivation, processing and marketing. 293 p. Daya Publishing House. Delhi.
8. Reddy A, Anusha C, Ramprasad, B, Kumar R and V Daravath. 2022. Importance of Beneficial Insects in Agriculture. Research Trends in Multidisciplinary Research and Development (pp.7-24). Wiser Publications, Germany.
9. Sathe T V and A D Jadhav. 2012. Sericulture & pest management. DAYA publishing house,
10. Savithri G, Sujathamma P and Neeraja P. 2016. Sericulture industry: An overview, Agrobios (India).

26AEX181

**Digital Farm Communications, Advisory Systems, and
Agricultural Media Production**

0 0 4 2

Objectives

- i. Understand the principles of digital agricultural communication and ICT-enabled extension services.
- ii. Develop farmer-oriented digital communication materials using text, graphics, audio and video.
- iii. Produce agricultural multimedia content suitable for social media and digital advisory platforms.
- iv. Utilize mobile applications, AI tools and digital advisory systems for farm communication.
- v. Design digital extension campaigns for technology dissemination and behavioural change.
- vi. Enhance employability and entrepreneurship skills in agricultural media, agri-content creation and digital extension.

Course Outcome:

Any student who has undergone the course shall be able to:

Sl.No	Course outcome	CO	Blooms level
1.	Explain the concepts and applications of digital agricultural communication and advisory systems.	CO1	Understand
2.	Create digital educational materials including posters, infographics, brochures and extension publications.	CO2	Create
3.	Produce and edit agricultural audio, video and multimedia content for farmer education.	CO3	Create

4.	Operate ICT tools, mobile applications and AI-assisted platforms for agricultural advisory services.	CO4	Apply
5.	Design and implement digital extension campaigns using social media and online communication platforms.	CO5	Create
6.	Analyze communication reach using digital analytics and recommend improvements for effective farmer outreach.	CO6	Analyze

Practical

Introduction to Digital Agriculture, Digital Extension and ICT-enabled Advisory Systems; Identification and use of digital communication tools for agricultural extension; Preparation of digital farmer database using spreadsheets and cloud platforms; Designing extension messages using effective communication principles; Preparation of agricultural posters using Canva or similar graphic design software; Development of agricultural infographics for farmer awareness; Preparation of digital leaflets, brochures and fact sheets; Writing agricultural news reports and farmer success stories for digital media; Preparation of blog articles on agricultural technologies; Script writing for agricultural awareness videos; Recording agricultural educational videos using smartphones and digital cameras; Video editing using open-source editing software; Preparation of short educational reels for social media platforms; Voice recording techniques for agricultural podcasts; Editing agricultural audio programmes and podcasts; Development of community radio programme scripts for agricultural extension; Preparation of narrated PowerPoint presentations for farmer training programmes; Designing educational animations using online animation tools; Creating QR code-enabled extension publications and digital learning resources; Development of WhatsApp-based agricultural advisory messages; Creating Telegram and other social media groups for farmer communication; Preparation of Facebook, Instagram, X (Twitter), and YouTube agricultural awareness campaigns; Preparation of a seasonal social media content calendar for crop advisory; Fact-checking agricultural information and identifying misinformation in digital media; Hands-on use of agricultural mobile applications such as Kisan Suvidha, Meghdoot, Damini, e-NAM and other digital advisory platforms; Using Artificial Intelligence (AI) tools for generating agricultural communication content and translation into regional languages; Preparation of weather-based crop advisory bulletins; Preparation of pest and disease surveillance advisory messages; Development of market intelligence and price advisory messages; Introduction to GPS, GIS and digital maps for agricultural advisory communication; Digital photography techniques for crop diagnosis and extension publications; Evaluation of digital communication effectiveness using social media analytics and engagement metrics; Group project on designing and producing an integrated digital extension campaign for a selected crop; Presentation, demonstration and evaluation of a comprehensive digital agricultural media portfolio comprising an infographic, extension publication, advisory bulletin, podcast, educational video, social media campaign and multimedia communication outputs.

Suggested Readings

1. Davis, K., & Sulaiman, R. (2014). The new extensionist: Roles, strategies and capacities to strengthen extension and advisory services. Global Forum for Rural Advisory Services (GFRAS).
2. Fleming, C., Hemmingway, E., & Moore, G. (2006). An introduction to journalism. Sage Publications.
3. Gunelius, S. (2011). 30-minute social media marketing. McGraw-Hill.
4. ICAR. (2024). Handbook of agriculture (7th ed.). Directorate of Knowledge Management in Agriculture (DKMA).
5. Kamath, M. V. (2009). Professional journalism. Vikas Publishing House.
6. Kerpen, D. (2019). Likeable social media (3rd ed.). McGraw-Hill Education.
7. Kotler, P., Kartajaya, H., & Setiawan, I. (2021). Marketing 5.0: Technology for humanity. Wiley.
8. Meera, S. N., Jhamtani, A., & Rao, D. U. M. (2004). Information and communication technology in agricultural development: A comparative analysis of three projects from India. Agricultural Research & Extension Network, Overseas Development Institute.
9. Narula, U. (2019). Handbook of mass communication: Theory and practice. Har-Anand Publications.
10. Oakley, P., & Garforth, C. (1985). Guide to extension training. Food and Agriculture Organization of the United Nations.
11. Philip, H., Radhakrishnan, T., & Theodore, R. K. (2012). Extension management in the information age: Initiatives and impacts. New India Publishing Agency.
12. Ray, G. L., & Mondal, S. (2017). Research methods in social sciences and extension education. Kalyani Publishers.
13. Rogers, E. M. (2003). Diffusion of innovations (5th ed.). Free Press.
14. Shrivastava, K. M. (2015). News reporting and editing. Sterling Publishers.
15. Van den Ban, A. W., & Hawkins, H. S. (1996). Agricultural extension (2nd ed.). Blackwell Science.

26AGM181 Production Technology for Bio agents, Bio fertilizer and Bio pesticide 0 0 4 2

Objectives

- To offer knowledge on different bio pesticides, bio fertilizers and bio rationales for improved crop protection and soil fertility

- To enable students to isolate and characterize bio pesticide and bio fertilizer producing microorganisms including botanicals
- To develop entrepreneurial skills among the students to start their own venture in the field of bio pesticide and bio fertilizers

Course Outcome:

Any student who has undergone the course shall be able to:

Sl.No	Course outcome	CO	Blooms level
1.	Screen and characterize bio pesticide, bio fertilizer producing microorganisms	CO1	Understand
2.	Demonstrate mass production technology and quality control of bio pesticide and bio fertilizers at lab scale	CO2	Apply
3.	Solve problems in identification, characterization and commercial production of bio fertilizer, biorationals	CO3	Apply

Practical

Isolation and purification of important biopesticides: Trichoderma Pseudomonas, Bacillus, Metarhizium etc. and its production. Identification of important botanicals. Visit to biopesticide laboratory in nearby area. Field visit to explore naturally infected cadavers. Identification of entomopathogenic entities in field condition. Quality control of biopesticides. Isolation and purification of Azospirillum, Azotobacter, Rhizobium, P-solubilizers and cyanobacteria. Mass multiplication and inoculums production of biofertilizers. Isolation of AM fungi -Wet sieving method and sucrose gradient method. Mass production of AM inoculants.

Suggested Readings

1. Biological Control of Crop Disease. Kuykendall Marel Dekker, INC. Ramanujam B and Rabindra R J. 2006.
2. Current Status of Biological Control of Plant Disease using Antagonistic Organisms in India. Precision Fototype Services, Bengaluru.
3. Singh Awani Kr. 2018. Handbook of Microbial Biofertilizers. Agrotech Press, Jaipur, India.

