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XXXI ACADEMIC COUNCIL – ANNEXURE 2.5

KL COLLEGE OF AGRICULTURE

Minutes of the First Board of Studies (BOS) meeting at KL College of Agriculture held on December 18, 2020, in Room No. 514, SDC Block, starting at 10:30 a. m.

The following members are present

1. Dr.Veera Ragavaiah, Director, Chairman- BoS
2. Dr.Raghuveer, Dean Academics, Patron
3. Dr.M.Kishore Babu, Dean, MHS and Dean, International Relations, Member
4. Mr.P.Gopala Krishna, President & CEO, Fertis India Private Limited, Member
5. Dr.P.V.Krishnayya, Professor and University Head – Entomology,ANGRAU-Member
6. Dr. Dinakaran Elango, Associate Professor, Member
7. Mr.Sunil Kumar, Assistant Professor, Member
8. Dr.M.Sreedevi, Assistant Professor, Member

Members Absent-Nil

WELCOMING ALL THE MEMBERS

At the beginning of the meeting, the BOS chair, Dr. Veera Raghavaiah Ravuri welcomed the invitees and members to the first BOS meeting of College of Agriculture, KLEF. The chair expressed sincere thanks to the KLEF management for the approval of B.Sc. (Hons.) Agriculture programme and briefed them about the structure and curriculum of college as per the Indian Council of Agriculture Research (ICAR) norms. As per the agenda, the following points were discussed. After that, the BOS reviewed and resolved the following items.

AGENDA and RESOLUTIONS

AGENDA ITEM-1

Briefing the overview of ICAR 5th Dean's council guidelines and statutory requirements	The council guidelines and statutory requirements were discussed

All the statutory requirements concerning academic rules, land requirements, lab facilities, and other council guidelines necessary for the B.Sc. (Hons.) Agriculture program were discussed, and valuable inputs were received from the invitees and members.

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AGENDA ITEM-2

Proposed to introduce B.Sc. (Hons.) Agriculture programme from 2020-21 academic year.

Discussion

The course structure and syllabus for the B.Sc. (Hons.) Agriculture program at KL College of Agriculture have been designed in accordance with the statutory requirements outlined by ICAR guidelines. The BOS members expressed their high appreciation and satisfaction with the course structure and syllabus of the program, subsequently approving the program and its structure for implementation starting from the 2020-21 academic year.

Resolution

It is resolved to approve the programme and course structure for B.Sc. (Hons.) Agriculture from 2020-21 academic year onwards and forwarded to academic coucil for further approval.

The detailed program structure is presented in Annexure I, while the course syllabus is provided in Annexure II

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LIST OF MEMBERS OF THE BOARD OF STUDIES

SL.NO	FULL NAME	DESIGNATION	ORGANIZATION	POSITION IN THE MEETING	SIGNATURE
1	Dr. Raghuveer	Dean Academics	KLEF, Vaddeswaram	Patron	
2	Dr. R Veera Raghavaiah	College of Agriculture	K L College of Agriculture	Chairman- BoS	
3	Dr. M. Kishore Babu	Dean, MHS and Dean, International Relations	KLEF, Vaddeswaram	Member	
4	Mr. P Gopala Krishna	President & CEO	Fertis India Private Limited Panjagutta, Hyderabad, Telangana	External Member-Industry	(Attended online) (18-12-2020)
5	Prof Dr. P V Krishnayya	Professor and University Head - Entomology Department of Entomology	Agricultural College, Bapatla Acharya N G Ranga Agricultural University	External Member-Academic peer	(Attended Online 18-12-2020)
6	Dr. Dinakaran Elango	Associate Professor	KLEF, Vaddeswaram	Member	
7	Mr. Sunil Kumar	Assistant Professor	KLEF, Vaddeswaram	Member	
8	Dr. M. Sreedevi	Assistant Professor	KLEF, Vaddeswaram	Member	

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Annexure I: Program structure (with all Courses)of BSc.(Hons.) Agriculture

Course Code	Name of the Course	Course category	L	T	P	S	Credits	Pre-Requisite	Year of Offering
20AGRO 101	Agriculture Heritage	PC	1	0	0	0	1	NIL	I Year (2020-21)
20AGRO 102	Fundamentals of Agronomy	PC	2	0	3	0	3	NIL	I Year (2020-21)
20BICM 101	Fundamentals of Plant Biochemistry and Biotechnology	PC	2	0	3	0	3	NIL	I Year (2020-21)
20ENGL 101	Comprehension and Communication Skills in English	HSS	1	0	3	0	2	NIL	I Year (2020-21)
20SSAC 121	Fundamentals of Soil Science	PC	2	0	3	0	3	NIL	I Year (2020-21)
20AECO 141	Fundamentals of Economics	PC	3	0	0	0	3	NIL	I Year (2020-21)
20HORT 181	Fundamentals of Horticulture	PC	1	0	3	0	2	NIL	I Year (2020-21)
20AEXT 190	Human Values and Ethics (non gradial)	HSS	1	0	0	0	1	NIL	I Year (2020-21)
20AEXT 191	Rural Sociology and Educational Psychology	PC	1	0	3	0	2	NIL	I Year (2020-21)
20COCA 100	NSS/NCC/Physical Education and Yoga Practices	HSS	0	0	6	0	2	NIL	I Year (2020-21)
20UC1102J	Design Thinking & Innovation	skilling	0	0	0	2	2	NIL	I Year (2020-21)
20AMBE 101	Agricultural Microbiology	PC	1	0	3	0	2	NIL	I Year (2020-21)
20AGRO 103	Introductory Agrometeorology and Climate Change	PC	1	0	3	0	2	NIL	I Year (2020-21)
20AGRO 104	Introduction to Forestry	PC	1	0	3	0	2	NIL	I Year (2020-21)
20GPBR 111	Fundamentals of Genetics	PC	2	0	3	0	3	NIL	I Year (2020-21)
20ENTO 131	Fundamentals of Entomology I (Insect Morphology and Taxonomy)	PC	2	0	3	0	3	NIL	I Year (2020-21)
20AENG 151	Soil and Water Conservation Engineering	PC	1	0	3	0	2	NIL	I Year (2020-21)
20CPHY 162	Fundamentals of Crop Physiology	PC	2	0	3	0	3	NIL	I Year (2020-21)
20PATH 171	Fundamentals of Plant Pathology I (Plant Pathogens - An Introduction)	PC	2	0	3	0	3	NIL	I Year (2020-21)
20HORT 182	Production Technology of Fruits and Plantation Crops	PC	1	0	3	0	2	NIL	I Year (2020-21)
20UC1102	Design Thinking & Innovation	skilling	0	0	0	2	2	NIL	I Year (2020-21)
20AGRO 201	Crop Production Technology - I *(Cereals, Millets and Pulses)*	PC	2	0	3	0	3	NIL	II Year (2021-22)
20GPBR 211	Fundamentals of Plant Breeding	PC	2	0	3	0	3	NIL	II Year (2021-22)
20ENTO 231	Fundamentals of Entomology II (Insect Ecology and Concepts of IPM)	PC	1	0	3	0	2	NIL	II Year (2021-22)
20AECO 241	Agricultural Finance and Co-operation	PC	1	0	3	0	2	NIL	II Year (2021-22)

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20AENG 251	Farm Machinery and Power	PC	1	0	3	0	2	NIL	II Year (2021-22)
20CPHY 261	Eco-physiology	PC	1	0	3	0	2	NIL	II Year (2021-22)
20PATH 271	Fundamentals of Plant PathologyII(PlantPathologyPrinciples)	PC	1	0	3	0	2	NIL	II Year (2021-22)
20HORT 281	Production Technology for Vegetables and Spices	PC	1	0	3	0	2	NIL	II Year (2021-22)
20AEXT 291	Fundamentals of Agricultural Extension	PC	2	0	3	0	3	NIL	II Year (2021-22)
20COCA 200	Education Tour**	PC	0	0	6	0	2	NIL	II Year (2021-22)
20AGRO 202	Crop Production Technology - II(Oilseeds, Fibre, Sugar, Tobacco and Fodder crops)	PC	2	0	3	0	3	NIL	II Year (2021-22)
20AGRO 203	Farming Systems and Sustainable Agriculture	PC	1	0	0	0	1	NIL	II Year (2021-22)
20AGRO 204	Irrigation Water Management	PC	1	0	3	0	2	NIL	II Year (2021-22)
20SMCA 201	Statistical Methods	PC	1	0	3	0	2	NIL	II Year (2021-22)
20LSPM 201	Live-stock and Poultry Management	PC	2	0	3	0	3	NIL	II Year (2021-22)
20SSAC 221	Manures, Fertilizers and Soil Fertility Management	PC	2	0	3	0	3	NIL	II Year (2021-22)
20AECO 242	Agricultural Marketing, Trade and Prices	PC	2	0	3	0	3	NIL	II Year (2021-22)
20AENG 252	Renewable Energy and Green Technology	PC	1	0	3	0	2	NIL	II Year (2021-22)
20HORT 282	Production Technology for Ornamental Crops, Medicinal and Aromatic Plants and Landscaping	PC	1	0	3	0	2	NIL	II Year (2021-22)
20AEXT292	Entrepreneurship Development and Business Communication	PC	1	0	3	0	2	NIL	II Year (2021-22)
20ELCT 222	Soil, Plant, Water and Seed Testing	PE	1	0	6	0	3	NIL	II Year (2023-24)
20ELCT 272	Food Safety Issues	PE	2	0	3	0	3	NIL	II Year (2023-24)
20ELCT 283	Hi-tech. Horticulture	PE	2	0	3	0	3	NIL	II Year (2023-24)
20AGRO 301	Geoinformatics and Nanotechnology for Precision Farming	PC	2	0	3	0	2	NIL	III Year (2022-23)
20AGRO 302	Practical Crop Production	PC	0	0	3	0	1	NIL	III Year (2022-23)
20BICM 300	Principles of Food Science and Nutrition	PC	2	0	0	0	2	NIL	III Year (2022-23)
20GPBR 311	Crop Improvement - I *(Cereals, Millets, Pulses and Oilseeds)*	PC	2	0	3	0	2	NIL	III Year (2022-23)
20GPBR 313	Intellectual Property Rights	PC	1	0	0	0	1	NIL	III Year (2022-23)
20SSAC 321	Problematic Soils and their Management	PC	2	0	3	0	2	NIL	III Year (2022-23)
20ENTO 331	Pests of Field crops and Stored Grain and their Management	PC	3	0	3	0	3	NIL	III Year (2022-23)

