



इंदिरा गांधी कृषि विश्वविद्यालय
कृषक नगर, रायपुर 492 012 (छत्तीसगढ़)
INDIRA GANDHI KRISHI VISHWAVIDYALAYA
KRISHAK NAGAR, RAIPUR 492 012 (CHHATTISGARH)

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क्र. न.क्र. वि.प.-148.26(अ.वि.) / शैक्ष.-1 / 2025 / 1230

रायपुर, दिनांक 04-09-2025

अधिसूचना

विश्वविद्यालय विद्या परिषद की दिनांक 11 जुलाई 2025 को सम्पन्न हुई 148वीं बैठक में विद्या परिषद द्वारा इंदिरा गांधी कृषि विश्वविद्यालय, रायपुर के अंतर्गत संचालित सभी स्नातक पाठ्यक्रम में नई शिक्षा नीति 2020 नियम एवं विनियम (Rules and Regulations) तथा Course outline for Under Graduate programmes in IGKV under New Education Policy 2020 को निम्नानुसार तथा संलग्नक 148.26 अनुसार अनुमोदन प्रदान किया जाता है तथा विश्वविद्यालय में लागू किया जाता है :-

The Academic Council approved the New Education Policy (NEP) 2020 of course outline under graduate programmes from 2nd year to 4th year along-with the modification in 1st year and 2nd year and revised courses of UG programmes **[B.Sc. (Hons.) Agriculture, B.Tech. (Agricultural Engineering), B.Tech. (Food Technology)]** in IGKV from this academic session 2025-26.

संलग्न :- उपरोक्तानुसार।

प्रमुख
कुलसचिव
4/9/25

पृ. क्र. न.क्र. वि.प.-148.26(अ.वि.) / शैक्ष.-1 / 2025 / 1231

रायपुर, दिनांक 04-09-2025

प्रतिलिपि सूचनार्थ एवं आवश्यक कार्यवाही हेतु प्रेषित :-

- माननीय कुलपति जी के निज सहायक, इंदिरा गांधी कृषि विश्वविद्यालय, रायपुर 492012 (छत्तीसगढ़)।
- निदेशक शिक्षण एवं परीक्षा नियंत्रक, इंदिरा गांधी कृषि विश्वविद्यालय, रायपुर 492012 (छत्तीसगढ़)।
- संचालक अनुसंधान/विस्तार सेवायें, इंदिरा गांधी कृषि विश्वविद्यालय, रायपुर 492012 (छत्तीसगढ़)।
- अधिष्ठाता छात्र कल्याण, इंदिरा गांधी कृषि विश्वविद्यालय, रायपुर 492012 (छत्तीसगढ़)।
- अधिष्ठाता, कृषि महाविद्यालय, कृषक नगर, रायपुर 492012 (छत्तीसगढ़)।
- अधिष्ठाता, स्वामी विवेकानंद कृषि अभियांत्रिकी एवं प्रौद्योगिकी महाविद्यालय एवं अनुसंधान केन्द्र, कृषक नगर, रायपुर 492012 (छत्तीसगढ़)।
- अधिष्ठाता, खाद्य प्रौद्योगिकी महाविद्यालय, कृषक नगर, रायपुर 492012 (छत्तीसगढ़)।
- अधिष्ठाता, बैरिस्टर ठाकुर छेदीलाल कृषि महाविद्यालय एवं अनुसंधान केन्द्र, सरकंडा, बिलासपुर 495001 (छत्तीसगढ़)।
- अधिष्ठाता, राजमोहिनी देवी कृषि महाविद्यालय एवं अनुसंधान केन्द्र, अजिरमा, अम्बिकापुर 497001 (छत्तीसगढ़)।
- अधिष्ठाता, शहीद गुण्डाधर कृषि महाविद्यालय एवं अनुसंधान केन्द्र, कुमहरावन्ड, जगदलपुर 494001 (छत्तीसगढ़)।
- अधिष्ठाता, संत कबीर कृषि महाविद्यालय एवं अनुसंधान केन्द्र, कवर्धा 491995 (छत्तीसगढ़)।
- अधिष्ठाता, कृषि महाविद्यालय एवं अनुसंधान केन्द्र, जिला अस्पताल के पिछे, जर्वे (च), जंजगीर चापा 495668 (छत्तीसगढ़)।
- अधिष्ठाता, दाऊ कल्याण सिंह कृषि महाविद्यालय एवं अनुसंधान केन्द्र, खपराडीह, भाटापाड़ा, जिला-बलौदा बाजार भाटापाड़ा 493118 (छत्तीसगढ़)।
- अधिष्ठाता, पं. शिव कुमार शास्त्री कृषि महाविद्यालय एवं अनुसंधान केन्द्र, राजनांदगांव 491 441 (छत्तीसगढ़)।
- अधिष्ठाता, कृषि महाविद्यालय एवं अनुसंधान केन्द्र, कांकेर 494 334 (छत्तीसगढ़)।
- अधिष्ठाता, कृषि महाविद्यालय एवं अनुसंधान केन्द्र, शासकीय बालक हायर सेकेंडरी स्कूल के पास, बेमेतरा 491 335 (छत्तीसगढ़)।
- अधिष्ठाता, कृषि महाविद्यालय एवं अनुसंधान केन्द्र, बैकुण्ठपुर, कोरिया 497 335 (छत्तीसगढ़)।
- अधिष्ठाता, कृषि महाविद्यालय एवं अनुसंधान केन्द्र, बोईरदादर फार्म, रायगढ़ 496 001 (छत्तीसगढ़)।
- अधिष्ठाता, कृषि महाविद्यालय एवं अनुसंधान केन्द्र, कृषि विज्ञान केन्द्र केम्पस, ग्राम-केरलापाल, नारायणपुर 494661 (छत्तीसगढ़)।
- अधिष्ठाता, कृषि महाविद्यालय एवं अनुसंधान केन्द्र, छुईखदान, राजनांदगांव (छत्तीसगढ़)।
- अधिष्ठाता, कृषि महाविद्यालय एवं अनुसंधान केन्द्र, जशपुर (छत्तीसगढ़)।
- अधिष्ठाता, कृषि महाविद्यालय एवं अनुसंधान केन्द्र, कोरबा (छत्तीसगढ़)।
- अधिष्ठाता, कृषि महाविद्यालय एवं अनुसंधान केन्द्र, कुरुद, धमतरी (छत्तीसगढ़)।
- अधिष्ठाता, कृषि महाविद्यालय एवं अनुसंधान केन्द्र, गरियाबंद (छत्तीसगढ़)।
- अधिष्ठाता, कृषि महाविद्यालय एवं अनुसंधान केन्द्र, महासमुन्द (छत्तीसगढ़)।
- अधिष्ठाता, कृषि महाविद्यालय एवं अनुसंधान केन्द्र, मर्मा (पाटन), दुर्ग (छत्तीसगढ़)।
- अधिष्ठाता, कृषि महाविद्यालय एवं अनुसंधान केन्द्र, साजा, बेमेतरा (छत्तीसगढ़)।
- अधिष्ठाता, कृषि महाविद्यालय, कृषि महाविद्यालय एवं अनुसंधान केन्द्र, लोरमी (छत्तीसगढ़)।
- अधिष्ठाता, कृषि महाविद्यालय एवं अनुसंधान केन्द्र, पखांजूर, कांकेर (छत्तीसगढ़)।
- अधिष्ठाता, कृषि महाविद्यालय एवं अनुसंधान केन्द्र, प्रतापपुर, सूरजपुर (छत्तीसगढ़)।
- अधिष्ठाता, कृषि महाविद्यालय एवं अनुसंधान केन्द्र, शंकरगढ़, बलरामपुर (छत्तीसगढ़)।
- अधिष्ठाता, भवनीलाल रामलाल साव मेमोरियल कृषि अभियांत्रिकी एवं प्रौद्योगिकी महाविद्यालय एवं अनुसंधान केन्द्र, मुंगेली 495334 (छत्तीसगढ़)।

33. प्राध्यापक एवं विभागाध्यक्ष, सस्य विज्ञान विभाग / आनुवंशिकी एवं पादप प्रजनन विभाग / कीट विज्ञान विभाग / पौध रोग विज्ञान विभाग / पादप कार्यिकी, कृषि जैव रसायन, औषधीय एवं संगंध पौध विभाग / कृषि अर्थशास्त्र विभाग / सूक्ष्म जीव विज्ञान विभाग / मृदा विज्ञान विभाग / कृषि मौसम विज्ञान विभाग / कृषि सांख्यिकी एवं सामाजिक विज्ञान विभाग / आपत्क जीव विज्ञान एवं जैव प्रौद्योगिकी विभाग / कृषि विस्तार शिक्षा विभाग / वन संवर्धन एवं कृषि वानिकी विभाग / कृषि व्यवसाय एवं ग्रामीण प्रबंधन विभाग / फल विज्ञान विभाग / सब्जी विज्ञान विभाग / पुष्प विज्ञान एवं भूदृश्य विभाग, कृषि महाविद्यालय, रायपुर, कृषक नगर, रायपुर 492012 (छत्तीसगढ़)।
प्राध्यापक एवं विभागाध्यक्ष, कृषि मशीनरी एवं शक्ति अभियांत्रिकी विभाग / मृदा एवं जल संरक्षण अभियांत्रिकी विभाग / प्रसंस्करण एवं खाद्य अभियांत्रिकी विभाग, स्वामी विवेकानंद कृषि अभियांत्रिकी एवं प्रौद्योगिकी महाविद्यालय एवं अनुसंधान केन्द्र, कृषक नगर, रायपुर 492012 (छत्तीसगढ़)।
34. पुस्तकालयाध्यक्ष, नेहरु पुस्तकालय/ओ.एस.डी. (स्थापना)/ओ.एस.डी. (लेखा)/उप-कुलसचिव (स्थापना)/ उप-लेखनियंत्रक/ प्रमारी, पीजी सेल/उप परीक्षा नियंत्रक/सहायक परीक्षा नियंत्रक/सूचना एवं जनसंपर्क अधिकारी/सहायक कुलसचिव (स्थापना)/सहायक लेखनियंत्रक/समस्त शाखा अधिकारी (विश्वविद्यालय प्रशासनिक भवन), इंदिरा गांधी कृषि विश्वविद्यालय, कृषक नगर, रायपुर 492012 (छत्तीसगढ़)।
35. नोडल अधिकारी (आईजीकेवीएमआईएस), नालेज एण्ड टेक्नालॉजी रिसोर्स सेंटर, इंदिरा गांधी कृषि विश्वविद्यालय, कृषक नगर, रायपुर 492012 (छत्तीसगढ़)।
36. सर्वर प्रमारी, विश्वविद्यालय वेबसाईट, इंदिरा गांधी कृषि विश्वविद्यालय, कृषक नगर, रायपुर की ओर सर्वसंबंधितों को ई-मेल करने एवं विश्वविद्यालय की वेबसाईट में अपलोड करने हेतु।
37. सहायक कुलसचिव/शाखा अधिकारी (शैक्षणिक)/शैक्षणिक-दो तथा शैक्षणिक-तीन, शैक्षणिक शाखा, इंदिरा गांधी कृषि विश्वविद्यालय, कृषक नगर, रायपुर को आवश्यक कार्यवाही करने हेतु प्रेषित।
38. प्राचार्य / संचालक, कृषि महाविद्यालय, जोरापाली (केनापाली) रोड, रायगढ़ (छत्तीसगढ़) / भारतीय कृषि महाविद्यालय, पद्मनाभपुर, पुलगांव चौक, दुर्ग (छत्तीसगढ़)/ छत्तीसगढ़ कृषि महाविद्यालय, सनराईस केम्पस, रिसाली (मिलाई), धनोरा रोड, ग्राम-धनोरा, पो.-हनोदा, दुर्ग (छत्तीसगढ़)/ महामाया कृषि महाविद्यालय, नगरी रोड, ग्राम-सियादेही, पो.-अरोद, धमतरी (छत्तीसगढ़)/ श्रीराम कृषि महाविद्यालय, श्रीराम परिसर, ग्राम-ठाकुरटोला, पो.-सोमनी, राजनांदगांव (छत्तीसगढ़)/ भोरमदेव कृषि महाविद्यालय, कवर्धा 491 995 (छत्तीसगढ़)/ मार्गदर्शन संस्थान कृषि महाविद्यालय, रिंग रोड, चोपड़ा पारा, अंबिकापुर, सरगुजा-497001 (छत्तीसगढ़)।
- कृपया इस अधिसूचना को स्थाई रूप से अपने कार्यालय में संधारित करने की व्यवस्था करें।

[Handwritten Signature]
कुलसचिव

Enclosure - 148.26(अ.वि.)

(Under NEP 2020)
Syllabus of Under Graduate Programme
(As per 6th Dean's committee recommendations)

B.Sc. (Hons.) Agriculture

Effective from academic session 2025-26



Indira Gandhi Krishi Vishwavidyalaya
Krishak Nagar, Raipur (Chhattisgarh) 492012

Detailed Course out line
For
Undergraduate Program in Agriculture

as per

National Education Policy 2020



**Indira Gandhi Krishi Vishwavidyalaya
Raipur (CG) 492012**

ACADEMIC PROGRAMME
Semester wise course and credits Allocation

First Year, I Semester

S. No.	Type of course	Enrolment	Subject	Course Number	Course Title	Credit Hours
1	FC	Compulsory	Multi-disciplinary	ADM 111	Deekshaarambh (1 week)	2(0+2) (NG)
2	SEC	Compulsory	Fruit Science	ASEC 111	Plantation crops production and management	4(0+4)
3	SEC	Compulsory (Any one)	Pathology	ASEC 112	Mushroom production technology	4(0+4)
4	SEC	Compulsory	Agro-met	ASEC 113	Organic Farming	4(0+4)
6	AEC	Compulsory	Extension	AEXT 111	Communication Skills	4(0+4)
7	CC	Compulsory	Agro-met	AGRO 111	Fundamentals of Agronomy	2(1+1)
8	CC	Compulsory	Soil Science	ASOIL 111	Fundamentals of Soil Science	3(2+1)
9	CC	Compulsory	Fruit Science	AHFR 111	Fundamentals of Horticulture	3(2+1)
10	MDC	Compulsory	Agro-met	AGRO 112	Farming based livelihood systems	3(2+1)
11	CC	Compulsory	Extension	AEXT 112	Rural Sociology and Educational Psychology	3(2+1)
12	VAC	Compulsory	Humanities	AHPD 111	Human value and professional ethics	2(2+0)
13	AEC	Compulsory	Student welfare	NSS I / NCC I	NSS-I / NCC-I	1(0+1) (NG)
14	Optional	Optional	Statistics	ASTAT 111	Introductory mathematics (need based)	1(0+1)
15	OC	Compulsory	Compulsory minimum 10 credits during whole degree program		Introductory mathematics (need based)	1(1+0) (NG)
Minimum Required (do not include NG courses and online courses)						21(11+10)

First Year, II Semester

1	SEC	Compulsory (Any one)	Plant Breeding	ASEC 121	Seed production technology	4(0+4)
2	SEC	Compulsory (Any one)	Fruit Sci., Veg and Floriculture	ASEC 122	Post-harvest processing technology	4(0+4)
3	SEC	Compulsory	Entomology	ASEC 123	Commercial Beekeeping	4(0+4)
5	AEC	Compulsory	Extension	AEXT 121	Personality Development	4(0+4)
6	VAC	Compulsory	Agro-met	AMET 121	Environmental Studies and Disaster Management	2(1+1)
7	CC	Compulsory	Soil Science	ASOIL 121	Soil Fertility Management	3(2+1)
8	CC	Compulsory	Entomology	AENT 121	Fundamentals of Entomology	3(2+1)
9	CC	Compulsory	Animal Sci	AVET 121	Livestock and Poultry Management	3(2+1)
10	CC	Compulsory	Pathology	APATH 121	Fundamentals of Plant Pathology	2(1+1)
11	AEC	Compulsory	Student welfare	NSS II / NCC II	NSS-II / NCC-II	3(2+1)
12	OC	Compulsory	Compulsory minimum 10 credits during whole degree program			1(0+1)
Minimum Required (do not include on-line courses)						21(10+11)
*Extension and other expert from any discipline for Personality Development and Human Values						

A	IP	Compulsory	Internship project only for those opting for an exit with UG-Certificate	10(0+10)
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Second Year I Semester

Second Year I Semester						
S. No.	Type of course	Enrolment	Subject	Course Number	Course Title	Credit Hours
1	SEC	Compulsory (Any one)	Entomology	ASEC 211	Scientific Cultivation of Silk	2(0+2)
2	SEC		Soil Science	ASEC 212	Soil, plant and water testing	2(0+2)
3	SEC		Microbiology	ASEC 213	Production technology for bioagents, biopesticides, biofertilizer	2(0+2)
4	MDC	Compulsory	Agri Business	ABM 211	Entrepreneurship Development and Business Communication	3(2+1)
5	AEC	Compulsory	Student welfare	ASW 211	Physical Education, First Aid and Yoga Practices	2(0+2)
6	CC	Compulsory	Plant Breeding	APB 211	Principles of Genetics	3(2+1)
7	CC	Compulsory	Agronomy	AGRO 211	Crop Production Technology-I (Kharif crops)	3(1+2)
8	CC	Compulsory	Fruit Science	AHFR 211	Production Technology of Fruit and Plantation Crops	2(1+1)
9	CC	Compulsory	Extension	AEXT 211	Fundamentals of Extension Education	2(1+1)
10	CC	Compulsory	Entomology	AENT 211	Fundamentals of Nematology	2(1+1)
11	CC	Compulsory	Agronomy	AGRO 212	Principles and Practices of Natural Farming	2(1+1)
12	OC	Compulsory	Compulsory minimum 10 credits during whole degree program			21(9+12)
Minimum Required (do not include on-line courses)						

Second Year II Semester

Second Year II Semester						
1	SEC	Compulsory (Any one)	Veg Science	ASEC 221	Horticulture nursery management	2(0+2)
2	SEC		Entomology	ASEC 222	Commercial Lac Cultivation	2(0+2)
3	SEC		Agronomy	ASEC 223	Rice production technology – processing, value addition and marketing	2(0+2)
4	VAC	Compulsory	Statistics	ASTAT 221	Agri informatics and Artificial Intelligence (AI)	3(2+1)
5	CC	Compulsory	Veg Science	AHVG 221	Production Technology of Vegetables and Spices	2(1+1)
6	CC	Compulsory	Economics	AEC 221	Principles of Agricultural Economics and Farm Management	2(2+0)
7	CC	Compulsory	Agronomy	AGRO 221	Crop Production Technology-II (Rabi Crops)	3(1+2)
8	CC	Compulsory	Engg	AENGG 221	Farm Machinery and Power	2(1+1)
9	CC	Compulsory	Agronomy	AGRO 222	Water Management	2(1+1)
10	CC	Compulsory	Soil Science	ASOIL 221	Problematic Soils and their management	2(1+1)
11	CC	Compulsory	Plant Breeding	APB 221	Basics of Plant Breeding	3(2+1)
12	CC	Compulsory	Entomology	AENT 221	Pest management in Crops and Stored Grains-I	2(1+1)
13	OC	Compulsory	Compulsory minimum 10 credits during whole degree program			23(12+11)
Minimum Required (do not include on-line courses)						

B	IP	Compulsory	Internship project only for those opting for an exit with UG-Diploma	10(0+10)
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Third Year I Semester

S. No.	Type of course	Enrolment	Subject	Course Number	Course Title	Credit Hours
1	MDC	Compulsory	Economics	AEC 311	Agricultural Marketing and Trade	3(2+1)
2	CC	Compulsory	Agro-met	AMET 311	Introduction to Agro-meteorology	2(1+1)
3	CC	Compulsory	Physiology	ACP 311	Fundamentals of Crop Physiology	3(2+1)
4	CC	Compulsory	Entomology	AENT 311	Pest management in Crops and Stored Grains-II	2(1+1)
5	CC	Compulsory	Plant Pathology	APATH 311	Diseases of Field & Horticultural Crops & their Management	3(2+1)
6	CC	Compulsory	Plant Breeding	APB 311	Crop Improvement - I	2(1+1)
7	CC	Compulsory	Agronomy	AGRO 311	Weed Management	2(1+1)
8	CC	Compulsory	Floriculture	AHFL 311	Ornamental Crops, MAPs and Landscaping	2(1+1)
9	CC	Compulsory	Forestry	AFOR 311	Introductory Agro-forestry	2(1+1)
10	ST	Compulsory	Student welfare	ASW 311	Study tour (10-14 days)	2(1+1)
11	OC	Compulsory	Compulsory minimum 10 credits during whole degree program			2(0+2) NG
Minimum Required (do not include NG course and online courses)						21(12+9)

Third Year II Semester

1	CC	Compulsory	Biotechnology	ABT 321	Fundamentals of Agri Biotechnology	3(2+1)
2	CC	Compulsory	Statistics	ASTAT 321	Basic and Applied Agricultural Statistics	3(2+1)
3	CC	Compulsory	Plant Breeding	APB 321	Crop Improvement - II	2(1+1)
4	CC	Compulsory	Engineering	AENG 321	Renewable energy in Agriculture and Allied Sector	2(1+1)
5	CC	Compulsory	Agronomy	AGRO 321	Dryland agriculture/ Rainfed agriculture and watershed management	2(1+1)
6	CC	Compulsory	Biotechnology	ABT 322	Essentials of Plant Biochemistry	3(2+1)
7	CC	Compulsory	Microbiology	AMB 321	Agricultural Microbiology and Bio-remediation	2(1+1)
8	CC	Compulsory	Economics	AEC 321	Agricultural Finance & Cooperation	2(1+1)
9	CC	Compulsory	Plant Breeding	APB 322	Fundamentals of Seed Science & Technology	2(1+1)
10	OC	Compulsory	Compulsory minimum 10 credits during whole degree program			21(12+9)
Minimum Required (do not include on-line courses)						21(12+9)

Forth Year I Semester

1	IP / Student READY	Compulsory	Multi-disciplinary	ASR 411	Student READY (RAWEP/ Industrial Attachment / Experiential Learning / Hands on Training/ Project Work / Internship)	20(0+20)
2	OC	Compulsory	Compulsory minimum 10 credits during whole degree program Minimum Required (do not include on-line courses)			20(0+20)

Forth Year II Semester

S. No.	Type of course	Enrolment	Subject	Course Number	Course Title	Credit Hours
1	Elective CC	Compulsory (Any five)	Agri Business	ABM 421	Agri-Business Management	4(3+1)
2	Elective CC		Agro, SWE	AGRO 421	Management of Natural Resources	4(3+1)
3	Elective CC		Ento, Path, SS	AENT 421	Agrochemicals	4(3+1)
4	Elective CC		Ag Extension	AEXT 421	Agricultural Journalism	4(3+1)
5	Elective CC		Floriculture	AHFL 421	Landscaping	4(3+1)
6	Elective CC		Plant breeding	APB 421	Commercial Plant breeding	4(3+1)
7	Elective CC		Biotechnology	ABT 421	Food safety and standards	4(3+1)
8	Elective CC		SS, Ento, Micro	ASOIL 421	Bioformulation and Nano-formulation	4(3+1)
9	Elective CC		Microbiology	AMB 421	Biopesticides and Biofertilizers	4(3+1)
10	Elective CC		Meteorology	AMET 421	System Simulation and Agro-advisory	4(3+1)
11	Elective CC		Veg Sci	AGVG 421	Hi-tech Horticulture	4(3+1)
12	Elective CC		Veg Sci	AGVG 422	Protected cultivation	4(3+1)
13	Elective CC		Meteorology	AMET 422	Climate Resilient Agriculture	4(3+1)
14	Elective CC		Biotechnology	ABT 422	Biotechnology of Crop Improvement	4(3+1)
15	Elective CC		Engineering	AENGG 421	Geoinformatics and Remote Sensing, precision farming	4(3+1)
16	Elective CC		Veg Sci	AGVG 423	Micro-propagation Technologies	4(3+1)
17	Elective CC		Plant breeding	APB 422	Commercial Seed Production	4(3+1)
18	Elective CC		Agronomy	AGRO 422	Principles and Practices of Organic Farming / Conservation Agriculture	4(3+1)
19	Elective CC		Physiology	ACP 421	Food Science and Nutrition	4(3+1)
20	Elective CC		Fruit Science	AHFR 421	Post-Harvest Technology and Value Addition	4(3+1)
21	Elective CC		Ag Extension	AEXT 422	Technology delivery and adoption	4(3+1)
22	Elective CC		Ag Extension	AEXT 423	Training Technology for capacity building	4(3+1)
23	Elective CC		Entomology	AENT 421	Vertebrates Pest Management	4(3+1)
24	Elective CC		Humanities	AHPD 421		4(3+1)
	OC	Compulsory	Compulsory minimum 10 credits during whole degree program Minimum Required (do not include on-line courses)			20(15+5)

On-line courses to be completed during the whole degree program. These courses are NON-GRADIAL

I	OC	Compulsory	Multi-disciplinary	Online courses offered by various platform like MOOCS / SWAYAM by government organizations (like UGC / ICAR / CSIR) / institutes (like IIT) / State Agriculture Universities. The course should be different than the one opted during the degree program offered by IGKV	10
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On-line courses be completed preferably within seven semesters so that their degree may be awarded timely.

General Credit Allocation Scheme of UG program

Semester	Core course (Major + Minor) CC	Multi-Disciplinary Course (MCD)	Value Added Course (VAC)	Ability Enhancement Course (AEC)	Skill Enhancement Course (SEC)	Internship / Project / Student READY (IP / Student READY)	Total Credits	Non-gradual (NG)	Online Course (OC) (NG)
I	11	3		3	4		21	2+1	
II	11		3	3	4		21		
Post-II						10			
III	14	3		2	2		21		
IV	18		3		2		23		
Post-IV						10			10
V	18	3					21	2	
VI	21						21		
VII	20						20		
VIII						20	20		
Total	113	9	6	8	12	20	168	5	10

178 (168+10) credits, plus 5 credits (Non-gradual) are minimum a student needs to opt for the during the degree program, at the most 9 credit extra can be opted over 178.