26AGR181 Organic Production Technology and Agriculture Waste Management 0 0 4 2

Objectives

- i. To impart practical knowledge and skills in organic production technologies for sustainable crop production.
- ii. To develop competency in agricultural waste management, recycling, and value addition through eco-friendly organic farming practices.

Course outcomes

Any student who has undergone the course shall be able to:

Sl.No	Course outcome	CO	Blooms level
1	Explain the principles and practices of organic production technology and agricultural waste management for sustainable crop production.	CO1	Understand
2	Demonstrate the preparation and application of organic inputs, bioformulations, composts, and agricultural waste recycling techniques under field conditions.	CO2	Apply
3	Analyze the effectiveness and economic feasibility of organic production technologies and agricultural waste management practices for sustainable farming systems.	CO3	Analyze

Practical

Introduction to organic production technology, organic standards, and safety practices; identification of organic inputs, biofertilizers, and biopesticides; collection and segregation of agricultural wastes; characterization of biodegradable and non-biodegradable farm wastes; preparation of compost pit; compost preparation using pit and heap methods; monitoring and management of the composting process; establishment and maintenance of a vermicompost unit; preparation of enriched compost, NADEP compost, and farmyard manure (FYM); preparation of Jeevamrutham, Ghanajeevamrutham, Beejamrutham, Panchagavya, Fish Amino Acid (FAA), and Fermented Plant Extract (FPE); preparation of botanical formulations such as Neemastra, Agniastra, and Brahmastra; seed treatment using biofertilizers and biocontrol agents; nursery raising under organic production systems; field preparation and application of organic nutrient management practices; organic weed, pest, and disease management; preparation and application of botanical pesticides; recycling of crop residues into organic mulch; preparation of biochar from agricultural residues; recycling of livestock wastes and preparation of liquid organic manures; harvesting, grading, packaging, and storage of organically produced crops; educational visit to a certified organic farm or organic input production unit; preparation of practical records and economic analysis of organic input production and agricultural waste management

Suggested Readings

1. Palaniappan, S.P. & Annadurai, K. Organic Farming: Theory and Practice. Scientific Publishers, Jodhpur.
2. Dahama, A.K. Organic Farming for Sustainable Agriculture. Agrobios (India), Jodhpur.

3. Lampkin, N. Organic Farming. Old Pond Publishing, UK.
4. Sathe, T.V. Vermiculture and Organic Farming. Daya Publishing House, New Delhi.
5. ICAR. Handbook of Agriculture. Indian Council of Agricultural Research, New Delhi.
6. Gaur, A.C. A Manual of Rural Composting. National Centre of Organic Farming (NCOF), Government of India.
7. National Centre of Organic Farming (NCOF). Package of Practices for Organic Farming. Ministry of Agriculture & Farmers Welfare, Government of India.
8. Yadav, A.K. (Ed.). Organic Agriculture: Principles and Practices. Scientific Publishers, Jodhpur.

26AGR182 Application of Artificial Intelligence, IoT, Sensor Technologies, 0 0 4 2

Drones and Robotics in Agriculture

Objectives

- i. To impart practical knowledge and skills in the application of Artificial Intelligence (AI), Internet of Things (IoT), sensor technologies, drones, and robotics for precision and smart agriculture.
- ii. To develop competency in the use of digital agriculture tools for efficient crop production, resource management, crop monitoring, decision support, and sustainable farming practices.

Course outcomes

Any student who has undergone the course shall be able to:

Sl.No	Course outcome	CO	Blooms level
1	Explain the fundamentals, and principles of Artificial Intelligence, IoT, sensor technologies, drones, and robotics in modern agriculture.	CO1	Understand
2	Demonstrate the application of AI-enabled tools, sensors, IoT devices, drones, and robotic systems for precision crop management under field conditions.	CO2	Apply
3	Analyze the dataset from IoT sensors, drones, and robotics using AI/ML models for improving agricultural productivity and resource-use efficiency.	CO3	Analyze

Practical

Introduction to digital agriculture: Artificial Intelligence (AI), Internet of Things (IoT), sensor technologies, drones, and agricultural robotics; familiarization with smart agriculture equipment and safety protocols; identification and demonstration of various agricultural sensors (soil moisture, AWS); installation and calibration of sensors for field data collection; installation and operation of IoT-enabled smart irrigation systems; introduction to AI applications in agriculture including crop health assessment, disease detection, yield prediction, weed identification, and decision support systems; demonstration of AI-enabled mobile applications and image-based crop diagnostics; demonstration of variable-rate technology (VRT) concepts; introduction to unmanned aerial vehicles (UAVs)/drones and DGCA safety regulations; identification of drone components and flight planning; pre-flight inspection, calibration, and mission planning; demonstration of drone operation for crop monitoring, aerial imaging, and field mapping; acquisition and interpretation of RGB and multispectral imagery for crop health assessment; demonstration of agricultural spraying drones and safety measures; introduction to agricultural robotics and autonomous farm machinery; demonstration of robotic systems for seeding, weeding, harvesting, and greenhouse operations; use of AI and robotic systems for precision weed management; introduction to machine vision systems for crop monitoring; integration of AI, IoT, sensors, drones, and robotics for precision farming applications.

Suggested Readings

1. Zhang, Q. (Ed.). Precision Agriculture Technology for Crop Farming. CRC Press, Boca Raton, USA. <https://doi.org/10.1201/b19336>
2. Ministry of Agriculture & Farmers Welfare, Government of India. Guidelines for Use of Agricultural Drones and Precision Farming Technologies. https://farmech.dac.gov.in/Content/New_Folder/SOPforDrone.pdf
3. Food and Agriculture Organization (FAO). Digital Technologies in Agriculture and Rural Areas. FAO, Rome. <https://openknowledge.fao.org/handle/20.500.14283/ca4887en>

26AMP181

Poultry Production Technology

0 0 4 2

Course Objectives

- i. To impart hands-on skills in the day-to-day management of commercial layer and broiler flocks, from the receipt of day-old chicks to the marketing of eggs and broilers.
- ii. To develop practical skills in poultry housing, brooding, environmental control, litter and cage management under Indian agro-climatic conditions.
- iii. To train learners in the formulation of balanced and least-cost rations and in the preparation of compound feed for layers and broilers at different stages of production.
- iv. To build working skills in flock health management, vaccination, deworming, water quality assessment, record keeping, and biosecurity implementation on a poultry farm.

- v. To develop entrepreneurial and industry-readiness skills through value addition, project report preparation and visits to poultry farms, feed plants and processing plants, enabling learners to establish and manage a small-scale commercial poultry enterprise.

Course Outcome

Any student who has undergone the course shall be able to:

S. No	Course outcome	CO	Bloom's level
1	Identify commercial egg-type and meat-type strains, describe farm layouts, housing systems used in layer and broiler units, and explain their suitability to Indian agro-climatic and market conditions.	CO1	Understand
2	Perform routine layer and broiler farm operations, including brooding, chick and grower management, litter and cage management, debeaking, lighting, egg collection and record maintenance.	CO2	Apply
3	Formulate balanced and least-cost rations for layers and broilers at different stages of growth and production, and prepare compound feed using locally available ingredients.	CO3	Apply
4	Analyse flock health, water quality and biosecurity status of a poultry unit and execute appropriate vaccination, deworming and disinfection schedules and corrective action plans for layer and broiler flocks.	CO4	Analyse
5	Evaluate the economics of egg and broiler meat production and prepare a bankable project proposal for a small-scale commercial layer or broiler enterprise.	CO5	Create

Practical Syllabus

Commercial layer production

Identification of egg-type breeds and commercial layer strains (White Leghorn, BV-300, Hy-Line, Lohmann, Babcock, Gramapriya, Gramalakshmi), study of external body parts of poultry, handling and restraining of birds, judging and selection of layer birds, culling of spent hens, maintenance of farm records, visit to an instructional/commercial layer farm. Preparation of the poultry house, deep litter, battery cage and free-range systems, litter management, chick management, grower management, transfer of pullets from grower to layer house, summer and

winter management of layers, lighting programmes for growers and layers including step-up lighting, moulting, debeaking and other routine procedures followed in a layer farm. Water requirement of layers, water quality analysis, types of feed (chick, grower, pre-layer and layer mash), feed ingredients and their quality assessment, feed additives and supplements, immunity boosters, storage of feed, nutrient requirements at different phases of growth and production, preparation of compound feed, restricted and phase feeding. Identification of common diseases of layers, their control and prevention, medication and routes of drug administration, maintenance of the cold chain for vaccines, vaccination schedule, deworming, microbiological testing of water for contamination, sanitation and disinfection of sheds, pest and rodent management, manure and waste management, biosecurity measures. Egg collection and reduction of breakage, candling of eggs, preparation of value-added egg products, marketing channels for table eggs, integrated farming systems combining layer production with fodder and crop cultivation, preparation of a project report for a layer farm unit for a bank loan.