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20AENG 351	Protected Cultivation and Post-harvest technologies	PC	2	0	3	0	2	NIL	III Year (2022-23)
20CPHY 361	Environmental Studies and Disaster Management	PC	2	0	3	0	2	NIL	III Year (2022-23)
20PATH 371	Diseases of Field and Horticultural Crops and their Management - I (Field Crops)	PC	3	0	3	0	3	NIL	III Year (2022-23)
20PATH 373	Principles of Integrated Pest and Disease Management	PC	2	0	3	0	2	NIL	III Year (2022-23)
20ELCT 305	Agricultural Waste Management	PE	2	0	3	0	3	NIL	III Year (2023-24)
20ELCT 333	Biopesticides and Biofertilizers	PE	2	0	3	0	3	NIL	III Year (2023-24)
20ELCT 342	Agribusiness Management	PE	2	0	3	0	3	NIL	IV Year (2023-24)
20ELCT 362	Micro propagation Technologies	PE	1	0	6	0	3	NIL	IV Year (2023-24)
20ELCT 382	Landscaping	PE	2	0	3	0	3	NIL	IV Year (2023-24)
20AGRO303	Rainfed Agriculture and Watershed Management	PC	1	0	3	0	2	NIL	III Year (2022-23)
20AGRO304	Principles of Organic Farming	PC	1	0	3	0	2	NIL	III Year (2022-23)
20SMCA 301	Agriculture Informatics	PC	1	0	3	0	2	NIL	III Year (2022-23)
20GPBR312	Crop Improvement-II *(Fibre, Sugar,Starches,Narcotics,Vegetables, Fruits and Flowers)*	PC	1	0	3	0	2	NIL	III Year (2022-23)
20GPBR314	Principles of SeedTechnology	PC	2	0	3	0	3	NIL	III Year (2022-23)
20ENTO332	Pest of Horticultural Crops and their Management and Beneficial insects	PC	2	0	3	0	3	NIL	III Year (2022-23)
20AECO341	Farm Management,Production and ResourceEconomics	PC	1	0	3	0	2	NIL	III Year (2022-23)
20PATH372	Diseases of Field and Horticultural Crops and their Management -II (Horticultural Crops)	PC	1	0	3	0	2	NIL	III Year (2022-23)
20HORT381	Post-harvest Management and Value Addition of Fruits and Vegetables	PC	1	0	3	0	2	NIL	III Year (2022-23)
20AEXT391	Communication Skills and PersonalityDevelopment	HSS	1	0	3	0	2	NIL	III Year (2022-23)
20ELCT 306	Weed Management	PE	2	0	3	0	3	NIL	III Year (2023-24)
20ELCT 315	Commercial Plant Breeding	PE	1	0	6	0	3	NIL	III Year (2023-24)
20ELCT 334	Agrochemicals	PE	2	0	3	0	3	NIL	III Year (2023-24)
20ELCT 383	Protected Cultivation	PE	2	0	3	0	3	NIL	III Year (2023-24)
20RAWE	Crop Production	PC					4 (0+4)	NIL	IV Year (2023-24)
20RAWE	Crop Protection	PC					3 (0+3)	NIL	IV Year (2023-24)
20RAWE	Rural Economics	PC					4 (0+4)	NIL	IV Year (2023-24)
20RAWE	Extension Programme	PC					4 (0+4)	NIL	IV Year (2023-24)
20RAWE	Research Station / KVK /DAATT Centre activities	PC					1 (0+1)	NIL	IV Year (2023-24)

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20RAWE	Internship	PC					6 (0+6)	NIL	IV Year (2023-24)
20ELP	Experiential LearningProgramme (ELP)	PC					**0+20**	NIL	IV Year (2023-24)
	Total credits						**187**		

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Annexure II: Syllabus for four years

20AGRO101 – Agricultural Heritage

L-T-P-S : 1-0-0-0
Credits : 1
Contact Hours : 1
Pre-requisite : NIL

Mapping of Course outcomes with PO/PSO:

Co No.	Course Outcome	PO/PSO	BTL
CO1	Understand ancient agricultural practices and it's relevance to modern agriculture practices and appreciate the agriculture practiced throughout the world and to know the richness of agricultural heritage in India	1	2
CO2	Understand judicious traditional agricultural practices and relate with modern methods and Our journey (Developments) in agriculture and vision for the Future	1	2
CO3	How we can make use of agricultural resources	1	1
CO4	Understand agricultural concepts	1	2

Course Objective: The objective of the course is to provide the student with a formalized way to build their historical knowledge and skills within the different areas of Agricultural Heritage to enhance their professional skills and/or to prepare to take the Agricultural Heritage Exam.

1. Discussing the importance and relevance of agriculture across civilizations
2. To Illustrating a lucid picture on Indian agriculture
3. Imparting knowledge on historical best agricultural practices relevant to today's agriculture

Syllabus: Theory

CO1: Introduction of Indian agricultural heritage, status of farmers in society, advice by sages to kings on their duties towards farmers

CO2: Soil management in ancient, medieval & pre-modern India and its relevance in modern day sustainable agriculture, heritage of crop & water management, plant growth and development

CO3: Plant protection through vrikshayurveda and traditional knowledge. Heritage of medicinal plants and their relevance today, seed health in ancient & medieval history and its relevance to present day agriculture

CO4: Description of Indian civilization and agriculture by travelers from China, Europe and United States, our journey in agriculture, green revolution and its impact and concerns, vision for the future.

Reference Books:

1. Choudary S.L, Sharma, G.S, and Nene, Y.L (eds). 2000. Ancient and Medieval History of Indian agriculture and its relevance to sustainable agriculture in the 21st century; Proceedings of the summer school held from 28 May to 17 June 1999. Rajasthan college of Agriculture, Udaipur 313001.

2. Nene, Y.L (Ed). 2005. Agricultural Heritage of Asia proceedings of the international conference, 6-8 December 2004, Asian-Agri history Foundation, Secunderabad- 500 009, Andhra Pradesh, India.
3. Nene, Y.L 2007. Glimpses of Agricultural heritage of India. Asian- Agri- History Foundation, 47 – ICRISAT Colony-1 Brig sayeed Road, Secunderabad -500009 A.P India 901PP ISBN-81-903963-0-7.

Web references/MOOC's:

1. http://ecoursesonline.iasri.res.in/Courses/Introductory%20Agriculture/AGRO102/Start%20to%20read%20the%20Course.html, Lecture Series

Fundamentals of Agronomy

Semester	**:**	**First**
Course Name	**:**	**Fundamentals of Agronomy**
Course Code	**:**	**20AGRO102**
L-T-P structure	**:**	**2-0-3-0**
Course Credits	**:**	**3(2+1)**
Course Coordinator	**:**	
Course Instructors	**:**	

MAPPING OF COURSE OUTCOMES WITH PO/PSO
COURSE OUTCOMES (CO):

CO No:	CO	PO	BTL
1	Understand the principles of agronomy often involves a summoning of resources from related disciplines such as Botany, Soil Science, Irrigation, plant protection, Plant Genetics and Breeding, Agrometeorology etc.	6,8	2
2	Understand the various nutrients and their effects on plant health and Plan irrigation measures for plant growth and development	3,6,8	2
3	Illustrate the weeds in a field. Plan for sustainable agricultural production, and apply scientific methods and tools in field preparation and for designing cropping	3,6,8	3
4	Illustrate the impact of the professional agricultural solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development	3,6,8	3
5	Demonstrate and Identification and proper crop management practices with practical knowledge to produce food for humans. Learning aspects to do calculations on fertilizers dose and water requirement for crops and also usage of different tillage implements.	3,6,8	3

COURSE OBJECTIVE:

1. To Imparting knowledge on different crops, crop nutrition and growth
2. To Describing crop-water relations in association to crop growth and development
3. To Illustrating crop management, cropping pattern and weed management
4. In a more fundamental sense, it can be categorized as an applied Science, the object of which is crop cultivation and management for the purpose of producing food for humans, feed for animals as well as raw materials for the industry.

References

1. Reddy, S.R. 2016. Principles of Agronomy. Kalyani Publishers,Ludhiana - 5th edition
2. Yellamanda Reddy, T. and Sankara Reddi, G. H. (2016) Principles of Agronomy. Kalyani Publishers,Ludhiana.
3. Gopal Chandra de.1989. Fundamentals of Agronomy. Oxford & IBH Publishing Co. Pvt. Ltd. , New Delhi.
4. Gupta,O.P. 2011. Modern weed management. Agrobios (India), Jodhpur.

20AGRO 103 Introductory Agrometeorology and climate change

Course Name	**: Introductory Agrometeorology and climate change**
Semester	**: Second**
Course Code	**: 20 AGRO103**
L-T-P structure	**: 1-0-3-0**
Course Credits	**: 2 (1+1)**
Course Coordinator	**:**

COURSE OUTCOMES (CO):

CO No:	CO	PO	BTL
1	Understand agrometeorology (definitions, aims, scope and importance) and to learn about the characteristics, behaviour of the atmosphere and agroclimatic zones.	1	2
2	Understand roles of agrometeorology in agriculture and the changes of individual weather elements and their relation to crop production. Gain the information of weather and climate which are considered as basic input in agricultural planning	2	2
3	Summarize the importance of monsoon in agriculture and the management of weather hazards for improving crop productivity.	2	2
4	Illustrate the Weather forecasting and impact of climate change on agriculture	2	3

5	Illustrate with the meteorological instruments and recording the observation from the agro meteorological observatory and also about the measurement and computation of different weather parameters.	8	3

Course objectives:

1. To gain knowledge to study about atmosphere and agroclimatic zones.
2. To gain knowledge about different climatic factors affecting growth and development.
3. To study about different weather aberrations and weather forecasting.
4. To impart knowledge on climate change, its causes and impacts.
5. To measure the weather parameters.

Syllabus: Theory

Earth atmosphere, composition, extent and structure; Atmospheric weather variables; Atmospheric pressure, its variation with height; Wind, types of wind, daily and seasonal variation of wind speed, cyclone, anticyclone, land breeze and sea breeze; Nature and properties of solar radiation, solar constant, depletion of solar radiation, short wave, long wave and thermal radiation, net radiation, albedo; Atmospheric temperature, temperature inversion, lapse rate, daily and seasonal variations of temperature, vertical profile of temperature, energy balance of earth; Atmospheric humidity, concept of saturation, 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, 15 mechanism and importance in Indian agriculture; Weather hazards, drought, floods, frost, tropical cyclones and extreme weather conditions such as heat-wave and coldwave; Agriculture and weather relations, modifications of crop microclimate, climatic normals for crop and livestock production; Weather forecasting, types of weather forecast and their uses; Climate change, climatic variability, global warming, causes of climate change and its impact on regional and national Agriculture.

Practical

Visit of Agrometeorological observatory, site selection of observatory, exposure of instruments and weather data recording; Measurement of total, shortwave and long wave radiation, and its estimation using Planck's intensity law; Measurement of albedo and sunshine duration, computation of Radiation Intensity using BSS; Measurement of maximum and minimum air temperatures, its tabulation, trend and variation analysis, measurement of soil temperature and computation of soil heat flux; Determination of vapor pressure and relative humidity. determination of dew point temperature; Measurement of atmospheric pressure and analysis of atmospheric conditions; Measurement of wind speed and wind direction, preparation of windrose;

Measurement, tabulation and analysis of rain; Measurement of open pan evaporation and evapotranspiration, computation of PET and AET.

References:

1. Radha Krishna Murthy,V.2016. Principles and practices of agricultural disaster management. B.S Publications, Koti, Hyderabad.

2. Reddy, S.R.2014. Introduction to Agriculture and Agrometeorology. Kalyani Publishers, Ludhiana, Punjab.

3. Radha Krishna Murthy, V. 2002. Basic Principles of Agricultural meteorology. B.S Publications, Koti, Hyderabad

4. M C Varshneya, P Balakrishna Pillai. 2019. Text book of Agricultural meteorology, Kalyani publishers, New Delhi.

5. Patra Alok Kumar, 2020. Introduction To Agrometeorology and Climate Change, New India Publishing Agency- Nipa.

6. D S Reddy and S R Reddy, 2014. Agrometeorology, Kalyani publishers, New Delhi.

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INTRODUCTION TO FORESTRY

Semester	:	**Second**
Course Name	:	**Introduction to forestry**
Course Code	:	**20 AGRO104**
L-T-P structure	:	**1-0-3-0**
Course Credits	:	**2(1+1)**
Course Coordinator	:	

MAPPING OF COURSE OUTCOMES WITH PO/PSO
COURSE OUTCOMES (CO):

CO No:	CO	PO	BTL
1	Understand various imparted basic information about various harvesting, transportation and processing systems used in the management of forest resources and production of forest products	1	2
2	Discuss acquainted with the management plans with multiple objectives and constraints	1	2
3	Understand how to develop and apply silviculture prescriptions appropriate to the management objectives	11	2
4	Illustrate and analyze the forest inventory information and project future forest stand and tree conditions	11	3
5	Apply laboratory equipment, and procedures for the study about the tree species description And aware of the growing stock and the management practices of forest	8	3

COURSE OBJECTIVE

1. Having a clear understanding of the subject related concepts and of contemporary issues
2. Students will learn about the silviculture and nursery technology of important agroforestry tree species. Manage the forest nursery by applying nursery techniques. Apply the required cultivation practices for different tree species.