Course type coding

FC	Foundation Course
SEC	Skill Development Course
AEC	Ability Enhancement Course
CC	Core Courses
Elective CC	Elective Core course
MDC	Multi-Disciplinary Course
Optional	Optional
VAC	Value Added Course
NG	Non-gradual
OC	online courses
IP	Internship / Project
ST	Study tour

ACADEMIC PROGRAMME
Semester wise course and credits Allocation

First Year, I Semester

S. No.	Type of course	Enrolment	Subject	Course Number	Course Title	Credit Hours
1	FC	Compulsory	Multi-disciplinary	ADM 111	Deekshaarambh (1 week)	2(0+2) (NG)
2	SEC	Compulsory (Any one)	Fruit Science	ASEC 111	Plantation crops production and management	4(0+4)
3	SEC		Pathology	ASEC 112	Mushroom production technology	4(0+4)
4	SEC		Agronomy	ASEC 113	Organic Farming	4(0+4)
6	AEC	Compulsory	Extension	AEXT 111	Communication Skills	2(1+1)
7	CC	Compulsory	Agronomy	AGRO 111	Fundamentals of Agronomy	3(2+1)
8	CC	Compulsory	Soil Science	ASOIL 111	Fundamentals of Soil Science	3(2+1)
9	CC	Compulsory	Fruit Science	AHFR 111	Fundamentals of Horticulture	3(2+1)
10	MDC	Compulsory	Agronomy	AGRO 112	Farming based livelihood systems	3(2+1)
11	CC	Compulsory	Extension	AEXT 112	Rural Sociology and Educational Psychology	2(2+0)
12	VAC	Compulsory	Humanities	AHPD 111	Human value and professional ethics	1(0+1) (NG)
13	AEC	Compulsory	Student welfare	NSS I / NCC I	NSS-I / NCC-I	1(0+1)
14	Optional	Optional	Statistics	ASTAT 111	Introductory mathematics (need based)	1(1+0) (NG)
15	OC	Compulsory	Compulsory minimum 10 credits during whole degree program	Minimum Required (do not include NG courses and online courses)		21(11+10)

First Year, II Semester

1	SEC	Compulsory (Any one)	Plant Breeding	ASEC 121	Seed production technology	4(0+4)
2	SEC		Fruit Sci., Veg and Floriculture	ASEC 122	Post-harvest processing technology	4(0+4)
3	SEC		Entomology	ASEC 123	Commercial Beekeeping	4(0+4)
5	AEC	Compulsory	Extension	AEXT 121	Personality Development	2(1+1)
6	VAC	Compulsory	Agro-net	AMET 121	Environmental Studies and Disaster Management	3(2+1)
7	CC	Compulsory	Soil Science	ASOIL 121	Soil Fertility Management	3(2+1)
8	CC	Compulsory	Entomology	AENT 121	Fundamentals of Entomology	3(2+1)
9	CC	Compulsory	Animal Sci	AVET 121	Livestock and Poultry Management	2(1+1)
10	CC	Compulsory	Pathology	APATH 121	Fundamentals of Plant Pathology	3(2+1)
11	AEC	Compulsory	Student welfare	NSS II / NCC II	NSS-II / NCC-II	1(0+1)
12	OC	Compulsory	Compulsory minimum 10 credits during whole degree program	Minimum Required (do not include on-line courses)		21(10+11)

*Extension and other expert from any discipline for Personality Development and Human Values

A	IP	Compulsory	Internship project only for those opting for an exit with UG-Certificate	10(0+10)
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Second Year I Semester

S. No.	Type of course	Enrolment	Subject	Course Number	Course Title	Credit Hours
1	SEC	Compulsory (Any one)	Entomology	ASEC 211	<i>Scientific Cultivation of Silk</i>	2(0+2)
2	SEC		Soil Science	ASEC 212	<i>Soil, plant and water testing</i>	2(0+2)
3	SEC		Microbiology	ASEC 213	Production technology for bioagents, biopesticides, biofertilizer	2(0+2)
4	MDC	Compulsory	Agri Business	ABM 211	Entrepreneurship Development and Business Communication	3(2+1)
5	AEC	Compulsory	Student welfare	ASW 211	Physical Education, First Aid and Yoga Practices	2(0+2)
6	CC	Compulsory	Plant Breeding	APB 211	Principles of Genetics	3(2+1)
7	CC	Compulsory	Agronomy	AGRO 211	Crop Production Technology-I (Kharif crops)	3(1+2)
8	CC	Compulsory	Fruit Science	AHFR 211	Production Technology of Fruit and Plantation Crops	2(1+1)
9	CC	Compulsory	Extension	AEXT 211	Fundamentals of Extension Education	2(1+1)
10	CC	Compulsory	Entomology	AENT 211	Fundamentals of Nematology	2(1+1)
11	CC	Compulsory	Agronomy	AGRO 212	Principles and Practices of Natural Farming	2(1+1)
12	OC	Compulsory	Compulsory minimum 10 credits during whole degree program			
Minimum Required (do not include on-line courses)						21(9+12)

Second Year II Semester

1	SEC	Compulsory (Any one)	Veg Science	ASEC 221	Horticulture nursery management	2(0+2)
2	SEC		Entomology	ASEC 222	Commercial Lac Cultivation	2(0+2)
3	SEC		Agronomy	ASEC 223	Rice production technology – processing, value addition and marketing	2(0+2)
4	VAC	Compulsory	Statistics	ASTAT 221	Agri informatics and Artificial Intelligence (AI)	3(2+1)
5	CC	Compulsory	Veg Science	AHVG 221	Production Technology of Vegetables and Spices	2(1+1)
6	CC	Compulsory	Economics	AEC 221	Principles of Agricultural Economics and Farm Management	2(2+0)
7	CC	Compulsory	Agronomy	AGRO 221	Crop Production Technology-II (Rabi Crops)	3(1+2)
8	CC	Compulsory	Engg	AENG 221	Farm Machinery and Power	2(1+1)
9	CC	Compulsory	Agronomy	AGRO 222	Water Management	2(1+1)
10	CC	Compulsory	Soil Science	ASOIL 221	Problematic Soils and their management	2(1+1)
11	CC	Compulsory	Plant Breeding	APB 221	Basics of Plant Breeding	3(2+1)
12	CC	Compulsory	Entomology	AENT 221	Pest management in Crops and Stored Grains-I	2(1+1)
13	OC	Compulsory	Compulsory minimum 10 credits during whole degree program			
Minimum Required (do not include on-line courses)						23(12+11)

B	IP	Compulsory	Internship project only for those opting for an exit with UG-Diploma			10(0+10)
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Third Year I Semester

S. No.	Type of course	Enrolment	Subject	Course Number	Course Title	Credit Hours	
1	MDC	Compulsory	Economics	AEC 311	Agricultural Marketing and Trade	3(2+1)	
2	CC	Compulsory	Agro-met	AMET 311	Introduction to Agro-meteorology	2(1+1)	
3	CC	Compulsory	Physiology	ACP 311	Fundamentals of Crop Physiology	3(2+1)	
4	CC	Compulsory	Entomology	AENT 311	Pest management in Crops and Stored Grains-II	2(1+1)	
5	CC	Compulsory	Plant Pathology	APATH 311	Diseases of Field & Horticultural Crops & their Management	3(2+1)	
6	CC	Compulsory	Plant Breeding	APB 311	Crop Improvement - I	2(1+1)	
7	CC	Compulsory	Agronomy	AGRO 311	Weed Management	2(1+1)	
8	CC	Compulsory	Floriculture	AHFL 311	Ornamental Crops, MAPs and Landscaping	2(1+1)	
9	CC	Compulsory	Forestry	AFOR 311	Introductory Agro-forestry	2(1+1)	
10	ST	Compulsory	Student welfare	ASW 311	Study tour (10-14 days)	2(0+2) NG	
11	OC	Compulsory	Compulsory minimum 10 credits during whole degree program				
Minimum Required (do not include NG course and online courses)						21(12+9)	

Third Year II Semester

1	CC	Compulsory	Biotechnology	ABT 321	Fundamentals of Agri Biotechnology	3(2+1)
2	CC	Compulsory	Statistics	ASTAT 321	Basic and Applied Agricultural Statistics	3(2+1)
3	CC	Compulsory	Plant Breeding	APB 321	Crop Improvement - II	2(1+1)
4	CC	Compulsory	Engineering	AENG 321	Renewable energy in Agriculture and Allied Sector	2(1+1)
5	CC	Compulsory	Agronomy	AGRO 321	Dryland agriculture/ Rainfed agriculture and watershed management	2(1+1)
6	CC	Compulsory	Biotechnology	ABT 322	Essentials of Plant Biochemistry	3(2+1)
7	CC	Compulsory	Microbiology	AMB 321	Agricultural Microbiology and Bio-remediation	2(1+1)
8	CC	Compulsory	Economics	AEC 321	Agricultural Finance & Cooperation	2(1+1)
9	CC	Compulsory	Plant Breeding	APB 322	Fundamentals of Seed Science & Technology	2(1+1)
10	OC	Compulsory	Compulsory minimum 10 credits during whole degree program			
Minimum Required (do not include on-line courses)						21(12+9)

Forth Year I Semester

1	IP / Student READY	Compulsory	Multi-disciplinary	ASR 411	Student READY (RAWEP/ Industrial Attachment /Experiential Learning / Hands on Training/ Project Work / Internship)	20(0+20)
2	OC	Compulsory	Compulsory minimum 10 credits during whole degree program			
Minimum Required (do not include on-line courses)						20(0+20)

Forth Year II Semester

S. No.	Type of course	Enrolment	Subject	Course Number	Course Title	Credit Hours
1	Elective CC	Compulsory (Any five)	Agri Business	ABM 421	Agri-Business Management	4(3+1)
2	Elective CC		Agro, SWE	AGRO 421	Management of Natural Resources	4(3+1)
3	Elective CC		Ento, Path, SS	AENT 421	Agrochemicals	4(3+1)
4	Elective CC		Ag Extension	AEXT 421	Agricultural Journalism	4(3+1)
5	Elective CC		Floriculture	AHFL 421	Landscaping	4(3+1)
6	Elective CC		Plant breeding	APB 421	Commercial Plant breeding	4(3+1)
7	Elective CC		Biotechnology	ABT 421	Food safety and standards	4(3+1)
8	Elective CC		SS, Ento, Micro	ASOIL 421	Bioformulation and Nano-formulation	4(3+1)
9	Elective CC		Microbiology	AMB 421	Biopesticides and Biofertilizers	4(3+1)
10	Elective CC		Meteorology	AMET 421	System Simulation and Agro-advisory	4(3+1)
11	Elective CC		Veg Sci	AGVG 421	Hi-tech Horticulture	4(3+1)
12	Elective CC		Veg Sci	AGVG 422	Protected cultivation	4(3+1)
13	Elective CC		Meteorology	AMET 422	Climate Resilient Agriculture	4(3+1)
14	Elective CC		Biotechnology	ABT 422	Biotechnology of Crop Improvement	4(3+1)
15	Elective CC		Engineering	AENG 421	Geoinformatics and Remote Sensing, precision farming	4(3+1)
16	Elective CC		Veg Sci	AGVG 423	Micro-propagation Technologies	4(3+1)
17	Elective CC		Plant breeding	APB 422	Commercial Seed Production	4(3+1)
18	Elective CC		Agronomy	AGRO 422	Principles and Practices of Organic Farming / Conservation Agriculture	4(3+1)
19	Elective CC		Physiology	ACP 421	Food Science and Nutrition	4(3+1)
20	Elective CC		Fruit Science	AHFR 421	Post-Harvest Technology and Value Addition	4(3+1)
21	Elective CC		Ag Extension	AEXT 422	Technology delivery and adoption	4(3+1)
22	Elective CC		Ag Extension	AEXT 423	Training Technology for capacity building	4(3+1)
23	Elective CC		Entomology	AENT 421	Vertebrates Pest Management	4(3+1)
24	Elective CC		Humanities	AHPD 421		4(3+1)
	OC	Compulsory	Compulsory minimum 10 credits during whole degree program			
Minimum Required (do not include on-line courses)						20(15+5)

On-line courses to be completed during the whole degree program. These courses are NON-GRADIAL

1	OC	Compulsory	Multi-disciplinary	Online courses offered by various platform like MOOCS / SWAYAM by government organizations (like UGC / ICAR / CSIR) / institutes (like IIT) / State Agriculture Universities. The course should be different than the one opted during the degree program offered by IGKV	10
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On-line courses be completed preferably within seven semesters so that their degree may be awarded timely.

General Credit Allocation Scheme of UG program

Semester	Core course (Major + Minor) CC	Multi-Disciplinary Course (MCD)	Value Added Course (VAC)	Ability Enhancement Course (AEC)	Skill Enhancement Course (SEC)	Internship / Project / Student READY (IP / Student READY)	Total Credits	Non-gradual (NG)	Online Course (OC) (NG)
I	11	3		3	4		21	2+1	
II	11		3	3	4		21		
Post-II						10			
III	14	3		2	2		21		
IV	18		3		2		23		
Post-IV						10			10
V	18	3					21	2	
VI	21						21		
VII	20						20		
VIII						20	20		
Total	113	9	6	8	12	20	168	5	10

178 (168+10) credits, plus 5 credits (Non-gradual) are minimum a student needs to opt for the during the degree program, at the most 9 credit extra can be opted over 178.

Course type coding

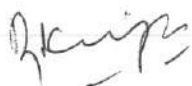
FC	Foundation Course
SEC	Skill Development Course
AEC	Ability Enhancement Course
CC	Core Courses
Elective CC	Elective Core course
MDC	Multi-Disciplinary Course
Optional	Optional
VAC	Value Added Course
NG	Non-gradual
OC	online courses
IP	Internship / Project
ST	Study tour

Objectives:

1. Help for cultural Integration of students from different backgrounds,
2. Know about the operational framework of academic process in the University/College/Institute
3. Instilling life and social skills,
4. Social Awareness, Ethics and Values, Team Work, Leadership, Creativity, etc.
5. Identify the traditional values and indigenous cultures along with diverse potentialities both in indigenous and developed scenario.
6. Identify strength and weakness of the students in different core areas of the discipline.

The overall structure shall include, but not restricted to:

- i. Discussions on operational framework of academic process in the University, as well as interactions with academic & research managers of the University
- ii. Interaction with alumni, business leaders, perspective employers, outstanding achievers in related fields, and people with inspiring life experiences
- iii. Group activities to identify the strength and weakness of students (with expert advice for their improvement) as well as to create a platform for students to learn from each other's life experiences
- iv. Activities to enhance cultural Integration of students from different backgrounds.
- v. Field visits to related fields/ establishments vi. Sessions on personality development (instilling life and social skills, social awareness, ethics and values, team work, leadership, etc.) and communication skills



1. Description and identification of coconut varieties
2. Selection of coconut and arecanut mother palm and seed nut
3. Planting of seed nuts in nursery, layout and planting of coconut, arecanut, oil palm, cashew nut, cacao gardens,
4. Manuring, irrigation; mulching, raising masonry nursery for palm,
5. Nursery management in cacao.
6. Description and identification of species and varieties in coffee, harvesting, grading, pulping, fermenting, washing, drying and packing of coffee, seed berry collection, seed extraction, treatment and sowing of coffee, epicotyl, softwood,
7. Grafting and top working in cashew, working out the economics and project preparation for coconut, arecanut, oil palm, cashew nut, cacao, etc.
8. Mother plant selection, preparation of cuttings and rooting of tea under specialized structure, training, centering, pruning, tipping and harvesting of tea

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1. Mushroom Diversity: Edible, Poisonous, Mycorrhizal and medicinal mushrooms
2. Identification, Taxonomy and Characterization of Mushrooms
3. Global status of Mushroom Spawn and Crop Production and its export from India
4. Mushroom cultivation & research in India
5. Medicinal and Nutraceutical Attributes of Mushroom
6. Acquaintance with different instruments used in mushroom spawn production
7. Pure Culture Techniques in Mushroom Spawn production and Strain Improvement
8. Preparation of mother and commercial spawn and their maintenance
9. Low Cost Techniques for Spawn Production at Village level
10. Advances in Composting during Button Mushroom Production
11. Commercial Production technology of Button Mushroom
12. Techniques of Strain Improvement in cultivable mushrooms
13. Seasonal Growing of Button Mushrooms
14. Pipe Technology of Seasonal Button Mushroom Production and Mushroom entrepreneurship
15. Recent advances in the cultivation technology of paddy straw mushroom
16. Cultivation of Paddy Straw Mushroom
17. Post-Harvest Processing of Paddy Straw mushroom
18. Milky Mushroom Production Technology
19. Production Technology of Oyster Mushroom
20. Cultivation of Lion's Mane (*Hericium* sp.) and Split gill Mushroom (*S. commune*)
21. Specialty Mushrooms (*Auricularia*, *Flammulina*, *Ganoderma*): Cultivation Prospects
22. Strainal Improvement and Cultivation Technology of Shitake Mushroom
23. Post-harvest Processing and management of Mushrooms
24. Important biotic stresses and their management in mushroom cultivation
25. Recycling of Spent Mushroom Substrate
26. Mushroom recipes and their value-added products
27. Extension Approaches for Popularization of Mushrooms
28. Field visits, Interaction and Success stories of progressive Mushroom Growers and Women SHGs in Chhattisgarh
29. Marketing Strategies, Start-Ups and Funding Avenues in Mushroom



1. Organic farming and present status and development; principles of organic farming: benefits and scope of organic farming.
2. Chemical farming vs organic farming
3. Organic Production Technology
4. International, National and State norms of organic farming
5. Farm designing, Planning and layout of organic farm, Buffer zone
6. Land preparation, tillage, Choice of crops and varieties, Seed treatment and planting, Water management and Contamination Control
7. Crop rotation, cropping pattern and cropping systems, intercropping, Farming system, Integrated farming system, Livestock management in organic farming, Farm implement
8. Indigenous Technical Knowledge
9. Initiatives taken by the central and state governments, NGOs and other organizations for promotion of organic agriculture in India.
10. Nutrient use in organic farming, Residue recycling: Preparation of enriched farm yard manure, Preparation of different methods of composting viz, Indore method, Bangalore methods, Coimbatore method and NADEP method, Vermicompost, Application of compost, Different methods of bio-fertilizers (*Azotobacter*, *Azospirillum*, *Azolla*, *BGA*, *Rhizobium*, *PSB* and *VAM*) application in various crops. Preparation and application of liquid manures viz. Vermi wash, Jeevamrit, Panchagavya, Amrit pani etc,
11. Fundamentals of insect, disease and weed management under organic mode of production-cultural, mechanical and biological methods- non-chemical pest & disease management. Mulching: types, advantages, Identification of beneficial farm insect, Botanical pesticide preparation of Neem products and other botanicals for pest and disease control viz. Neemastra, Agnishtra, Brahmanastra Beejamrit, Deshparni etc. Use of eco-friendly insect management techniques viz. Pheromone trap, light trap, yellow cards, bird perch etc. for monitoring and insect management purpose, Dose calculation and application method of bio-pesticides viz. *Trichogramma*, *Pseudomonas*, *Fusarium*, *Bacillus thuringiensis*, *Metrhizium* and *Beauvaria bassnia*; Ha- NPV and SL-NPV etc. Myco-herbicides.
12. Visit of organic farm and field based organic experiments to study the various components, visit to organic clusters and bio control lab to study the maintenance of biofertilizers/bio-inoculant cultures, Case studies of Indigenous Technical knowledge (ITK) for nutrient, insect, pest, disease and weed management.
13. Organic certification- Requirement, guidelines, agencies, registration, documentation, advantages and procedure of organic certification, Visit to organic certification agencies for understating certification procedure. Various Current Government schemes related to organic farming. Crop production standards, Quality consideration- labelling and accreditation procedures for organic products, Marketing Strategies of organic produces – past experiences and future prospects, import and export policies, requirements for export, agencies involved in export of organic produce and incentives for organic production & geo-tagging. Start-Ups and Funding Avenues in Organic farming.

Objective

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

Theory:**Unit-I**

Communication: Concept, meaning, definition and principles of communication. The magic of affective communication; Building self-esteem and overcoming fears. Nature and significance of communication process. Various elements of communication. Importance of communication in agricultural development.

Unit-II

Communication Process: Models of communication; Types of communication; Verbal and non-verbal communication; Linguistic and non-linguistic barriers to communication and reasons behind communication gap/miscommunication. Noise and distortions in communication process

Unit-III Basic

Communication Skills: Listening, Speaking, Reading and Note taking. Writing Skills; Precise writing, Abstracting, Summarizing; Style of technical article writing, Curriculum vitae/resume writing; Innovative methods to enhance vocabulary, analogy questions

Unit-IV

Supporting Communication Skills: Individual and group presentations, impromptu presentation. Introduction to group discussion. Public speaking, stage manners and body language. Writing technical and research articles. Letter writing. Effective business correspondences.

Unit-V

Structural and Functional Grammar: Sentence structure, connecting words and verbal's; phrases and clauses, Case: subjective, possessive and 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

1. Listening and note taking
2. Writing skills: précis writing, summarizing and abstracting, letter writing
3. Reading and comprehension (written and oral) of general and technical articles
4. Presentation skill and Impromptu Presentations: Feedback on presentations
5. Stage manners: grooming, body language, voice modulation and speed
6. Group discussions
7. Public speaking exercises
8. Vocabulary building exercise

Suggested readings

1. Allport, GW, 1937, Personality: A Psychological Interpretation. Holt, New York.
2. Brown Michele & Gyles Brandreth, 1994, How to Interview and be Interviewed. Sheldon Press, London.
3. Carnegie Dale, 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 AJ and Martinet AV, 1977, A Practical English Grammar. Oxford University

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Objectives: To impart the basic and fundamental knowledge of Agronomy.

Theory:

Unit – I

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.

Unit –II

Tillage and till: 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 /un-combined forms

Unit – III

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: 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,

Unit – IV

Water management: Water resources of the world, India and the state; Soil Moisture Constants –gravitational water, capillary water, hygroscopic water, Soil moisture constants, Concept of water availability to plants, soil- plant-water relationship, crop water requirement, water use efficiency, Methods of irrigation: Scheduling of irrigation, different approaches of scheduling irrigation

Unit-V

Weeds: Definition, Importance and basics of classification of weeds and their control
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:

1. A visit to Instructional Crop farm and study on field crops,
2. Identification of crops, seeds, fertilizers, pesticides
3. Crops and cropping systems in different Agro-climatic zones of the state
4. Study of some preparatory tillage implements, Study of inter tillage implements
5. Practice of ploughing / puddling, Study and practice of inter cultivation in field crops
6. Numerical exercises on calculation of seed, plant population and fertilizer requirement
7. Study of yield contributing characters and yield estimation of crops
8. Identification of weeds in different crops
9. Seed germination and viability test of seed
10. Practice on time and method of application of manures and fertilizers
11. Measurement of soil moisture by gravimetric and volumetric method
12. Determination of bulk density, Determination of field capacity
13. Determination of gross and net irrigation requirement
14. Determination of infiltration rate

Suggested readings:

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

Theory:**Unit-I**

Soil- Pedological and edaphological concepts. Rocks and minerals, weathering, soil formation, soil profile, Components of soil. soil temperature, soil air, soil water.

Unit-II

Soil colour, soil texture, soil structure. bulk density and particle density, soil consistency and plasticity soil temperature, soil air, soil water.

Unit-III

Soil reaction and buffering capacity. Soil colloids- Inorganic and organic, silicate clays: constitution and properties. Sources of charge on soil colloids. Ion exchange, cation exchange capacity, base saturation.

Unit-IV

Soil taxonomy, keys to soil orders. Soils of India and Chhattisgarh

Unit-V

Soil organic matter: composition, properties and its influence on soil properties. Soil organisms, macro and microorganisms, their beneficial and harmful effects. Soil pollution, prevention and mitigation of soil pollution

Practical

1. Study of general properties of minerals,
2. study of minerals-silicate and non-silicate minerals,
3. study of rocks-igneous, sedimentary and metamorphic rocks;
4. study of a soil profile, collection and processing of soil for analysis,
5. study of soil texture-feel method, mechanical analysis, determination of bulk density, particle density and soil porosity,
6. determination of soil colour, determination of soil moisture, Study of infiltration rate of soil
7. Introduction to analytical chemistry and expression of strength of solutions.
8. Introduction to titrimetric analysis.
9. Determination of soil pH and electrical conductivity
10. Estimation of organic matter content of soil

Suggested Readings:

1. Soil science- An Introduction (2015): Indian Society of Soil Science, New Delhi.
2. डॉ विनय सिंह और डॉ संदीप सिंह (2014): मृदा विज्ञान-उर्वरक एवं खाद, भारती भंडार मेरठ.
3. अबदेश प्रताप सिंह: मृदा विज्ञान के मूलभूत तत्व, कल्याणी पब्लिशरलुधियाना
4. Dr. D. K. Das (2022); Introductory Soil Science, Kalyani Publishers. Ludhiana.
5. S. J. Rajput: Concept of Soil Science, Kalyani Publishers. Ludhiana.
6. Patil and Mali (1999); Fundamentals of Soil Science, Aman publishing house, Meerut



Objectives:

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

Theory:**Unit I**

Horticulture- Definition, branches, importance and scope. Botanical classification of Horticultural crops, Soil and climate requirement for Horticultural Crops. Introduction of Medicinal and Aromatic plants.

Unit II

Plant propagation methods and propagation structures. Causes and types of seed dormancy and their remedial measures. Seed germination- types, process and factor affecting seed germination.

Unit III

Principles of orchard establishment. Principles and methods of training and pruning of fruit crops.

Unit IV

Juvenility and flower bud differentiation of fruit crops. Unfruitfulness in fruit orchard, pollination, pollinizers and pollinators, fertilization and parthenocarpy.

Unit V

Importance and applications of bio-regulators in Horticultural crops. Irrigation methods and Fertilizer application, fertigation and water-soluble fertilizers in Horticultural crops.