Commercial broiler production

Identification of commercial strains of broilers (Cobb, Ross, Hubbard, Vencobb), selection and grading of day-old broiler chicks, culling, visit to an instructional/commercial broiler unit. Layout of a commercial broiler farm, space requirements at different ages, deep litter system and cage system, litter management and control of caking and ammonia, preparation of the brooder house, chick management, grower management, summer management of broilers, winter management of broilers, lighting programmes for broilers, ventilation and environmental control, common procedures followed in a broiler farm, all-in all-out management. Water requirement of broilers, quality analysis of drinking water, types of feed (pre-starter, starter and finisher), feed ingredients, feed additives including enzymes, probiotics, coccidiostats and antioxidants, storage of feed, nutrient requirements, preparation of compound feed, computation of feed conversion ratio. Control and prevention of common diseases of broilers, vaccination schedule, litter disposal, cleaning, disinfection and fumigation of sheds, pest and rodent control, biosecurity measures. Record maintenance, computation of cost of production per kilogram of live weight, marketing channels in broiler farming, contract and integrated broiler farming, economics of broiler farming, preparation of a project report for a broiler farm unit for a bank loan, visit to a commercial broiler farm and a feed plant.

Suggested Readings

- **Singh, R. A.** 2018. *Poultry Production*. 4th Edn. Kalyani Publishers, New Delhi.
- **ICAR.** 2022. *Handbook of Animal Husbandry*. 4th Edn. Indian Council of Agricultural Research, New Delhi.
- **Jadhav, N. V., & Siddiqui, M. F.** 2011. *Handbook of Poultry Production and Management*. 2nd Edn. Jaypee Brothers Medical Publishers, New Delhi.
- **Prasad, J.** 2016. *Poultry Production and Management*. 7th Edn. Kalyani Publishers, New Delhi.
- **Bell, D. D., & Weaver, W. D.** 2002. *Commercial Chicken Meat and Egg Production*. 5th Edn. Springer, New York.

26ENR181 Farm mechanization, irrigation systems, design, water harvesting, soil and water conservation, and farm infrastructure development 0 0 4 2

Objectives

- i. To develop practical skills in farm mechanization, irrigation systems and farm infrastructure development for efficient agricultural operations.
- ii. To apply engineering principles to the design and selection of irrigation, water harvesting and soil and water conservation structures.
- iii. To enhance competency in planning and implementing sustainable farm resource management practices.

Course Outcome:

Any student who has undergone the course shall be able to:

Sl. No	Course outcome	CO	Blooms level
1	Demonstrate proficiency in the operation of farm machinery	CO1	Apply
2	Design suitable irrigation systems and water harvesting structures based on field requirements	CO2	Analyse
3	Implement appropriate soil and water conservation measures for land and water resource management	CO3	Apply
4	Plan essential farm infrastructure for efficient agricultural production	CO4	Analyse

Practical

Selection of suitable tractors and farm machinery based on crop, soil and farm conditions. Farm mechanization planning for small, medium, and large farms. Preparation of machinery operation schedules for major agricultural operations. Field capacity, field efficiency, and machinery performance. Estimation of fuel consumption, operational costs, and machinery economics. Preparation of a custom hiring centre plan for a village or Farmer Producer Organization (FPO). Assessment of field conditions for selecting suitable irrigation systems. Pump discharge, pressure, and pumping efficiency. Selection of irrigation pumps based on water source and field requirements. Design of drip irrigation systems. Design of sprinkler irrigation system. Selection and sizing of pipes, fittings, and accessories for irrigation systems. Troubleshooting, operation, and maintenance of drip and sprinkler irrigation systems. Preparation of irrigation schedules based on crop water requirements. Site selection for farm ponds and rainwater harvesting structures. Design of farm ponds based on catchment area and storage requirements. Selection of appropriate soil conservation measures based on land characteristics. Preparation of farm layout. Planning of machinery sheds, storage structures,

and utility buildings. Cost estimation and preparation of a detailed project report for farm development.

Suggested Readings

1. Jain S C and Rai C R. 2019. Farm Tractor Maintenance and Repair. Standard Publishers, 1705-B, Nai Sarak. Delhi- 110006
2. Ojha T P and Michael A M. 2023. Principles of Agricultural Engineering (Vol. I). (15th Edn.). Jain brothers, 16/893, East Park Road, Karol Bagh, New Delhi -110005.
3. Michael, A.M & T. P. Ojha. 2018. Principles of Agricultural Engineering Vol:2. Jain brothers, New Delhi.
4. Suresh. R. 1982. Soil and Water Conservation Engineering. Standard Publication, New Delhi.
5. Morgan, R.P.C. 2005. Soil erosion and conservation (3rd edition). Blackwell publishing company, United Kingdom.

26FSN181 Food Processing, Post harvest Processing Technology, and 0 0 4
Commercial Agrifood Enterprises 2

Objectives

- To provide basic knowledge of food processing and post-harvest processing technologies for agricultural products.
- To develop practical skills in the preparation, preservation, and value addition of cereals, pulses, milk, fruits, and vegetables.
- To understand consumer demand, quality, and market opportunities for processed food products.
- To promote entrepreneurial skills for establishing commercial agrifood enterprises and creating self-employment opportunities.

Course Outcome:

Any student who has undergone the course shall be able to:

Sl.No	Course outcome	CO	Blooms level

1	Explain the principles of food processing, post-harvest handling, preservation methods, and factors affecting the quality and shelf life of agricultural produce.	CO2	Understand
2	Apply appropriate food processing, preservation, dehydration, and value-addition techniques for cereals, pulses, milk, fruits, and vegetables.	CO3	Apply
3	Analyze consumer demand, product quality, and market opportunities to develop suitable value-added food products and agrifood enterprises.	CO4	Analyse
4	Develop a basic business plan for a commercial agrifood enterprise by integrating technical, economic, and marketing aspects.	CO6	Create

Practical

General orientation to food processing, post-harvest processing technology, and commercial agrifood enterprises; laboratory safety and quality management practices; identification, grading, sorting, washing, and packaging of fruits and vegetables; assessment of maturity indices and quality parameters; preparation of dehydrated and minimally processed vegetables, soup mixes, pickles, tomato products, canned vegetables, osmotically dehydrated fruits, fruit purees, ready-to-serve beverages, squash, jam, jelly, fruit bars, and candies; processing of cereal-, millet-, milk-, and coconut-based value-added products, including health mixes, instant mixes, bakery products, flavoured milk, buttermilk, coconut beverages, and convenience foods; preparation of health-promoting products such as herbal tea mixes, low glycaemic index food mixes, and iron-enriched beverages; study of preservation techniques, drying, dehydration, osmotic dehydration, fermentation, canning, packaging, labeling, and quality evaluation of processed products; estimation of raw material requirements, production costs, pricing, profitability, and marketing strategies; market survey to assess consumer demand and commercialization opportunities; preparation of a business plan for a selected agrifood enterprise covering production process, financial feasibility, sales forecasting, and marketing; educational visits to food processing industries and post-harvest processing units; and preparation and presentation of an enterprise business plan and industry visit.