Course outlines (Syllabus)

Theory

Introduction, definitions of basic terms related to forestry; Objectives of silviculture, forest classification, salient features of Indian forest policies; Forest regeneration, natural regeneration from seed and vegetative parts, coppicing, pollarding, root suckers; Artificial regeneration, objectives, choice between natural and artificial regeneration, essential preliminary considerations. Crown classification. Tending operations, weeding, cleaning,thinning, mechanical, ordinary, crown and advance thinning; Forest mensuration, objectives, diameter measurement, instruments used in diameter measurement; Non instrumental methods of height measurement, shadow and single pole method, instrumental methods of height measurement, geometric and trigonometric principles, instruments used in height measurement, tree stem form, form factor, form quotient, measurement of

volume of felled and standing trees, age determination of trees; Agroforestry, definitions, importance, criteria of selection of trees in agroforestry, different agroforestry systems prevalent in the country, shifting cultivation, taungya, alley cropping, wind breaks and shelter belts, home gardens; Cultivation practices of two important fast growing tree species of the region.

Practical

Identification of tree-species, diameter measurements using calipers and tape, diameter measurements of forked, buttressed, fluted and leaning trees; Height measurement of standing trees by shadow method, single pole method and hy0psometer; Volume measurement of logs using various formulae; Nursery lay out, seed sowing, vegetative propagation techniques; Forest plantations and their management, visits to nearby forest-based industries.

References

1. Dwivedi, A.P.1980.Forestry in India, Jugal Kishore and Company, DehraDun

2. Negi, S.S.1999. Agroforestry handbook, International book distributor, DehraDun.

3. Ram Prakash and Drake Hocking.1986. Some favourite trees for fuel and fodder,

International book distributor, Dehradun.

4. Singh, S.P. 2009. Tree farming-. Agrotech Publishing academy, Udaipur.

5. Singh, S.P. 2010. Favourite Agroforestry trees, Agrotech Publishing academy, Udaipur.

6. Troup, T.S.1986. Silviculture of Indian trees (Vol. II & III)- International book distributor,

Dehradun

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20AGRO 202-CROP PRODUCTION TECHNOLOGY-I 3 (2+1)

Semester	:	**Third**
Course Name	:	**Crop Production Technology-I**
Course Code	:	**20 AGRO201**
L-T-P structure	:	**2-0-3-0**
Course Credits	:	**3(2+1)**
Course Coordinator	:	
Course Instructors	:	

MAPPING OF COURSE OUTCOMES WITH PO/PSO
COURSE OUTCOMES (CO):

CO No:	CO	PO	BTL
1	Illustrate about origin, geographical distribution, and economic importance of Kharif crops	6,8	3
2	Illustrate about Soil and climatic requirements, varieties, cultural practices and yield of Kharif crops	3,6,8	3
3	Apply the constraints in production of oilseeds and pulses maybe identified through course content.	3,6,8	3
4	Apply the production technology of Kharif cereals and millets fulfil the need of human consumption and milch cattle. Analysis pf comparative benefits of the different kharif crops	3,6,8	3
5	Demonstrate on seed to seed of field management practices and also identification of growth stages critical stages, pest and disease management etc. Which can be solved at field level. Also, complete awareness on crop cultivation practices of Kharif crops	3,6,8	3

COURSE OBJECTIVE:

1. To impart knowledge to the students on Improving productivity of field and forage crops. (Kharif Crops)
2. To build knowledge on Ensuring sound use of natural resources, reducing soil erosion
3. To enhance the skill in the applications and improving soil quality. Implementing newly developed and tested methods that improve soil on both conventional and organic farms.

SYLLABUS
THEORY
Course outlines

Origin, geographical distribution, economic importance, area, production and productivity; Soil and climatic requirements, climate resilience;Varieties, cultural practices and yield of cereal, millet and pulse crops; Cereals, rice, wheat, barley, maize, sorghum, pearl millet, finger millet, proso millet, little millet, kodo millet, foxtail millet and barnyard millet; Pulses, pigeonpea, greengram, blackgram, bengalgram, lentil, peas, horsegram and cowpea.

Practical

Rice nursery preparation, transplanting of rice, sowing of pigeonpea , greengram and maize, effect of seed size on germination and seedling vigour of cereal and pulse crops, effect of sowing depth on germination of cereal and pulse crops, identification of weeds in cereal and pulse crops, top dressing and foliar feeding of nutrients, study of yield contributing characters and yield calculation of cereal and pulse crops, study of crop varieties and important agronomic experiments at experimental farm, morphological description of cereal and pulse crops, visit to research centers of related crops.

References

1. Rajendra Prasad. 2006. Textbook of field crops production. ICAR, New Delhi.
2. Reddy, S.R. and Reddi Ramu. 5th edition. 2016. Agronomy of field crops. Kalyani publishers, Ludhiana.
3. Gururaj hunsigi and Krishna, K.R. 2007. Scientific field crop production. Oxford &IBH Publishing Co.Pvt.LTD.
4. De Datta, S.K.1981. Principles and practices of rice Production. John Wiley and Sons, New York

20AGRO202- CROP PRODUCTION TECHNOLOGY-II 3 (2+1)
Course code-20AGRO202

Semester	:	**Fourth**
Course Name	:	**Crop Production Technology-II**
Course Code	:	**20 AGRO202**
L-T-P structure	:	**2-0-3-0**
Course Credits	:	**3(2+1)**
Course Coordinator	:	
Course Instructors	:	

Course Outcomes (CO):

CO No:	CO	PO	BTL
1	Illustrate with the knowledge of profitable crop Production technology.	3,6,8	3
2	Complete knowledge on Origin, geographical distribution, economic importance, soil and climatic Requirements, important varieties, pest, and diseases resistance varieties, cultural practices, and yield of Rabi crops	3,6,8	3
3	Apply on Identification on different weeds in rabi season crops like Pulses, oilseeds, sugar crops and forage crops with details study on improving their package and practices and storages technologies	3,6,8	3
4	Illustrate with proper knowledge about irrigation scheduling in Rabi season crops, the additional area can Increase of low water required crops.	3,6,8	3
5	Demonstrate on seed to seed of field management practices and also identification of growth stages critical stages, pest and disease management	3,6,8	3

	etc. Which can be solved at field level. Also, complete awareness on crop cultivation practices of Rabi crops		

COURSE OBJECTIVE:

1. To impart knowledge to the students on Improving productivity of field and forage crops.(Rabi crops)
2. To build knowledge on Ensuring sound use of natural resources, reducing soil erosion
3. To enhance the skill in the applications and improving soil quality. Implementing newly developed and tested methods that improve soil on both conventional and organic farms.

Course outlines

Theory

Origin, geographical distribution, economic importance, soil and climatic requirements, varieties, cultural practices and yield of oil seeds, fiber, sugar, tobacco and fodder crops; Oilseeds, groundnut, sesamum, soybean, rapeseed, mustard, sunflower, safflower, castor, linseed and niger; Fibre crops, cotton, jute, mesta; Sugar crops, sugarcane, sugarbeet; Other crops, potato, tobacco; Forage crops, sorghum, cowpea, cluster bean, napier, maize, lucerne, berseem and oat.

Practical

Sowing methods of sugarcane, sowing of soybean, cotton, groundnut, jute, mesta; Identification of weeds in oil seeds, fiber crops; Study of morphological characteristics of oil seeds, fiber crops ; Study of yield contributing characters of oil seeds, fiber crops; Yield and juice quality analysis of sugarcane; Study of important agronomic experiments of oil seeds, fiber crops at experimental farms, study of forage experiments, hay and silage; Oil extraction of medicinal crops, visit to research stations of related crops.

References:

1. Reddy, S.R. and Reddi Ramu. 5th edition, 2016. Agronomy of field crops. Kalyani publishers, Ludhiana.
2. Chidda Singh, Singh, P and Singh, R. 2003. Modern techniques of raising field crops. Oxford & IBH Publishing house, New Delhi.
3. Rajendra Prasad. 2004. Textbook of field crops production. Commercial crops, volume-II Technical Editor, ICAR, New Delhi.
4. Panda S.C.2014. Agronomy of fodder and forage crops, Kalyani publishers, Ludhiana.

FARMING SYSTEM & SUSTAINABLE AGRICULTURE 1(1+0)
Course code-20AGRO203

Semester	:	**Fourth**
Course Name	:	**Farming Sy m & S aina l Agri l r**
Course Code	:	**20 AGRO202**
L-T-P structure	:	**1-0-0-0**
Course Credits	:	**3(2+1)**
Course Coordinator	:	
Course Instructors	:	

Course Outcomes (CO):

CO No:	CO	PO	BTL
1	Apply major aspects of agricultural practices and traditions through time and throughout the world.	4,6	3
2	Illustrate with gaining knowledge about general relationships among culture, economics, politics, science, and agricultural development.	4,6	3
3	Apply various enterprises including farming system. Students studied types of farming, crop rotation and other practices of field.	4,6	3
4	Apply to show how agricultural scientists are attempting to minimize agricultural pollution and sustain food production adequate for the world's population	4,6	3

COURSE OBJECTIVE:

1. To impart knowledge to the students on the fundamentals of farming systems and sustainable agriculture
2. To study the various components of organic agriculture

Course Outlines

Theory

Farming system-scope, importance, and concept; Types and systems of farming system and factors affecting types of farming; Farming system components and their maintenance; Cropping system and pattern, multiple cropping system, efficient cropping system and their evaluation; Allied enterprises and their importance, tools for determining production and efficiencies in cropping and farming system; Sustainable agriculture, problems and its impact on agriculture, indicators of sustainability, adaptation and mitigation, conservation agriculture strategies in agriculture, HEIA, LEIA and LEISA and its techniques for sustainability; Integrated farming system, historical background, objectives and characteristics, components of IFS and its advantages, site specific development of IFS model for different agro-climatic zones; Resource use efficiency and optimization techniques, resource cycling and flow of energy in different farming system, farming system and environment; Visit of IFS model in different agro-climatic zones of nearby states University/ institutes and farmers field.

References

1. Arun K. Sharma. 2006. A hand book of organic farming - Agrobios (India) Jodhpur
2. Jayanthi C, Devasenapathy P and Vinnila, C. 2008. Farming systems principles and practice. Satish serial publishing house, Delhi
3. Panda.S.C. 2011. Cropping and farming systems. Agrobios (India) Jodhpur.
4. Ruthenburg, H. 1980. Farming systems in the tropics. Oxford university press.