Practical:

1. Identification and nomenclature of fruits.
2. Layout of fruit orchard.
3. Digging of pit and system of planting.
4. Nursery raising techniques of fruit crops.
5. Understanding of plant propagation structures.
6. Propagation through seeds and plant parts.
7. Containers, potting mixture, potting and repotting.
8. Propagation of plants through cutting and layering.
9. Propagation plants through budding and grafting.
10. Training and pruning methods in fruit crops.
11. Preparation of fertilizer mixture and application.
12. Preparation and application of plant growth regulators.
13. Layout of different irrigation systems.
14. Maturity studies, harvesting, grading, packaging and storage.

Suggested readings:

1. Basics of Horticulture by Jitendra Singh
2. Introduction to Horticulture by N. Kumar
3. Handbook of Horticulture by K.L. Chadda

Objectives:

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

Theory**Unit – I**

Status of agriculture in India and different states, Income of farmers and rural people in India, Livelihood-Definition, concept and livelihood pattern in urban & rural areas, Different indicators to study livelihood systems.

Unit – II

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.

Unit – III

Types of traditional & modern farming systems. Components of farming system/ farming based livelihood systems- Crops and cropping systems, Livestock, (Dairy, Piggery, Goatry, Poultry, Duckry etc.), Horticultural crops, Agro-forestry systems, Aqua culture Duck/Poultry cum Fish, Dairy cum Fish, Piggery cum Fish etc., Small, medium and large enterprises including value chains and secondary enterprises as livelihood components for farmers, Factors affecting integration of various enterprises of farming for livelihood.

Unit – IV

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.

Unit-V

Risk & success factors in farming-based livelihood systems, Schemes & programmes by Central & State Government, Public & 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 & changing life style.

Practical:

1. Survey of farming systems and agricultural based livelihood enterprises,
2. Study of components of important farming-based livelihood models/ systems in different agro-climatic zones,
3. Study of production and profitability of crop based, livestock based, processing based and integrated farming-based livelihood models,
4. Field visit of innovative farming system models.
5. Visit of Agri-based enterprises & their functional aspects for integration of production, processing & distribution sectors
6. Study of agri-enterprises involved in industry and service sectors (Value Chain Models),
7. Learning about concept of project formulation on farming-based livelihood systems along with cost & profit analysis,
8. Case study of Start-Ups in agri-sectors.

Suggested readings:

1. Dixon, J. and A. Gulliverwith D. Gibbon (2001). Farming Systems and Poverty: Improving Farmers' Livelihoods in a Changing World. FAO & World Bank, Rome, Italy & Washington, DC, USA
2. Ashley, C.; Carney, D. (1999). Sustainable Livelihoods: Lessons from Early Experience; Department for International Development: London, UK.; Volume 7
3. Reddy, S.R. 2016. Farming System and Sustainable Agriculture, Kalyani Publishers, New Delhi.
4. Panwar et al. 2020. Integrated Farming System models for Agricultural Diversification, Enhanced Income and employment, Indian Council of Agricultural Research, New Delhi.
5. Singh, J.P., et al. 2015. Region Specific Integrated Farming System Models, ICAR-Indian Institute of Farming Systems Research, Modipuram. Walia, S. S. and U. S. Walia, 2020. Farming System and Sustainable Agriculture, Scientific Publishers, Jodhpur, Rajasthan.
6. Livelihood Improvement of Underprivileged Farming Community: Some Experiences from Vaishali, Samastipur, Darbhanga and Munger Districts of Bihar by B. P. Bhatt, 8Abhay Kumar, P.K. Thakur, Amitava Dey Ujjwal Kumar, Sanjeev Kumar, B.K. Jha, L9okendra Kumar, K. N.

Pathak, A. Hassan, S. K. Singh, K. K. Singh and K. M. Singh ICAR Research Complex for Eastern Region ICAR Patna, P.O. Bihar Veterinary College, Patna - 800 014, Bihar

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



Objective:

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

Theory:**Unit-I**

Sociology and Rural sociology: Meaning, Definition, Scope, Importance of Rural Sociology in Agricultural Extension, and Interrelationship between Rural Sociology & Agricultural Extension. Indian Rural Society, Important characteristics, Differences and Relationship between Rural and Urban societies.

Unit-II

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 & Caste System.

Unit-III

Cultural concepts- Culture, Customs, Folkways, Mores, Taboos, Rituals and Traditions- Meaning, Definition and their Role 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.

Unit-IV

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. Advantages and Limitations in use of local leaders in Agricultural Extension.

Unit-V

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. Motivation- Concept and types of motivation. 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. J.B. Chitambar-Introductory Rural Sociology
2. Ray, G.L. -Extension Communication and Management
3. Dahama O.P. and Bhatnagar, O.P.-Education and Communication for Development
4. Sandhu A.S.- Text book on Agricultural Communication
5. A.R. Desai-Rural Sociology in India
6. R Velusamy Textbook on Rural Sociology and Educational Psychology
7. M.B. Ghorpade- Essential of psychology
8. Web Materials
9. Prepared YouTube videos

Thank 9/5/25

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Objectives:

Understanding human values, Professional ethics, Critical thinking, Moral reasoning and Personal & professional development

Practical:

- Values and Ethics-An Introduction.
- Human being as a co-existence of the Self and the Body
- Goal and Mission and Vision of Life
- Values in Human-to-Human Relationship,
- Values in Professional Relationship – Honesty, Cooperation, Contribution
- Professional Ethics in the light of Right Understanding
- Trust – the Foundational Value in Relationship & Respect – as the Right Evaluation,
- Understanding Harmony in the Nature, Balance in production system – sustainability.
- Decision Making: factors, resources, cause and effect, fear and greed
- Need, Aspiration, Ambition and Motivation of Human being
- Success, Selfless Service and Responsibility in society
- Vision for Holistic Technologies, Production Systems and Management Models
- Inherent Contradictions and Dilemmas and their Resolution: Exercise
- Educational tour/workshop/interactive sessions

Suggested Readings:

1. A Foundation Course In Human Values And Professional Ethics By R.R. Gaur, R. Asthana, And G.P. Bagaria, UHV Publications
2. Professional ethics and Human value GOVINDARAJAN, M., NATARAJAN, S., SENTHILKUMAR, V. S. PHIL learning
3. Jeevan Vidya An Introduction : A. Nagraj
4. Human Values and Ethics, Prof. Bhushan Manachanda, Vikas Publishing Hosue
5. A Textbook on Professional Ethics and Human Values by R S Naagraazan


Dr. Shubha Banerjee

Objective

1. To develop qualities of character, courage, comradeship, discipline, leadership, secular outlook, spirit of adventure and sportsmanship and the ideals of selfless service among the youth to make them useful citizen.
2. To create a human resource of organized trained and motivated youth to provide leadership in all walks of life including the Armed Forces and be always available for the service of the nation.

Practical/ Awareness activities

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

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Objective

1. To develop qualities of character, courage, comradeship, discipline, leadership, secular outlook, spirit of adventure and sportsmanship and the ideals of selfless service among the youth to make them useful citizen.
2. To create a human resource of organized trained and motivated youth to provide leadership in all walks of life including the Armed Forces and be always available for the service of the nation.

Practical / Awareness activities

- Arms Drill- Attention, stand at ease, stand easy. Getting on parade. Dismissing and falling out. Ground/take up arms, examine arms. Shoulder from the order and viceversa, present from the order and vice-versa. Saluting at the shoulder at the halt and on the march. Short/long trail from the order and vice- versa. Guard mounting, guard of honor, Platoon/Coy Drill.
- Characteristics of rifle (.22/.303/SLR), ammunition, fire power, stripping, assembling, care, cleaning, and sight setting. Loading, cocking, and unloading. The lying position and holding.
- Trigger control and firing a shot. Range Procedure and safety precautions. Aiming and alteration of sight. Theory of groups and snap shooting. Firing at moving targets. Miniature range firing. Characteristics of Carbine and LMG.
- Introduction to map, scales, and conventional signs. Topographical forms and technical terms.
- The grid system. Relief, contours, and gradients. Cardinal points and finding north. Types of bearings and use of service protractor. Prismatic compass and its use. Setting a map, finding north and own position. Map to ground and ground to map. Knots and lashings, Camouflage and concealment, Explosives and IEDs.
- Field defenses obstacles, mines and mine lying. Bridging, waterman ship. Field water supplies, tracks and their construction. Judging distance. Description of ground and indication of landmarks. Recognition and description of target. Observation and concealment. Field signals. Section formations. Fire control orders. Fire and movement. Movement with/without arms. Section battle drill. Types of communication, media, latest trends and developments.
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14/05/2025

Theory:**Unit I**

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.

Unit II

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.

Unit III

Partial differentiation: Homogeneous function, Euler's theorem, Maxima and Minima of the functions of the form $y = f(x)$ and $y = f(x_1, x_2)$.

Unit IV

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

Unit V

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

Suggested Readings

1. The Elements of Coordinate Geometry by Loney, S.L. (Sidney Luxton) Publisher London Macmillan & Co.
2. Mathematics By R. D. Sharma, Vol-I and Vol-II



1. Seed, seed industry and its scope
2. Definition, Characters of good quality seed,
3. Different classes of seed.
4. Seed Act and Seed Act enforcement. Duty and powers of seed inspector, offences and penalties.
5. Seeds Control Order 1983, Seed certification, phases of certification, procedure for seed certification, field inspection.
6. Foundation and certified seed production of important cereals, pulses, oilseeds, fodder and vegetables.
7. Deterioration causes of crop varieties and their control
8. Hybrid seed production technology cereals, pulses, oilseeds and vegetable crops.
9. Seed processing & storage, factor affecting seed storage.
10. Maintenance of genetic purity during seed production
11. Germination test, purity percent and quality parameter
12. Varietal Identification through Grow Out Test and Electrophoresis, Molecular and Biochemical test.
13. Seed multiplication, marketing and linking Public & private seed companies.
14. Visit of agri seed park, seed processing plant and seed certification and seed testing laboratory.
15. Market of Indian Seed Industry
16. Business model for Agri-start-ups

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, 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. McDonald M.B. Jr & Copeland L.O. 1997. Seed Production: Principles and Practices. Chapman & Hall.
5. Tunwar, N.S. & Singh S.N. 1988. Indian Minimum Seed Certification Standards. CSCB, Ministry of Agriculture, New Delhi.
6. Practical Manual on Principles of Seed Technology by Department of Genetics and Plant Breeding, IGKV, Raipur.



Objective

1. To impart knowledge about post-harvest management and processing of Horticulture crops.
2. To develop human resource and entrepreneurs in Horticulture processing industries.

Practical**Unit I**

Importance and scope of post-harvest processing of horticulture crops. Post-harvest handling (Pre-cooling, sorting, grading, waxing); Harvesting and Storage. Principles and methods of preservation; primary and minimal processing; processing equipment.

Unit II

Layout and establishment of processing industry. Jam, Jelly, marmalade, Preserves, candy; Fermented and non-fermented beverages; Freezing.

Unit III

Ketchup, Sauce, Pickle, Chutneys; Drying/Dehydration of fruits, vegetables and flowers; canning/ bottling.

Unit IV

Physico-chemical and sensory analysis. Packaging and labelling of processed products of fruits, vegetables and flowers. Essential oil extraction techniques (rose, jasmine tuberose etc.).

Unit V

Food safety standards, importance of hygiene; plant sanitation :By-products & waste utilization. Visit to processing units.

Suggested Readings:

- Bella Prach.2020. The art of Preserving and Drying Flowers, Second Edition. Published by Webmentum Media.
- Battacharjee, S. K. and De, L. C. 2005. Post Harvest Technology of Flowers and Ornamentals Plants. Ponteer Publisher, Jaipur, India.
- Lal, Girdhari, Siddappaa, G.S. and Tandon, G.L.2022. Preservation of fruits & vegetables, ICAR, New Delhi.
- Mayani, J. M., Patel, N. V. and Dev Raj. 2016. Practical Manual for Processing of Horticultural Crops. ACHF, NAU, Navsari, pp 114.
- Rehman, M.S.2020. Handbook of Food preservation. CRC Press.
- Srivastava, R.P. and Sanjeev Kumar.2002. Fruit & Vegetable Preservation: Principles and Practices, 3rd Edition, International Book Distributing Co., Lucknow.
- Vaclavik, V.A. and Christian, E.W.2020. Essentials of Food Science, 4th Edition. Springer International Publishers, London.

V. K. Chandra
13.05.2025

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Objective: To develop the entrepreneurship opportunities among students and thus enhancing the ancillary income of the beekeeping & farmers.

Unit 1

Introduction to Apiculture: scope, importance and history of bee keeping.

Types of bee keeping: Traditional bee keeping, Modern beekeeping, Urban or backyard beekeeping.

Honey bee species, identification, origin and distribution.

Acquaintance with bee keeping essential equipment and their safe handling with bee colony.

Unit 2

Study of artificial hive (Langstroth/Newton), its various parts and handling of frames with colonies.

Social organization in honey bees: drone, worker and queen, colony life and social organization, annual biological cycle of the bee colony.

Social behavior of honey bees and understand communication system of a honey bee colony.

Identification of queen cells, drone cells & brood. Methods of multiplication of bee colonies.

Swarming and Absconding of honey bee.

Unit 3

General as well as seasonal management tactics of apiary.

Study of bee flora and their importance, bee pollination and floral calendar.

Multiplication of bee colony, prevention of bee poisoning.

Study and significance of bee products – An introduction, honey, pollen, royal jelly, bees wax, propolis and bee venom.

Unit 4

Value added honey products. Properties of honey products, Nutrients and composition of honey, Acid content and flavor effects.

Production of honey, wax, royal jelly and venom by honeybee: its nutritional & medicinal properties and application in various fields.

Honey extraction, handling, processing & packaging - quality control standards - honey testing kit.

Mass rearing technique of queen bees which include prerequisite to produce good queen, basic grafting, and management of cell builder colony and handling of queens produced.

Unit 5

Understand the importance of honey bee colony in elephant corridor.

Natural enemies and diseases of honeybees and their management.

To understand economic value of commercial beekeeping.

Startups of bee products with students and SHGs.

Field visits and interaction with bee keepers and other support agencies.

Suggested Field Visits

- Field visits are to be organized to facilitate students to have first-hand experience and exposure to technology / production / functioning of an organization / unit or witness a relevant activity.
- Visit to one of the units with one or multiple activities such as, Honey bee Keeping / Honey Processing / Honey Marketing.
- Visit any production units such as, Honey Processing Unit or any Food Industry Government Offices such as

National Bee Board (NBB), New Delhi.

Central Bee Research and Training Institute, Khadi and Village Industries Commission, Pune.

All India Co-ordinated Research Project on Honeybees and Pollinators, RMD CARS Ambikapur (C.G.)

Suggested Readings:

- David Cramp, 2012. The Complete Step-by-step Book of Beekeeping: A Practical Guide to Beekeeping, from Setting Up a Colony to Hive Management and Harvesting the Honey. Lorenz Books. London.
- Gupta, J.K. 2016. Apiculture, Indian Council of Agricultural Research, New Delhi Master Beekeeping
- Kim Pezza, 2013. Backyard Farming: Keeping Honey Bees: From Hive Management to Honey Harvesting and More. Hatherleigh Press, U.S.

- Laidlaw, H.H., 1997. Contemporary queen rearing. Published by Dadant and Sons. R. A. Morse, Rearing queen honey bees. Wicwas press, NY.
- Mishra, R.C. 1995. Honeybees and their Management in India. Indian Council of Agricultural Research, New Delhi
- Mishra, R.C. and Rajesh Gar. 2002. Prospective in Indian Apiculture, Agrobios, Jodhpur.
- Painkra, G.P., Painkra, K.L., Bhagat, P.K., and Jaiswal, S.K. 2023. Commercial Beekeeping, BFC Publications.
- Roger A. Morse and Kim Flottum, 1998. Honey Bee Pests, Predators and Diseases. Wicwas Pr; 3rd edition.
- Singh, S. 1962. Beekeeping in India, Indian Council of Agricultural Research, New Delhi.
- The Backyard Beekeeper - 3rd Edition: An Absolute Beginner's Guide to Bee Keeping – Kim Flottum.

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Objective

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

Theory**Unit-I**

Personality: Concept, Definition, Nature, characteristics and importance of personality, Personality traits. Types of personality: Realistic, investigative, artistic, social, enterprising and conventional personality.

Unit-II

Theories of personality, The humanistic approach-Maslow's self-actualization theory, Shaping of personality, Determinants of personality, Myers-Briggs Typology Indicator, Locus of control and personality disorders. Personality and organizational behaviour.

Unit-III

Human Behavior: Concept, definition and nature of human behavior. Foundations of individual behavior. Factors influencing individual/human behavior. Models of individual behavior. Type A and Type B Behaviours. Attires and etiquette in organizations. Human Values and Ethics

Unit-IV

Concept and definition of Perception, Factors affecting perception and attributes. Attribution theory. Case studies on perception and attribution. Decision: Concept and determinants of decision process Learning: Meaning and definition, theories and principles of learning. Learning and organizational behavior, Learning and training, Learning feedback.

Unit-V

Meaning, definitions and concept of Attitude and values. Intelligence: types of intelligence, theories of intelligence, measurements of intelligence, factors influencing intelligence, Emotional intelligence. Intelligence and Organizational behaviour. Motivation:- definition, types, theories and principles of motivation, Brief concept about conflict and conflict management skills Teamwork and group dynamics.

Practical

1. Personality analysis,
2. Learning Styles and Strategies,
3. Motivational needs,
4. Team work and team building,
5. Group Dynamics,
6. Conflict Management,
7. Leadership styles,
8. Case studies on Personality and Organizational Behavior.

Suggested reading

1. Andrews, Sudhir, 1988, How to Succeed at Interviews. 21st (rep.) New Delhi. Tata Mc Graw-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

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Objective

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

Theory**Unit I**

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.

Unit II

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.

Unit III

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.

Unit IV

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.

Unit V

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

1. Visit to a local area to document environmental assets river/ forest/ grassland/ hill/ mountain. Energy: Biogas production from organic wastes.
2. Visit to wind mill / hydro power / solar power generation units.
3. Biodiversity assessment in farming system.
4. Floral and faunal diversity assessment in polluted and un polluted system.
5. Visit to local polluted site - Urban/Rural/Industrial/Agricultural to study of common plants, insects and birds.
6. Environmental sampling and preservation.
7. Water quality analysis: pH, EC and TDS.
8. Estimation of Acidity, Alkalinity.
9. Estimation of water hardness.

10. Estimation of DO and BOD in water samples.
11. Estimation of COD in water samples.
12. Enumeration of E. coli in water sample.
13. Assessment of Suspended Particulate Matter (SPM).
14. Study of simple ecosystem – Visit to pond/river/hills.
15. Visit to areas affected by natural disaster

Suggested Readings

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

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Objectives:

Understanding - soil fertility, Soil nutrient management, Soil testing and analysis, Fertilizer management, Sustainable soil management, Crop nutrition, and Environmental considerations

Theory**Unit-I**

History of soil fertility and plant nutrition. criteria of essentiality. Forms of nutrients in soil. Role, deficiency and toxicity symptoms of essential plant nutrients, factors affecting nutrient availability to plants.

Unit-II

Mechanisms of nutrient transport to plants, Chemistry of macro and micronutrients. Soil fertility evaluation, Soil testing. Critical levels of different nutrients in soil. plant analysis, rapid plant tissue tests. Indicator plants.

Unit-III

Introduction and importance of organic manures, properties and methods of preparation of bulky and concentrated manures Green / leaf manuring.

Unit-IV

Chemical fertilizers: classification, composition and properties of major fertilizers, secondary & micronutrient fertilizers. Manufacturing process of major fertilizers. Complex fertilizers, nano fertilizers Fertilizer Storage, Fertilizer Control Order.

Unit-V

Fertilizer recommendation approaches. Integrated nutrient management. Methods of fertilizer recommendations to crops. STCR / RTNM / IPNS. Soil amendments, Factor influencing nutrient use efficiency (NUE), methods of application under rainfed and irrigated conditions.

Practical:

1. Introduction of analytical instruments and their principles, calibration and applications of Colorimetry and flame photometry;
2. Estimation of alkaline hydrolysable N in soils;
3. Estimation of soil extractable P in soils;
4. Estimation of available K in soils;
5. Estimation of exchangeable Ca and Mg in soils;
6. Estimation of soil extractable S in soils;
7. Estimation of DTPA extractable Zn in soils;
8. Estimation of N in plants;
9. Estimation of P in plants;
10. Estimation of K in plants;
11. Estimation of S in plants

Suggested Reading:

1. R. K. Basak: Fertilizer- A textbook, Kalyani Publishers. Ludhiana.
2. Soil science- An Introduction (2015): Indian Society of Soil Science, New Delhi.
3. Biswas D. R. (2021): A textbook of Fertilizers. New India Publishing Agency,
4. Yawalkar, K S et al. (2016): Manures and Fertilizers 12th edn (PB): Jain Book, Agency.
5. डॉ विनय सिंह और डॉ संदीप सिंह (2014): मृदा विज्ञान-उर्वरक एवं खाद, भारती भंडार मेरठ.



Objectives:

1. To know the history of entomology, classification of insects and their relationship with other arthropods.
2. To study the various morphological characters of class Insecta and their importance for classification of insects
3. To get an idea about the different physiological system of insect and their roles in growth and development and communications of insects.
4. Insect Ecology and effect of biotic and abiotic factors on the growth and development of insects.
5. To study the characteristics of agriculturally important insect orders.

Theory**Unit 1**

History of Entomology in India.

Major points related to dominance of Insecta in Animal Kingdom.

Classification of phylum Arthropoda upto classes.

Relationship of class Insecta with other classes of Arthropoda

Unit 2

Morphology: Structure and function of insect cuticle and molting.

Body segmentation. Structure of Head, thorax and abdomen.

Structure and modification of insect antennae, mouth parts, legs,

Wing venation, Modification and wing coupling apparatus.

Structure of male and female genital organ.

Unit 3

Structure and functions of digestive, circulatory, excretory, respiratory, nervous, secretory (Endocrine) and reproductive system, in insects.

Metamorphosis and diapause in insects. Types of larvae and pupae

Types of reproduction in insects.

Unit 4

Insect Ecology: Introduction, Environment and its components.

Effect of abiotic factors and biotic factors. Categories of pests. Concept of IPM, Practices, scope and limitation of

IPM. Classification of insecticides

Unit 5

Systematics: Taxonomy, Classification and importance of class Insecta upto Orders. Basic groups of present-day insects with special Emphasis to orders of Agriculture importance like Orthoptera, Isoptera, Thysanoptera, Hemiptera, Lepidoptera, Coleoptera, Hymenoptera and Diptera

Practical

1. Methods of collection and preservation of insects including immature stages
2. External features of Grasshopper.
3. Types of insect antennae, mouthparts and legs
4. Wing venation, types of wings and wing coupling apparatus
5. Types of insect larvae and pupae
6. Dissection of digestive system in insects (Grasshopper)
7. Study of characters of orders of agricultural importance
8. Orthoptera, Isoptera, Thysanoptera, Hemiptera, Lepidoptera, Coleoptera, Hymenoptera, Diptera
9. Pesticide appliances and their maintenance.

Suggested readings:

1. Imm's General Text book of Entomology- O.W. Rechards and R. G. Davies
2. Introduction to the study of Insects- D. J. Borror and DeLong's
3. Fundamentals of Ecology - Eugene. P. Odum & Gray W. Barrett
4. Integrated pest Management Concept and Approaches- G.S. Dhaliwal and Ramesh Arora

Objectives:

1. Provide basic knowledge to the students about scientific livestock and poultry rearing practices
2. Entrepreneurship development through Livestock/poultry and Agriculture Integrated farming System

Theory:**Unit I**

Role of livestock in the national economy. Reproduction in farm animals and poultry. Housing principles, space requirements for different species of livestock and poultry.

Unit II

Management of calves, growing heifers and milch animals. Management of sheep, goat and swine. Incubation, hatching and brooding. Management of growers and layers.

Unit III

Important Indian and exotic breeds of cattle, buffalo, sheep, goat, swine and poultry.

Unit IV

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.

Unit V

Introduction of livestock and poultry diseases. Prevention (including vaccination schedule) and control of important diseases of livestock and poultry.

Practical:

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

Suggested readings:

1. A Textbook of Animal Husbandry by G. C Banerjee
2. A text Book of Livestock Production management in Tropics by D. N. Verma

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(Ashutosh Dubey)

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Objectives:

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

Theory:**Unit- I**

Introduction to Plant Pathology: Concept of disease in plants; Different terms used in Plant Pathology, History of Plant Pathology with special references to India,

Unit- II

Causes of plant disease: Inanimate and animate causes; Classification of plant disease; Parasitism and pathogenesis, Development of disease in plants: Disease Triangle, Disease cycle,

Unit- III

Fungi and their morphology, reproduction and classification of fungi, Bacteria: Morphology, reproduction classification of phytopathogenic bacteria,

Unit- IV

Other plant pathogens: Mollicutes; Flagellant protozoa; FVB; Green algae and parasitic higher plants; Viruses and viroids, virus transmission,

Unit- V

Principles of Plant disease management: Disease management with chemicals, Host resistance, cultural and biological method of Integrated Disease Management (IDM).