Suggested Readings

1. Sinha, N. K., Sidhu, J., Barta, J., Wu, J., & Cano, M. P. (Eds.). (2012). *Handbook of fruits and fruit processing*. John Wiley & Sons.
2. Sharma S K and Nautiyal M C. 2019. Post-harvest technology of horticultural crops. New India Publishing.
3. Khetarpaul, N. (2005). *Bakery Science and Cereal Technology*. Daya Books. New Delhi.

4. Ajay Kumar Gupta. (2020). Handbook on Manufacture of Indian Kitchen Spices (Masala Powder) with Formulations, Processes and Machinery Details, NPCS, New Delhi.
5. Patrick Kabangi. (2023). Marketing of Agricultural and Agri-Food Products. Our Knowledge Publishing, New Delhi

26GPB181

Seed Production and Seed Testing Technology

0 0 4 2

Objectives

- i. To understand the principles and practices of quality seed production, seed certification, and seed multiplication systems for agricultural and horticultural crops.
- ii. To develop practical skills in seed processing, seed sampling, and laboratory seed quality testing using standard procedures and equipment.
- iii. To evaluate seed quality parameters and interpret test results to support quality assurance and certification in the seed industry.

Course Outcome:

Any student who has undergone the course shall be able to:

Sl.No	Course outcome	CO	Blooms level
1	Explain the principles of seed production, seed multiplication systems, seed certification, isolation requirements, and seed production planning for quality seed production.	CO1	Understand
2	Perform seed extraction, seed processing, seed sampling, and standard laboratory procedures for assessing physical purity, germination, moisture, vigour, viability, and seed health.	CO 2	Apply
3	Analyze and evaluate seed quality test results, genetic purity, and field inspection observations to determine compliance with seed certification standards and recommend appropriate quality assurance measures.	CO3	Evaluate

Practical

Seed and its type- concept seed quality - genetic principles of seed production - agronomical principles of seed production - generation system of seed multiplication - SMR, SRR and VRR - breeder seed production system in India - seed production planning - seed certification system in India – seed certification for export and import - isolation requirement for seed production in cereal pulse, oil seeds and vegetable crops - method of taking field count during quality seed production - maturity indices of different crops- seed extraction procedures - Seed processing equipment and grading - seed sampling and sampling procedure - physical purity test - seed

germination test and seedling evaluation - viability test - Seed vigour testing- Seed health testing (Blotter method) – seed moisture estimation - Electrical conductivity test for seed vigour – genetic purity test - Visit to a seed processing plant/seed testing laboratory/seed certification office

Suggested Readings

1. Agarwal, R.L. (2015). Seed Technology (2nd Ed.). Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi.
2. Copeland, L.O. and McDonald, M.B. (2001). Principles of Seed Science and Technology (4th Ed.). Kluwer Academic Publishers, Boston.
3. Vanangamudi, K., Srimathi, P., Natarajan, N. and Bhaskaran, M. (2010). Seed Science and Technology. New India Publishing Agency, New Delhi.
4. Justice, O.L. and Bass, L.N. (1978). Principles and Practices of Seed Storage. Castle House Publications Ltd., London.
5. Basra, A.S. (Ed.) (2006). Handbook of Seed Science and Technology. Food Products Press, New York.
6. International Seed Testing Association (ISTA). (Latest Edition). International Rules for Seed Testing. ISTA, Bassersdorf, Switzerland.
7. Ministry of Agriculture & Farmers Welfare, Government of India. (Latest Edition). Indian Minimum Seed Certification Standards (IMSCS). Department of Agriculture & Farmers Welfare, New Delhi.
8. Ministry of Agriculture & Farmers Welfare, Government of India. The Seeds Act, 1966; Seeds Rules, 1968; and Seeds (Control) Order, 1983 (Latest Amendments).
9. OECD. (Latest Edition). OECD Seed Schemes: Rules and Directions. Organisation for Economic Co-operation and Development, Paris.

26HOR181 Commercial Horticulture: Floriculture and Landscaping 0 0 4 2

Objectives

- i. To learn about open and protected cultivation technology, propagation and specialized cultural practices of commercial flower crops
- ii. To educate the students on post-harvest handling and marketing of commercial flower crops
- iii. To educate the students on principles, components and designing of gardens
- iv. To enable students to design landscapes in softwares like AUTOCAD, ARCHICAD and execution of garden

Course Outcome

- i. CO-1 Apply standard nursery techniques for the propagation, production, and maintenance of commercial flower crops. (**Apply**)
- ii. CO-2 Demonstrate practical skills in the open and protected cultivation, harvesting, grading, post-harvest handling, and value addition of commercial flower crops. (**Apply**)
- iii. CO-3 Understand the principles, landscape components and suitability of ornamental plants for different landscape situations (**Analyze**)
- iv. CO-4 Design and execute landscape garden designs by integrating principles of landscaping, plant selection, and garden features. (**Create**)

Practical

Identification of varieties of commercial flowers. Propagation methods: Seed propagation - Seed collection, germination tests and storage. Vegetative Propagation methods: Cuttings and Layerings. Nursery practices for commercial flower crops. Special practices for important commercial flower crops. Post-harvest handling, and value addition of commercial flower crops. Identification of ornamental plants; Identification of tools and implements used in landscape design. Propagation of trees, shrubs, potted plants and annuals, care and maintenance of plants, potting and repotting, Preparation of plans and laying out of gardens. Training and pruning of plants for special effects, lawn establishment and maintenance, layout of formal gardens, informal gardens, special type of gardens (Vertical garden, sunken garden, terrace garden, rock garden and water garden) and Use of computer software, Bonsai and Care and Maintenance of Bonsai, Terrarium and miniature garden. Visits to important gardens/ parks/ institute garden. Visit to commercial flower production unit/nursery.

Reference:

1. Arora J S. 2010. Introductory Ornamental Horticulture. (6th Edn.). Kalyani Publishers. 230p.
2. Randhawa G S and Mukhopadhyay A. 2001. Floriculture in India. Allied Publishers. 660p.
3. Bhattacharjee S K and De L C. 2004. Advances in Ornamental Horticulture. Vol. V. Pointer Publishers, Jaipur. Bose T K and Yadav L P. 1989. Commercial Flowers. Naya Prokash, Kolkata.
4. Bose T K, Maiti R G, Dhua, R S and Das P. 1999. Floriculture and Landscaping. Naya Prokash.
5. Nowak, J and Rudnicki, R M. 1990. Postharvest Handling and Storage of Cut Flowers, Florist Greens, and Potted Plants. Timber Press, USA. 210p.

26HOR182 Plantation Crops Production, Processing, Commercialisation, 0 0 4 2

and Supply chain

Objectives

- i. To impart hands-on skills in nursery raising, establishment, and production management of major plantation crops (coconut, arecanut, cocoa, cashew, oil palm, tea, coffee and rubber).
- ii. To train students in primary and value-added processing techniques of plantation crop produce.
- iii. To develop competency in grading, commercialisation, and supply chain management of plantation crop-based enterprises.