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IRRIGATION WATER MANAGEMENT 2 (1+1)
Course code-20AGRO204

Semester	**: Fourth**
Course Name	**: Irrigation Water Management**
Course Code	**: 20 AGRO202**
L-T-P structure	**: 1-0-3-0**
Course Credits	**: 2(1+1)**
Course Coordinator	**:**
Course Instructors	**:**

Course Outcomes (CO):

CO No:	CO	PO	BTL
1	Illustrate the knowledge of irrigation water management to maximising crop yield and quality by developing irrigation and water management techniques can help growers demonstrate best practice to retailers and consumers.	6,8	3
2	Apply the ways for growers to improve crop performance by evaluating the different types of irrigation and water managements systems available.	6,8	3
3	Apply the knowledge of various irrigation methods which are more efficient to minimize the water loss and improve the water use efficiency of crop and water requirements of the crops,	6,8	3
4	Apply the knowledge on Water requirements of crops, soil-plant- relationship, Irrigation requirements, duty and delta, Irrigation efficiencies, methods of irrigation, Quality of irrigation water.	6,8	3
5	Demonstrate on increasing need for efficient and effective irrigation and water management to maximize crop yield and quality whilst making best use of the water available.	6,8	3

COURSE OBJECTIVE:

1. The knowledge of irrigation water management to maximising crop yield and quality by developing irrigation and water management techniques can help growers demonstrate best practice to retailers and consumers.
2. This course will recommend ways for growers to improve crop performance by evaluating the different types of irrigation and water managements systems available.
3. To impart the knowledge of various irrigation methods which are more efficient to minimize the water loss and improve the water use efficiency of crop and water requirements of the crops,
4. There is an increasing need for efficient and effective irrigation and water management to maximise crop yield and quality whilst making best use of the water available

Course outlines
Theory
Irrigation : Definition and objectives; Water resources, Irrigation projects (major, medium & minor) in India and Andhra Pradesh; Soil - plant - water relationships; Methods of soil moisture estimation; Evapotranspiration and Crop water requirement; Duty of water; Conjunctive use of water; Scheduling

of irrigation; Methods of irrigation - Surface, Subsurface, Sprinkler and Drip irrigation; Irrigation efficiency and Water use efficiency; Irrigation water quality criteria and its management; Waterlogging; Agricultural drainage.

Practical

Measurement of bulk density, study of soil moisture measuring devices, determination of field capacity and permanent wilting point, measurement of infiltration rate, irrigation water, scheduling of irrigation by IW/CPE ratio method, calculations on soil moisture, irrigation water needs, duty of water and irrigation efficiencies, layout of surface methods of irrigation, demonstration of drip and sprinkler irrigation, visit to micro irrigation systems in farmers fields ,water management practices in different crops.

References

1. Michael, A.M. 2006. Irrigation – Theory and Practice. Vikas Publishing House Pvt. Ltd., New Delhi.
2. Reddy, S.R. 2016.Irrigation Agronomy 3 rd Edition.Kalyani Publishers, Ludhiana.
3. Sankara Reddi, G.H. and Yellamanda Reddy, T. 2006.Efficient Use of Irrigation Water.Kalyani Publishers, Ludhiana. Majumdar, D.K. 2013. Irrigation water management: Principles and practices. PHI learning Pvt Ltd, Delhi-92

20AGRO 301 Geoinformatics and Nanotechnology for Precision Farming

Semester	**:**	**Fifth**
Course Name	**:**	**Geoinformatics a d Na otech olo y f r P ecisio Farming**
Course Code	**:**	**20AGRO301**
L-T-P structure	**:**	**1-0-3-0**
Course Credits	**:**	**2(1+1)**
Course Coordinator	**:**	
Course Instructors	**:**	

MAPPING OF COURSE OUTCOMES WITH PO/PSO
COURSE OUTCOMES (CO):

CO No:	CO	PO	BTL
1	Understand precision agriculture concepts and techniques, principles and practices, geoinformatics concepts, use and crop discrimination monitoring techniques	1	2
2	Understand geodesy principles, management of spatial data, global positioning system and application of nanotechnology in rainfed agriculture	2	2

3	Describe about cartography, application of remote sensing techniques in rainfed agriculture, fertilizer recommendation using geospatial technologies in precision farming	2	2
4	Apply geo referencing, Nanotechnology concepts and techniques, nano sensors, Nano-fertilizers and nano pesticides	2	3
5	Apply knowledge on use of GPS for watershed management, crop yield, GIS software, image processing software, remote sensing and nano technology	8	3

COURSE OBJECTIVE:

1. To introduce the basic concepts of geoinformatics and nanotechnology
2. To create awareness about various applications of geoinformatics and nanotechnology for precision agriculture
3. To teach basic handling of various geoinformatic tools

SYLLABUS

THEORY

Theory Precision agriculture: concepts and techniques; their issues and concerns for Indian agriculture; Geo-informatics- definition, concepts, tool and techniques; their use in Precision Agriculture. Crop discrimination and Yield monitoring, soil mapping; fertilizer recommendation using geospatial technologies; Spatial data and their management in GIS; Geodesy and its basic principles; Remote sensing concepts and application in agriculture; Image processing and interpretation; Global positioning system (GPS), components and its functions; System Simulation- Concepts and principles, Introduction to crop Simulation Models and their uses for optimization of Agricultural Inputs; STCR approach for precision agriculture; Nanotechnology, definition, concepts and techniques, brief introduction about nanoscale effects, nano-particles, nano-pesticides, nano-fertilizers, nano-sensors, Use of nanotechnology in tillage, seed, water, fertilizer, plant protection for scaling-up farm productivity.

PRACTICAL

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

agricultural survey. Formulation, characterization and applications of nanoparticles in agriculture. Projects formulation and execution related to precision farming.

References

1. Pradeep. T. 2007. NANO: The Essentials: Understanding Nanoscience and Nanotechnolgy. Tata McGraw-Hill Publishing Company Limited, New Delhi

2. Lillesand, T.M. and Kiefer, R. W. 1994. Remote sensing and image interpretation. (3rd edition), John Wiley and Sons.

3. Anji Reddy, M. 2006. Text book of Remote sensing and Geographical Information Systems, (3rd edition), B.S. Publications, Hyderabad.

20 AGRO 302 Practical Crop Production

Semester	:	**Fifth**
Course Name	:	**Practical Crop Production**
Course Code	:	**20 AGRO 302**
L-T-P structure	:	**0-0-3-0**
Course Credits	:	**1(0+1)**
Course Coordinator	:	
Course Instructors	:	

MAPPING OF COURSE OUTCOMES WITH PO/PSO
COURSE OUTCOMES (CO):

CO No:	CO	PO	BTL
PRACTICAL			
CO5	Apply practical knowledge on crop planning, raising field crops and their management practices from field preparation to harvesting and seed production	8	3

COURSE OBJECTIVE:

1. To know cultivation technology of different crops in respect to different situations and understand crop cycle, environmental requirements, agronomic management and economics of crop production.

SYLLABUS
PRACTICAL

Crop planning, raising field crops in multiple cropping systems, field preparation, seed, treatment, nursery raising, sowing, nutrient, water and weed management and management of insect-pests

diseases of crops, harvesting, threshing, drying, winnowing, storage and marketing of produce. The emphasis will be given to seed production, mechanization, resource conservation and integrated nutrient, insect-pest and disease management technologies, preparation of balance sheet including cost of cultivation, net returns per student as well as per team of 8-10 students.

References

1. Rajendra Prasad. 2006. Text book of field crops production. ICAR, New Delhi.
2. 2. Reddy, S.R. and Reddi Ramu. 5th edition. 2016. Agronomy of field crops. Kalyani publishers, Ludhiana.
3. 3. Gururaj hunsigi and Krishna, K.R. 2007. Scientific field crop production. Oxford &IBH Publishing Co.Pvt. LTD.
4. 4. De Datta, S.K.1981. Principles and practices of rice Production. John Wiley and Sons, New York

20AGRO 303 Rainfed Agriculture & Watershed Management 2(1+1)

Semester	**: Sixth**
Course Name	**: Rainfed Agriculture & Watershed Management**
Course Code	**: 20 AGRO 303**
L-T-P structure	**: 1-0-3-0**
Course Credits	**: 2(1+1)**
Course Coordinator	**:**
Course Instructors	**:**

Course Outcomes (CO):

CO No:	CO	PO	BTL
1	**Understand about rainfed agriculture and its introduction, problem and prospects in India.**	1	2
2	Describe different tillage practices for rainfed crops, losses due to erosion, management of rainfed crops	2	2
3	Discuss different harvesting structures, conservation measures, using of fertilizers in rainfed areas and the different cropping systems in rainfed regions	2	2
4	Apply contingent crop planning, evapotranspiration and land capability classification	2	3
5	Apply Acquaint practical knowledge on cropping pattern of dryland areas. cultural practices in dryland areas, soil moisture conservation measures, watershed and rainfall analysis	8	3

COURSE OBJECTIVE:

1. To know basic knowledge of rain fed agriculture and water shed management.
2. To understand objective, principles and component of watershed management
3. To gain knowledge on rainfed agriculture and its introduction, problem and prospects in India

Course outlines

Theory

Rainfed agriculture: Introduction, types, History of rainfed agriculture & watershed in India; Problems and prospects of rainfed agriculture in India ; Soil and climatic conditions prevalent in rainfed areas; Drought: types, effect of water deficit on physio- morphological characteristics of the plants, Mechanism of crop adaptation under moisture deficit condition; Water harvesting: importance, its techniques, Efficient utilization of water through soil and crop management practices, Management of crops in rainfed areas, Contingent crop planning for aberrant weather conditions, Concept, objective, principles and components of watershed management, factors affecting watershed management.

Practical

Studies on climate classification, studies on rainfall pattern in rainfed areas of the country and pattern of onset and withdrawal of monsoons. Studies on cropping pattern of different dry land areas in the country and demarcation of dry land area on map of India.Interpretation of meteorological data and scheduling of supplemental irrigation on the basis of evapo-transpiration demand of crops.Critical analysis of rainfall and possible drought period in the country, effective rainfall and its calculation. Studies on cultural practices viz; mulching, plant density, depth of sowing, thinning and leaf removal for mitigating moisture stress. Characterization and delineation of model watershed.Field demonstration on soil & moisture conservation measures.Field demonstration on construction of water harvesting structures. Visit to rainfed research station/watershed.

References:

1. Reddy, S. R. and Prabhakar Reddy, G. 2015. Dryland Agriculture. Kalyani Publishers.
2. Arnon,I. 1972. Crop Production in Dry Regions (Vol.I), Leonard Hill Pub. Co, London.
3. Dhruva Narayana, V.V., Sastry, G.S. and Patnaiak, V.S. 1999. Watershed Management in India. ICAR, New Delhi.
4. Jeevananda Reddy,S.2002. Dryland Agriculture in India: An agro-climatological and agro-meteorological perspective. B S publications

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20AGRO 304 Principles of Organic Farming 2(1+1)

Semester	**: Sixth**
Course Name	**: Principles of Organic Farming 2(1+1)**
Course Code	**: 20 AGRO304**
L-T-P structure	**: 2-0-3-0**
Course Credits	**: 3(2+1)**
Course Coordinator	**:**
Course Instructors	**:**

Course Outcomes (CO):

CO No:	CO	PO	BTL
1	Discuss the concept and principles of organic production technology and Role of organic farming in National economy.	1	2
2	Understand the method of composting and nutrient management in organic farming.	6	2
3	Understand the Selection of crops and varieties cereals and commercial for organic farming and increase production of organic products by managing pests, diseases and by using botanicals.	6	2
4	Illustrate the Quality analysis of organic inputs and products, Relative economics of organic production programmes Socio-economic impacts, certification process and standard of organic produce	6	3
5	Demonstrate Indigenous technology knowledge (ITK), Vermicompost and other organic manures production methodology and their application.	8	3

COURSE OBJECTIVE:

1. To impart fundamental principles of farming systems & organic farming towards sustainable agriculture to improve the economic conditions of the farmer.
2. Impart practical knowledge involved in vermicomposting, biofertilizers and other components of organic farming.
3. To understand the Selection of crops and varieties cereals and commercial for organic farming and increase production of organic products by managing pests, diseases and by using botanicals and other manures.

Course Outlines

Theory

Organic farming, principles and its scope in India; Initiatives taken by Government (central/state), NGOs and other organizations for promotion of organic agriculture; Organic ecosystem and their concepts; Organic nutrient resources and its fortification; Restrictions to nutrient use in organic farming; Choice of crops and varieties in organic farming; Fundamentals of insect, pest, disease and weed management under organic mode of production; Operational structure of NPOP; Certification process and standards of organic farming; Processing, leveling, economic considerations and viability, marketing and export potential of organic products.