Practical:

1. Study of the microscope,
2. Acquaintance with laboratory material and equipments,
3. Study of different plant disease symptoms,
4. Microscopic examination of general structure of fungi,
5. Simple staining of bacteria: Direct and indirect staining, Gram staining of bacteria,
6. Microscopic examination of fungal diseased specimen, Microscopic examination of bacterial diseased specimen,
7. Preparation of culture media,
8. Isolation of plant pathogens: Fungi, bacteria and viruses, Purification of plant pathogens,
9. Study on plant disease diagnosis: Koch's Postulates,
10. Characteristics, formulation, methods of application and calculation on fungicides

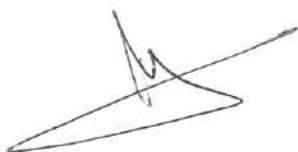
Suggested readings:

1. Pathak, V. N. Essentials of Plant Pathology. Prakash Pub., Jaipur
2. Agrios, GN. 2010. Plant Pathology. Acad. Press.
3. Kamat, M. N. Introductory Plant Pathology. Prakash Pub, Jaipur
4. Singh RS. 2008. Plant Diseases. 8 th Ed. Oxford & IBH. Pub. Co.
5. Singh RS. 2013. Introduction to Principles of Plant Pathology. Oxford and IBH Pub. Co.
6. Alexopoulos, Mims and Blackwel. Introductory Mycology
7. Mehrotra RS & Aggarwal A. 2007. Plant Pathology. 7 th Ed. Tata Mc Graw Hill Publ. Co. Ltd.
8. Gibbs A & Harrison B. 1976. Plant Virology - The Principles. Edward Arnold, London
9. Hull R. 2002. Mathew.s Plant Virology. 4th Ed. Academic Press, New York.
10. Verma JP. 1998. The Bacteria. Malhotra Publ. House, New Delhi.
11. Goto M. 1990. Fundamentals of Plant Bacteriology. Academic Press, New York.
12. Dhingra OD & Sinclair JB. 1986. Basic Plant Pathology Methods. CRC Press, London, Tokyo.
13. Nene YL & Thapliyal PN. 1993. Fungicides in Plant Disease Control. 3rd Ed. Oxford & IBH,



New Delhi.

14. Vyas SC. 1993. Handbook of Systemic Fungicides. Vols. I-III. Tata McGraw Hill, New Delhi.
15. Rajeev K & Mukherjee RC. 1996. Role of Plant Quarantine in IPM. Aditya Books.
16. Rhower GG. 1991. Regulatory Plant Pest Management. In: Handbook of Pest Management in Agriculture. 2nd Ed. Vol. II. (Ed. David Pimental). CRC Press.



H

Objective

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.

Practical/ Awareness activities

- Orientation: history, objectives, principles, symbol, badge; regular programmes under NSS
- Organizational structure of NSS, Code of conduct for NSS volunteers, points to be considered by NSS volunteers' awareness about health.
- NSS programme activities. Concept of regular activities, special camping, day camps, basis of adoption of village/slums, conducting survey, analyzing guiding financial patterns of scheme. youth programmes/ 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 youthadult partnership. Social harmony and national integration
- Indian history and culture, role of youth in nation building, conflict resolution and peacebuilding. Volunteerism and shramdaan. Indian tradition of volunteerism, its need, importance, motivation, and constraints; shaman as part of volunteerism
- Citizenship, constitution, and human rights. Basic features of constitution of India, fundamental rights and duties, human rights, consumer awareness and rights and rights to information. Family and society. Concept of family, community (PRIs and other community-based organizations) and society

Samul
14/05/25

JK

1. Arms Drill- Attention, stand at ease, stand easy. Getting on parade. Dismissing and falling out. Ground/take up arms, examine arms.
2. Shoulder from the order and vice-versa, present from the order and vice-versa.
3. Saluting at the shoulder at the halt and on the march. Short/long trail from the order and vice-versa.
4. Guard mounting, guard of honour, Platoon/Coy Drill.
5. Characteristics of rifle (.22/.303/SLR), ammunition, fire power, stripping, assembling, care, cleaning and sight setting.
6. Loading, cocking and unloading. The lying position and holding.
7. Trigger control and firing a shot. Range Procedure and safety precautions. Aiming and alteration of sight.
8. Theory of groups and snap shooting. Firing at moving targets. Miniature range firing.
9. Characteristics of Carbine and LMG.
10. Introduction to map, scales and conventional signs. Topographical forms and technical terms.
11. The grid system. Relief, contours and gradients. Cardinal points and finding north. Types of bearings and use of service protractor.
12. Prismatic compass and its use. Setting a map, finding north and own position. Map to ground and ground to map.
13. Knots and lashings, Camouflage and concealment, Explosives and IEDs.
14. Field defenses obstacles, mines and mine lying. Bridging, watermanship.
15. Field water supplies, tracks and their construction.
16. Nuclear, Chemical and Biological Warfare (NCBW)
17. Judging distance. Description of ground and indication of landmarks.
18. Recognition and description of target. Observation and concealment. Field signals. Section formations.
19. Fire control orders. Fire and movement. Movement with/without arms. Section battle drill.
20. Types of communication, media, latest trends and developments.

Vinod
(Vinod Nayak)

AK

Objectives:

To provide scientific knowledge of sericulture towards increasing silk production, improving quality and promoting scientific practices.

Practical**Unit-I**

Types of silkworm in India: distribution of mulberry and non-mulberry silk in India food plant of non-mulberry and mulberry silkworm. Rearing equipment of silkworms outdoor and indoor

Unit-II

Host plant raising for Tasar and mulberry silkworm. Morphology of Tasar and mulberry silkworm and silk glands

Unit-III

Tasar silkworm and mulberry silkworm rearing techniques, Early and late instar rearing techniques of silkworm

Unit-IV

Insect pests and diseases of silkworm

Unit-V

Cocoon harvest, Post-harvest techniques reeling viewing use of silk and byproducts

Suggested Field Visits

- Field visits are to be organized to facilitate students to have first-hand experience and exposure to technology / production / functioning of an organization / unit or witness a relevant activity.
- Visit any production units or Industry or Government Offices.
- Exposure Visit to Farmers Field of Chhattisgarh.

Text Books

1. Sericulture Manual-1 (Mulberry cultivation) (1972); Food and Agriculture Organization of the United Nations, Rome.
2. Sericulture Manual-2 (Silkworm rearing) (1972); Food and Agriculture Organization of the United Nations, Rome.
3. Sericulture Manual-3 (Silk reeling) (1972); Food and Agriculture Organization of the United Nations, Rome.
4. Hand Book of Silkworm rearing (1972); Fuji Publishing Co., Ltd., Tokyo, Japan.
5. Text book of Tropical Sericulture (1975) Japan Overseas Corporation Volunteers 4-2- 24, Hiroo, Shibuya-ku, Tokyo, Japan.
6. Charles J. Huber (1929); The Raw silk Industry of Japan. The Silk Association of America, Inc.
7. Chaudhury S.N. (1981); Muga Silk Industry, Directorate of Sericulture and Weaving, Government of Assam, Gowhati, Assam.
8. Sarkar D.C. (1980); Sericulture in India, Central Silk Board, Government of India, Bangalore.
9. Sainosuka Omura (1973); Silkworm rearing Techniques in Tropics, Overseas Technical Co- operation Agency, Tokyo, Japan.
10. Tanaka Y. (1964); Sericology, Central Silk Board Publication, Bangalore.
11. Devaiah M.C et al. (2001); Advances in Mulberry Sericulture. Dept. of Sericulture, UAS, Bangalore.

Objectives:

1. To equip students with fundamental knowledge and practical skills in soil, plant, and water analysis using qualitative, quantitative, and instrumental methods.
2. To enable students to assess soil fertility, plant nutrient status, and water quality for sustainable agricultural management.

Unit I:

Basic principles of chemical analysis. Characteristics of primary and secondary standard chemicals. Preparation of standard solutions: Concentration (ppm, percentage), Normality, Molarity, Formality, and Molal solutions. Principle and practice of qualitative and quantitative analysis (gravimetric, volumetric, and titrimetric analysis). Working principles and applications of various analytical instruments: pH meter, Electrical conductivity (EC) meter, Spectrophotometer, Flame photometer, Atomic absorption spectrophotometer (AAS).

Unit II:

Collection and preparation of soil samples for analysis. Determination of soil pH and electrical conductivity (EC). Determination of lime requirement. Determination of gypsum requirement. Estimation of organic carbon (OC) in soil.

Unit III:

Determination of primary nutrients in the soil: available nitrogen (N) using alkaline KMnO_4 method, available phosphorus (P) using Olsen's and Bray's methods and available potassium (K) using NN ammonium acetate methods. Determination of secondary and micronutrients in the soil: Available sulfur (S) using turbidimetric method, available boron (B) using hot water extraction method and DTPA extracted available Fe, Mn, Zn, Cu. Interpretation of soil test results for fertilizer recommendations.

Unit IV:

Principles of wet and dry digestion techniques for plant samples. Preparation of diacid and triacid for digestion. Estimation of macronutrients from plant samples: Nitrogen (N) using Kjeldahl method, Phosphorus (P) using vanadomolybdate method, Potassium (K) using flame photometry and Sulfur (S) using turbidimetric method. Estimation of micronutrients (Fe, Mn, Zn, Cu) through atomic absorption spectrophotometry (AAS).

Unit V:

Collection and preservation of water samples. Determination of water quality parameters: pH and electrical conductivity (EC), Estimation of cations: Calcium (Ca^{2+}), Magnesium (Mg^{2+}), Sodium (Na^+) using titrimetric and instrumental methods. Estimation of anions: Carbonate (CO_3^{2-}), Bicarbonate (HCO_3^-), Chloride (Cl^-), Nitrate (NO_3^-), Sulfate (SO_4^{2-}), and Boron (B). Computation of irrigation water quality indices: Residual Sodium Carbonate (RSC), Sodium Adsorption Ratio (SAR), Total Soluble Salt (TSS) and Total Cations.

Suggested readings:

1. "Soil Testing and Plant Analysis" by the Soil Science Society of America
2. "Methods of Soil Analysis" by the Soil Science Society of America
3. "Soil Fertility and Fertilizers" by John L. Havlin et al.
4. "Plant Analysis: An Interpretation Manual" by David Reuter and J. B. Robinson
5. "Plant Nutrition: A Guide to Plant Tissue Testing" by the International Plant Nutrition Institute
6. "Water Analysis: A Practical Guide" by the American Water Works Association
7. "Water Quality Testing and Interpretation" by the United States Environmental Protection Agency
8. "Soil, Plant, and Water Analysis: A Manual" by the International Crops Research Institute for the Semi-Arid Tropics
9. "Laboratory Manual for Soil, Plant, and Water Analysis" by the Food and Agriculture Organization of the United Nations



Objectives:

- To understand the principles and methods of producing bio-agents and bio-fertilizers;
- To learn techniques for mass production and formulation of beneficial microorganisms;
- To explore the role of bio-agents and bio-fertilizers in sustainable agriculture and soil health management; and
- To develop skills to integrate bio-agents and bio-fertilizers into crop production systems for enhanced yield and reduced environmental impact.

Unit A. Agricultural Microbiology:

1. Relevance of Biofertilizer in Agriculture. Types of Biofertilizers
2. Nitrogen fixers: *Rhizobium*, *Azotobacter*, *Azospirillum*, *Glucanacetobacter*, *Cyanobacteria* and *Azolla*;
3. P- solubilizers: PSB, PSF
4. K-solubilizers;
5. Zn-solubilizers
6. P-mobilizers: AM fungi
7. Development of consortia
8. Preparation of mother culture, sterilization, fermentation, quality analysis, mixing, packing and labeling
9. Isolation and enumeration of bacterial biofertilizer / biocontrol agents from soil;
10. Mass Production Techniques (a): Carrier based
11. Mass Production Techniques (b): Liquid Biofertilizers
12. Methods of application. Quality Control (Standards as per FCO (1985) amended in 2009)

Unit B. Agricultural Entomology:

1. Importance of biopesticides and other non-chemical approaches in pest management.
2. Mass production of laboratory host, parasitoids and predators.
3. Mass rearing techniques of rice moth, *Corcyra cephalonica* Stainton,
4. *Trichogramma* Spp., *Goniozus nephantidis* (Muesebeck) and *Bracon brachicornis* Wesm., predators, *Chrysoperla zastrowi sillemi* (Esben-Petersen), *Cryptolaemus montrouzieri* Mulsant, *Micromus gorotus* Banks.
5. Mass rearing techniques of Pallister, aquatic weed killer, *Cyrtobagous salviniae* Calder, weed killers, *Zygogramma bicolorata*
6. Preparation of culture media,
7. Culturing and spore counting of *Nomuraea rileyi* (Farl.) Samson and *Beauveria bassiana* (Bals.) / *Metarhizium anisopliae* (Met.) and *Lecanicillium lecanii* (Zimmerman),
8. Mass production of Ha NPV/SI NPV,
9. Estimation of spore load from microbial pesticides,
10. Conservation measures for Natural Enemies and Visit to Bio control Laboratories.

Unit C. Plant Pathology

1. Isolation and enumeration of fungal biocontrol agents from soil;
2. Hands on skills on mass production of *Trichoderma harzianum* and *Pseudomonas fluorescens* (isolation)
3. Characterization of fungal (*Trichoderma harzianum* and *Pseudomonas fluorescens*); Studies on antagonistic ability of fungal biocontrol agents through dual plate technique;
4. Hands on skills on mass production of *Pseudomonas fluorescens* and *Bacillus subtilis* (isolation)
5. Studies on antagonistic ability of bacterial biocontrol agents through dual plate technique;
6. Field Evaluation of biocontrol agents against diseases of vegetables under protected cultivation;
7. Preparation and evaluation of plant extracts (neem, tulsi, pongamia, etc) and liquid organic manures (panchagavya, beejamruta, Jeevamruta) against plant diseases;
8. Registration procedures for biocontrol agents; Cost of production of various biocontrol agents.

Suggested readings:**Agricultural Microbiology**

1. The Complete Technology Book on Biofertilizer and Organic Farming. Dr. Himadri
2. Panda.
3. Recent Trends in Biofertilizers. by Bikas R. Pati and Santi M. Mandal
4. Michael Madigan; John Martinko; David Stahl And David Clark, Brock- Biology Of

5. Microorganisms, Pearson (Thirteen Edition)
6. Mark S. Coyne, Soil Microbiology-An Exploratory Approach, Delmar Publishers-
7. 2004
8. Atlas Bartha, Microbial Ecology -Fundamentals and Application, Pearson (Fourth)

Agricultural Entomology:

1. Biopesticides in Sustainable Agriculture Progress and Potential Hardcover – 1
2. January 2014 by O Koul (Author), G S Dhaliwal (Author), S Khokhar (Author)
3. Woolmer PL & Swift MJ. 1994. The Biological Management of Tropical Soil Fertility. TSBF & Wiley.

Plant Pathology

1. Biopesticides- Use and Delivery, Franklin R. Hall, Julius J. Menn
2. Advances in Plant Biopesticides- Dwijendra Singh

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Objective:

1. To provide student an insight in to the concept and scope of entrepreneurship.
2. To expose the student to various aspects of establishment and management of a small business unit.
3. To enable the student to develop financially viable agribusiness proposal.

Theory:**Unit-I**

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.

Unit-II

Environment scanning and opportunity identification need for scanning- spotting of opportunity- scanning of environment- identification of product/service- starting a project; factors influence sensing the opportunities. Infrastructure and support systems - good policies, schemes for entrepreneurship development; role of financial institutions, and other agencies in entrepreneurship development.

Unit-III

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.

Unit-IV

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.

Unit-V

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/agri-entrepreneurs. Visit to financial institution 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 V., 2015, Entrepreneurship: Development and Management, Himalaya Publishing House.
3. Gupta CB. 2001. Management Theory and Practice. Sultan Chand & Sons.
4. Indu Grover. 2008. Handbook on Empowerment and Entrepreneurship. Agrotech Public Academy.
5. Khanka SS. 1999. Entrepreneurial Development. S. Chand & Co.
6. Mehra P., 2016, Business Communication for Managers. Pearson India, New Delhi.
7. Pandey M. and Tewari D., 2010, The Agribusiness Book. IBDC Publishers, Lucknow.
8. Singh D. 1995. Effective Managerial Leadership. Deep & Management, Katson Books.
9. Tripathi PC & Reddy PN. 1991. Principles of Management. Tata McGraw Hill.
10. Vasant Desai, 1997. Small Scale Industries and Entrepreneurship. Himalaya Publ. House

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Objectives: To make the students aware about Physical Education, First Aid and Yoga Practices To disseminate the knowledge and skill how to perform physical training, perform first aid and increase stamina and general wellbeing through yoga.

Practical

Unit I:

Physical education; Training and Coaching - Meaning and Concept; Methods of Training; aerobic and aerobic exercises; Calisthenics, weight training, circuit training, interval training, Fartlek training; Effects of Exercise on Muscular, Respiratory, Circulatory and Digestive systems;

Unit II:

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 III:

Yoga; History of Yoga, Types of Yoga, Introduction to Yoga: • Asanas: Definition and Importance, Padmasan, Gaumukhasan, Bhadrasan, Vajrasan, Shashankasan, Pashchimotasan, Ushtrasan, Tadasan, Padhastasan, Ardchchandrasan, Bhujangasan, Utanpadasan, Sarvangasan, Parvatasan, Patangasan, Shishupalanasan- left leg right leg, Pavanmuktasan, Halasan, Sarpasan, Ardhhdhanurasan, Sawasan • Suryanamskar Pranayama (Definition and Importance) Omkar, Suryabhedan, Chandrabhedan, AnulomVilom, Shitali, Shitkari, Bhastrika, 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, Vyannmudra, Uddanmudra • Role of yoga in sports • Teaching of Asanas – demonstration, practice, correction and practice.

Unit IV:

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 V:

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

Kalavya
Dr. R.K. Thakur

HS

Objective:

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

Theory**Unit I**

Introduction and definition of genetics, cytogenetics, cytology and their interrelation, Pre and post Mendelian concepts of heredity, mendelian principles of heredity, Architecture of chromosomes, chromonemata, chromosome matrix, chromomeres, centromere, secondary constriction and telomere, special types of chromosomes.

Unit II

Chromosomal theory of inheritance, Cell cycle and cell division-mitosis and meiosis, Epistatic interactions with example, Dominance relationships, Multiple alleles, blood group genetics, pleiotropism and pseudoalleles.

Unit III

Sex determination and sex linkage, Sex limited and sex influenced traits, Probability and chi-square test, Linkage and its estimation, Crossing over mechanism, chromosome mapping.

Unit IV

Structural and numerical variations in chromosomes and their implications, Genetic disorders, Use of haploids, dihaploids and double haploids in Genetics, Mutation, classification, methods of inducing mutations, mutagenic agents, induction of mutation.

Unit V

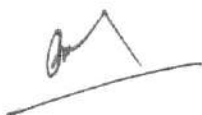
Qualitative and quantitative traits, Polygenes and continuous variations, Multiple factor hypothesis, Cytoplasmic inheritance, Nature, structure and replication of genetic material, Transcriptional and translational mechanism of genetic material.

Practical

1. Study of microscope
2. Study of cell structure
3. Experiments on monohybrid, dihybrid, trihybrid, test cross and back cross
4. Experiments on epistatic interactions including test cross and back cross
5. Study and practice on mitotic and meiotic cell division
6. Experiments on probability and chi-square test
7. Determination of linkage and cross-over analysis (through two-point test cross and three-point test cross data)
8. Study on sex linked inheritance in *Drosophila*
9. Study on models of DNA and RNA structures

Suggested readings

1. Fundamentals of Genetics: B. D. Singh
2. Principles of Genetics: Gardner, Simmons and Snustad
3. Genetics: M. W. Strickberger
4. Principles of Genetics: Sinnott, Dunn and Dobzhansky
5. Practical Manual on Principles of Genetics by Department of Genetics and Plant Breeding, IGKV, Raipur



Objectives:

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

Theory:

Origin, geographical distribution, economic importance, soil and climatic requirements, varieties, cultural practices and yield of Kharif crops.

Unit – I

Cereals-Rice, Maize, Sorghum, Pearl millet and Finger millet

Unit – II

Pulses- Pigeonpea, Mungbean and Urdbean

Unit – III

Oilseeds- Groundnut and Soybean

Unit – IV

Fibre crops- Cotton & Jute

Unit – V

Forage crops- Sorghum, Cowpea, Cluster bean and Napier.

Practical

1. Rice nursery preparation & transplanting of rice
2. Sowing of soybean, pigeonpea, mungbean, maize, groundnut and cotton
3. Effect of seed size on germination and seedling vigour of kharif season crops
4. Effect of sowing depth on germination of kharif crops
5. Identification of weeds in kharif season crops
6. Top dressing and foliar feeding of nutrients
7. Study of yield contributing characters and yield calculation of kharif season crops
8. Study of crop varieties and important agronomic experiments at experiential farm
9. Study of forage experiments and morphological description of kharif season crops
10. Visit to Research centers of related crops

Suggested readings:

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

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Theory**Unit –I**

Importance and scope of fruit and plantation crop industry in India. Seed propagation-merits & demerits, Importance of vegetative propagation and rootstock.

Unit –II

Production technology for the cultivation – Mango, Banana, Papaya, Citrus, Grapes Guava.

Unit –II

Production technology for the cultivation – Litchi, Aonla, Ber, Bael, Jackfruit, Custard apple.

Unit –IV

Production technology for the cultivation – Apple, Pear, Peach, Plum, Strawberry

Unit –V

Production technology for the cultivation of Plantation crops– Coconut, Cashewnut, Tea, Coffee and Rubber.

Practical

1. Identification of fruit and plantation crops.
2. Methods of Seed treatment.
3. Commercial propagation methods of fruit and plantation crops.
4. Methods of planting and calculation of planting density for orchard establishment.
5. Methods of Orchard layout and planting in the field.
6. Calculation of fertilizer and chemical doses.
7. Methods of irrigation and nutrient application
8. Preparation of plant growth regulators solutions and their application.
9. Identification of important pests and diseases of fruit and plantation crops.
10. Identification of physiological disorders of fruit and plantation crops.
11. Visit to commercial fruit and plantation crop orchards.

Suggested Readings

1. Bal, JS. 2013. Fruit growing.
2. Bose, TK, Mitra, SK & Sanyal, D. (Ed.). 2002. Fruits of India- Tropical and Sub-tropical. 3rd Ed. Vols. I, II. Naya Udyog.
3. Chadha, KL (ed). Handbook of Horticulture, ICAR, New Delhi.
4. Chadha, KL & Pareek, OP. 1996. (Eds.). Advances in Horticulture. Vol. I. Malhotra Publ. House.
5. Kishore, DK, Satish, K. Sharma and Pramanik, K.K. 2006. Temperate Horticulture- Current Scenario. New India Publ. Agency.
6. Singh, S, Shivankar, VJ, Srivastava, AK & Singh, IP. (Eds.). 2004. Advances in Citriculture. Jagmander Book Agency.
7. Sharma, Girish, Sharma, O.C. and Thakur, B.S. 2009. Systematics of fruit crops. New India Publishing Agency, New Delhi.
8. Radha, T and Mathew, L. 2012. Fruit crops (Vol. 3): Horticulture Science Series. New India Publishing Agency, New Delhi.
9. Prasad and Kumar. 2014. Principles of Horticulture 2nd Edu. Agrobios (India).
10. Singh, Prabhakar and Agrawal, Shalendra 2010. Phal utpadan – Siddhant evam prodyogiki. Kushal Publications and distributors, Varanasi.

Objective

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

Theory**Unit-I**

Education: Meaning, definition and Types; Extension Education: meaning, definition, scope and process; objectives and principles of Extension Education; Extension Program planning: Meaning, Process, Principles and Steps in Program Development.

Unit-II

Extension systems in India: extension efforts in pre-independence era (Sriniketan, Marthandam, Firka Development Scheme, Gurgaon Experiment, etc.) and Post-independence era (Etawa Pilot Project, Nilokheri Experiment, etc.) Reorganized Extension System (T&V system) various extension/ agriculture development programs launched by ICAR/ Govt. of India (IADP, IAAP, HYVP, KVK, IVLP, ORP, ND, NATP, NAIP, ATMA etc.). Social Justice and poverty alleviation program: ITSA, IRDP/SGSY/NRLM.

Unit-III

Women Development Program: 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, DWCR, Commodity Interest Groups (CIGs), self Help Group (SHGs) Farmers Producer Group (FPG).

Unit-IV

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 function.

Unit-V

Monitoring and evaluation: concept and definition, monitoring and evaluation 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 Application in TOT (New and Social Media), media mix strategies; concept, and techniques of PRA & RRA.

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 status and 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 program 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. Jalihal, 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).

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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

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Theory**Unit I**

Introduction-History of phyto-nematology and economic importance.

General characteristics of plant parasitic nematodes.

Nematode-General morphology and biology.

Unit II

Classification of nematode up to family level with

Emphasis on group of containing economical importance genera (Taxonomic).

Classification of nematode by habitat.

Unit III

Identification of economically important plant nematodes up to generic level with the help of key and description.

Symptoms caused by nematodes with examples.

Interaction of nematodes with microorganism

Unit IV

Different methods of nematode management.

Cultural methods

Physical methods

Biological methods

Chemical methods

Unit V

Entomophilic nematodes-Species Biology

Mode of action

Mass production techniques for EPN

Practical

1. Collection of Soil and plant sample.
2. Laboratory techniques for examination of nematodes.
 - To study the Baerman funnel method of nematode extraction.
 - To study the Sieving and gravity method of nematode extraction.
3. Extraction and identification of nematode.
4. Mass production techniques for EPN.

Suggested readings:

1. A Text Book of Plant Nematology—K. D. Upadhyay & Kusum Dwivedi, Aman Publishing House
2. Fundamentals of Plant Nematology —E.J. Jonathan, S. Kumar, K. Devirajan, G. Rajendran, Devi Publications, 8, Couvery Nagar, Karumanolapam, Trichirappalli, 620 001.
3. Plant Nematodes- Methodology, Morphology, Systematics, Biology & Ecology Majeebur Rahman Khan, Department of Plant Protection, Faculty of Agricultural Sciences, Aligarh Muslim University, Aligarh, India.
4. Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi.
5. Introductory Nematology (Theory Notes)—Dr. B.S. Shewale

Objectives:

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

Theory**Unit – I**

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 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.

Unit – II

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.

Unit – III

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.

Unit – IV

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

Unit – V

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

1. Visit of natural farm and chemical free traditional farms to study the various components and operations of Natural Farming principles in the farm.
2. Indigenous technical knowledge (ITK) for seed, tillage, water, nutrient, insect-pest, disease and weed management.
3. On-farm inputs preparation methods and protocols. Studies in green manuring in-situ and green leaf manuring.
4. 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.
5. Techniques of Indigenous seed production-storage and marketing. Partial and complete nutrient and financial budgeting in Natural Farming.
6. Evaluation of ecosystem services in Natural Farming (Crop, Field and System).