Course Outcome:

On completion of this course, the student will be able to:

Sl.No	Course outcome	CO	Blooms level
1	Perform nursery raising, propagation, and field establishment operations of major plantation crops.	CO1	Apply
2	Carry out crop management, nutrient/water management, and pest-disease scouting in plantation crops.	CO2	Apply
3	Execute primary processing operations (curing, fermentation, drying) of plantation crop produce.	CO3	Apply
4	Prepare value-added products and evaluate grading/packaging standards for plantation commodities.	CO4	Apply
5	Formulate a business plan and design the supply chain map for a plantation crop-based enterprise.	CO5	Create

Practical

Study of planting material standards and quality parameters for coconut and arecanut seedlings, Nursery raising and polybag mixture preparation for cocoa and cashew, Vegetative propagation: bud grafting in cashew, patch budding/bud grafting in rubber, Study of tea nursery, VP (vegetative propagation) plant production, and clone selection, Study of coffee nursery raising and shade tree management, Field visit to observe planting systems, spacing, and layout in a plantation crop garden, Nutrient and water management practices: fertigation scheduling in coconut/arecanut, Canopy/crown management practices – deblading, deleafing, pruning demonstration, Identification of major pests and diseases and IPM/IDM practices in plantation crops, Copra making and coconut oil extraction (wet and dry method), Arecanut processing: chali and kalipak, Cocoa fermentation, drying, and quality evaluation of dry beans, Cashew apple processing (juice/feni) and cashew nut roasting/shelling, Tea manufacturing: withering, rolling, fermentation, and drying (visit to a tea factory/model unit), Coffee curing: wet and dry processing methods and cup quality basics, Rubber tapping demonstration and latex-to-sheet (RSS) processing, Preparation of value-added products from plantation crops (coconut/cocoa/cashew-based products), Grading, packaging, and labelling as per AGMARK/FSSAI/export quality standards, Visit to a plantation crop processing unit/cooperative society/export house, Study of supply chain components: procurement, storage, transport, and cold chain, Costing, market survey, and preparation of a business plan for a plantation crop enterprise.

Suggested Readings

1. Peter, K.V. 2002. *Plantation Crops*. National Book Trust, New Delhi.

2. Nair, K.P.P. 2010. *The Agronomy and Economy of Important Tree Crops of the Developing World*. Elsevier.
3. Sethuraj, M.R. and Mathew, N.M. 1992. *Natural Rubber: Biology, Cultivation and Technology*. Elsevier.
4. Wintgens, J.N. 2004. *Coffee: Growing, Processing, Sustainable Production*. Wiley-VCH.
5. ICAR. 2019. *Handbook of Horticulture* (2nd ed.). ICAR, New Delhi.
6. Wood, G.A.R. and Lass, R.A. 2001. *Cocoa* (4th ed.). Blackwell Science.
7. Thampan, P.K. 1981. *Handbook on Coconut Palm*. Oxford & IBH Publishing, New Delhi
8. Barua, D.N. 1989. *Science and Practice in Tea Culture*. Tea Research Association, Calcutta–Jorhat.

26PAT181

Mushroom cultivation technology

0 0 4 2

Objectives

- i. Acquire knowledge on importance of mushrooms and its nutritional value.
- ii. Facilitate hands on training to the students for the preparation of beds for different varieties of mushroom and spawn production.
- iii. Understand product diversification, value addition of mushrooms and cost economics of mushroom cultivation.

Course Outcome:

Any student who has undergone the course shall be able to:

Sl.No	Course outcome	CO	Blooms level
1	Identify and differentiate edible and poisonous mushrooms and develop skills on cultivation of different types of edible mushrooms and spawn production.	CO1	Understand
2	Review various biotic and abiotic factors that reduce the yield of mushroom and manage them and conceptualize value-added products of mushrooms.	CO 2	Understand
3	Analyse market intelligence and support systems to realise maximum yield and profit and acquire entrepreneurial skills leading to start ups and business ventures.	CO3	Apply

Practical

Students will learn the facilities required for construction of mushroom shed, cultivation room/structure and disinfection, maintenance of aseptic condition. Learn cultivation techniques for oyster mushroom: procurement of mother culture and spawn preparation - sterilization of straw- bed preparation – mushroom seeding – moisture maintenance – harvesting. Learn cultivation techniques for milky mushroom compost preparation and pasteurization - procurement of mother culture and spawn preparation - procurement of casing soil and preparation for production -mushroom seeding - casing with soil and maintenance – harvesting. - Value added processing - Grading, packing - marketing and Cost economics of mushroom culture. Exposure visit to mushroom cultivation units.

Suggested Readings

1. Aggarwal, A., Sharma, Y.P. and Jangra, E. (2021). *A Textbook on Mushroom Cultivation: Theory and Practice*. Newrays publishing House, New Delhi, India.
2. Pathak, V. N., Yadav, N. and Gaur, M. (2020). *Mushroom production and processing Technology*. Agribios (India) Ltd., New Delhi, India.
3. Gupta, S., Summuna, B., Gupta, M. and Annepu, S. K., (2018). Edible mushrooms: cultivation, bioactive molecules, and health benefits. *Bioact. Mol. Food*, 1:1-33.
4. Pandey, V.V., Kumari, A., Kumar, M., Saxena, J., Kainthola, C. and Pandey, A., (2018). Mushroom cultivation: Substantial key to food security. *J. Appl. Natural Sci.* 10(4):1325-1331.
5. Sarita, S.S., Yadav, K. and Sharma, A.K., (2022). Studies on Standardization of Production Technology of Oyster Mushroom. *Eco. Env. Cons.* 200-204
6. Shirur, M., Shivalingegowda, N.S., Chandregowda, M.J. and Rana, R.K. (2016). Technological adoption and constraint analysis of mushroom entrepreneurship in Karnataka. *Econ. Aff.* 61(3):427-436.
7. Thakur, M.P. (2020). Advances in mushroom production: key to food, nutritional and employment security: A review. *Indian Phytopathol.* 73:377-395.
8. Yaeger, W., Jawed, M., Tauman, D., Ho, P., Ali, A., Gomanie, N.N. and Mehta, K. (2022). September. Modular methods for oyster mushroom cultivation in low-resource settings. In 2022 IEEE Global Humanitarian Technology Conference (GHTC) (pp. 30-37). IEEE.

26SAC181

Soil, Plant, Water Testing and Farm Mapping

0 0 4 2

Objectives

- To train students in the standard protocols for collecting, processing, and preparing soil, plant, and water samples for laboratory analysis.
- To develop hands-on technical skills in operating analytical instruments like pH meters, EC meters, spectrophotometers, and flame photometers.
- To enable students to interpret analytical data and generate customised fertilizer recommendations and water suitability reports.
- To equip students with modern digital skills in mobile-based and open-source GIS platforms for physical and digital farm boundary mapping.

Sl.No	Course outcome	CO	Blooms level
1	Execute scientifically sound sampling methods for soil, plant tissue, and irrigation water from diverse farm topologies.	CO1	Apply
2	Quantify key chemical properties (pH, EC, Organic Carbon) and essential nutrients using standardized laboratory equipment.	CO2	Analyze
3	Evaluate the quality of irrigation water and soil health status against standard agricultural thresholds.	CO3	Evaluate
4	Formulate precise fertilizer dosages and soil-ameliorant recommendations based on diagnostic test reports.	CO4	Create
5	Develop digital farm layout maps, mark spatial boundaries, and overlay nutrient data using GPS and GIS tools.	CO5	Create

Practical

Introduction to soil, plant, and water testing laboratory and laboratory safety; Collection, labelling, processing, and storage of representative soil samples; Determination of soil pH, electrical conductivity (EC), organic carbon, and available macronutrients (N, P, K); Estimation of selected secondary and micronutrients using standard laboratory procedures; Collection and analysis of irrigation water samples for pH, EC, SAR, RSC, and water quality parameters; Collection, processing, and preparation of plant samples for nutrient analysis; Interpretation of soil, plant, and irrigation water analytical reports and preparation of fertilizer and soil amendment recommendations; Preparation of Soil Health Cards and nutrient management plans; Familiarization with handheld GPS, mobile GPS applications, and Global Navigation Satellite Systems (GNSS); Collection of field coordinates and farm boundary survey using GPS-enabled devices; Preparation of digital farm maps using GIS software; Generation of thematic maps including soil fertility, land use, irrigation layout, and crop distribution maps; Farm resource inventory and field documentation; Demonstration of precision agriculture tools for site-specific nutrient management; Field visit to Soil Testing Laboratory, Water Quality Testing Laboratory, and Precision Farming Centre for hands-on exposure to analytical instruments and farm mapping technologies.