Practical

Visit of organic farms to study the various components and their utilization; Preparation of enrich compost, vermicompost, bio-fertilizers/bio-inoculants and their quality analysis; Indigenous technical knowledge (ITK) for nutrient, insect, pest disease and weed management; Cost of organic production system; Post harvest management; Quality aspect, grading, packaging and handling.

References

Arun K. Sharma. 2002. A Handbook of organic farming. Agrobios, India. 627p.
2. Palaniappan, S.P and Annadurai, K.1999. Organic farming-Theory and Practice. Scientific publishers, Jodhpur,India. 257p.
3. Mukund Joshi and Prabhakarasetty, T.K. 2006. Sustainability through organic farming. Kalyani publishers, New Delhi. 349p.
4. Balasubramanian, R., Balakishnan, K and Siva Subramanian, K. 2013. Principles and practices of organic farming. Satish Serial Publishing House. 453p 39
5. Tarafdar, J.C., Tripathi, K.P and Mahesh Kumar, 2009. Organic agriculture. Scientific Publishers, India. 369p.
6. Tiwari, V.N., Gupta, D.K., Maloo, S.R and Somani, L.L. 2010. Natural, organic, biological, ecological and biodynamic farming. Agrotech Publishing Academy, Udaipur. 420p.
7. Dushyent Gehlot. 2005. Organic farming- standards, accreditation, certification and inspection. Agrobios, India. 357p

20 ELCT 305 AGRICULTURAL WASTE MANAGEMENT

Semester	**: Elective course**
Course Name	**: AGRICULTURAL WASTE MANAGEMENT**
Course Code	**: 20 ELCT 305**
L-T-P structure	**: 2-0-3-0**
Course Credits	**: 3(2+1)**
Course Coordinator	**:**
Course Instructors	**:**

CO No:	CO	PO	BTL
1	Understand Various eco-friendly methods for agricultural waste management.	1	2
2	Understand Nutritive value and energy production potential of agro wastes.	2	2
3	Describe effectively in written essays showing the principals of waste management	44	3
4	Apply use of calculations and writing assignments to show effective knowledge of waste management issues as they relate to poultry production.	44	3
5	Illustrate on Techniques of Agriculture waste management, and critical thinking skills to show how to solve waste management problems	8	3

Course Objectives

1. To impart knowledge to students on various methods of agricultural waste management for eco-friendly energy and manure production.
2. Design and understand the operation of anaerobic digesters for wastewater and solid waste treatment - Learn about biogas cleanup and utilization - Analyze economics of anaerobic digestion processes - Learn about feedstock preparation for composting - Design and operation of open and in-vessel composting systems
3. Quantify the kinetics of microbial transformations - Understand the principles of bioreactor design and operation - Design lagoon systems - Characterize the processes occurring in an anaerobic digester

Course outlines

Theory

Introduction to agricultural waste management, Nature and characteristics of agricultural waste and their impact on the environment, Kinds of wastes, Classification, role of soil and plants in waste management, sources of waste, impact of waste on soil and plant quality, Biological processes of waste management, Utilization and Recycling of Agricultural waste, Potential of Recyclable Crop Residues and its management, Insitu management of agriculture waste, Composting and Vermicomposting for bio conservation of biodegradable waste, Biogas Technology, Agricultural waste and water, air and animal resources, Impacts of waste on human, animal health and environment. Management of bedding & litter, wasted feed, run-off from feed lots and holding areas and wastewater from dairy parlors, agro-waste recycling through farming system, waste management machineries, environmental benefit of waste management.

Practical

Collection and preparation of agricultural waste sample. Determination of pH, EC, CECe, heavy metals, BOD, COD, TSS, TDS, NH4, Total P, and dissolved reactive P. Nutrient status (N, P, K, secondary and micronutrients) analysis of agricultural waste. Waste management equipment operation, Maintenance and safety hazards, computer software and models. Survey of different agri waste from live-stock, dairy, poultry, food processing, fruit & vegetable and agri-chemicals, Preparation of compost, vermicomposting, biogas and analysis of compost.

20ELCT 306 Weed Management 3(2+1)

Semester	**: Elective course**
Course Name	**: Weed Management**
Course Code	**: 20 ELCT 306**
L-T-P structure	**: 2-0-3-0**
Course Credits	**: 3(2+1)**
Course Coordinator	**:**
Course Instructors	**:**

Course Outcomes (CO):

CO No:	CO	PO	BTL
1	Understand the knowledge on weed biology, their classification, reproduction and characteristics of weeds, crop weed competition, survey of weeds in varied ecosystem and their management	1	2
2	Classify on herbicide mode of action, their classification, formulations and their selectivity	2	2
3	Discuss the herbicides compatibility with nutrients, integrated weed management and management of weeds in different crops	4	2
4	Discuss the weed management in aquatic ecosystems, management of problematic weeds and resistance of herbicides in weeds	4	3
5	Illustrate on Techniques of weed preservation, Weed identification Study of herbicide formulations and mixture of herbicide, Herbicide and nutrient compatibility, methods of herbicide application, spraying equipments and Calculations of herbicide doses, weed control efficiency and weed index	8	3

COURSE OBJECTIVE:

1. To familiarize the students about the weeds, herbicides and methods of weed control.
2. To understand the menace caused by weeds, identify weeds, quantify damage and manage in integrated manner.
3. To study biology and control of problem weeds including aquatic and parasitic weeds.

Course outlines

Theory

Introduction to weeds, characteristics of weeds their harmful and beneficial effects on ecosystem. Classification, reproduction and dissemination of weeds. Herbicide classification, concept of adjuvant, surfactant, herbicide formulations and their use. Introduction to mode of action of herbicides and selectivity. Allelopathy and its application in weed management. Bio-herbicides and their application in agriculture. Concept of herbicide mixture and utility in agriculture. Herbicide compatibility with nutrients and their application. Integration of herbicides with non-chemical methods of weed management. Herbicide resistance and its management.

Practical

Techniques of weed preservation. Weed identification and the losses due to weedsstudy. Biology of important weeds. Study of herbicide formulations and mixture of herbicide. Herbicide and nutrient compatibility study. Shift of weed flora study in long term experiments. Study of methods of herbicide application, spraying equipments. Calculations of herbicide doses, weed control efficiency and weed index.

References

1. Gupta, O.P. 2012. Modern Weed Management (4th edition), Agrobios (India) Ltd, Jodhpur
2. Rao,V.S. 1992. Principles of Weed Science (2nd edition), Oxford& IBH Publishing Co.Pvt Ltd, New Delhi.
3. Ross, M.A and Lembi, C.A. 1999. Applied Weed Science. (2nd edition), Prentice Hall of India Pvt Ltd, New Delhi
4. Saraswat, V.N., Bhan, V.M. and Yaduraju, N.T. (eds.).1998. Weed management –ICAR Publication

Semester	**:**	**Second**
Course Name	**:**	**Fundamentals of Genetics**
Course Code	**:**	**20 GPBR111**
L-T-P structure	**:**	**2-0-3-0**
Course Credits	**:**	**3(2+1)**
Course Coordinator	**:**	
Course Instructors	**:**	

MAPPING OF COURSE OUTCOMES WITH PO/PSO

COURSE OUTCOMES (CO):

CO NO.	COURSE OUTCOMES (CO)	PO/PSO	BTL
THEORY			
CO1	Memorize the basic knowledge about the pre-mendelian and mendelian genetics.	1,2, 10	1

CO2	Understand the major characteristic features of the genetic interactions and epistatic effect, self-incompatibility, pleiotropic effect, linkage, crossing over and its significance in the plant breeding and chromosome mapping.	1,3	2
CO3	Observe and understand knowledge about the sex determination and linkage studies. Study of biotechnological tools like DNA and RNA structure and protein synthesis.	2,4, 5	2
CO4	Employ the knowledge about the gene regulation, mutations and chromosomal aberrations and their role in breeding.	6,9	3
PRACTICAL			
CO5	Calculations of mendelian genetics problems, genetics interactions, test and back cross, linkage determination and crossing over analysis through two point and three-point test cross data.	7,8, 11	3

COURSE OBJECTIVE:

1. To impart knowledge to the students on the ultrastructure of organelles, fundamental of genetics and their applications in plant breeding for improving agricultural productivity.
2. To build knowledge on heredity, inheritance, and gene regulation at transcriptional level.
3. To enhance the skill in the applications of the genetic principles in day-to-day life and to propagate the science of genetics.

SYLLABUS
THEORY

CO1: Pre Mendelian concepts of heredity- Early history of heredity, inheritance of acquired traits, preformation theory, pangenesis and germplasm theory. Chromosome - Structure of chromosome, types of chromosomes based on position of centromere. Cell division - Cell cycle - Mitosis - Process of mitosis - Significance. Meiosis - Process - Differences between mitosis and meiosis - Significance. Mendelian principles of heredity - Terminology, Mendel's experiments - Reasons for selection of pea as experimental material- characters studied - Reasons for mendel's success. Mendel's laws - Law of segregation - Law of independent assortment - Principle of dominance - Principle of unit characters - Exceptions to mendel's laws - Rediscovery of mendelian principles. Probability and Chi-square - Concept of probability, predicting results of a monohybrid cross, predicting results of a dihybrid cross - Chi-square test. Dominance relationships - Complete dominance, incomplete dominance, co dominance, over dominance, pseudodomiance, lethal factors.

CO2: Gene interaction - Nonepistatic interaction - Interaction of factors; epistatic interactions - Complementary epistasis, dominant epistasis. Recessive epistasis, duplicate dominant gene action, dominant suppression or inhibitory gene action, duplicate genes with cumulative effect. Multiple alleles - Characteristics of multiple alleles - Blood groups in humans, coat colour in rabbits, self-incompatibility alleles in plants - pleiotropism, penetrance and expressivity. Linkage - Definition - Classification of linkage - Characteristic features of linkage - Linkage groups. Detection of linkage - Estimation of linkage - Importance of test cross in linkage studies - significance in plant breeding. Crossing over mechanisms - Mechanism of crossing over - Types of crossing over - Factors affecting crossing over. Significance of crossing over in plant breeding - Cytological proof of crossing over in Drosophila. Chromosome mapping - 2-point and 3-point test cross - Cytological maps and genetical maps - Coincidence and interference.

CO3: Sex determination - Various mechanisms of sex determination - Chromosomal sex determination, genie balance mechanism of sex determination in Drosophila melanogaster, male haploidy, single gene effects etc. Sex linkage - White eye colour in Drosophila, colour blindness and haemophilia in humans - sex influenced traits - Horns in sheep, baldness in humans, sex limited - Milk production in cattle, beard in man - Pseudohermaphrodites - Gynandromorphs. Qualitative and Quantitative traits, Polygenes and continuous variations – Definition-Inheritance and their differences, multiple factor hypothesis. Cytoplasmic inheritance - Definition - Chloroplast inheritance (leaf variegation in *Mirabilis jalapa*) - mitochondrial inheritance (cytoplasmic male sterility in maize) - Characteristic features of cytoplasmic inheritance - Differences between chromosomal and extrachromosomal inheritance. Nature and structure of genetic material - DNA and its structure -Watson and Crick's model - Function - Experiments to prove DNA as genetic material. Replication of DNA - Modes of DNA replication - Semi-conservative DNA replication- Experimental proof. Types of RNA- Messenger RNA, ribosomal RNA, and transfer RNA- structure of tRNA, differences between DNA and RNA. Protein synthesis - Central dogma, transcription, and translational mechanism of genetic material - Genetic code - Properties of genetic code - Wobble hypothesis. Steps in protein synthesis - Transcription and translation

CO4: Gene regulation - Lac operon concept - Gene concept - Cistron - Recon - Muton.Mutation - Classification - Gene mutations - Introduction - Definition - Types of mutations - Spontaneous and induced mutations - Point mutations - Characters of mutations - Xenia and metaxenia - Chimera Types and their significance in plant breeding. Methods of inducing mutations, Physical and chemical mutagens - Detection of sex linked lethal in Drosophila (CIB method given by Muller). Molecular basis of mutations - Transitions, transversions and frame shift mutations- Importance of mutations in plant breeding. Structural changes in chromosome - Breakage - fusion - bridge cycle - Deletions (deficiency) - Duplications and their significance in plant breeding. Inversions - pericentric inversions and paracentric inversions - inversions as cross over suppressors. Translocations - simple and reciprocal - their role in plant breeding.