Suggested readings:

1. Nalini S. 1999. Krishi-Parashara (Agriculture by Parashara) by Parashara. Brig Sayeed Road, Secunderabad, Telangana: AAHF Classic Bulletin, Asian Agri-History Foundation.
2. Ecological Farming-The seven principles of a food system that has people at its heart. May 2015, Greenpeace.
3. FAO. 2018. The 10 elements of agro-ecology: guiding the transition to sustainable food and agricultural system. <https://www.fao.org/3/i9037en/i9037en.pdf>. Agro ecosystem Analysis for Research and Development Gordon R. Conway.
4. Behera U.K. 2013. A text Book of Farming System. Agrotech Publishing House, Udaipur.

5. Hill S.B and Ott. P. (eds.). 1982. Basic Techniques in Ecological Farming Berkhauser Verlag, Basel, Germany
6. Boeringa R.(ed.).1980. Alternative Methods of Agriculture. Elsevier, Amsterdam.
7. Fukuoka M. 1978. The One-Straw Revolution: An Introduction to Natural Farming. Rodale Press, Emmaus, PA.
8. Fukuoka M. 1985. The Natural Way of Farming: The Theory and Practice of Green Philosophy. Japan Publications, Tokyo.
9. Hill S.B. and Ott P. (eds.). 1982. Basic Techniques in Ecological Farming. Berkhauser Verlag, Basel, Germany.
10. INFR. 1988. Guidelines for Nature Farming Techniques. Atami, Japan.
11. Khurana, A. and Kumar, V. 2020. State of Organic and Natural Farming: Challenges and Possibilities, Centre for Science and Environment, New Delhi.
12. Nicole Faires 2016. The Ultimate Guide to Natural Farming and Sustainable Living :Permaculture for Beginners (Ultimate Guides).
13. Shripad A. Dabholkar 2021. Plenty For All: Natural Farming A To Z Prayog Pariwar Methodology.
14. Prathapan Paramu 2021. Natural Farming Techniques: Farming without tilling.
15. David B. Lindenmayer, Suzannah M. Macbeth, et al. 2022. Natural Asset Farming: Creating Productive and Biodiverse Farms.

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Practical

1. Methods of nursery raising.
2. Propagation of horticultural crops through seeds
3. Propagation of horticultural crops through cuttings
4. Propagation of horticultural crops through budding
5. Propagation of horticultural crops through grafting
6. Propagation of horticultural crops through separation
7. Propagation of horticultural crops through layering
8. Preparation of growing media for propagation
9. Use of containers for raising plants, potting, depotting and repotting
10. Cultural operations in nursery (fertilizer application, irrigation,) of horticultural crops.
11. Preparation of solution of plant growth regulators and their application in nursery.
12. Selection of Ex-plants and protocol for micro propagation.
13. Media preparation in micro-propagation.
14. Visit to horticultural nurseries and tissue culture lab

Suggested Readings

1. Davies F T Geneve R L and Wilson S B 2018.
2. Hartmann and Kester's Plant Propagation Principles and Practices 9th Edition Pearson. USA.
3. Sharma R R and Krishna H 2017. Textbook of Plant Propagation and Nursery Management. C B S Publishers. New Delhi.
4. Sharma R R and Srivastava M 2004. Plant Propagation and Nursery Management. IBDC Publishers. New Delhi
5. Handbook of Horticulture 2nd Edition ICAR Vol 1 & 2. New Delhi.
6. Peter K V 2002. Plantation crops. National Book Trust India, New Delhi.

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Objectives:

To provide a basic knowledge of livelihood, conserves biodiversity and industrial importance of Lac through Lac cultivation.

Unit-I

Lac insect life, lac crop cycle and lac related terminologies
Raising and management of major host plants for lac cultivation
Lac associated insect fauna
Conventional & scientific method of Lac cultivation

Unit-II

Management of major lac hosts and lac cultivation
Kusmi lac cultivation on *kusum* and *ber* trees
Rangeeni lac cultivation on *Palas* and *Ber*
Intensive lac cultivation on bushy lac host (*Flemingia semialata*)

Unit-III

Pest management in lac cultivation
Lac integrated farming system (LIFS)
Collection and conservation of lac-insect & host plant biodiversity
Management of Broodlac farm

Unit-IV

Value addition & its implications in lac
Role of biotechnology in lac production
Post harvest care, handling and storage of Lac
Processing of lac- seedlac, shellac, bleached lac and lac dye

Unit-V

Lac processing on small scale-village level entrepreneurship
Implements for lac cultivation
Small scale lac processing unit
Socio-economic silhouette and value chain analysis: An overview of lac sector

Suggested Field Visits

- Field visits are to be organized to facilitate students to have first-hand experience and exposure to technology / production / functioning of an organization / unit or witness a relevant activity.
- Visit to one of the units with one or multiple activities such as, Lac cultivation / Lac Processing / Lac Marketing.
- Visit any production units or Industry or Government Offices.
- Exposure visit to Farmers Field of Chhattisgarh

Suggested Reading:

1. Jaiswal AK and Singh JP. 2013. Insect pests of lac crop and their management. Indian Institute of Natural Resins and Gums. Ranchi (Jharkhand). Bulletin (Technical) No. 02 (2013). 44 pp
2. Jaiswal AK and Singh JP. 2014. *Ziziphus mauritiana* for lac cultivation. Indian Institute of Natural Resins and Gums. Ranchi, India. Extension bulletin No.07 (2014) 1-44 pp
3. Sharma KK and Ramani R. 2011. Lac Insect Systematics and Geographical Distribution. In Recent Advances in Lac Culture. Indian Lac Research Institute. Ranchi India pp. 27-36
4. Sharma KK and Jaiswal AK 2011. Lac cultivation operations: Basics concepts. In: Recent Advances in Lac Culture. Indian Lac Research Institute. Ranchi India pp. 138-145
5. Pandey SK, Prasad N and Sharma SC. 2015. Processing of lac- seedlac, shellac, bleached lac and lac dye. pp- 118-130. In: Advances in Lac Production, Processing, product development and Value addition. ICAR- Indian institute of Natural Resins and Gums. Ranchi (Jharkhand) India Edited by: Alok Kumar, AK Jaiswal, AK Singh, RK Yogi 1-206 pp
6. Yadav SK and Giri SK. 2015. Post harvest care, handling and storage of lac. Pp-113-117. In: Advances in Lac Production, Processing, product development and Value addition. ICAR- Indian institute of Natural Resins and Gums. Ranchi (Jharkhand) India Edited by: Alok Kumar, AK Jaiswal, AK Singh, RK Yogi 1-206 pp

1. Origin, geographical distribution, economic importance, soil and climatic requirements, Rice nursery preparation and transplanting of rice, varieties, cultural practices and yield of rice.
2. Different types of rice available in world and Indian market.
3. Visualization of different rice samples produced in the market and discussion.
4. Traditional methods of rice processing and milling. Requirement of space for different capacity of mills. Importance of knowledge on rice milling techniques.
5. Conventional methods of rice processing - Single steam parboiling and Double steam parboiling.
6. Modern methods of rice processing, Hot soaking - Improved hot soaking method.
7. Assessment of physical parameters. Assessment of paddy/rice for FAQ standard.
8. Gelatinization properties. Assessment of Rice cooking quality.
9. Packaging and storage of rice - Evaluate the comprehension of methods used in the assessment of paddy and rice quality. Storage and packaging of paddy/rice, Prevention of high moisture, paddy packaging methods and their impact on maintaining rice quality.
10. Preparation of ethnic food products, puffing, flaking, parching and roasting. By product utilization. Production of value-added products - Potential traditional processing techniques and By-product utilization. Value added products from rice. Traditional foods, extruded products, health drinks, convenient food products.
11. Estimation of moisture and oil content in rice bran.
12. Marketing - eNAM, future trading of agricultural commodities. Latest marketing tools- Digital and Internet-based cashless system of transactions.

Suggested readings:

1. De Datta, Surajit, K. 1981. Principles and Practices of Rice Production. A WILEY-INTERSCIENCE PUBLICATION.
2. John Norman Efferson. 2012. The Production and Marketing of Rice. Literary Licensing, LLC (USA).
3. Pathak, H., Nayak, A.K. et al. 2018. Rice research for enhancing productivity, profitability and climate resilience. ICAR-National Rice Research Institute, Cuttack 753006, Odisha, India.
4. C. Wayne Smith, Robert H. Dilday 2002. Rice – Origin, History, Technology & Production. John Wiley & Sons.
5. Rajendra Prasad. Text book of Field Crops Production – Commercial Crops. Volume III ICAR Publication.

Objective:

1. To acquaint student with the basics of computer applications in agriculture, multimedia, database management, application of mobile app and decision- making processes, etc.
2. To provide basic knowledge of computer with applications in Agriculture
3. To make students familiar with Agricultural-Informatics, its components and applications in agriculture

Theory:**Unit-I**

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.

Unit-II

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.

Unit-III

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, 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.

Unit-IV

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. Digital India and schemes to promote digitalization of agriculture in India.

Unit-V

Introduction to artificial intelligence, background and applications, Turing test. Control strategies, Breadth-first search, Depth-first search, Heuristics search techniques: Best-first search, A* algorithm, IoT and Big Data; Use of AI in agriculture for autonomous crop management, intelligent pesticide application, yield mapping and predictive analysis, Concepts of smart agriculture

Practical:

1. Study of computer components, accessories, practice of important DoS Commands, Introduction of Windows operating system, File Management.
2. Use of MS-Word and MS Power-point for creating, editing and presenting a scientific documents.
3. MS-EXCEL-Creating a spreadsheet, Use of statistical tools, Writing expressions, Creating graphs, Analysis of scientific data,
4. MS-ACCESS: Creating Database, preparing queries and reports, Demonstration of Agri- information system.
5. Introduction to World Wide Web (WWW) and its components, Introduction of programming language: C.
6. Hands on practice on Crop Simulation Models (CSM), DSSAT/Crop-Info/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
7. Use of smartphones and other devices in agro-advisory and dissemination of market information, 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.

Theory

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

Unit - I

Tomato, Brinjal, Capsicum, French bean, Peas, Okra.

Unit - II

Cucumber, Melons, Gourds, Pumpkin

Unit -III

Cole crops (Cabbage, Cauliflower, Knol-Khol), Leafy vegetables (Amaranth, Palak, Perennial leafy vegetables)

Unit -IV

Onion, Carrot, Radish, Beetroot and Potato

Unit -V

Chili, Garlic, Black Pepper, Turmeric, Ginger, Cardamom

Practical

1. Identification of vegetables & spice crops and their seeds.
2. Study of morphological characters of different vegetables &spices.
3. Nursery raising.
4. Direct seed sowing
5. Transplanting.
6. Fertilizers application
7. Water management.
8. Harvesting & Picking
9. Product preparation for market.
10. Economics of vegetables and spices cultivation.

Suggested Readings:

1. Vegetable crops by J. Kabir, T.K. Bose, M.G. Som
2. Olericulture, Fundamentals of Vegetable Production (Vol.I) by K.P. Singh, Anant Bahadur
3. Vegetable crops (Production technology, Vol II) by M.S. Fagaria, B.R. Choudhury, R.S. Dhaka

MS
09/05/25

MS

Objectives:

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

Theory:**UNIT-I**

Economics: Meaning, scope and subject matter, definitions, activities, approaches to economic analysis; micro and macroeconomics, positive and normative analysis. Concept of equilibrium. Basic concepts: Goods and services, desire, want, demand, utility, cost and price, wealth, capital, income and welfare. Agricultural economics: meaning, definition, characteristics, importance and its role in economic development.

UNIT -II

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.

UNIT -III

Production: factors of production, input output relationship. Laws of returns: Law of variable proportions and law of returns to scale. CACP cost concepts, short run and long run cost curves. Supply: law of supply, supply schedule, supply curve, elasticity of supply. Distribution theory; concepts of rent, wage, interest and profit.

UNIT -IV

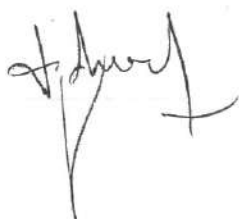
National income: Meaning and importance, circular flow, concepts of national income, difficulties in measurement. Population: Importance, Malthusian and Optimum population theories, current policies and programmes on population control.

UNIT-V

Money: Barter system of exchange, evolution, meaning and functions of money, classification of money, inflation and deflation. International trade and balance of payments. GST and its implication on Indian economy.

Suggested Readings:

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



Objectives:

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

Theory

Origin, geographical distribution, economic importance, soil and climatic requirements, varieties, cultural practices and yield of rabi crops.

Unit – I

Cereals- Wheat & Barley

Unit – II

Pulses- Chickpea, Lentil & Pea

Unit – III

Oilseeds- Rapeseed, Mustard & Sunflower

Unit – IV

Sugar crops & Medicinal crops – Sugarcane, Mentha, Lemon Grass & Citronella

Unit – V

Forage crops- Berseem, Lucerne & Oat

Practical

1. Sowing methods of wheat and sugarcane.
2. Identification of weeds in rabi season crops.
3. Study of morphological characteristics of rabi crops.
4. Study of yield contributing characters of rabi season crops.
5. Yield and juice quality analysis of sugarcane.
6. Study of important agronomic experiments of rabi crops at experimental farms.
7. Study of rabi forage experiments and oil extraction of medicinal crops.
8. Visit to research stations of related crops.

Suggested readings:

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



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.

Theory**Unit I**

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;

Unit II

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;

Unit III

Cost analysis of tractor power and attached implement; Criteria for selection of tractor and machine implements.

Unit IV

Familiarization with Primary and Secondary Tillage implement; Implement for hill agriculture; implement for intercultural operations;

Unit V

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

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

Suggested readings

1. Jagdiswar Sahay – Elements of Agricultural Engineering
2. Jain, S.C. and C.R. Rai-Farm Tractor and maintenance and repair. Standard Publishers, 1705-B, Naisarak. Delhi- 110006 82
3. Ojha, T.P. and A.M. Michael, A.M. Principles of Agricultural Engineering. Vol.I. Jain brothers, 16/893, East Park Road, Karol Bagh, New Delhi -110005
4. Surendra Singh- Farm machinery –Principles and applications, ICAR, New Delhi

Dr. P. K. SHrivastava

Dr. P. K. SHrivastava

Objectives:

1. To study the important properties of soil affecting water availability to crops and water requirement for optimum growth and development.
2. To study different methods of irrigation and water management practices of both field and horticultural crops and drainage.

Theory**Unit – I**

Irrigation: definition and objectives, Importance, Function of water for plant growth, Water resources and irrigation development for different crops in India.

Unit – II

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.

Unit – III

Methods of soil moisture estimation, Evapo-transpiration 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.

Unit – IV

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)

Unit – V

Agricultural drainage. Water management problem, Quality of irrigation water, Irrigation management practices for different soils and crops. Layout of Drip, sprinkler and underground pipeline system.

Practical

1. Determination of Bulk density.
2. Determination of soil moisture content by Gravimetric method, Tensiometer, Electrical resistance block and Neutron moisture meter.
3. Determination of Field capacity
4. Determination of Permanent wilting point.
5. Measurement of irrigation water by using water measuring devices viz., Flumes and Weirs.
6. Calculation of irrigation water requirement (Problems). Determination of infiltration rate.
7. Demonstration of furrow method of irrigation.
8. Demonstration of Check basin and Basin method of irrigation.
9. Demonstration of Filter cleaning, Fertigation, Injection and flushing of laterals, Layout for different methods of irrigation, Erection and operation of Sprinkler irrigation system.
10. Measurement of Emitter discharge rate, Wetted diameter and Calculation of Emitter discharge variability
11. Determination of EC, pH, carbonates, bio-carbonates, Ca^{++} and Mg^{++} in irrigation water (quality parameters)
12. Visit to farmers field and cost estimation of drip irrigation system.

Suggested readings:

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

Objectives:

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

Theory**Unit-I**

Soil quality and health, Distribution of Waste land and problem soils in India with special reference to Assam and North Eastern Region and Chhattisgarh

Unit-II

Categorization of Problem soils based on properties. Reclamation and management of Acid soils, Saline, Sodic soils, Acid Sulphate soils,

Unit-III

Eroded and Compacted soils, polluted soils. Management of Riverine soils, Waterlogged soils, Contaminated soils (Pesticide contamination, Heavy metal contamination), Mined soils (Coal mined, Oil mined),

Unit-IV

Irrigation water – quality and standards, utilization of saline water in agriculture. Use of Remote sensing and GIS in diagnosis and management of problem soils. Irrigation and water quality

Unit-V

Multipurpose tree (MPT) species, bio remediation through MPTs of soils, land capability and classification, land suitability classification.

Practical

1. Determination of pH and EC of saturation extract of problematic soil
2. Determination of redox potential in soil
3. Estimation of water-soluble and exchangeable cations in soil and computation of SAR and ESP and Characterization of problematic soil
4. Determination of gypsum requirement of alkali/sodic soil
5. Determination of lime requirement of acidic soil
6. Determination of quality of irrigation water (Parameters: pH, EC, Ca, Mg, Na, CO₃, HCO₃, Cl, SAR, and RSC)
7. Determination of nitrate (NO₃) from irrigation water
8. Determination of dissolved oxygen and free carbon dioxide levels in water samples

Suggested Readings:

1. Soil science- An Introduction (2015): Indian Society of Soil Science, New Delhi.
2. Dr. D. K. Das (2022); Introductory Soil Science, Kalyani Publishers. Ludhiana.
3. S. J. Rajput: Concept of Soil Science, Kalyani Publishers. Ludhiana.
4. Patil and Mali (1999); Fundamentals of Soil Science, Aman publishing house, Meerut
5. डॉ विनय सिंह और डॉ संदीप सिंह (2014): मृदा विज्ञान-उर्वरक एवं खाद, भारती भंडार मेरठ.
6. अवदेश प्रताप सिंह: मृदा विज्ञान के मूलभूत तत्व, कल्याणी पब्लिशर लुधियाना




Objectives:

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

Theory**Unit -I**

Historical development, concept, nature and role of plant breeding, major achievements and future prospects; Genetics in relation to plant breeding, modes of pollination and reproduction, apomixis, self-incompatibility and male-sterility-genetic consequences, cultivar options (landraces, obsolete & extant varieties, hybrids, mutants and advance breeding lines).

Unit -II

Centres of origin/diversity, Domestication, Introduction and Acclimatization, Components of Genetic variation, Heritability and genetic advance, Universal plant breeder's equation, Genetic basis and breeding methods in self-pollinated crops-mass and pureline selection, hybridization techniques and handling of segregating population. Multiline concept.

Unit -III

Concepts of population genetics and Hardy-Weinberg Law, Genetic basis and methods of breeding cross-pollinated crops, modes of selection; Population improvement schemes- Ear to Row method, Modified Ear to Row, Recurrent selection schemes.

Unit -IV

Heterosis and inbreeding depression, development of inbred lines and hybrids, composite and synthetic varieties; Breeding methods in asexually propagated crops, clonal selection and hybridization; Maintenance of breeding records and data collection.

Unit -V

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 & Farmer's Rights.

Practical

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

Suggested readings

1. Essentials of Plant Breeding by Phundan Singh
2. Plant Breeding: Principles & Practices by J.R. Sharma
3. Plant Breeding by B.D. Singh
4. Principles and Procedures of Plant Breeding - Biotechnological and Conventional Approaches by G.S. Chahal and S.S. Ghosal
5. Principles of Plant Genetics and Breeding by George Acquaah
6. Practical Manual on Principles of Plant Breeding by Department of Genetics and Plant Breeding, IGKV, Raipur



Objectives:

To provide a comprehensive understanding of the different stages of a pest's life cycle, enabling effective pest management strategies by identifying the most vulnerable points to target control measures.

Theory

Scientific name, order, family, host range, distribution, identification, nature of damage, biology and management of insect pests of major crops.

Unit -I

Cereals :- Wheat :- Stem borer, termite, root aphid, cutworm.

Pulses:- Gram: - Pod borer, cutworm; Pea: - Pod borer; Lathyrus :- Thrips

Unit -II

Oilseeds:- Linseed: - Budfly, linseed caterpillar, thrips; Safflower:-Aphid, budfly;

Sunflower & Niger: - Bihar hairy caterpillar; Mustard: - Aphid, sawfly, painted bug.

Unit -III

Cash crops:- Potato: - Tuber moth, aphid, cutworm.

Vegetables :- Sweet potato:- Sweet potato weevil.

Cruciferous:- Cabbage semilooper, diamond back moth, leaf webber.

Tomato: - Fruit borer, white fly.

Ginger & Turmeric: - Shoot borer, Rhizome scale insect.

Onion & Garlic: - Thrips, onion fly.

Coriander: - Aphid, whitefly.

Protected cultivation:- Pests of high value crops.

Unit -IV

Fruits - Pomegranate :- Anar butter fly, bark borer.

Cashew: - Tea mosquito bug, cashew stem and root borer.

Sapota: - Leaf webber, fruit fly.

Mango:- Inflorescence midge, mango hopper, mealy bug, stone weevil, stem borer

Citrus: - Lemon butterfly, citrus psylla, fruit sucking moth, citrus black fly

Papaya: - Fruit fly, aphid, whitefly, mite;

Ber- Ber butterfly.

Litchi: - Nut borer, Erionose mite.

Unit -V

Store grain pests:

Grain moth, Rice moth, Rice weevil, Khapra beetle, Rust red flour beetle, Lesser grain borer

Pulse beetle- their biology, damage, preventive & curative methods of control. Storage structure

Rodents and their management.

Practical

1. Identification and study of life cycle and seasonal history of various insect pests attacking crops and their produce: (a) Field Crops; (b) Vegetable Crops; (c) Fruit Crops; (d) Plantation crops.
2. Identification of insect pests associated with stored grain.
3. Determination of insect infestation by different methods. Assessment of losses due to insects.
4. Determination of moisture content of grain.
5. Visit to Indian Storage Management and Research Institute, Hapur and Quality laboratory, Department of Food, Delhi.
6. Visit to nearest FCI godowns.

Suggested Readings:

1. Atwal, A.S. 1976. *Agricultural Pests of India and South East Asia*. Kalyani Publishers, Ludhiana.
2. Butani, D.K. and Jotwani, M.G. 1984. *Insects in Vegetables*. Periodical Export Book Agency, New Delhi.
3. Butani, D. K. 1984. *Insects and Fruits*. Periodical Export Book Agency, New Delhi.
4. Dennis S Hill 1987 *Agricultural Insect Pests of tropics and their control*, Cambridge University Press, New York

5. Khare, S.P. 1993. *Stored Grain Pests and Their Management*. Kalyani Publishers, Ludhiana
6. Kumar, R., (2017). *Insect Pests of Stored Grains*. Tylor and Francis Groups, Florida USA. 978-1-77188.
7. David, B. B and Ramamurthy, V. V., (2016). *Elements of Economic Entomology*. Brillion Publishing House, New Delhi. 9780994869104.

10/11

10/11

Objective:

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

Theory**Unit-I**

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; producer's surplus – meaning and its types, marketable and marketed surplus, factors affecting marketable surplus of agri-commodities;

Unit-II

Pricing and promotion strategies; market promotion – advertising, personal selling, sales promotion and publicity – meaning, merits and demerits; Marketing functions: 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.

Unit-III

Marketing integration, efficiency, costs and price spread: Meaning, definition and types of market integration; marketing efficiency; marketing costs, margins and prices spread; factors affecting cost of marketing; reasons for higher marketing costs of farm commodities; ways of reducing marketing costs;

Unit-IV

Role of Govt. in agricultural marketing: Public sector institutions- CWC, SWC, FCI, CACP & DMI – their objectives and functions; cooperative marketing in India; Risk in marketing: Types of risk in marketing; speculation & hedging; an overview of futures trading;

Unit-V

Agricultural prices and policy; Trade: present status and prospects of international trade in agri-commodities; WTO; Agreement on Agriculture (AoA) and its implications on Indian agriculture; IPR. 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; 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 Pub, N Delhi.
3. Dominic Salvatore, Micro Economic Theory 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 Joginder Singh, 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. Sharma, R., 2005, Export Management, Laxmi Narain Agarwal, Agra.

Objectives:

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

Theory**Unit-I**

Meaning and scope of agricultural meteorology; Earth atmosphere- its composition, extent and structure; Atmospheric weather variables; Atmospheric pressure, its variation with height; General circulation, Wind, types of wind, daily and seasonal variation of wind speed, cyclone, anticyclone, land breeze and sea breeze;

Unit-II

Nature and properties of solar radiation, solar constant, 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, energy balance of earth;

Unit-III

Atmospheric humidity, types of humidity, vapor 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;

Unit-IV

Weather hazards - drought, floods, frost, tropical cyclones and extreme weather conditions such as heat-wave and cold wave; Weather forecasting- types of weather forecast and their uses.

Unit-V

Climate change, climatic variability, global warming, causes of climate change and its impact on regional and national Agriculture.

Practical

1. Visit of Agrometeorological Observatory, site selection of observatory, exposure of instruments and weather data recording.
2. Measurement of sunshine duration, computation of radiation intensity using BSS.
3. Measurement of maximum and minimum air temperatures.
4. Measurement of soil temperature.
5. Determination of vapor pressure and relative humidity.
6. Determination of dew point temperature.
7. Measurement of atmospheric pressure and analysis of atmospheric conditions.
8. Measurement of wind speed and wind direction, preparation of wind-rose.
9. Measurement and analysis of rain.
10. Measurement of evaporation and evapotranspiration.
11. Measurement of Dew.
12. Computation of PET and AET.

Suggested readings:

1. Introduction to Agrometeorology & Climate Change by Alok Kumar Patra
2. Fundamentals of Agrometeorology and Climate Change by G. S. Mahi & P. K. Kingra
3. Text Book of Agricultural Meteorology by MC Varshneya & PB Pillai
4. Introduction to Agrometeorology by H. S. Mavi
5. Agricultural Meteorology by G.S.L.H.V. Prasado Rao
6. Introduction to Agrometeorology by H.S. Mavi
7. Principles of Agrometeorology by O.P. Bishnoi
8. Meteorology by S.R. Ghadekar
9. Krishi Mausam and Jalavayu Vigyan (Hindi) by R. V. S. Dhiman
10. Agrometeorology by S.R. Reddy & D.S.Reddy

Objective:

To acquaint the students with the basic concepts of plant physiology and their application in agriculture

Theory**UNIT -I**

Definition of 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 its components, Water absorption by plants: Concept of active and passive absorption, Transpiration, stomatal physiology and guttation, Water use efficiency and factors affecting WUE.