Suggested readings

1. Brady, N.C. & Weil, R.R. (2017). The Nature and Properties of Soils (15th ed.). Pearson Education.
2. Tandon, H.L.S. (2013). Methods of Analysis of Soils, Plants, Waters and Fertilizers. Fertiliser Development and Consultation Organisation (FDCO), New Delhi.

3. Jackson, M.L. (1973). Soil Chemical Analysis. Prentice Hall of India, New Delhi.
4. Page, A.L., Miller, R.H. & Keeney, D.R. (Eds.). (1982). Methods of Soil Analysis, Part 2: Chemical and Microbiological Properties (2nd ed.). ASA and SSSA, Madison, Wisconsin.
5. Richards, L.A. (Ed.). (1954). Diagnosis and Improvement of Saline and Alkali Soils. USDA Agriculture Handbook No. 60.
6. Motsara, M.R. & Roy, R.N. (2008). Guide to Laboratory Establishment for Plant Nutrient Analysis. FAO Fertilizer and Plant Nutrition Bulletin 19, Rome.
7. Tan, K.H. (2005). Soil Sampling, Preparation and Analysis (2nd ed.). CRC Press.
8. USDA Natural Resources Conservation Service (NRCS). Soil Survey Manual. USDA Handbook 18.
9. Burrough, P.A. & McDonnell, R.A. (1998). Principles of Geographical Information Systems. Oxford University Press.
10. Chang, K.T. (2021). Introduction to Geographic Information Systems (9th ed.). McGraw-Hill Education.
11. Lillesand, T.M., Kiefer, R.W. & Chipman, J.W. (2015). Remote Sensing and Image Interpretation (7th ed.). Wiley.

26CRS201

Career Readiness Skills I

L-T-P-C: 1-0-2-2

CIR Course - ASAS - UG (3/5-year Programmes) – Paper I

Pre-requisite:

SOFT SKILLS - The curiosity to build insights and expressing the willingness to engage in iterative self-critique and peer feedback

VERBAL - Basic English language skills

APTITUDE – Basic knowledge in arithmetic and algebra.

Course Objective:

SOFT SKILLS

- Encouraging students in acquiring the sense of commitment and responsibility
- Facilitating them in presenting their insights

VERBAL - To help students develop the ability to understand, analyze, and communicate in English effectively.

APTITUDE - Assist them in improving their problem solving and reasoning skills

Course Outcomes

CO1: Soft Skills - To develop greater morale and positive attitude to face, analyze, and practice focus on a competitive environment like placement process.

CO2: Soft Skills - To empower students to create better impact on a target audience through content creation, effective delivery, appropriate body language and overcoming nervousness, in situations like presentations.

CO3 - Aptitude: To manage time while applying suitable methods to solve questions in arithmetic and algebra.

CO4 - Aptitude: To investigate, understand and use appropriate techniques to solve questions in logical reasoning and data analysis.

CO5: Verbal – To use enhanced vocabulary and be grammatically precise

CO6: Verbal – To use logical reasoning and draw clear conclusions.

CO-PO Mapping

PO	PO1	PO2	PO3	PO4	PO5	PO6
CO						
CO1			2	3	3	3
CO2				3	3	3
CO3	3	2				
CO4	3	2				
CO5					3	3
CO6				3	3	3

Syllabus

Soft Skills

Introduction to Life Skills: Importance of Soft Skills, Soft Skills vs Hard Skills, Role of Soft Skills in life, Campus to Corporate transition

Individual Accountability: Growth Mindset and strategies, Cognitive load and energy management, Personal productivity – SWOT Analysis, Goal setting in career planning, Emotional Intelligence for Career Success

Presentation Skills: Effective technical presentations, Preparation & delivery Techniques, Slide Preparation, Ethical use of AI tools in preparing slides, Do's & Don'ts, Presentation by students, Handling Feedback & Questions

Communication Skills: Process, Barriers, Active Listening, Nonverbal verbal communication, Personal branding

Aptitude

Numbers - Power Cycles, Divisibility, HCF and LCM, **Percentage** - Profit, Loss & Discount, and Simple & Compound Interest, **Ratio, Proportion & Variation** - Alligations, Mixtures, and Partnership Problems, **Averages**, **Logical Reasoning** - Blood Relations, Direction Test, Syllogisms, Series, Odd One Out, Coding & Decoding, Cryptarithmic Problems and Input-Output Reasoning, **Data Interpretation** - Tables, Bar Diagrams, Line Graphs, Pie Charts, Caselets and Mixed Varieties, **Puzzles** - Optimization Puzzles, Fermi Problems, Game-Based Puzzles and Sudoku, **Speed Mathematics**, and **Shortcuts**.

Verbal Skills

Vocabulary: Familiarize students with the etymology of words, help them realize the relevance of word analysis, and enable them to answer synonym and antonym questions.

Grammar (Basics): To learn the usage of grammar and facilitate students to identify errors and correct them.

Reasoning: Stress the importance of understanding the relationship between words through analogy questions. Emphasize the importance of avoiding the gap (assumption) in the argument/ statements/ communication.

Speaking Skills: Make students conscious of the relevance of effective communication in today's world through individual speaking activities.

References:

Soft Skills:

1. Guides and Workbooks:

- Student's Guide for Career Planning, CIR (UG)
- Soft Skills Handbook for UG

2. Communication and listening skills:

- Andrew J DuRbin, Applied Psychology: Individual and organizational effectiveness. Pearson-Merril Prentice Hall, 2004
- Michael G Aamodt, An Applied Approach, 6th edition, 2010, Wadsworth Cengage Learning

3. Assertiveness skills:

- People Style at Work. And Beyond: Making Bad Relationships Good and Good ...By Robert Bolton, Dorothy Grover Bolton, 2009, Ridge Associates Inc
- Interpersonal skills at work, John Hayes, Routledge, 2003
- Nord, W. R., Brief, A. P., Atieh, J. M., & Doherty, E. M. (1990). Studying meanings of work: The case of work values. In A. Brief & W. Nord (Eds.), Meanings of occupational work: A collection of essays (pp. 21- 64). Lexington, MA: Lexington Books.