PRACTICAL

CO5: Practical study of microscope, cell structure, mitotic and meiotic cell division. Calculation based practical on probability, chi-square, monohybrid and dihybrid crosses, epistatic interactions including test and back cross, linkage determination and crossing over analysis through two point and three-point test cross data. DNA and RNA structure.

REFERENCE BOOKS:

1. Pundhan Singh. 2006. *Genetics*. Kalyani Publishers, Ludhiana.
2. Singh, B.D. 2015. *Fundamentals of Genetics*. Kalyani Publishers, Ludhiana.
3. Gupta, P.K.2007. *Genetics*. Rastogi Publications, Meerut.
4. Khanna, V.K. 2002. *Genetics Numerical Problems*. Kalyani publishers. 2nd edition. 43
5. Pundhan Singh. 2011. *Genetics at a Glance*. Kalyani Publishers, Ludhiana.
6. Verma, P.S. and Agarwal, P.K. 2013. *Cell Biology, Genetics, Molecular Biology, Evolution and Ecology*. S. Chand & Company Pvt. Ltd., Kolkata.
7. Snustad, D.P. and Simmons, M.J. 2010. *Principles of Genetics*. 5th Ed. John Wiley & Sons, 111, River Street, Hoboken, NJ, U.S.A.

8. Strickberger, M.W. 2006. *Genetics*. Prentice – Hall of India Pvt. Ltd., New Delhi

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2. https://www.youtube.com/watch?v=MKLVmPua9D0
3. https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=&cad=rja&uact=8&ved=2ahUKEwjnstOzm_TzAhW4xzgGHU_fDI0QFnoECAwQAQ&url=http%3A%2F%2Fwww.jnkvv.org%2FPDF%2F06042020134718442016l3.pdf&usg=AOvVaw2Usas5nRqtef_xCWh7pfR9

Semester	:	**Third**
Course Name	:	**Fundamentals of Plant Breeding**
Course Code	:	**20GPBR211**
L-T-P structure	:	**2-0-3-0**
Course Credits	:	**3(2+1)**
Course Coordinator	:	
Course Instructors	:	

MAPPING OF COURSE OUTCOMES WITH PO/PSO

COURSE OUTCOMES (CO):

CO NO.	COURSE OUTCOMES (CO)	PO/PSO	BTL
THEORY			
CO1	Define plant breeding, modes of reproductions, self and cross pollination, self-incompatibility, and male sterility in crops. Study about the plant introduction agencies in India and their role.	1,2	1
CO2	Explain different breeding methods for self-pollinated and cross-pollinated crops and concept of population genetics and manage the crops on field level and statistical analysis.	3,5,6	2
CO3	Understand the genetic basis of heterosis, inbreeding depression to solve the agricultural problems and development of inbred lines, hybrids, composite and synthetic varieties. To be well versed with different methodologies for asexually propagated crops and wide hybridization area.	7,8	2
CO4	Apply the knowledge about the polyploidy and mutation breeding concepts on the field level. To be able to help in Agricultural Research Systems in the areas of crop improvement through breeding for important biotic and abiotic stresses involving both conventional and biotechnological approaches and its adaptation both on field and lab level.	4,9, 10	3
PRACTICAL			
CO5	Employ the germplasm maintenance in various crops, emasculation, and hybridization techniques in self and cross- pollinated crops. Study of male sterility systems, analysing statistical parameters, design, heterosis,	4,5,9, 11	3

	heritability estimation and prediction of hybrid performance on field level and work out the extent of natural out crossing in crops.		

COURSE OBJECTIVE:

1. Describe sources and types of genetic variation and explain their importance for plant improvement.
2. Describe the progression of stages within a modern breeding programme from the setting of breeding objectives, through the development and implementation of breeding strategies to the commercialization of plant varieties.
3. Formulate and justify a plan for the application of plant breeding methods to achieve a specific objective. Impart knowledge of marker assisted selection in plant breeding. Study of plant introduction agencies in India

SYLLABUS

THEORY

CO1: Historical developments, concept, nature and role of plant breeding, major achievements, and prospects - Definition, aim, objectives, history and developments of plant breeding, scientific contributions of eminent scientists - Landmarks in plant breeding - Scope of plant breeding. Modes of reproduction and apomixis - Asexual reproduction (vegetative reproduction and apomixis) and sexual reproduction - Their classification and significance in plant breeding. Modes of pollination - Classification of crop species based on mode of pollination- self-pollination - mechanisms promoting self-pollination - Genetic consequences of self-pollination - Cross pollination - Mechanisms promoting cross pollination - Genetic consequences of cross pollination - Often cross-pollinated crops. Self- incompatibility- Classification on - Heteromorphic, homomorphic, gametophytic and sporophyte systems of incompatibility - Advantages and disadvantages - Utilization in crop improvement. Male sterility- Genetic consequences, cultivar options - Different types - Genetic, cytoplasmic, and cytoplasmic genetic male sterility- Inheritance and maintenance utilization of male sterile lines in hybrid seed production - Their advantages and disadvantages. Domestication, acclimatization, and introduction - Plant introduction - Primary introduction and secondary introduction - Plant introduction agencies in India - National Bureau of Plant Genetic Resources (NBPGR) and its activities - Procedure of plant introduction - Merits and demerits of plant introduction.

CO2: Centre of origin/diversity - Centres of diversity- Centres of origin - Classification - law of homologous series - Types of centres of diversity - Germplasm collections - Genetic erosion - Main reasons of genetic erosion - Extinction - Gene sanctuaries - Introgression - Gene banks - Types of gene banks. Breeding methods in self-pollinated crops - Modes of selection - Selection - Natural and artificial selection - Basic principles of selection - Basic characteristics and requirements of selection - Selection intensity - Selection differential, heritability (narrow and broad sense) - Genetic advance as per cent of mean. Mass selection - Procedure for evolving a variety by mass selection - Modification of mass selection - Merits, demerits, and achievements. Pure line selection - Johannsen's pure line theory and its concepts and significance. Origin of variation in pure lines - Characters of pure lines - Progeny test, genetic basis of pure line selection - General procedure for evolving a variety by pure line selection - Merits, demerits, and achievements - Comparison between mass and pure line selection. Hybridization techniques - Hybridization - Aims and objectives - Types of

hybridization - Pre-requisites for hybridization - Procedure / steps involved in hybridization. Handling of segregating population - Pedigree method - Procedure - Merits, demerits, and achievements. Bulk method - Procedure - Merits, demerits, and achievements - Comparison between pedigree and bulk methods - Single seed descent method - Merits and demerits. Backcross method of breeding-Its requirements and applications - Procedure for transfer of single dominant gene - Procedure for transfer of single recessive gene - Merits, demerits, and achievements - comparison between pedigree and backcross method. Multiline concept - Definition - Characteristics of a good multiline - Development of multiline varieties - Achievements. Concepts of population genetics and Hardy - Weinberg Law - Hardy Weinberg Law-Factors affecting equilibrium frequencies in random mating populations - Selection without progeny testing - Selection with progeny testing - Merits and demerits of progeny selection - Line breeding- achievements. Recurrent selection - Different types - Detailed procedure of simple recurrent selection and other recurrent selection methods - Conclusion on the efficiency of different selection schemes.

CO3: Heterosis - Heterosis and hybrid vigour- Luxuriance - Heterobeltiosis - Brief history heterosis in cross pollinated and self-pollinated species- Manifestations of heterosis- Genetic basis of heterosis - Dominance, over dominance and epistasis hypotheses- Objections and their explanations - Comparison between dominance and over dominance hypotheses - Physiological basis of heterosis - Commercial utilization. Inbreeding depression - Brief history - Effects of inbreeding - degrees of inbreeding depression - Procedure for development of inbred lines and their evaluation. Development of inbred lines and hybrids - Exploitation of heterosis - History of hybrid varieties - Important steps in production of single and double cross hybrids-Brief idea of hybrids in maize, pearl millet, sunflower, and rice. Composite and synthetic varieties - Production procedures - Merits, demerits, and achievements - Factors determining the performance of synthetic varieties - Comparison between synthetics and composites. Breeding methods in asexually propagated crops, clonal selection, and hybridization-Characteristics of asexually propagated crops - Characteristics of clones -Clonal selection - Procedure - Advantages and disadvantages - Problems in breeding asexually propagated crops- Genetic variation within a clone-Clonal degeneration -Achievements - Comparison among clones, pure lines and inbreds - Breeding of annual asexually propagated species through hybridization - interspecific hybridization. Wide hybridization and pre-breeding - History - Objectives - Barriers to produce distant hybrids- Techniques for production of distant hybrids - applications of wide hybridization in crop improvement-Sterility in distant hybrids-Limitations and achievements -use of gene pools to develop intermediate breeding material.

CO4: Polyploidy in relation to plant breeding - Polyploidy - Autopolyploids - Origin and production - Morphological and cytological features- Applications in crop improvement - Limitations- Allopolyploidy - Morphological and cytological features- Applications in crop improvement - Limitations. Mutation breeding- Methods and uses- Mutation breeding - Procedure of mutation breeding - Applications - Advantages, limitations, and achievements. Breeding for important biotic and abiotic stresses - Disease resistance - Mechanisms of disease resistance in plants (disease escape, tolerance, resistance, immunity, and hypersensitivity) - Genetic basis of disease resistance - Gene for gene hypothesis - sources of disease resistance - Breeding methods for disease resistance - Achievements. Insect resistance - Mechanism of insect resistance in plants (non-preference, antibiosis, tolerance, and avoidance)- Nature of insect resistance-Genetics of insect resistance - Horizontal and vertical resistance- Sources of insect resistance - breeding methods for insect resistance - Problems in breeding for insect resistance. Achievements. Drought resistance- Mechanisms of drought resistance (drought escape, avoidance, tolerance, and resistance) - Features associated with drought resistance - Sources of drought resistance - Breeding methods for drought

resistance - Limitations - achievements - Resistance to water logging - Effects of water logging - Mechanism of tolerance - Ideotype for flooded areas. Salt tolerance - Response of plants to salinity - Symptoms - Mechanisms of salt tolerance - Breeding methods for salt tolerance - Problems - Achievements. Cold tolerance - Chilling resistance - Effects of chilling stress on plants - Mechanism of chilling tolerance - Sources of chilling tolerance - Selection criteria. Biotechnological tools - DNA markers and markers assisted selection - Definition and classification of DNA markers and applications. Participatory plant breeding - Definition - Goals - Methodology - Advantages and limitations.