UNIT -II

Classification of mineral elements: Essential and beneficial elements, passive and active transport mechanism of mineral element, Function of essential elements and their deficiency and toxicity symptoms, Hydroponics and sand culture.

UNIT- III

Brief outline of Photosynthetic apparatus, pigment system, Red drop and Emerson enhancement effect, 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, Pigment system I & II. Introduction to light reaction and Hill reaction of photosynthesis, Brief introduction to cyclic and non-cyclic photophosphorylation, production of assimilatory powers.

UNIT -IV

Introduction to C3, C4 and CAM pathways: Calvin Cycle, Hatch & Slack Cycle, CAM Cycle and their significance, Factors affecting photosynthesis, Outline of the process of Respiration: Definition and importance, Glycolysis, Krebs Cycle and ETC, Factors affecting respiration, Definitions: Growth, Development and Differentiation, factors affecting growth and development, Introduction to Growth analysis.

UNIT -V

Photoperiodism: Classical works of Garner and Allard. 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 and devernialization, Classification of senescence, 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

1. Study on structure and distribution of stomata
2. Demonstration of imbibition, osmosis, plasmolysis
3. Estimation of water potential
4. Estimation of relative water content
5. Tissue test for mineral nutrients, identification of nutrient deficiency and toxicity symptoms in plant
6. Estimation of photosynthetic pigments
7. Measurement of rate of photosynthesis
8. Measurement of rate of respiration
9. Measurement of rate of transpiration
10. Study of Plant growth analysis
11. Study on senescence and abscission, hormonal regulation of senescence
12. Demonstration of the effects of different PGRs on plants

Suggested readings

1. Hopkins, W.G. and Huner, N.P.A. 2004. *Introduction to Plant Physiology*. John Wiley & Sons.
2. Kuruwanshi, V.B. and Dubey, Shambhavi. 2023. *Fundamentals of Plant Physiology*. Kushal Publications and Distributors, Varanasi (U.P.)
3. Salisbury, F.B. and Ross, C. 1992. *Plant Physiology*. 4th Ed. Wadsworth Publ.
4. Taiz, L. and Zeiger, E. 2006. *Plant Physiology*. 4th Ed. Sinauer Associates.

Objectives:

To provide a comprehensive understanding of the different stages of a pest's life cycle, enabling effective pest management strategies by identifying the most vulnerable points to target control measures.

Theory

Scientific name, order, family, host range, distribution, identification, nature of damage, biology and management of insect pests of major crops.

Unit-I

Cereals: Rice: - Gall midge, stem borer, leaf and planthoppers, leaf folder, case worm, army worm, Swarming caterpillar, gundhi bug. Sorghum & maize: - Stem borer, sorghum shoot fly

Unit-II

Pulses: Soybean: - Girdle beetle, stem fly, tobacco caterpillar, semilooper, whitefly. Pigeonpea: - Pod borer, pod fly, plume moth, spotted pod borer, bug. Urid & Mung: - Pod borer, red hairy caterpillar

Unit-III

Oilseeds: Groundnut: - Aphid, leaf miner, white grub; Sesamum: - Gall fly, Hawk moth, leaf webber & pod borer; Castor: - Castor semilooper, capsule borer, Tussock hairy caterpillar

Unit-IV

Fibre crop: Cotton: - Boll worms, red cotton bug, whitefly, jassid

Cash crops: Sugarcane: - Top shoot borer, stem borer, leaf hopper, white fly, mealy bug.

Unit-V

Vegetables: Okra: - Shoot & fruit borer, whitefly, jassid; Brinjal: - Shoot & fruit borer, Red vegetable mite;

Chilli: - Thrips; Tomato: - Fruit borer, White fly; Cucurbitous vegetables: - Red pumpkin beetle. Fruit fly, pumpkin caterpillar; Ginger & Turmeric: - Shoot borer, Rhizome scale insect.

Fruits: Banana: - Rhizome weevil, stem borer; Gauva: - Bark borer, fruit fly; Pomegranate: - Anar butter fly, bark borer; Cashew: - Tea mosquito bug, cashew stem and root borer; Sapota: - Leaf webber, fruit fly.

Practical

1. Identification and study of life cycle and seasonal history of various insect pests attacking crops and their produce:
 - a. Field Crops;
 - b. Vegetable Crops
 - c. Fruit Crops
 - d. Plantation crops.

Suggested Readings

1. A Textbook of Agricultural Entomology by H.S. Pruthi
2. Entomology in India, By Entomological Society of India.
3. Some South Indian Insects by T.V. R. Ayyar.
4. Agricultural Pests of South Asia by A. S. Atwal. & G.S. Dhariwal.
5. Krishi Kit Vigyan By J.P. Sharma,
6. Arthik Kit Shastra By O.P. Singh,
7. Krishi Kit Vigyan by Upadhyaya and Mathur.
8. Applied Agricultural Entomology by L.K. Jha.
9. Faslon ke Hanikarak keet- S.V.Dhamdhare.
10. Insect pests of fruit crops, vegetables & spices & condiments and their management by Anand Prakash, J. Rao and V. Nandagopal.
11. Text book of applied Entomology Vol. I by K.P. Shrivastava.
12. General and applied Entomology by B.V. David and T.N. Ananthakrishnan.
13. Hand book of Agriculture: ICAR.
14. Hand book of Horticulture: ICAR.
15. Insects & fruits by Bhutani, D.K. Periodical Expert Book Agency, New Delhi.
16. Faslon ke Haniker keet by Bindra Prasad Khare.
17. Phalon ke Hanikarak keet by Virendra Kumar Sharma.
18. Sabjijon ke Haniker keet by Virendra Kumar Sharma.

Theory**Unit-I**

Symptoms, etiology, disease cycle and management of major diseases of following crops: Field Crops: Rice: blast, brown spot, bacterial blight, sheath blight, false smut, khaira and tungro, Wheat: rusts, loose smut, karnal bunt, powdery mildew, alternaria blight and ear cockle; Finger millet: Blast and leaf spot; Maize: stalk rots, downy mildew, Sorghum: smuts, Sugarcane: red rot, smut, Bajra: downy mildew and ergot;

Unit-II

Groundnut: early and late leaf spots, wilt, Soybean: Rhizoctonia blight, bacterial spot, Linseed: Alternaria Blight, Mustard and Rapeseed: Alternaria blight, Powdery mildew, Cotton: Anthracnose, vascular wilt and black arm

Unit-III

Pigeonpea: Phytophthora blight, wilt and sterility mosaic; Gram: wilt, Wet and dry root rot, rust; Lentil: rust and wilt; Black & green gram: Cercospora leaf spot, and anthracnose, web blight and yellow mosaic.

Unit-IV

Horticultural Crops: Guava: wilt and anthracnose; Banana: Panama wilt, bacterial wilt, Sigatoka and bunchy top; Papaya: foot rot, leaf curl and mosaic; Pomegranate: bacterial blight; Mango: anthracnose, malformation, bacterial blight and powdery mildew; Citrus: canker and gummosis

Unit-V

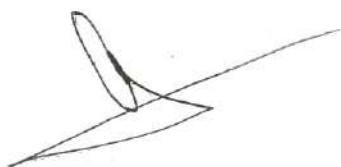
Cruciferous vegetables: Alternaria leaf spot and black rot; Cucurbits: downy mildew, powdery mildew, wilt; Onion and garlic: purple blotch Turmeric: leaf spot; Coriander: stem gall, Potato and Tomato: damping off, wilt, early and late blight, Okra: Yellow Vein Mosaic; Beans: anthracnose and bacterial blight;

Practical

1. Acquaintance with various laboratory equipment and Microscopy.
2. Collection and Preservation of disease samples
3. Herbarium preparation
4. Symptomatology of various plant diseases.
5. Microscopic identification of Plant pathogens
6. General study of different structure of fungi.
7. Staining and identification of plant pathogenic organisms.
8. Preparation of Bordeaux mixture
9. Study of fungicides and their formulations. Methods of pesticides application, Calculation of pesticides sprays concentrations.
10. Diagnostic visits
11. Seed treatment with fungicides and bioagents
12. Use of Crop Doctor App of IGKV

Recommended Books

1. Plant Pathologists' Pocketbook by J. M. Waller; J. M. Lenn'e; S. J. Waller
2. Concise Encyclopedia of Plant Pathology by P. Vidhyasekaran
3. *Plant pathology* by G.N.Agrios
4. *Principles Of Plant Pathology* by R.S. Singh
5. *Plant diseases* by R.S.Singh
6. *Modern plant pathology* by H.C.Dube
7. *Plant bacteriology* by K.K.mondal



Objectives

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

Theory**Unit -I**

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* crops.

Unit -II

Plant genetic resources (PGRs), its utilization and conservation; Ideotype concept, climate resilient crop varieties for future.

Unit -III

Study of genetics of qualitative and quantitative characters, Important concepts of breeding self-pollinated, cross-pollinated and vegetatively propagated crops.

Unit -IV

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 and nutritional).

Unit -V

Hybrid seed production technology in Maize, Rice, Sorghum, Pearl Millet and Pigeon pea etc.

Practical

1. Floral biology, emasculation and hybridization techniques in different crop species viz. Rice, Maize, Ragi, Pigeonpea, Urdbean, Mungbean, Soybean, Groundnut, Cotton, Brinjal, Okra and Cucurbitaceous crops.
2. Maintenance breeding of different varieties of *Kharif* crops.
3. Handling of germplasm and segregating populations by different methods like pedigree, bulk and single seed decent methods.
4. Study of field techniques for seed production and hybrid seed production in *Kharif* crops.
5. Estimation of heterosis, inbreeding depression and heritability.
6. Study of quality characters, donor parents for different characters.
7. Visit to seed production plots.
8. Visit to AICRP breeding plots of different *Kharif* 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. Borthakur
8. Practical manuals on Crop Improvement I (*Kharif* crops) by Rajendra Kumar Yadav

Objectives

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

Theory**Unit – I**

Introduction to weeds, characteristics of weeds, their harmful and beneficial effects on ecosystem.

Unit – II

Classification, reproduction and dissemination of weeds, crop-weed competition, factors of competition, losses in growth and yield of crops; factors affecting growth and development.

Unit – III

Concepts of weed management - Physical, Cultural, Chemical and Biological; Principles and methods of integrated weed management, Implements for weed control, Robotic weed control, Weed management in Organic/ Natural farming.

Unit – IV

Herbicide classification and properties of important herbicides, Concept of adjuvants, Surfactants, Herbicide formulation and their use. Mode of action of herbicides and selectivity phenomenon.

Unit – V

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.

Practical

1. Techniques of weed preservation.
2. Weed identification and losses caused by weeds.
3. Biology of important weeds.
4. Study of weeds in different situations.
5. Study on shift in weed flora in long term trials
6. Study of herbicide formulations and mixture of herbicide.
7. Study of methods of herbicide application.
8. Herbicide spraying equipments, their parts, use and maintenance.
9. Study of Weed control implements.
10. Calculation of herbicide doses and requirement, weed control efficiency and weed index.

Suggested readings:

1. Crafts, A.S. and Robbins, W.W. 1973. Weed Control. Tata McGraw-Hill Publishing Co. Ltd., New Delhi.
2. Gupta, O.P. 2015. Modern Weed Management. Agro Bios (India), Jodhpur.
3. Naidu, V.S.G.R., Handbook of Weed Identification. Directorate of Weed Research, Jabalpur.
4. Rajagopal, A., Aravindan, R. and Shanmugavelu, K. G., 2015. Weed management of Horticultural Crops. Agr (India), Jodhpur.
5. Ramamoorthy, K. and Subbian, P. Predominant Weed flora in hill – ecosystems. Agrobios (India), Jodhpur.
6. Rao, V.S. 2000. Principles of Weed Science. Oxford & IBH Publishing Co., New Delhi.
7. Subramanian, S., Mohammed Ali, A. and Jayakumar, R. 1991. All about Weed Control. Kalyani Publication, Ludhiana.
8. Thakur, C. 1977. Weed Science. Metropolitan Book Co. Pvt. Ltd., New Delhi.



Objectives:

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

Theory**Unit-I**

Importance and scope of ornamental crops and landscaping; Importance and scope of medicinal and aromatic plants; Principles of landscaping; Landscape uses of trees, shrubs and climbers.

Unit-II

Brief concept of Home landscaping, Carpet bedding, Topiary, Bonsai, Lawn, flower arrangement, Herbaceous Border, Hedge, Edge etc.

Unit-III

Production technology of important cut flowers like rose, gerbera and orchids; Production technology of gladiolus, tuberose and liliun; Production technology of chrysanthemum and carnations; Package of practices for loose flowers like marigold and jasmine under open conditions.

Unit-IV

Production technology of important medicinal plants like ashwagandha, asparagus, aloe, costus, Cinnamomum, periwinkle, isabgol and aromatic plants like mint, lemongrass, citronella, palmarosa, ocimum, rose, geranium, vetiver.

Unit-

Processing and value addition of important ornamental crops and MAPs produce.

Practical

1. Identification of Ornamental plants (Trees, Shrubs, Climbers, Seasonal flowers and house plants) and MAPs.
2. Planning and layout of garden.
3. Nursery bed preparation and sowing of seasonal flower seeds.
4. Propagation of ornamental plants by terminal/herbaceous cuttings.
5. Propagation of Anthurium, Orchids and Bougainvillea.
6. Planting of Gerbera suckers and Gladiolus corms and Tuberose bulbs.
7. Bed preparation, propagation and planting of MAP.
8. Training and pruning of ornamental plants and raising of hedge and edge.
9. Establishment and maintenance of lawn.
10. Harvesting and post-harvest handling of cut and loose flowers.
11. Preparation of flower preservatives and their use in extending the vase-life of cut flowers.
12. Processing and value addition in ornamental crops and MAPs produce.
13. Visit to commercial flower/MAP unit.

Suggested readings

1. Randhawa G.S. and Mukopadhyay A. Floriculture in India. Allied Publishers
2. Kumar N., Abdul Khader, Ramaswamy, P. and I. Irulappan.1997. Introduction to spices, plantation crops, medicinal and aromatic plants. Oxford Publishing Company.
3. Anil K. Singh and Anjana Sisodia.2017 Textbook of Floriculture and Landscaping. New India Publishing Agency.
4. T.K. Bose. Commercial Flowers (Vol I and 2).2003. Naya Udyog.

Varsha
09.05.2025

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Objectives:

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

Theory**Unit-I**

Agro-forestry: Definition and scope of Agroforestry, Type of Agroforestry system, potential of Agroforestry in India, Prevailing agroforestry system in central India, Multi purpose tree species (MPTS) - definition, role of MPTS in agroforestry system, its selection for different agroforestry system, MPTS of central India.

Unit-II

Ecological aspects of agroforestry system, tree -crop interaction – competition, nutrient cycling, Traditional Agroforestry as a viable choice to conserve Agro biodiversity in central India.

Unit-III

Management of Agro-forestry system, Role of agroforestry in soil and water conservation, windbreak, shelterbelt-definition, objectives., Socio- economic aspects of Agroforestry, Design and Diagnostic study of agroforestry,

Unit-IV

Silviculture: Definition and scope of silviculture, 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.

Unit-V

Management of tree species. Silviculture of important tree species e.g. Teak, Khamar, Bamboo, Neem, Eucalyptus, Siris and Sissoo; choice of species- site factors, root, crown and bole characteristics, phenology, nutritional and water requirement, ground operation, tending, harvesting utility etc.

Practical

1. Study of tree growth measurement
2. Study of environmental parameters affecting AF System .
3. Plant propagation methods.
4. Pre-sowing seed treatment, preparation of nursery bed exercise.
5. Practical thinning, pruning, coppicing, pollarding etc.
6. Exposure Visit to prevailing agroforestry systems of the state and related important institutions.

Suggested readings

1. Nair, P.K.R : 1993. An Introduction to Agroforestry, Kluwer Academic Publisher

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I/c Academic Forestry

PH

Objectives:

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

Theory**Unit -I**

1. Introduction to Plant Tissue Culture. Principle & applications in crop improvement
2. Cellular totipotency; Micropropagation techniques; Callus culture, suspension culture; Organogenesis and somatic embryogenesis
3. Somaclonal variation; Embryo rescue technique; Protoplast isolation; Somatic hybridization; Anther and pollen culture for haploid production
4. Meristem culture; Synthetic seeds.
5. National certification and Quality management of TC plants. *In vitro* germplasm conservation

Unit-II

1. Introduction to Molecular Biology: DNA structure and function;
2. RNA, types and function; Structure of prokaryotic and eukaryotic gene
3. Central dogma of life –
 - a. DNA replication
 - b. transcription
 - c. genetic codes, translation and protein synthesis
4. Lac Operon concept
5. Nucleic acid hybridization; DNA sequencing – Sanger's method

Unit-III

1. Introduction to genetic engineering (recombinant DNA technology)
2. DNA modifying enzymes and vectors
3. Plant genetic transformation – physical (Gene gun method), chemical (PEG mediated) and Agrobacterium-mediated gene transfer methods
4. Transgenic and its importance in crop improvement with successful stories
5. Introduction to Biosafety and Biosafety levels

Unit-IV

1. Polymerase chain reaction and its applications;
2. Introduction to various molecular markers: RFLP, RAPD, SSR, SNP etc.
3. Marker-assisted breeding in crop improvement,

Unit-V

1. Industrial Biotechnology: Fermentation- Bacterial, Fungal and Yeast, Basic Biochemistry of fermentation.
2. Basic concepts of Upstream and Downstream processing in Bioprocess.
3. Primary Metabolites- Production of commercially important primary metabolites like organic acids, amino acids and alcohols.
4. Secondary Metabolites- Production processes for various classes of secondary metabolites: Antibiotics, Vitamins and Steroids.
5. Production of Industrial Enzymes, Biopesticides, Biofertilizers, Cheese, Beer, Bioremediation.

Practical

1. Introduction to Plant Tissue Culture Laboratory
2. Good Laboratory Practices
3. Media Preparation
4. Glassware sterilization and sterilization techniques
5. Micropropagation; Callus induction and culture
6. Anther culture
7. Apical meristem culture
8. Preparation of synthetic seeds
9. Isolation of Plant genomic DNA
10. Isolation of plasmid DNA
11. Quantification of DNA
12. Agarose Gel Electrophoresis and visualization of plasmid DNA

13. Restriction digestion of plasmid DNA and agarose gel electrophoresis
14. PCR amplification of DNA
15. Gel electrophoresis of amplified DNA
16. Visit to tissue culture units /biotech labs

Suggested readings

1. Bhojwani SS. 1983. Plant Tissue Culture: Theory and Practice. Elsevier.
2. Singh BD. 2007. Biotechnology: Expanding Horizon. Kalyani
3. Christou P and Klee H. 2004. Handbook of Plant Biotechnology. John Wiley & Sons.
4. Lewin B. 2008. Gene IX. Peterson Publications/ Panima. W.H. Freeman & Co.
5. Primrose SB. 2001. Molecular Biotechnology. Panima.
6. Chawla, HS. 2020. Introduction to plant biotechnology. 3rd edition CBS Publishers
7. Singh, P. 2013. Principles of Plant Biotechnology. Kalyani

HL
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HL

Objective:

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

Theory**Unit-I**

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

Unit-II

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

Unit-III

Measures of Dispersion. Characteristics for an Ideal Measure of Dispersion. Different Types of Measures of Dispersions. Definition of Range, Interquartile Range, Quartile Deviation and Mean Deviation. Standard Deviation- Definition, Properties. S.D. and Variance for Grouped and Ungrouped Data. Variance of Combined Series. Co-efficients of Dispersions. Co-efficient of Variation. Measures of Skewness and Kurtosis. Definition of Symmetrical Distribution. Definition of Skewness, Measures of Skewness. Definition of Kurtosis. Measure of Kurtosis. Relationship between Mean, Median and Mode for Symmetrical and Skewed Distribution. Probability Theory and Normal Distribution. Introduction to Probability. Basic Terminologies. Classical Probability-Definition and Limitations. Empirical Probability- Definition and Limitations. Axiomatic Probability.

Unit-IV

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.

Unit-V

Tests of Significance. Definition. Null and Alternative Hypothesis. Type I and Type II Error. Critical Region and Level of Significance. One Tailed and Two Tailed Tests. 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.

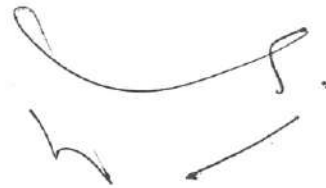
Practical

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

Suggested Readings:

1. Fundamentals of Statistics by D. N. Elhance, Kitab Mahal Publishers.

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



HL

Objectives:

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

Theory**Unit-I**

Centres of origin, distribution of species, wild relatives in different cereals; pulses; oilseeds; fibres; fodders and cash crops; vegetable and other horticultural crops.

Unit -II

Plant genetic resources, its utilization and conservation; Ideotype concept, climate resilient crop varieties for future.

Unit -III

Study of genetics of qualitative and quantitative characters. Important concepts of breeding self-pollinated, cross-pollinated and vegetatively propagated crops.

Unit-IV

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 and nutritional).

Unit-V

Hybrid seed production technology in Wheat, Oat, Sunflower, Safflower, Rapeseed & Mustard etc.

Practical

1. Floral biology, emasculation and hybridization techniques in different *rabi* crop species viz., Wheat, Oat, Linseed, Sunflower, Safflower, Rapeseed & Mustard, Fieldpea, Chickpea, Lathyrus, Potato, Sugarcane, Tomato, Chilli, Onion etc.
2. Study of field techniques for seed production and hybrid seed production in *rabi* crops.
3. Study of quality characters, donor parents for different *rabi* crops.
4. Visit to seed production plots.
5. Visit to AICRP breeding plots of different *rabi* crops.

Suggested readings

1. Essentials of Plant Breeding by Phundan Singh
2. Plant Breeding by B.D. Singh
3. Breeding Field Crops-I by V.L. Chopra
4. Genetic Improvement of Field Crops by C.B. Singh and D. Khare
5. Genetics and Breeding of Pulse crops by D.P. Singh
6. Vegetable Breeding – Principles and Practices by Hari Har Ram
7. Breeding Field Crops by D.A. Sleper and J.M. Poehlman
8. Plant Breeding –Theory and Practice by S.K. Gupta
9. Breeding Asian Field Crops by J.M. Poehlman and D.N. Borthakur
10. Practical Manuals on Crop Improvement I (*Rabi* crops) by Rajendra Kumar Yadav



Objectives

1. To gain the knowledge on different types of materials used in Renewable Energy To understand the importance of Renewable Energy technology and its applications To train the students on the applications of solar thermal technology

Theory**Unit I**

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

Unit II

Familiarization with biomass utilization for biofuel production and their application;

Unit III

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

Unit IV

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;

Unit V

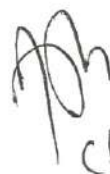
Introduction of wind energy and their application. Availability of bio mass and their application in different places.

Practical

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

Suggested readings

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

 29/12/25
A.K. SHRIVASTAVA



Objectives:

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

Theory:**Unit – I**

Dryland /Rainfed agriculture: Introduction, types and characteristics; History of dryland/ rainfed agriculture in India; Problems and prospects of dry land/rainfed agriculture in India.

Unit – II

Soil and climatic conditions prevail in dry land/rainfed areas, Soil and water conservation techniques.

Unit – III

Drought: Types, Effect of water deficit, Physio-morphological characteristics of the plants, Crop adaptation and mitigation to drought;

Unit – IV

Water harvesting: Importance, its techniques, Efficient utilization of water through soil and crop management practices, Crops and cropping system in dryland /rainfed areas.

Unit – V

Management of crops in dryland/ rainfed areas, Contingent crop planning for aberrant weather conditions, Concept, history, objective, Principles and components of watershed management, Factors affecting watershed management.

Practical

1. Studies on climate classification.
2. Studies on rainfall pattern in rainfed areas of the country and pattern of onset and withdrawal of monsoons.
3. Studies on cropping pattern of different rainfed areas in the country and demarcation of rainfed area on the map of India.
4. Interpretation of meteorological data and scheduling of supplemental irrigation on the basis of evapo-transpiration demand of crops.
5. Critical analysis of rainfall and possible drought prone areas in the country.
6. Effective rainfall and its calculation. Studies on cultural practices for mitigating moisture including mechanical and agronomic measures.
7. Soil moisture determination under different land situations.
8. Importance of seed priming to mitigate drought.
9. Assessment of meteorological drought.
10. Characterization and delineation of watershed.
11. Field demonstration on soil & moisture conservation measures.
12. Field demonstration on construction of water harvesting structures.
13. Visit to rainfed research station/watershed.

Suggested readings:

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

Objective: To impart the fundamental knowledge on structure and function of cellular components, biomolecules and the biological processes in plants

Theory**Unit-I**

1. Biochemistry – Introduction and importance
2. Properties of water, Hydrogen Bond
3. pH and buffer
4. Plant cell and its components.