4. Soft Skills:

- Barun K. Mitra – Personality Development and Soft Skills (Oxford Press)
- HBR's 10 Must Reads on Managing Yourself (with bonus article "How Will You Measure Your Life?" by Clayton M. Christensen) Kindle Edition
- Emotional Intelligence: Why It Can Matter More Than IQ by Daniel Goleman
- Mindset: The New Psychology of Success by Carol S. Dweck (Author)
- Stephen Covey, "The habits of highly effective people", Free press Revised edition, 2004
- The 25 Best Time Management Tools & Techniques: How to Get More Done Without Driving Yourself Crazy, Kenneth H Blanchard, 2005, Peak Performance Press, 1st edition

- The One Minute Manager Kenneth H. Blanchard and Spencer Johnson,
Publishers: William Morrow, 1984

1. Gulati. S., (1006) "Corporate Soft Skills", New Delhi, India: Rupa & Co.
2. The hard truth about Soft Skills, by Amazon Publication.
3. Verbal Skills Activity Book, CIR, AVVP
4. Nova's GRE Prep Course, Jeff Kolby, Scott Thornburg & Kathleen Pierce
5. The BBC and British Council online resources
6. Owl Purdue University online teaching resources
7. www.thegrammarbook.com online teaching resources
8. www.englishpage.com online teaching resources and other useful websites
9. Student Workbook: Quantitative Aptitude & Reasoning, Corporate & Industry Relations, Amrita Vishwa Vidyapeetham.
10. Quantitative Aptitude for All Competitive Examinations, Abhijit Guha.
11. How to Prepare for Quantitative Aptitude for the CAT, Arun Sharma.
12. How to Prepare for Data Interpretation for the CAT, Arun Sharma.
13. How to Prepare for Logical Reasoning for the CAT, Arun Sharma.
14. Quantitative Aptitude for Competitive Examinations, R S Aggarwal.
15. A Modern Approach to Logical Reasoning, R S Aggarwal.
16. A Modern Approach to Verbal & Non-Verbal Reasoning, R S Aggarwal.

Evaluation Pattern

Assessment	Internal	External
Continuous Assessment (CA)* – Soft Skills	30	-
Continuous Assessment (CA)* – Aptitude	10	25
Continuous Assessment (CA)* – Verbal	10	25
Total	50	50

*CA - Can be **presentations, speaking activities and tests.**

CIR Course - ASAS - UG (3/5-year Programmes) – Paper II

Pre-requisite:

SOFT SKILLS - Demonstration of fundamental level of self-reflection and emotional maturity to engage in collaborative dialogue

VERBAL - Possess basic English language skills and reasoning ability.

APTITUDE – Basic knowledge in arithmetic and algebra.

Course Objective:**SOFT SKILLS**

- To develop the social and cognitive agility required to navigate complex workplace dynamics by resolving interpersonal friction and implementing structured solutions to achieve the goals
- To activate the healthy competitive mindset in group environment with active listening and ensuring inclusive participation to steer the group towards cohesive conclusion.

VERBAL - To help students develop English language proficiency and critical reasoning.

APTITUDE - To assist students to improve their problem-solving skills

Course Outcomes

CO1: Soft Skills - To improve the inter-personal skills, and leadership skills, vital for arriving at win-win situations in Group Discussions and other team activities

CO2: Soft Skills - To develop the ability to create better impact in Group Discussions through examination, participation, perspective-sharing, ideation, listening, brainstorming and consensus.

CO3 - Aptitude: To analyze, understand and solve questions in arithmetic by employing the most suitable methods.

CO4 - Aptitude: To investigate and apply suitable techniques to solve questions in logical reasoning.

CO5: Verbal - To be able to use vocabulary in the right context and to be competent in spotting grammatical errors and correcting them.

CO6: Verbal - To be able to logically connect words, phrases, sentences and thereby communicate their perspectives/ideas convincingly.

CO-PO Mapping

PO CO	PO1	PO2	PO3	PO4	PO5	PO6
CO1			2	3	3	3
CO2				3	3	3
CO3	3	2				
CO4	3	2				
CO5					3	3
CO6				3	3	3

Syllabus

Soft Skills

Interpersonal Effectiveness: Transactional Analysis, Assertiveness & confidence building, Networking, Influencing & persuasion, Professional presence & personal impact

Problems Solving Skills: Foundation of Problem Solving, Critical thinking, Problem Solving Process, Industry case studies & real-world problems

Conflict Management: Intrapersonal vs Interpersonal Conflict, Conflict Management Styles, Steps in Conflict Resolution, Handling Workplace Conflicts, Learning from Conflict & Personal Growth

Group discussion: Advantages of Group discussion, Types of Group discussion, Do's and Don'ts, How to perform well in a group discussion and how to summarize and conclude the group discussion effectively

Aptitude

Logarithms, Inequalities, Sequence, Series, Time and Work - Pipes & Cistern, and Work Equivalence, **Time, Speed and Distance** - Boats & Streams, Races and Circular Tracks, **Logical Reasoning** - Arrangements, Sequencing, Scheduling, Venn Diagram, Network Diagrams, Binary Logic, and Logical Connectives, Clocks, Calendars, Cubes, Non-Verbal Reasoning and Symbol-Based Reasoning, **Puzzles** - Anagrams, Futoshiki, Rebus Puzzles, Lateral Thinking Problems, and Riddles, **Speed Mathematics** and **Shortcuts**.

Verbal Skills

Vocabulary: Help students understand the usage of words in different contexts. Create an awareness about the frequently misused words, commonly confused words and wrong form of words in English.

Grammar (Intermediate Level): Train students to comprehend the nuances of grammar and empower them to spot errors in sentences and correct them.

Reading Comprehension: Introduce students to smart reading techniques, help them understand different tones in comprehension passages – basic to advanced.

Reasoning: Enable students to connect words, phrases, and sentences logically.

Oral Communication Skills: Orient students in elevating their public speaking skills, and persuasive skills. Aid students in using the gift of the gab to interpret images, do a video synthesis, try a song interpretation or elaborate on a literary quote.

Writing Skills: Practice previous years' email writing questions

References:

Soft Skills:

1. Student's Guide for Career Planning, CIR (UG)
2. Soft Skills Handbook for UG
3. Interpersonal skills at work, John Hayes, Routledge, 2003
4. Conflict Communication: A New Paradigm in Conscious Communication – by Rory Miller
5. Fixed: How to Perfect the Fine Art of Problem Solving by Amy E Herman
6. Cracked it! How to solve big problems and sell solutions like top strategy consultants by Bernard Garrette, Corey Phelps, and Olivier Sibony
7. Upstream: The Quest to Solve Problems Before They Happen by Dan Heath
8. Problem Solving 101: A Simple Book for Smart People by Ken Watanabe
9. 101 Creative Problem-Solving Techniques: The Handbook of New Ideas for Business /James M. Higgins.
10. What's Your Problem? To Solve Your Toughest Problems, Change the Problems You Solve by Thomas Wedell-Wedellsborg
11. Bulletproof Problem Solving: The One Skill That Changes Everything by Charles Conn and Robert McLean
12. Getting to Yes: Negotiating Agreement Without Giving in by Roger Fisher, William L. Ury, and Bruce Patton
13. Conflict Resolution Playbook: Practical Communication Skills for Preventing, Managing, and Resolving Conflict by Jeremy Pollack
14. HBR Guide to Dealing with Conflict by Amy Gallo
15. Barun K. Mitra – Personality Development and Soft Skills (Oxford Press)
16. "The Power of Habit: Why We Do What Do in Life and Business" by Charles Duhigg
17. Simply Said: Communicating Better at Work and Beyond by Jay Sullivan
18. Words That Work: It's Not What You Say, It's What People Hear by Dr. Frank Luntz

19. The Fine Art of Small Talk: How to Start a Conversation, Keep It Going, Build Networking Skills — and Leave a Positive Impression! By Debra Fine
20. Communication Skills Training: A Practical Guide to Improving Your Social Intelligence, Presentation, Persuasion and Public Speaking by Ian Tuhovsky
21. Just Listen: Discover the Secret to Getting Through to Absolutely Anyone by Mark Goulston by Ian Tuhovsky
22. The Art of Communicating by Thich Nhat Hanh
23. Mastering Behaviour: Managing Self and Others (SAGE IIM-Kozhikode Series for New Managers) by Payal Anand (Author)
24. Group Discussion and Interview Skills - Priyadarshi Patnaik