PRACTICAL

CO5: Plant Breeder's kit. Study of germplasm of various crops. Emasculation and hybridization techniques in self-pollinated crops- rice, groundnut. Emasculation and hybridization techniques in self-pollinated crops - green gram, sesame. Emasculation and hybridization techniques in cross pollinated crops - maize, castor. Emasculation and hybridization techniques in often cross-pollinated crops - cotton, red gram. Consequences of inbreeding on genetic structure of resulting populations. Study of male sterility systems. Handling of segregation populations. Methods of calculating mean, range, variance, standard deviation. Designs used in plant breeding experiments. Layout of field experiment. Analysis of Randomized Block Design. Estimation of heterosis, inbreeding depression and heritability. Prediction of performance of double cross hybrids. Work out the mode of pollination in a given crop and extent of natural out crossing.

REFERENCE BOOKS:

1. Phundan Singh, 2014. *Essentials of Plant Breeding*. Kalyani Publishers, New Delhi.
2. Singh, B.D. 2015. *Plant Breeding: Principles and Methods*. Kalyani Publishers, New Delhi.
3. Gupta, S.K. 2010. *Plant Breeding Theory and Techniques*.Wiley India Pvt. Ltd. New Delhi.
4. Allard, R.W. 2010. *Principles of Plant Breeding*. John Wiley and Sons, New York.
5. Poehlman, J.M. and Borthakur, D. 1995. *Breeding of Asian Field Crops*. Oxford and IBH Publishing Co., New Delhi.
6. Sharma, J.R. 1994. *Principles and Practice of Plant Breeding*. Tata McGraw Hill, Publishing Company Ltd., New Delhi.

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1. https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=&cad=rja&uact=8&ved=2ahUKEwjVi9yznPTzAhUSWX0KHUkRBkAQFnoECA0QAQ&url=https%3A%2F%2Fjru.edu.in%2Fstudentcorner%2Flab-manual%2Fagriculture%2FLaboratory%2520Manual%2520FPB.pdf&usg=AOvVaw2qugpTuJX_tKwiE38cWy6y
2. https://www.youtube.com/watch?v=9vUFdsqh8U8
3. https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=&cad=rja&uact=8&ved=2ahUKEwi5quHDnfTzAhVy4zgGHZVgBIIQFnoECAMQAQ&url=https%3A%2F%2Fwww.rvskvv.net%2Fimages%2FII-Year-II-Sem_Principles_Plant-Breeding_YNAU_20.04.2020.pdf&usg=AOvVaw10KTufasLkJmDmLTpl8QDQ

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Semester	:	**Fifth**
Course	:	**Crop improvement-I (*Cereals, Millets, Pulses* and *Oilseeds*)**
Course Code	:	**20GPBR311**
L-T-P structure	:	**1-0-3-0**
Course Credits	:	**2(1+1)**
Course Coordinator	:	
Course Instructors	:	

MAPPING OF COURSE OUTCOMES WITH PO/PSO

COURSE OUTCOMES (CO):

CO NO.	COURSE OUTCOMES (CO)	PO/PSO	BTL
THEORY			
CO1	Memorize the basic knowledge about the plant breeding. Study about the conventional and modern innovative approaches for the development of hybrids/varieties in cereals like wheat, barley and rice.	1,2	1
CO2	Explain the different breeding methods for the development of hybrids and varieties in major and minor millets.	4,6	2
CO3	Understand the knowledge regarding the conventional and modern innovative approaches for the development of hybrids or varieties in pulses like, chickpea, pigeonpea, urd bean, mung bean, soybean, cowpea and horsegram and field management.	2,3,8	2
CO4	Assign the breeding procedures in oilseeds. To be able to help in Agricultural Research Systems in the areas of crop improvement through conventional and modern innovative approaches for the development of hybrids and varieties in oilseed crops like groundnut, castor, sesame, sunflower, safflower, rapeseed, mustard, linseed, niger, coconut and oil palm.	4, 5, 7,11	3
PRACTICAL			
CO5	Employ the knowledge about the floral biology, emasculation and pollination techniques in cereals, millets, pulses and oilseeds. Visit to Agriculture research stations/AICRP projects and policies of crops. To gain knowledge about the parentage of released varieties and about the specialized characters in various crops.	4,6, 8, 9, 10	3

COURSE OBJECTIVE:

1. To understand the origin, distribution, and different breeding methods to be adopted for the development of varieties / hybrids in various Kharif crops
2. To study about the plant genetic resources, centres of diversity and breeding for resistance to biotic and abiotic stresses
3. To learn about the influence of Genotype x Environment interaction on yield / performance

SYLLABUS

THEORY

CO1: Introduction - General Breeding Objectives - Concepts of breeding self-pollinated, cross pollinated and vegetatively propagated crops - Breeding populations relevance in crop improvement. Cereals - Rice - Origin - Distribution of species - Wild relatives and forms -Breeding objectives - Major breeding procedures (conventional and modern innovative approaches) for development of hybrids / varieties - Seed production technology of varieties and hybrids-Accomplishments. Cereals - Wheat and Barley - Origin - Distribution of species - Wild relatives and forms - Breeding objectives - Major breeding procedures (conventional and modern innovative approaches) for development of hybrids / varieties - Seed production technology of varieties and hybrids - Accomplishments.

CO2: Millets - Sorghum and Pearl millet - Origin - Distribution of species - Wild relatives and forms - Breeding objectives - Major breeding procedures (conventional and modern innovative approaches) for development of hybrids / varieties - Seed production technology of varieties and hybrids - Accomplishments. Millets - Finger millet, Kodo millet and Proso millet - Origin - Distribution of species - Wild relatives and forms -Breeding objectives - Major breeding procedures (conventional and modern innovative approaches) for development of hybrids / varieties - Seed production technology of varieties and hybrids-Accomplishments.

CO3: Pulses - Chickpea - Origin - Distribution of species - Wild relatives and forms - Breeding objectives - Major breeding procedures (conventional and modern innovative approaches) for development of hybrids / varieties - Seed production technology of varieties and hybrids-Accomplishments. Pulses - Pigeon pea - Origin - Distribution of species - Wild relatives and forms - Breeding objectives - Major breeding procedures (conventional and modern innovative approaches) for development of hybrids / varieties - Seed production technology of varieties and hybrids - Accomplishments. Pulses - Urd bean and Mung bean - Origin - Distribution of species - Wild relatives and forms -Breeding objectives - Major breeding procedures (conventional and modern innovative approaches) for development of hybrids / varieties - Seed production technology of varieties and hybrids - Accomplishments. Pulses - Soybean and Cowpea - Origin - Distribution of species - Wild relatives and forms-Breeding objectives - Major breeding procedures (conventional and modern innovative approaches) for development of hybrids / varieties - Seed production technology of varieties and hybrids - Accomplishments. Pulses - Horse gram, Field pea and Lentil - Origin - Distribution of species - Wild relatives and forms -Breeding objectives - Major breeding procedures (conventional and modern innovative approaches) for development of hybrids / varieties-seed production technology of varieties and hybrids -Accomplishments.

CO4: Oilseeds - Groundnut- Origin - Distribution of species - Wild relatives and forms - breeding objectives - Major breeding procedures (conventional and modern innovative approaches) for development of hybrids / varieties - Seed production technology of varieties and hybrids-Accomplishments. Oilseeds - Castor and Sesame - Origin - Distribution of species - Wild relatives and forms-Breeding objectives - Major breeding procedures (conventional and modern innovative approaches) for development of hybrids / varieties - Seed production technology of varieties and hybrids - Accomplishments. Oilseeds - Sunflower and Safflower - Origin - Distribution of species - Wild relatives and forms - Breeding objectives - Major breeding procedures (conventional and modern innovative approaches) for development of hybrids / varieties - Seed production technology of varieties and hybrids - Accomplishments. Oilseeds - Rapeseed and Mustard - Origin - Distribution of species - Wild relatives and forms - Breeding objectives - Major breeding procedures (conventional

and modern innovative approaches) for development of hybrids / varieties - Seed production technology of varieties and hybrids - Accomplishments. Oilseeds - Linseed and Niger - Origin - Distribution of species - Wild relatives and forms -Breeding objectives - Major breeding procedures (conventional and modern innovative approaches) for development of hybrids / varieties - Seed production technology of varieties and hybrids - Accomplishments. Oilseeds - Coconut and Oil palm - Origin - Distribution of species - Wild relatives and forms - Breeding objectives - Major breeding procedures (conventional and modern innovative approaches) for development of hybrids / varieties - Seed production technology of varieties and hybrids - Accomplishments.

PRACTICAL

CO5: Hybridization techniques and precautions to be taken, Floral morphology, selfing, emasculation and crossing techniques in field crops. Floral biology, anthesis, pollination, selfing, emasculation and crossing techniques in rice. Floral biology, anthesis, pollination, selfing, emasculation and crossing techniques in Wheat and Barley. Floral biology, anthesis, pollination, selfing, emasculation and crossing techniques in Maize and Sorghum. Floral biology, anthesis, pollination, selfing, emasculation and crossing techniques in Pearl millet and Finger millet. Floral biology, anthesis, pollination, selfing, emasculation and crossing techniques in Kodo millet and Proso millet. Floral biology, anthesis, pollination, selfing, emasculation and crossing techniques in Chickpea and Pigeon pea. Floral biology, anthesis, pollination, selfing, emasculation and crossing techniques in Urd bean and Mung bean. Floral biology, anthesis, pollination, selfing, emasculation and crossing techniques in Soyabean and Cowpea. Floral biology, anthesis, pollination, selfing, emasculation and crossing techniques in Groundnut and Castor. Floral biology, anthesis, pollination, selfing, emasculation and crossing techniques in and Sesame and Linseed. Floral biology, anthesis, pollination, selfing, emasculation and crossing techniques in Rapeseed and Mustard. Floral biology, anthesis, pollination, selfing, emasculation and crossing techniques in Sunflower and Safflower. Visit to Agricultural Research stations/ AICRP projects of crops. Sources of donors for different characters in various crops & Parentage of released varieties/ hybrids of important crops. Study of special quality characters in various crops.

REFERENCE BOOKS:

1. Allard, R.W. 1960. *Principles of Plant Breeding*. John Wiley & Sons, New York.
2. Phundan Singh. 2006. *Essential of Plant Breeding*. Kalyani Publishers, Ludhiana.
3. Poehlman, J.M. and Borthakur, D. 1995. *Breeding of Asian Field Crops*. Oxford & IBH Publishing Co. Pvt. Ltd. New Delhi.
4. Sharma, J.R. 1994. *Principles and Practices of Plant Breeding*. Tata McGraw-Hill Publishing Co. Ltd., New Delhi.
5. Kalloo, G.1994. *Vegetable Breeding*. Panima Educational Book Agency,New Delhi.
6. Kumar, N.2006. *Breeding of Horticultural Crops-Principles and Practices*. New India Publishing Agency, New Delhi
7. George Acquaah. 2012. *Principles of Plant Genetics and Breeding*. Blackwell Publishing Ltd.,USA
8. Mono graphs available on specific crops.