Unit-II

1. Bio-molecules– Structure, classification
2. Structure, Properties and function of carbohydrates
3. Structure, Properties and function of amino acids
4. Proteins, lipids and nucleic acids

Unit-III

1. Vitamins – physiological and metabolic role
2. Enzymes: General properties
 - a. Classification
 - b. Mechanism of action
 - c. Michaelis and Menten equation
 - d. Line Weaver Burk equation and plots
3. Introduction to allosteric enzymes, immobilized enzymes, use of enzymes

Unit-IV

1. Metabolic energy and its generation – Metabolism – Basic concepts
2. Biosynthetic Pathways – Photosynthesis, gluconeogenesis
3. Fatty acid and starch formation
4. Oxidative phosphorylation, Fatty acid oxidation
5. Glycolysis, Citric acid Cycle,
6. Pentose phosphate pathway
7. Nitrogen fixation

Unit-V

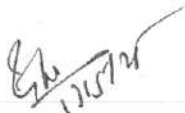
1. Regulation of metabolic pathways (two classes)
2. Secondary metabolites: Terpenoids, Alkaloids, Phenolic
3. Applications of secondary metabolites in food and pharmaceutical industries

Practical

1. Preparation of standard solutions and reagents,
2. Determination of pH
3. Qualitative tests of carbohydrates
4. Qualitative tests of amino acids
5. Quantitative estimation of soluble sugars and starch
6. Estimation of protein by Kjeldhal method and Lowry's method
7. Preparation of mineral solution from ash
8. Estimation of fat by Soxhlet method
9. Determination of acid value, saponification value and iodine number
10. Estimation of ascorbic acid
11. Qualitative tests of secondary metabolites
12. Quantitative tests of secondary metabolites

Suggested reading

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



Objectives:

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

Theory**Unit-I**

Introduction to Microbiology: Definition, applied areas of Microbiology and Importance of Microbiology. History of Microbiology: Discovery of microorganisms, spontaneous generation theory, Germ theory of diseases.

Unit-II

Bacteria: cell structure, chemoautotrophy, photo autotrophy, growth. Bacterial genetics: Genetic recombination- transformation, conjugation and transduction Genetic Engineering: Plasmids, episomes, and genetically modified organisms

Unit-III

Phyllosphere microflora, Phylloplane microflora, microflora of floral parts etc.

Microbial spoilage and principles of food preservations, Food poisoning, Microbial products, Biodegradation, Biogas production,

Unit-IV

Concepts of rhizosphere microbiology- Rhizodeposits - biochemical nature, release mechanism in rhizosphere, Rhizosphere microbiome- residents and their roles Potential of plant growth promoting rhizobacteria (PGPR) and endophytes on soil health and sustainability

Unit-V

Bioremediation of polluted soils using microbial mediators. Bio-remediation of polluted soils. Water Microbiology, water microorganisms, and microbial analysis of water e.g. coliform test, Purification of water.

Practical

Study of the microscope, Acquaintance with laboratory material and equipments, 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,

Suggested readings

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



Objectives:

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

Theory:**Unit-I**

Agricultural Finance- meaning, scope and significance, credit needs and its role in Indian agriculture. Agricultural credit: meaning, definition, need, classification. Credit analysis: 4 R's, and 3 C's of credits.

Unit-II

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.

Unit-III

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.

Unit-IV

Agricultural Cooperation –Meaning, brief history of cooperative development in India, objectives, principles of cooperation, significance of cooperatives in Indian agriculture. Credit, marketing, consumer and multi-purpose cooperatives, farmers' service cooperative societies, processing cooperatives, farming cooperatives, cooperative warehousing;

Unit V

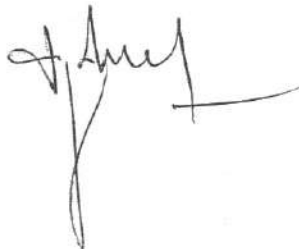
Role of ICA, NCUI, NCDC, NAFED. 3 R's, 5 C's and 7 P's of credit. Crop insurance: its scope, significance and limitations and the potential of the newly launched 'Pradhan Mantri Fasal Bima Yojana' (Prime Minister's Crop Insurance Scheme).

Practical

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

Suggested readings

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



Objectives

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

Theory**Unit-I**

Introduction to seed technology, definition and importance. Seed quality - definition, characters of good quality seed, Causes of deterioration of varietal purity and assessment of genetic purity.

Unit-II

Different classes of seeds, foundation and certified seed production of important cereals, pulses and oilseed; seed & field standards; field inspection- importance and procedures.

Unit-III

Post-harvest seed quality management, seed processing procedures, seed drying, seed treatment- methods and importance, seed packing.

Unit-IV

Seed storage - general principles, stages and factors affecting seed longevity during storage, Seed health management during storage.

Unit-V

Seed Certification and legislation, Seed Act 1966 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

1. Seed Structure
2. Seed sampling
3. Physical purity test
4. Moisture determination
5. Germination test
6. Seed and seedling vigour test
7. Seed Viability test
8. Genetic purity test: Grow out test
9. Field inspection
10. Seed health testing using blotter and agar plate method
11. Visit to seed production farms
12. Visit to seed testing laboratories
13. Visit to 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, 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. McDonald M.B. Jr & Copeland L.O. 1997. Seed Production: Principles and Practices. Chapman & Hall.
5. Tunwar, N.S. & Singh S.N. 1988. Indian Minimum Seed Certification Standards. CSCB, Ministry of Agriculture, New Delhi.
6. Practical Manual on Principles of Seed Technology by Department of Genetics and Plant Breeding, IGKV, Raipur.

Objectives:

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

Theory**Unit-I**

Transformation of agriculture into agribusiness, various stakeholders and components of agribusiness systems. Importance of agribusiness in the Indian economy and New Agricultural Policy. Distinctive features of Agribusiness Management: Importance and needs of agro-based industries, Classification of industries and types of agro based industries.

Unit-II

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 & SWOT analysis.

Unit-III

Management functions: Roles & 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.

Unit-IV

Marketing Management: Segmentation, targeting & positioning. Marketing mix and marketing strategies. Consumer behavior analysis, Product Life Cycle (PLC). Sales & Distribution Management. Pricing policy, various pricing methods.

Unit-V

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

Agribusiness
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AG

Objectives

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

Theory:**Unit - I**

Introduction to Natural Resource Bases: Concept of resource, classification of natural resources. Factors influencing resource availability, distribution and uses. Interrelationships among different types of natural resources. Concern on Productivity issues. Ecological, social and economic dimension of resource management.

Unit -II

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 & 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.

Unit -III

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.

Unit -IV

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.

Unit -V

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:

1. Identifying natural resources and their utility
2. Practicing survey – Principles and educating to use pacing technique for measurement.
3. Area calculations through chain survey
4. GPS demo for tracking and area measurement.
5. Estimation of soil loss and calculation of erosion index.
6. Leveling concepts and practical utility in agriculture.
7. Preparation of contour maps.
8. Concept of Vegetative water ways and design of grassed water ways.
9. Wind erosion and estimation process.
10. Different irrigation pumps and their constructional differences
11. Farm pond construction and its design aspects.
12. Visit to nearby farm pond.
13. Visit to an erosion site
14. Exposure to strip cropping/contour bunding.

Note:-

1. Unit 1 to 3 of Theory (Department of Agronomy)
2. Unit 4 to 5 of Theory and all the Practical's (Department of Soil and Water Engineering)

Suggested readings:

1. Sustainable Natural Resource Management by Danill R. Lynch
2. Management of Natural Resource for Sustainable Development, by Vijay Singh Rathor and B S Rathor, Daya Publishing House
3. Managing Natural Resources : Focus On Land And Water: Ed. Harikesh N. Mishra PHI, 2014 Learning, 496p.

4. Management of Resources for Sustainable Development: Sushma Goel, The Orient Blackswan 2016, 284p.
5. Natural Resources: Their Conservation and Management: Arvindrai Upadhyay, Aspiration Academy, 320p.
6. Natural Resource Management for Growth Development and Sustainability: Vasudeva Srishti Pal, 2023, Today & Tomorrows Printers And Publishers, 336p.

*Gu
9/5/23*

HL

Objectives: To impart knowledge on different classes of agrochemicals

Theory:

Unit I

An introduction to agrochemicals, their type and role in agriculture, effect on environment, soil, human and animal health, merits and demerits of their uses in agriculture, management of agrochemicals for sustainable agriculture.

Unit II

Herbicides- Major classes, properties and important herbicides. Fate of herbicides.

Unit III

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.

Unit IV

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 & plant. IGR Biopesticides, Reduced risk insecticides, Botanical, Plant and animal systemic insecticides their characteristics and uses. Plant bio-pesticides for ecological agriculture, Bio-insect repellent

Unit V

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.

Practical:

1. Sampling of fertilizers and pesticides application technology to study about various pesticides appliances.
2. Quick tests for identification of common fertilizers.
3. Identification of anion and cation in fertilizer.
4. Calculation of doses of insecticides to be used.
5. To study and identify various formulations of insecticide available in market.
6. Estimation of nitrogen in Urea.
7. Estimation of water soluble P₂ O₅ and citrate soluble P₂ O₅ in single super phosphate.
8. Estimation of potassium in Murate of Potash/ Sulphate of Potash by flame photometer.
9. Determination of copper content in copper oxychloride.
10. Determination of sulphur content in sulphur fungicide.
11. Determination of thiram.
12. Determination of ziram content.

Suggested readings:

1. Buchel KH (Ed.) 1992. Chemistry of pesticides. John Wiley & Sons.
2. Panda H. 2022. The Complete Technology Book on Pesticides, Insecticides, Fungicides and Herbicides (Agrochemicals) with Formulae, Manufacturing Process, Machinery & Equipment Details 2nd Revised Edition. NPCS.
3. Singh D.R. 2021. A Text Book of Fertilizers. New India Publishing Agency.
4. Larramendy, M.L. 2017 Toxicity and Hazard of Agrochemicals., INTECH, 170p.
5. R. K. Basak: Fertilizer- A textbook, Kalyani Publishers. Ludhiana.
6. Soil science- An Introduction (2015): Indian Society of Soil Science, New Delhi.
7. Biswas D. R. (2021): A textbook of Fertilizers. New India Publishing Agency,

8. Yawalkar, K S et al. 2016: Manures and Fertilizers 12th edn (PB): Jain Book, Agency.

AEXT 421 Agricultural Journalism

4(3+1)

Objectives: To impart knowledge and skill in agricultural journalism

Theory

Unit-I

Journalism – Meaning, nature, importance, and types of journalism. Agricultural Journalism – Meaning, definition, principle, objectives, types, and scope. Similarities and difference between agricultural journalism and other types of journalism. Role of agricultural journalist, Training of agricultural journalist. Qualities of journalist, Role of journalist/Journalism in agricultural development and development of newspaper and magazines readers.

Unit-II

Newspaper and magazines as communication media: Characteristics, kinds and functions of newspaper and magazines, Characteristics of newspaper and magazines readers. Form, content, style and language of newspaper and magazines, Standard part of newspaper and magazines.

Unit-III

The agricultural story: Type 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.

Unit-IV

Success stories – definition, nature, components, guidelines of writing a success story. Writing a new story, difference between news and feature 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.

Unit-V

Use of photograph in agricultural journalism-Basic principles of photography – composition, exposure, lens, light Use of artwork (Graphs, charts maps, etc) Writing the captions Editorial mechanism: Copy reading, headline and title writing Proofreading: definition, signs and symbols of proofreading, level of proofreading, duties of a proof-reader Layout – meaning, principles of layout and design.

Practical

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

Suggested readings:

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

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Objective:

1. To educate the students about concept, designing principles and components of landscaping.
2. To enable the students to identify different ornamental plants and their utilization in landscaping.
3. To develop knowledge about lay-out and maintenance of gardens.
4. To develop skill and competency in landscape development.

Theory**Unit-I**

Importance and scope of commercial landscape gardening. Elements and principles of landscape design, garden styles and types, terrace gardening, vertical gardening, garden components(living and non-living), adornments, lawn making, rockery, water garden, walk-paths, bridges, other constructed features etc. and gardens for special purposes.

Unit-II

Trees: selection, propagation, planting schemes and canopy management. Shrubs and herbaceous perennials: selection, propagation, planting schemes and architecture.

Unit-III

Climber and creepers: Importance, selection, propagation and planting. Annuals: selection, propagation and planting scheme. Other garden plants: palms, ferns, grasses, cacti and succulents. Pot plants: selection, arrangement and management.

Unit-IV

Bio-aesthetic planning: definition, need, planning; landscaping of urban and rural areas, Peri-urban landscaping, Landscaping of schools, public places like bus stands, railway stations, townships, river banks, hospitals, play grounds, airports, industries, institutions etc.

Unit-V

Bonsai: Principles and management. Lawn: establishment and maintenance.

Practical

1. Identification of various ornamental plants -trees, shrubs, annuals, pot plants.
2. Identification of tools and implements used in landscape design and training and pruning of plants for special effects.
3. Propagation of trees, shrubs and annuals, care and maintenance of plants, potting and repotting.
4. Practice of lawn establishment and maintenance.
5. Layout of formal gardens and informal gardens.
6. Special type of gardens (sunken garden, terrace garden, rock garden) and designing of conservatory and lath houses.
7. Special techniques in garden landscaping (burlaping, waterscaping, xeriscaping, topiary styles), planting of edges hedges, herbaceous and shrubbery borders.
8. Basics in computer aided design (CAD) for developing garden landscape plan.
9. Visits to important gardens/ parks/ institutes.

Suggested readings:

1. Bose, Chowdhury and Sharma.1991.Tropical Garden Plants in colour .Horticulture and allied publishers, 3D Madhab Chatterjee Street Kolkata.
2. K.V.Peter.2009.Ornamental plants. New India publishing agency, Pitampura, New Delhi.
3. Richard Bird. 2002. Flowering trees and shrubs. Printed in Singapore by Star Standard Industries pvt. Ltd.
4. Bimaldas Chowdhury and Balaj Lal Jana.2014.Flowering Garden trees. Pointer publishers, Jaipur. India.
5. Arora, J.S. 2006. Introductory Ornamental Horticulture. Kalyani Publishers, Ludhiana
6. Randhawa, G.S. Amitabha Mukhopadhyay, 2004. Floriculture in India. Allied Publishers Pvt. Ltd., New Delhi.
7. Bose, T.K. Mukherjee, D. 2004. Gardening in India. Oxford & IBH Publishers.
8. Chadha, K.L. and Chaudhary, B. 1986. Ornamental Horticulture in India. Publication and Information division. ICAR,New Delhi.
9. Singh A.K.and Anjana Sisodia.2017. Textbook of Floriculture and Landscaping. New India Publishing Agency

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10. Y. Chandrasekhar and Hemala Naik B. 2020. Principles of Landscape Gardening: ICAR, New Delhi.
11. Rajaneesh Singh and Brijendra Kumar Singh. 2020. Introductory Ornamental Horticulture and Landscape Gardening: Bio-Green Books.
12. Pragnyashree Mishra and Bhimasen Naik. 2022. Principles of Landscape Architecture, New India Publishing Agency.
13. Sudhir Pradhan, 2018, Landscape Gardening .Scientific Publishers India.

✓ Received
19-05-2025

At

Objectives:

1. To discuss about hybrid development and various crop improvement aspects of field crops viz. Rice, Wheat, Maize, Pigeonpea, Chickpea, Green gram, Black gram, Lathyrus, Soybean, Ground nut, Linseed, Safflower, Rapeseed-mustard, Cotton and important vegetable crops etc.
2. To provide understanding on tissue culture and biotechnological approaches as alternative strategies for development of line and cultivar.
3. To impart knowledge on seed production, release and notification of varieties and PPVFR Act, 2001.

Theory**Unit I**

Types of crops and modes of 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.

Unit II

Genetic test of commercial hybrids. Advances in hybrid seed production of Maize, Rice, Sunflower, Cotton, Pigeon pea, Brassica etc.

Unit III

Speed breeding, breeding management system, high-through put phenotyping and genotyping platforms.

Unit IV

Quality seed production of Vegetable crops. Alternative strategies for the development of the line cultivars: Haploid inducers, tissue culture techniques and biotechnological tools.

Unit V

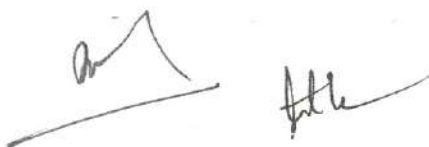
IPR issues in commercial plant breeding: DUS testing and registration of varieties under PPVFR Act. Variety testing, release and notification systems in India. Principles and techniques of seed production, types of seeds, quality testing in self and cross pollinated crops.

Practical

1. Floral biology in self and cross pollinated species, selfing and crossing techniques
2. Techniques of seed production in self and cross pollinated crops using A/B/R and two line system
3. Learning techniques in hybrid seed production using male sterility in field crops
4. Understanding the difficulties in hybrid seed production.
5. Tools and techniques for optimizing hybrid seed production
6. Concept of roguing in seed production plot
7. Concept of line, its multiplication and purification in hybrid seed production
8. Role of pollinators in hybrid seed production
9. Hybrid seed production techniques in Rice, Wheat, Maize, Pigeonpea, Chickpea, Green gram, Black gram, Lathyrus, Soybean, Ground nut, Linseed, Safflower, Rapeseed-mustard, Cotton and important vegetable crops etc.
10. Sampling and analytical procedures for purity testing and detection of spurious seed.
11. Seed drying and storage structure in quality seed management.
12. Screening technique during seed processing, viz. grading and packaging.
13. Visit to public private seed production and processing plants.

Suggested Reading

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 by R.W. Allard.
4. Breeding Field Crops by J.M. Pochlmen and Borthakur
5. Commercial Plant Breeding Objective: Phundan Sigh, Mridula Billore and Monika Singh. Astral Publishing.
6. Breeding and Crop Production: H. Padmalatha.
7. Biotechnology for Agricultural Breeding by Mangal S.K.



Objectives:

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

Theory**Unit-I**

1. Food safety –Definition, Importance, Scope and Factors affecting Food Safety.
2. Hazards and Risks, Type of Hazards - Biological, Chemical Physical hazards.
3. Management of hazards – Need.
4. Control of Parameters.
5. Temperature Control.

Unit -II

1. Food Storage.
2. Production Design.
3. Hygiene and Sanitation in Food Service Establishments- Introduction.
4. Sources of contamination and their control.
5. Waste Disposal.
6. Pest and Rodent Control.

Unit -III

1. Food safety Measures.
2. Food Safety Management Tool- Basic concepts.
3. PRPs, GHPs, GMPs, SSOPs etc.
4. HACCP.ISO series.
5. TQM- concept and need for quality, components of TQM, Kaizen and Risk Analysis.
6. Accreditation and Auditing,

Unit-IV

1. Water Analysis,
2. Surface Sanitation
3. Personal Hygiene.
4. Food laws and Standards Indian Food Regulatory Regime, FSSAI. Global Scenario CAC.
5. Other laws and standards related to food.

Unit -V

1. Packaging, Product labelling and Nutritional labelling.
2. Genetically modified food/transgenic. Organic foods.
3. Newer approaches to food safety.
4. Recent Outbreaks. Recent concerns -New and Emerging Pathogens.
5. Indian and International Standards for food products.

Practical

1. Water quality analysis physico – chemical and microbiological
2. Preparation of different types of media
3. Microbiological examination of different food samples
4. Assessment of surface sanitation by swab/rinse method
5. Assessment of personal hygiene
6. Biochemical tests for identification of food borne bacteria
7. Scheme for the detection of food borne pathogens
8. Preparation of plans for Implementation of FSMS-HACCP, ISO:22000.

Suggested readings

1. Text book of Food Science and Technology: Avasthi Sharma.
2. Handbook of Food Safety: D.S.L. Khatekar and N. Sarkate. Step Up Academy, 576p.
3. Food and Beverage Management: Bernard Davis. Andrew Lockwood, Ioannis Pantelidis, Peter Alcott Routledge
4. Food safety and Quality Control: Pulkit Mathur. The Orient Blackswan.332p.
5. Safe Food Handling: HACCP booklet for Food Handlers. Cletus Fernandes, Notion Press.

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Objectives:

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

Theory:**Unit I**

Introduction and history of biological control of pest and diseases. Microbial biopesticides: the global and Indian market scenario; biopesticides for organic agriculture, Different phytopathogenic biocontrol agents: Mode of action, Regulatory system of biopesticides in India.

Unit II

Formulations of plant essential oils, botanicals, Pheromone, and parapheromone and their application in insect pest management.

Unit III

Use of predators and parasitoids for insect pest management.

Unit IV

Nanotechnology: its applications in pest and disease diagnosis and management.

Nano biopesticides: Concept and importance, different techniques of producing nano biopesticides.

Unit V

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, Microbial inoculants as biofertilizers.

Practical:

1. Preparation of biofertilizers (e.g., Rhizobium, Azospirillum)
2. Formulation of biopesticides (e.g., Bacillus thuringiensis)
3. Quality control and testing of bioformulations
4. Synthesis of nanoparticles (e.g., silver, gold, or iron oxide)
5. Formulation of nano-pesticides or nano-fertilizers
6. Characterization of nanoparticles (e.g., size, shape, zeta potential)
7. Microscopy: Light microscopy, scanning electron microscopy (SEM), or transmission electron microscopy (TEM) to visualize microorganisms or nanoparticles.
8. Spectroscopy: UV-Vis spectroscopy, Fourier transform infrared spectroscopy (FTIR), or dynamic light scattering (DLS) to characterize nanoparticles.
9. Colony counting: Enumerating microorganisms in bioformulations.
10. Agriculture: Bioformulations and nano-formulations for crop protection, plant growth promotion, or nutrient delivery.
11. Environmental science: Bioremediation or pollution control using bioformulations or nano-formulations.
12. Personal protective equipment: Gloves, lab coats, and safety glasses to prevent exposure to microorganisms or nanoparticles.
13. Sterile techniques: Aseptic handling to prevent contamination of bioformulations.
14. Nanoparticle handling: Precautions to prevent exposure to nanoparticles, such as using fume hoods or glove boxes.

Suggested readings:

1. Baker, E.F. and James, R.C. 1982. Biological Control of Plant Pathogens. American Phythological Society.
2. Borkar, S.G. 2015. Beneficial Microbes as Biofertilizers and its Production Technology
3. Boland, G.J. and David, L. 1998. Plant microbe interactions and Biological Control. Kuykendall Marel Dekker, INC.
4. Ciancea, A. and Mukerji, K.J. 2007. General Concepts of Interated Pest and Disease Management. Edited Published by Springer.

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5. Cincholkar, S.B. and Mukherji, K.G. 2007. Biological Control of Plant Disease. Hawarth Food and Agricultural products.
6. Gnanamanickam, S.S. 2002. Biological control of crop Disease. Kuykendall Marel Dekker, NIC.
7. Ramanujam, B. and Rabindra, R.J. 2006. Current Status of Biological Control of Plant Disease using Antagonistic Organisms in India. Precision Fototype Services Bangalore.
8. Singh, S.P. and Hussnini, S.S. '1998. Biological Suppression of Plant Disease, Phytoparasitic Nematodesand Weeds. Precision Fototype Services Bangalore.
9. Allhoff, Fritz and Lin, Patrick (Eds) 2009. Nanotechnology and Society, ISBN: 978-1-4020-6280-7 Springer Publications, UK.
10. R. K. Basak:Fertilizer- A textbook, Kalyani Publishers. Ludhiana.
11. Soil science- An Introduction (2015): Indian Society of Soil Science, New Delhi.
12. Biswas D. R. (2021): A textbook of Fertilizers. New India Publishing Agency,
13. Yawalkar, K S et al. 2016:Manures and Fertilizers 12th edn (PB): Jain Book, Agency.

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Objectives:

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

Theory**Unit I**

Biofertilizers - History, introduction, status and scope. Structure and characteristics features of bacterial biofertilizers - *Azospirillum*, *Azotobacter*, *Bacillus*, *Pseudomonas*, *Rhizobium* and *Frankia*; Cynobacterial biofertilizers- *Anabaena*, *Nostoc*, *Hapalosiphon* and fungal biofertilizers - AM mycorrhiza and ectomycorrhiza.

Unit II

Nitrogen fixation -Free living and symbiotic nitrogen fixation. Mechanism of P-solubilisation and P- mobilization, K solubilisation. Production Technology: Strain selection, sterilization, growth and fermentation, mass production of carrier based and liquid biofertilizers.

Unit III

Application technology of Bio-fertilizers for seeds, seedlings, tubers, sets etc. Bio-fertilizers storage, shelf life, quality control and marketing. Factors influencing the efficiency of biofertilizers.FCO specifications and quality control of biofertilizers .

Unit IV

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.

Unit V

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.

Practical

Isolation and purification of *Azospirillum*, *Azotobacter*, *Rhizobium*, *Pseudomonas*, *Bacillus*, 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.

Isolation and purification of important biopesticides: *Trichoderma*, *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.

Suggested readings**Biofertilizers**

1. Handbook of Microbial Biofertilizers- Dr. Awani Kr. Singh, Agrotech Press, Jaipur, India
2. Biofertilizers for Sustainable Agriculture- Sampat Nehra, Aavishkar Publishers, Jaipur, India
3. Organic Farming- A.K. Singh, New India Publishing Agency, New Delhi
4. Fungal Biopesticides and VAM applications-P.C.Trivedi, Pointer publishers, Jaipur, India

Biopesticides

1. Baker, E.F. and James, R.C. 1982. Biological Control of Plant Pathogens. American Phytopathological Society
2. Boland, G.J. and David, L.1998. Plant microbe interactions and Biological Control. Kuykendall Marel Dekker, INC.
3. Borkar, S.G. 2015. Beneficial Microbes as Biofertilizers and its Production Technology
4. Ciancia, A. and Mukerji, K.J. 2007. General Concepts of Integrated Pest and Disease Management, Edited Published by Springer.
3. Cincholkar, S.B. and Mukherji, K.G. 2007. Biological Control of Plant Diseases. Hawarth Food and Agricultural products.

Objectives

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

Theory**Unit -I**

System approach for representing soil-plant-atmospheric continuum, system boundaries. Crop models, concepts and techniques, types of crop models, data requirements, relational diagrams. **Unit-II**

Evaluation of crop responses to weather elements; Elementary crop growth models; calibration, validation, verification and sensitivity analysis.

Unit-III

Yield prediction models; crop simulation models; forecasting models for insects and diseases. Crop production in moisture and nutrients limited conditions; components of soil water and nutrients balance.

Unit-IV

Weather forecasting, types methods, tools and techniques of weather forecasting, forecast verification; Value added weather forecast, ITK for weather forecast and its validity

Unit-V

Crop -Weather Calendars; Synoptic charts, Preparation of agro-advisory bulletins based on weather forecast and its effective dissemination.