1. Adair. J., (1.986), "Effective Team Building: How to make a winning team", London, U.K: Pan Books.
2. Gulati. S., (2006) "Corporate Soft Skills", New Delhi, India: Rupa & Co.
3. The Hard Truth about Soft Skills, by Amazone Publication.
4. Verbal Skills Activity Book, CIR, AVVP
5. Nova's GRE Prep Course, Jeff Kolby, Scott Thornburg & Kathleen Pierce
6. The BBC and British Council online resources
7. Owl Purdue University online teaching resources
8. www.thegrammarbook.com online teaching resources
9. www.englishpage.com online teaching resources and other useful websites
10. Student Workbook: Quantitative Aptitude & Reasoning, Corporate & Industry Relations, Amrita Vishwa Vidyapeetham.
11. Quantitative Aptitude for All Competitive Examinations, Abhijit Guha.
12. How to Prepare for Quantitative Aptitude for the CAT, Arun Sharma.
13. How to Prepare for Data Interpretation for the CAT, Arun Sharma.
14. How to Prepare for Logical Reasoning for the CAT, Arun Sharma.
15. Quantitative Aptitude for Competitive Examinations, R S Aggarwal.
16. A Modern Approach to Logical Reasoning, R S Aggarwal.
17. A Modern Approach to Verbal & Non-Verbal Reasoning, R S Aggarwal.

Evaluation Pattern

Assessment	Internal	External
Continuous Assessment (CA)* – Soft Skills	30	-
Continuous Assessment (CA)* – Aptitude	10	25
Continuous Assessment (CA)* – Verbal	10	25
Total	50	50

*CA - Can be **presentations, speaking activities and tests.**

CIR Course - ASAS - UG (3/5-year Programmes) – Paper III

Pre-requisite:

SOFT SKILLS - The intelligence to crack the interview process and along with insights for creating impressive resume enhancing their uniqueness.

VERBAL - Demonstrate basic English skills and simple reasoning.

APTITUDE – Basic knowledge in arithmetic and algebra.

Course Objective:

SOFT SKILLS

- To equip students with the ability to lead and contribute to high-performing teams by mastering group discussion strategies, conflict resolution, and corporate etiquette.
- To cultivate a high-performance professional persona by integrating strategic self-marketing, and sophisticated interpersonal dynamics to successfully navigate and lead in the modern industry ecosystem.

VERBAL - To help students develop verbal reasoning and persuasive communication.

APTITUDE - Assist them in improving their problem -solving and reasoning skills

Course Outcomes

CO1: Soft Skills - To develop a professional presence that harmonizes individual conduct with collective coordination, ensuring students can lead high-performing teams while upholding the highest standards of organization decorum.

CO2: Soft Skills - The students will have the ability to analyze every question asked by the interviewer, compose correct responses and respond in the right manner to justify and convince the interviewer of one's right candidature through displaying etiquette, positive attitude and courteous communication.

CO3 - Aptitude: To interpret, critically analyze and solve questions in geometry, probability, permutations & combinations, and statistics by employing the most suitable methods.

CO4 - Aptitude: To analyze, understand and apply suitable methods to solve questions in logical reasoning and data analysis.

CO5: Verbal – To demonstrate accuracy and clarity in verbal expression by identifying errors and constructing well-formed sentences.

CO6: Verbal – To analyze and structure verbal information logically to solve reasoning tasks and communicate persuasively.

CO-PO Mapping

PO	PO1	PO2	PO3	PO4	PO5	PO6
CO						
CO1			2	3	3	3
CO2				3	3	3
CO3	3	2				
CO4	3	2				
CO5					3	3
CO6				3	3	3

Syllabus

Soft Skills

Corporate Culture and Managing Diversity: Corporate Etiquette, Workplace Rules, Policies & Discipline, Sensitivity & Professional Conduct, Allyship, Inclusive Behavior

Team Management: Stages of team development, Collaboration & building Rapport diverse teams, Collaboration in diverse teams, Leadership Styles, Team Motivation & Influencing Skills, Ethical Leadership & Integrity

Resume: Resume writing, Cover letter, Digital profile, Video resume

Interviewing Skills (Experiential session): Types of Interviews (Technical, HR, Managerial, Research), Understanding Job Descriptions & Role Expectations, Competency, Based & Behavioral Interviews, STAR Technique for Behavioral Questions, Professional Grooming for interviews

Aptitude

Equations – Linear and Quadratic Equations, **Geometry** - 2D, 3D, Coordinate Geometry, and Heights & Distance, **Permutations & Combinations** – Linear & Circular Arrangements, and Derangements, **Probability** - Addition & Multiplication Theorems, and Conditional Probability, **Statistics** - Mean, Median, Mode, Standard Deviation and Standard Deviation, **Data Sufficiency**, **Campus Recruitment Papers**, **Puzzles** - Logical Puzzles, Deduction Puzzles, Calculation Puzzles, and Other Interview Puzzles, **Time Management Strategies**.

Verbal Skills

Vocabulary: Create an awareness of using refined language through idioms, phrasal verbs, and one-word substitution.

Grammar (Advanced Level): Enable students to master the strategies involved in solving grammar questions and improve sentences through a clear understanding of the rules of grammar.

Reasoning Skills: Facilitate students to tap their reasoning skills through understanding critical reasoning arguments and solving questions.

Public Speaking Skills: Empower students to overcome glossophobia and speak effectively and confidently before an audience. Enable learners to develop compelling 60-second narratives from their experiences and achievements and transform conventional reports into meaningful narratives that enhance professional communication and personal branding.

Writing Skills: Practice cloze tests that assess basic knowledge and skills in writing such as punctuation, basic grammar and usage, sentence structure and rhetorical skills such as writing strategy, organization, and style.

References:

1. Students' Career Planning Guide, Corporate & Industry Relations, Amrita Vishwa Vidyapeetham.
2. Soft Skill Handbook, Corporate & Industry Relations, Amrita Vishwa Vidyapeetham.
3. Adair. J., (1986), "Effective Team Building: How to make * winning team", London, U.K
4. Gulati. S., (1006) "Corporate Soft Skills", New Delhi, India: Rupa & Co.
5. The hard truth about Soft Skills, by Amazon Publication.
6. Teamwork Isn't My Thing and I Don't Like to Share! – Julia Cook
7. The Sapp Brothers' Story: Tough Times, Teamwork, & Faith - Tom Osborne
8. Successful Interview Skills – Rebecca Corfield
9. Hindle, Tim, Interviewing Skills
10. Julie Ann Amos, Handling Tough Job Interviews
11. Verbal Skills Activity Book, CIR, AVVP
12. Nova's GRE Prep Course, Jeff Kolby, Scott Thornburg & Kathleen Pierce
13. The BBC and British Council online resources
14. Owl Purdue University online teaching resources
15. www.thegrammarbook.com online teaching resources
16. www.englishpage.com online teaching resources and other useful websites
17. Student Workbook: Quantitative Aptitude & Reasoning, Corporate & Industry Relations, Amrita Vishwa Vidyapeetham.
18. Quantitative Aptitude for All Competitive Examinations, Abhijit Guha.
19. How to Prepare for Quantitative Aptitude for the CAT, Arun Sharma.
20. How to Prepare for Data Interpretation for the CAT, Arun Sharma.

21. How to Prepare for Logical Reasoning for the CAT, Arun Sharma.
22. Quantitative Aptitude for Competitive Examinations, R S Aggarwal.
23. A Modern Approach to Logical Reasoning, R S Aggarwal.
24. A Modern Approach to Verbal & Non-Verbal Reasoning, R. S. Aggarwal.

Evaluation Pattern

Assessment	Internal	External
Continuous Assessment (CA)* – Soft Skills	30	-
Continuous Assessment (CA)* – Aptitude	10	25
Continuous Assessment (CA)* – Verbal	10	25
Total	50	50

*CA - Can be **presentations, speaking activities and tests.**