Practical

1. Preparation of crop weather calendars.
2. Preparation of agro-advisories based on weather forecast using various approaches
3. Preparation of synoptic charts.
4. Working with statistical and simulation models for crop growth
5. Potential and achievable production
6. Yield forecasting, insect and disease forecasting models
7. Sensitivity analysis of varying weather and crop management practices
8. Use of statistical approaches in data analysis and preparation of historical, past and present meteorological data for medium range weather forecast
9. Feedback from farmers about the agro- advisory

Suggested readings

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



Theory**Unit -I**

Introduction & importance; Nursery management and mechanization; micro propagation of horticultural crops, hydroponic & aeroponic culture.

Unit -II

Modern field preparation and planting methods, Protected cultivation: advantages, controlled environmental conditions, method and techniques,

Unit -III

Micro irrigation systems and its components, EC, pH-based fertilizer scheduling,

Unit -IV

Canopy management, high density orcharding, Components of precision farming, Remote sensing, Geographical Information System (GIS), Different Geo-positioning System (DGPS), Variable Rate Applicator (VRA)

Unit -V

Application of precision farming in horticultural crops (fruits, vegetables and ornamental crops), vertical garden, mechanized harvesting of produce.

Practical

1. Types of polyhouses
2. Structure of shade net houses.
3. Intercultural operations,
4. Tools and equipments identification and their application,
5. Micro propagation,
6. Nursery- Management,
7. Micro-irrigation, EC, pH based fertilizer scheduling,
8. Canopy management,
9. Visit to hi-tech orchard/nursery.

Suggested readings:

1. Hi-tech Horticulture by T.A. More
2. Greenhouse operation and management by Paul V. Nelson
3. Hi Tech Horticulture (Pb), S. Prasad, Dharam Singh and R'L, Bharadwaj, 2020, Agrobios
4. Instant Horticulture, S.N.Gupta, Jain Brothers, 2023, 488p.
5. Hydroponics for Beginners and Advanced: The Ultimate Hydroponic and Aquaponic Gardening Guide, Tom Garden, Webb Eleanor

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Theory**Unit -I**

Protected cultivation- importance and scope, status of protected cultivation in India and abroad.

Unit -II

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.

Unit -III

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.

Unit -IV

Cultivation of economically important medicinal and aromatic plants.

Unit -V

Cultivation practices of vegetables under protected cultivation.

Practical

1. Types of protected cultivation.
2. Tools and equipments identification and their application,
3. Raising of seedlings.
4. Growing media.
5. Preparation of beds
6. Transplanting of crop plants.
7. Fertilizers application
8. Water management.
9. Harvesting & Piciking.

Suggested readings:

1. Greenhouse operation and management by Paul V. Nelson
2. Protected cultivation of Horticultural crops by Madan Kr. Jha, SujanSinghPaikra, Manju Rani Sahu
3. Protected Cultivation of Horticulture Crops by Itigi Prabhakar, 2020, IBPSS.
4. Advances in Protected Cultivation byBrahma Singh and Balraj Singh, 2015, NIPA,252p.
5. Protected Cultivation and Smart Agriculture by Eds. Sagar Maitra, Dinkar J. Gaikwad and Tanmoy Shankar, 2020 New Delhi Publishers, 263p.
6. Textbook Of Protected Cultivation and Precision Farming For Horticultural Crops by B. Ashok Kumar, Eggadi Ramesh and Sindhu V, 2022, Jain Brothers.

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Objectives

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

Theory**Unit -I**

Climate change and impacts of climate change on agriculture and food security; crop productivity under different climate change scenarios including extreme events such as drought, flood, pest and disease outbreak etc.

Unit-II

Basics of adaptation 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.

Unit-III

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

Unit-IV

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

Unit-V

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

1. Acquaintance with meteorological instruments including AWS, Statistical techniques to study trend of climatic parameters
2. Analysis of extreme weather events using non-parametric tests
3. Building climate change scenarios under different futuristic emission of GHGs
4. Designing strategies to mitigate the effect of climate change using climate resilient crops/cultivars, Climate resilient technologies and manipulation of cropping patterns
5. Acquaintance with ICTs for effective dissemination of local weather information and agro-advisories
6. Analysing carbon sequestration potential of different agro-ecosystems
7. Designing climate smart village model considering the availability of resources
8. Awareness programme on climate change and climate resilient agriculture among farming community

Suggested readings

1. Climate Resilient Animal Agriculture by GSLHV Prasada Rao. New India Publishing Agency. 460 pages
2. Climate Resilient Agriculture Adaptation and Mitigation Strategies by Bhan Manish. New India Publishing Agency 304 page
2. Climate-Smart Agriculture Source book. FAO (2013).
3. 4., Implications for Climate Smart Agriculture by Wahid Hasan, Sachin G. Mundhe, Abdul Majid Ansari and Shivani Kumari. Biotech Books, 357p.
4. Climate Change and Agriculture Over India by Prasad Rao. PHI Learning, 352p.
5. Climate Smart Agriculture for Sustaining Crop Productivity and Improving Livelihood
6. Security by Prakash M. Satish Serial Publishing House. 178p.



Objectives

1. To acquaint with biotechnological tools of crop improvement
2. To know about direct and indirect methods of gene transfer
3. To introduce about gene editing in plants
4. To provide knowledge about marker assisted breeding and genomic selection

Theory**Unit I**

Impact of Biotechnology on crop improvement and the perspective of society; Various biotechnological techniques available for crop improvement – Plant Tissue Culture, Genetic Engineering, Genome editing, Marker Assisted breeding and Genomic Selection. Biosafety regulations and their application in Agricultural Biotechnology. Somaclonal variation and its use in crop improvement; embryo culture; anther/pollen culture; somatic embryogenesis; artificial seeds; techniques of protoplast culture, regeneration and somatic cell hybridization, achievements and limitations, utility in the improvement of crop plants.

Unit II

Direct and Indirect methods of gene transfer in plants - Agrobacterium-mediated gene transfer in dicots and monocots; Direct DNA delivery methods (microinjection, particle gun method, electroporation); gene targeting;

Unit III

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.

Unit IV

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.

Unit V

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

1. Agrobacterium-mediated transformation in Tobacco:
 - a. preparation of construct,
 - b. transfer to binary vector,
 - c. transform Agrobacterium,
 - d. prepare explant,
 - e. Inoculation and Co-cultivation,
 - f. antibiotic based selection of putative transformants,
 - g. validation using PCR;
2. Genome editing:
 - a. preparation of CRISPR/CAS construct,
 - b. direct transfer to plant,
 - c. analysis of the targets;
3. Planning of a MABB program:
 - a. selection of parents
 - b. crossing strategies
 - c. 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. Old, R. W., Primrose, S. B. and Twyman, R. M. 2001. Principles of Gene Manipulation and Genomics 7th Edition: Oxford: Blackwell Scientific Publications.
5. Sander, J.D. and Joung, J.K. 2014. CRISPR-Cas systems for Editing, Regulating and Targeting Genomes. Nat Biotechnol. 32:347-355.
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Objective

To provide a comprehensive knowledge of remote sensing, precision farming and its benefits in improving crop production and soil health management.

Theory**UNIT I**

Introduction and history of remote sensing; sources, principles of remote sensing, propagation of radiations in atmosphere; Interaction with matter, application of remote sensing techniques land use soil surveys, crop stress and yield forecasting, Advantages and disadvantages of remote sensing, Remote sensing institutes in India, Basic concepts about geoinformatics.

UNIT II

Artificial intelligence: History of artificial intelligence, Fundamentals of Big data and machine learning (ML), Use of artificial intelligence in autonomous systems: agricultural robots and drone monitoring systems, driverless tractors, automated sprinklers and self- harvesting machines etc.;

UNIT III

Use of AI in crop analysis: monitoring soil quality, promoting organic crops, monitoring weeds, precision agriculture, using drones for crop analysis; Role of AI for sustainability and climate change, yield and demand forecasting, food tech/ wider value chain including impact of blockchain, AI use for in the emerging markets;

UNIT IV

Technology deployment like sensors, AI and agricultural technologies and How to scale AI for agricultural technologies applications, Responsible AI in agriculture, Data sharing;

UNIT V

Expert System: Introduction to expert system, Characteristics and features of expert system, Applications of Expert System, Importance of Expert systems, Rule based system architecture; Software Agents.

Practical

1. Familiarization with different remote sensing equipments and data products,
2. Interpretation of aerial photographs and satellite data for mapping of land resources,
3. Global positioning system (GPS), Basics of Geographic Information System (GIS), Georeferencing of topo sheets.
4. Live examples and case study of AI use in Agriculture, Search and Control strategies:
5. Blind search, Breadth - first search, Depth First search, Hill climbing method, Best First search, Branch and Bound search,
6. Programming in Prolog Syntax and meaning of Prolog Programs,
7. Using Data Structures, Controlling Back- tracking, Input and Output, Built-in Predicates, Using Prolog Grammar Rules, Higher level assignments/exercises for implementation using Prolog.

Suggested Readings

1. Data Analytics in Bioinformatics: A Machine Learning Perspective. Editor (s):. Rabinarayan Satpathy, Tanupriya Choudhary, Suneeta Satpathy, Sachi Nandan.
2. Machine Learning Approaches to Bioinformatics by Zheng Rong Yang.
3. Precision Agriculture Technologies for Food Security and Sustainability, By A El- Kader, M Sherine, M El-Basioni, M Basma.
4. Text Book of Remote Sensing and Geographical Information Systems by M. Anji Reddy.



Theory**Unit-I**

Introduction, History, Advantages and limitations of Micro propagation, Laboratory required & organization.

Unit-II

Media and components of media – inorganic nutrients, organic supplements, carbon source, vitamins, gelling agents, phytohormones & growth regulators. commonly used culture media (MS and Gamborg media)

Unit-III

Types of cultures (seed, embryo, organ, callus, cell), Stages of micro propagation. Axillary bud proliferation (Shoot tip and meristem culture, bud culture), Organogenesis (calyx and direct organ formation) Somatic embryogenesis.

Unit-IV

Cell suspension cultures, production of secondary metabolites

Unit -V

Somaclonal variation, Cryopreservation.

Practical

1. Identification and use of equipment in tissue culture Laboratory.
2. Nutrition media composition, containers and small instruments.
3. Sterilization techniques for explants & media.
4. Preparation of stocks and working solution, Preparation of working medium.
5. Culturing of explants: Seeds, shoot tip and single node.
6. Callus induction, Induction of somatic embryos regeneration of whole plants from different explants.
7. Hardening procedures.
8. Visit of tissue culture laboratory & Hardening Chamber.

Suggested readings:

1. Basics of Horticulture by Jitendra Singh
2. Introduction to Horticulture by N. Kumar
3. Handbook of Horticulture by K.L. Chadda
4. Plant Tissue Culture: Basic and Applied by Timir Baran Jha and Biswajit Ghosh, 2016, Platinum Publishers, 439p.

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

Theory

Unit I

General Principles of Seed Production: Different types of seed, Registration for raising the seed crop, Monitoring and certification system. Principles and practices of selection of area and agronomic requirement for seed production of field crops, Importance of isolation distance and Roguing. Seed Certification: History, concept and objectives of seed certification; seed certification agency/organization and staff requirement, Indian Minimum Seed Certification Standards (I.M.S.C.S.)-general and specific crop standards including GM varieties, field and seed standards.

Unit II

Principles of hybrid seed production in field and horticultural crops, Principles and practices of selection of area and agronomic requirement of seed production, Concept of apomixis, male sterility and self-incompatibility and its application in hybrid seed production of horticultural crops. Farmers participatory seed production.

Unit III

General Principles of Seed Processing: Introduction, Objectives of Seed Processing, Seed Drying, Principles of Drying, Methods of drying seeds, Cleaning and grading, Air and screen machines, Different kind of separators, 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.

Unit IV

Seed Industry and Seed Marketing : Evolution of the seed industry, Development of the seed industries related to field and horticultural crops, Seed marketing-concept, importance and promotion of quality seed, formal and informal seed supply systems, Seed marketing intelligence, sales promotion, distribution channels, marketing costs and margins; packaging and labelling, Seed Associations (SHGs/FPOs etc), 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; Seed pricing and price policy. Seed processing and /packaging, demand forecasting and factors affecting demand for seeds, role of WTO in Seed marketing.

Unit V

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.

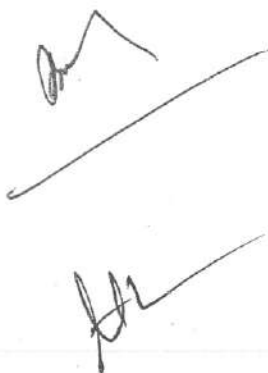
Practical

1. Planning of Seed Production, requirements for different classes of seeds in field crops
2. Operation and Handling of mechanical drying equipment's; effect of drying temperature and duration on seed germination and storability
3. Seed processing equipment's and Seed treating equipment's
4. 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
5. 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.
6. Visit to seed processing plant and commercial controlled and uncontrolled Seed Stores
7. Visit to Seed industries and local entrepreneurship nearby areas
8. Visit to Seed Certification agency to learn 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.
9. Maintenance of aseptic conditions and sterilization techniques
10. Preparation of nutrient stocks for synthetic media, Selection of explants for callus induction,

11. Preparation of MS medium for micro-propagation and Callus induction, Inoculation of explants for micropropagation,
12. 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.
2. McDonald, M.B. Jr & Copeland L.O. 1997. Seed Production: Principles and Practices. Chapman & Hall
3. Thompson, J.R. 1979. An Introduction to Seed Technology. Leonard Hill.
4. Singhal, N.C. 2003. Hybrid Seed Production in Field Crops. Kalyani.
5. Justice, O.L. & Bass, L.N. 1978. Principles and Practices of Seed Storage. Castle House Publ. Ltd.
6. Tunwar, N.S. & Singh, S.N. 1988. Indian Minimum Seed Certification Standards. CSCB, Ministry of Agriculture, New Delhi.
7. Chawla H.S. (2008) Introduction to Plant Biotechnology second edition, Oxford & IBH publishing Co. Ltd. 113-B Shahpur Jat, New Delhi-110049



Objectives:

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

Theory**Unit – I**

Concept of organic farming, Principles and its scope in India, Choice of crops and varieties in Organic farming, Nutrient management in Organic farming and their sources.

Unit – II

Fundamentals of Insect, Pest, Disease and Weed management under organic mode of production.

Unit – III

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.

Unit – IV

Initiatives taken by Government (central/state), NGOs and other organizations for promotion of organic agriculture.

Unit – V

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.

Practical

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

Suggested readings

1. Gaur. A.C. Hand book of Organic farming and biofertilizers.
2. Dahama. A.K. Organic farming for sustainable agriculture. Agrobios (India), Jodhpur.
3. Sharma, Arun. K. Hand book of Organic farming. Agrobios (India), Jodhpur.
4. Palaniappan, S.P. and Annadurai K.. Organic farming–Theory and Practice. Scientific Publishers. Jodhpur.
5. U. Thapa and P. Tripathy. Organic farming in India-Problems and Prospects. Agrotech publishing agency, Udaipur.
6. G.K. Veeresh. Organic farming. Foundation Books. New Delhi.
7. Purshit, S. S. Trends in Organic Farming in India. Agros Bios (INDIA), Jodhpur.
8. Thampan, P. K. Organic Agriculture. Peckay tree Crops Development Foundation, Cochin, Kerala.
9. Sathe, T.V. Vermiculture and Organic Farming. Days Publishing House, New Delhi.
10. Singh, Abhinandan, Ojha, Pankaj Kumar and Rahul Kumar. 2018. Conservation Agriculture Technologies, Biotech Books.

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

Theory

UNIT I

Introduction on fundamentals of foods and human nutrition; Basic food groups; Concept of balanced diets; Recommended Daily Allowances (RDA) for various age groups. Biochemical composition, energy and food value of various food grains, fruits and vegetables; Carbohydrates, proteins, fats as nutrients and their interactions.

UNIT II

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.

UNIT III

Biochemical and nutritional aspects of vitamins, minerals, nutraceuticals, antioxidant, antinutritional factors and biochemistry of post-harvest storage, losses during processing.

UNIT IV

Effect of cooking, processing and preservation on nutrients of different food products, biochemical aspects of food spoilage; Food fads, food safety and quality standards.

UNIT V

Enzymes in food industry, food additives, nutritional quality of plant, animal, dairy, marine and fermented products.

Practical

1. Estimation of moisture content in food sample
2. Estimation of oil/fat content in food sample
3. Estimation of protein content in food sample
4. Estimation of carbohydrate content in food sample
5. Estimation of ash content in food sample
6. Estimation of calorific value of food sample
7. Estimation of vitamin C content in food sample
8. Estimation of carotenoids content in food sample
9. Estimation of protease inhibitor activity in food sample
10. Estimation of essential amino acid in food sample

Suggested readings

1. Damodaran S. and Parkin KL (ed.) 2017. Fennema's Food Chemistry. CRC Press
2. Gibney MJ, Lanham-New SA, Cassidy, A and Voster HH (ed.) 2009. Introduction to Human Nutrition. Wiley-Blackwell
3. Trueman, P. 2007. Nutritional Biochemistry. MJP Publishers
4. Rekhi, Tejmeet and Heena Yadav, 2014. Fundamentals of Food and Nutrition by, Elite Publishing House, 257p.
5. Dharmesh Kumar, Food Science and Nutrition by, RANDOM.

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Theory**UNIT I**

Importance of post-harvest processing of fruits and vegetables, extent and possible causes of post harvest losses; Pre-harvest factors affecting postharvest quality, maturity, ripening and changes occurring during ripening; Respiration and factors affecting respiration rate.

UNIT II

Post harvest handling (Pre-Cooling, sorting & grading, waxing); Harvesting and field handling; Storage (ZECC, cold storage, CA, MA and hypobaric)

UNIT III

Value addition concept; Principles and methods of preservation; Intermediate moisture food –Jam, Jelly, marmalade, Preserve, candy-Concepts and Standards; Fermented and non-fermented beverages.

UNIT IV

Tomato products-Concepts and Standards; Drying /Dehydration of fruits and vegetables –concept and methods, osmotic drying. Canning –Concepts and standards, packaging of products.

UNIT V

By-products and waste utilization, food safety standards (FPO specifications); FSSAI, HACCP.

Practical

1. Analyzing maturity stages of commercially important horticultural crops, studies on ripening techniques
2. Applications of different types of packing, containers for shelf life extension.
3. Effect of temperature on shelf life and quality of produce.
4. Demonstration of chilling and freezing injury in vegetables and fruits.
5. Extraction and preservation of pulps and juices.
6. Preparation of jam, Jelly, RTS, nectar, squash, osmotically dried products, fruit bar candy and tomato products, canned products.
7. Quality evaluation of products- Physico-chemical and sensory.
8. Visit to processing unit/industry.

Suggested readings:

1. Post-harvest technology of horticultural crops by S.K. Sharma and M.C Nautiyal
2. Post-Harvest Technology by Suja Nabi Qureshi, Kounser Javeed and Abhay Kumar Sinha, 2018, Bioscientific Publishers.
3. Postharvest Technology of Horticultural Crops by K.P. Sudheer and V. Indira, 2020, Horticulture Science Series-7 (Ed.: K.V. Peter), New India Publishing Agency, 320p.
4. Post-harvest Management and Value Addition by Aswini Kumar Goel, Rajender Kumar and Satwinder S. Mann, 2014, Daya Publishing House.
5. Postharvest Management and Value Addition of Fruits and Vegetables by Kureel M.K., Biotech, 181p.
6. Fruit and Vegetable Preservation: Principles and Practices by Shrivastava, R.P. and Kumar, Sanjeev. International Book Distributing Co., Lucknow, U.P., India.
7. Post – harvest management and processing of fruits and vegetables. 2018. Rathore, n.S., Mathur, G.K., Chasta, S.S. Indian Council of Agricultural Research, New Delhi.


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Objective: To impart knowledge on vertebrate pests like birds, rodents, mammals and others of different crops, their biology, damage they cause and management strategies.

Theory

Unit -I

Introduction to vertebrate pests of different crops; biology of vertebrate pests such as rodents, birds and other mammals.

Unit -II

Bio-ecology of birds of agricultural importance, patterns of pest damage and assessment, roosting and nesting systems in birds; management of pestiferous birds; conservation of predatory birds.

Unit-III

Bio-ecology of rodents of agricultural importance, patterns of pest damage and assessment, burrowing pattern and habitat of rodents; management of pestiferous rodents.

Unit-IV

Bio-ecology of higher vertebrates of agricultural importance, patterns of damage and assessment, their habitat; management of pestiferous vertebrates.

Unit-V

Management strategies- physical (trapping, acoustics and visual), chemical (poisons, repellents, fumigants and anticoagulants), biological (predators, parasites), cropping practices, alteration of habitats, diversion baiting and other eco-friendly methods – Operational practices- baiting, equipment and educative program.

Practical

- Identification of important rodents, birds and other vertebrate pests of agriculture, food preference and hoarding;
- Social behavior, damage assessment, field survey, population estimation, management strategies: preventive and curative methods.

Suggested Reading

- Ali S. 1965. The Book of Indian Birds. The Bombay Natural History Society, Bombay.
- Fitzwater WD and Prakash I. 1989. Handbook of Vertebrate Pest Control. ICAR, New Delhi.
- Prakash I and Ghosh PK. 1997. Rodents in Indian Agriculture. Vol. I. State of Art Scientific Publ., Jodhpur.



Theory**Unit-I**

Concept of technology, technology delivery and its application to stakeholders, Types of technology, Diffusion: concept, meaning and definition. Elements of diffusion process (Innovation, communication channel, over time and social system), traditions of research on diffusion, Diffusion effects. Constraints in diffusion.

Unit-II

Innovation: concept, meaning and definition. Perceived attributes of innovation (Adaptability, Complexity, Compatibility, Triability, Relative advantage, etc.). The generation of innovations; Innovation Development Process. Tracing the innovation-development process, converting research into practice. The innovation-decision process a critical appraisal of the new formulation. Types of innovation decisions: Optional, Collective and Authority and contingent innovation decisions.

Unit-III

Consequences of Innovation decisions: Desirable or Undesirable, Direct or Indirect, Anticipated or Unanticipated Consequences. Multi-step flow of innovation; Concepts of homophily and heterophily and their influence on flow of innovations.

Unit-IV

Adoption: Concepts, meaning and definition. Adoption process: concept and stages, dynamic nature of stages, covert and overt processes. Concept of over adoption. Decision making- meaning, theories, process, steps, factors influencing decision-making. Important sources of information at different stages of adoption.

Unit-V

Adopter categories: innovativeness and adopter categories, adopter categories as ideal types, Characteristics of adopter categories and their rate of adoption, Factors influencing rate of adoption. Measurement and characteristics of opinion leaders, theories of leadership. Role of leaders in technology dissemination

Practical

- Identification of adopter categories on a selected technology in the village
- Sources of information at different stages of adoption on selected technology
- Study of factors increasing or retarding the rate of adoption
- Identification of Opinion Leaders in society
- Individual and community adoption process, content analysis of adoption study in village
- Case study on over-adoption & consequences
- Identification of various constraints in adoption of recommended technology among the farmers in village
- Find out the reasons for disenchantment of rural youth from Agriculture
- Preparation and Presentation of reports on various dimensions of adoption and diffusion of innovations

Suggested readings

1. Dahama, O. P. and Bhatnagar, O.P. 1998. Education and Communication for Development, Oxford and IBH publishing Co. Pvt. Ltd, New Delhi.
2. Muthaiah Manoraharan, P. and Arunachalam, R., Agricultural Extension, Himalaya Publishing House (Mumbai).
3. Rathore, O. S. et al. 2012. Handbook of Extension Education, Agrotech Publishing Academy, Udaipur.
4. Singh, A.K., Laxhan Singh, R. and Roy Burman. 2006. Dimensions of Agricultural Extension. Aman Publishing House, Meerut
5. Web Materials



Objectives: To impart knowledge and skill in training and capacity building

Theory

Unit-I

Concept and definition of Training and Capacity Building. Meaning, Definition, Need, Objective and Principle of Training. Difference between Training and Education. Capacity Building of Farmer, Farm women and Rural Youth. Brief Description about Different Organizations & Institutions involved in Training and Capacity Building at National & State level.

Unit-II

Methods of Training (Lecture, Group Discussion, Seminar, Symposium, Panel Discussion and Colloquium methods, Case study, Brainstorming, Role playing etc.) Types of Training: pre-service and inservice. Simple & Elaborated models of Training.

Unit-III

Training Need Assessment (TNA). Designing of an effective training program and training session. Multiple effects of individual training for extension personnel. Elements of Training: Trainers, Trainees, Subject Matter, Teaching Methods and Physical Facilities.

Unit-IV

Monitoring and Evaluation: Concept, Meaning and Definition. Types of Evaluation. Various steps involved for evaluation of training programs. Indicators for Impact Assessment of Training Programs.

Unit-V

Concept of Extension as education, as profession and as services. History of Extension Services in India. Brief concept of various extension systems involved in ToT in India. Various approaches and methods involved in transfer of technology. Various constraints in transfer of technology in Extension services.

Practical

1. Training Need Assessment
2. Designing training program for different stakeholders
3. Developing Training sessions
4. Training evaluation and impact analysis
5. Critical review of ongoing training programs
6. Visit and participation in training programs at various institutions

Suggested reading

1. American Society for Training and Development. (1976). *Training and development handbook: A guide to human resource development* (2nd ed.). New York: McGraw-Hill.
2. Blank, W. E. (1983). *Handbook for developing competency-based training programs*. Englewood Cliffs, NJ: Prentice-Hall.
3. Camp, R.R., Blanchard, P.N., & Huszycz, G.E. (1986). *Toward a more organizationally effective training strategy and practice*. Englewood Cliffs, NJ: Prentice-Hall.
4. Carnevale, A. (1983). *Human capital: A high-yield corporate investment*. Baltimore: ASTD Publishing Services.
5. Fournies, F. F. (1982). *Coaching for improved work performance*. Baltimore: ASTD Publishing Services.
6. Knowles, M.S. (1980). *The modern practice of adult education* (2nd ed.). New York: Cambridge Books.

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