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2. https://www.youtube.com/watch?v=L0dHVMbXErw
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4. https://www.youtube.com/watch?v=0oSX1S54VAw

Semester	**: Sixth**
Course	**: Crop improvement-II (*Fibres, Sugars, Starches, Narcotics, Vegetables, Fruits* and *Flowers*)**
Course Code	**: 20GPBR312**
L-T-P structure	**: 1-0-3-0**
Course Credits	**: 2(1+1)**
Course Coordinator	**:**
Course Instructors	**:**

MAPPING OF COURSE OUTCOMES WITH PO/PSO

COURSE OUTCOMES (CO):

CO NO.	COURSE OUTCOMES (CO)	PO/PSO	BTL
THEORY			
CO1	Memorize the basic knowledge about the plant breeding. Study about the conventional and modern innovative approaches for the development of hybrids/varieties in fibres crop like cotton and jute and in sugar and starches.	1,2	1
CO2	Explain the different breeding methods for the development of hybrids and varieties in narcotics like tobacco and in vegetable crops like tomato, brinjal, chilli, okra, cucumber, cabbage, cauliflower, garlic, onions, gourds and melons.	4,6	2
CO3	Understand the knowledge regarding the conventional and modern innovative approaches for the development of hybrids or varieties in fruit crops like banana, guava, mango, papaya, lime, lemons, apple, pomegranate and sapota and field management.	2, 3,8	2
CO4	Assign the breeding procedures in flower crops. To be able to help in Agricultural Research Systems in the areas of crop improvement through conventional and modern innovative approaches for the development of hybrids and varieties in flower crops like rose, jasmine, chrysanthemum and marigold.	4, 5, 7,11	3
PRACTICAL			
CO5	Employ the knowledge about the floral biology, emasculation and pollination techniques in fibres, vegetables, fruit crops and in flowers. Visit to Agriculture research stations/AICRP projects and policies of crops. To gain knowledge about the parentage of released varieties and about the specialized characters in various crops.	4,6, 8, 9, 10	3

COURSE OBJECTIVE:

To impart knowledge to the students on the botanical description, origin, distribution and various breeding approaches used for the development of varieties / hybrids in various field and horticultural crops.

SYLLABUS

THEORY

CO1: Introduction - General breeding objectives - Concepts of breeding self-pollinated, cross pollinated and vegetatively propagated crops - Breeding populations relevance in crop improvement. Fibres - Cotton and Jute- Origin - Distribution of species - Wild relatives and forms -Breeding objectives - Major breeding procedures (conventional and modern innovative approaches) for development of hybrids / varieties - Seed production technology of varieties and hybrids - Accomplishments. Sugars and starches - Sugarcane - Origin - Distribution of species - Wild relatives and forms -Breeding objectives - Major breeding procedures (conventional and modern innovative approaches) for development of hybrids / varieties - Seed production technology of varieties and hybrids - Accomplishments. Sugars and starches - Potato and sweet potato - Origin - Distribution of species - wild relatives and forms - Breeding objectives - Major breeding procedures (conventional and modern innovative approaches) for development of hybrids / varieties -Seed production technology of varieties and hybrids -Accomplishments.

CO2: Narcotics - Tobacco- Origin - Distribution of species - Wild relatives and forms - breeding objectives - Major breeding procedures (conventional and modern innovative approaches) for development of hybrids / varieties - Seed production technology of varieties and hybrids - Accomplishments. Vegetables - Tomato and Brinjal - Origin - Distribution of species - Wild relatives and forms -Breeding objectives - Major breeding procedures (conventional and modern innovative approaches) for development of hybrids / varieties - Seed production technology of varieties and hybrids - Accomplishments. Vegetables - Chilli and Okra - Origin - Distribution of species - Wild relatives and forms-Breeding objectives - Major breeding procedures (conventional and modern innovative approaches) for development of hybrids / varieties - Seed production technology of varieties and hybrids - Accomplishments. Vegetables-Cucumber, Cabbage and cauliflower - Origin - Distribution of species - wild relatives and forms - Breeding objectives - Major breeding procedures (conventional and modern innovative approaches) for development of hybrids / varieties - Seed production technology of varieties and hybrids -Accomplishments. Vegetables - Garlic and Onion - Origin - Distribution of species - Wild relatives and forms -Breeding objectives - Major breeding procedures (conventional and modern innovative approaches) for development of hybrids / varieties - Seed production technology of varieties and hybrids - Accomplishments. Vegetables - Gourds and Melons- Origin - Distribution of species - Wild relatives and forms - Breeding objectives - Major breeding procedures (conventional and modern innovative approaches) for development of hybrids / varieties - Seed production technology of varieties and hybrids - Accomplishments.

CO3: Fruit crops - Banana and Guava - Origin - Distribution of species - Wild relatives and forms- Breeding objectives - Major breeding procedures (conventional and modern innovative approaches) for development of hybrids / varieties - Seed production technology of varieties and hybrids - Accomplishments. Fruit crops-Mango and Papaya - Origin - Distribution of species - Wild relatives and forms -Breeding objectives - Major breeding procedures (conventional and modern innovative approaches) for development of hybrids / varieties-seed production technology of varieties and hybrids-Accomplishments. Fruit crops- Lime, Lemons and Apple - Origin - Distribution of species - Wild relatives and forms -Breeding objectives - Major breeding procedures (conventional and modern innovative approaches) for development of hybrids / varieties - Seed production technology of varieties and hybrids - Accomplishments. Fruit crops- Pomegranate and Sapota -Origin - Distribution of species-Wild relatives and forms -Breeding objectives - Major breeding procedures (conventional and modern innovative approaches) for development of hybrids / varieties - Seed production technology of varieties and hybrids – Accomplishments.

CO4: Flower crops - Rose and Jasmine - Origin - Distribution of species - Wild relatives and forms - Breeding objectives - Major breeding procedures (conventional and modern innovative approaches) for development of hybrids / varieties - Seed production technology of varieties and hybrids - Accomplishments. Flower crops - Chrysanthemum and Marigold - Origin - Distribution of species - wild relatives and forms -Breeding objectives - Major breeding procedures (conventional and modern innovative approaches) for development of hybrids / varieties -Seed production technology of varieties and hybrids -Accomplishments.

PRACTICAL

CO5: Hybridization techniques and precautions to be taken - Floral morphology, selfing, emasculation and crossing techniques in field crops. Floral biology, anthesis, pollination, selfing, emasculation and crossing techniques in Cotton and Jute. Floral biology, anthesis, pollination, selfing, emasculation and crossing techniques in Sugarcane and Tobacco. Floral biology, anthesis, pollination, selfing, emasculation and crossing techniques in Tomato and Brinjal. Floral biology, anthesis, pollination, selfing, emasculation and crossing techniques in Chilli and Okra. Floral biology, anthesis, pollination, selfing, emasculation and crossing techniques in and Cucumber, Cabbage and Cauliflower. Floral biology, anthesis, pollination, selfing, emasculation and crossing techniques in Garlic and Onion. Floral biology, anthesis, pollination, selfing, emasculation and crossing techniques in Bitter gourd and Watermelon. Floral biology, anthesis, pollination, selfing, emasculation and crossing techniques in Banana and Mango. Floral biology, anthesis, pollination, selfing, emasculation and crossing techniques in Papaya and Guava. Floral biology, anthesis, pollination, selfing, emasculation and crossing techniques in Lime and Lemon. Floral biology, anthesis, pollination, selfing, emasculation and crossing techniques in Rose and Jasmine. Floral biology, anthesis, pollination, selfing, emasculation and crossing techniques in Marigold and Chrysanthemum. Visit to Agricultural Research stations/AICRP Centres of crops. Sources of donors for different characters in various crops & Parentage of released varieties / hybrids of important crops. Study of special quality characters in various crops.

REFERENCE BOOKS:

1. Allard, R.W. 1960. *Principles of Plant Breeding*. John Wiley & Sons, New York.
2. Phundan Singh. 2006. *Essential of Plant Breeding*. Kalyani Publishers, Ludhiana.
3. Poehlman, J.M. and Borthakur, D. 1995. *Breeding of Asian Field Crops*. Oxford & IBH Publishing Co. Pvt. Ltd. New Delhi.
4. Sharma, J.R. 1994. *Principles and Practice of Plant Breeding*. Tata McGraw-Hill Publishing Co. Ltd., New Delhi.
5. Kalloo, G.1994. *Vegetable Breeding*. Panima Educational Book Agency, New Delhi.
6. Kumar, N. 2006. *Breeding of Horticultural Crops - Principles and Practices*. New India Publishing Agency, New Delhi.
7. George Acquaah.2012. *Principles of Plant Genetics and Breeding*. Blackwell Publishing Ltd., USA.

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1.https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=&cad=rja&uact=8&ved=2ahUKEwjrxbOgn_TzAhXnxzgGHTKHAbAQFnoECAIQAQ&url=http%3A%2F%2Fcourseware.cutm.ac.in%2Fwp-content%2Fuploads%2F2020%2F05%2FQuestion-Bank-1.pdf&usg=AOvVaw3a9n0YJ0fg3jrAPSBaVxHz

2. https://www.youtube.com/watch?v=7BhQg6f1_9M
3.https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=&cad=rja&uact=8&ved=2ahUKEwity7GSoPTzAhX_4zgGHTmMC5wQFnoECAIQAQ&url=https%3A%2F%2Fwww.coabnau.in%2Fuploads%2F1610707872_PRACTICALMANUALGPB-5.6.pdf&usg=AOvVaw0lWZrSDqBggLhfs8AqE11K

Semester	:	**Fifth**
Course	:	**Intellectual Property Rights**
Course Code	:	**20GPBR313**
L-T-P structure	:	**1-0-0-0**
Course Credits	:	**1(1+0)**
Course Coordinator	:	
Course Instructors	:	

MAPPING OF COURSE OUTCOMES WITH PO/PSO

COURSE OUTCOMES (CO):

CO NO.	COURSE OUTCOMES (CO)	PO/PSO	BTL
THEORY			
CO1	Understand the basic knowledge about the IPR, different organizations working under IPR. Study about the treaties for IPR protection and types of IPR and legislations covering IPR in India.	1,2, 10	1
CO2	Explain the patent systems in India and management strategies related to patent allied activities. To be well versed with different methodologies for UPOV for protection of plant varieties and plant breeders' rights and utilization of agriculture technologies to modernize it.	4,5, 6,7	2
CO3	Assign the registry of plant varieties under PPV&FR Act, 2001, breeders' rights, researcher rights, farmers rights and rights of TK holders and their management in the agriculture research system.	3,6, 10	3
CO4	Adapt the knowledge about the convention of biological diversity. To be able to help in Agricultural Research Systems through the gain of knowledge regarding the international treaties on plant genetic resources for food and agriculture. To impart knowledge to make the environment safe i.e., Indian biological diversity act, 2002 and its salient features, access and benefit sharing.	5,8, 9,11	3

COURSE OBJECTIVE:

1. Understanding, defining and differentiating different types of intellectual properties (IPs) and their roles in contributing to organizational competitiveness.
2. Understanding the Framework of Strategic Management of Intellectual Property (IP).
3. Appreciating and appraising different IP management (IPM) approaches and describing how pioneering firms initiate, implement, and manage IPM programs.
4. Explaining how to derive value from IP and leverage its value in new product and service Development and study of international treaty on plant genetic resources for food and agriculture.

SYLLABUS

THEORY

CO1: Introduction and meaning of intellectual property. Brief introduction to GATT, WTO, TRIPs and WIPO. Treaties for IPR protection: Madrid protocol, Berne Convention, Budapest treaty, etc. Types of Intellectual Property and legislations covering IPR in India: Patents and Copyrights, Trademark, Industrial design, Geographical indications, Integrated circuits, Trade secrets.

CO2: Patents Act 1970. Patent system in India, patentability, process and product patent, filing of patent, patent specification, patent claims, Patent opposition and revocation, infringement, Compulsory licensing, Patent Cooperation Treaty, Patent search and patent database. Origin and history including a brief introduction to UPOV for protection of plant varieties. Protection of plant varieties under UPOV and PPV&FR Act of India, Plant breeders rights.

CO3: Registration of plant varieties under PPV&FR Act, 2001. Breeders, researcher and farmers rights. Traditional knowledge-meaning and rights of TK holders.

CO4: Convention on Biological Diversity. International treaty on plant genetic resources for food and agriculture (ITPGRFA). Indian Biological Diversity Act, 2002 and its salient features, access and benefit sharing.

REFERENCE BOOKS:

1. Acharya, N.K. 2014. *Textbook of Intellectual Property Rights*. Asia Law House, Hyderabad.
2. Loganathan, E.T. 2012. *Intellectual Property Rights*. New Century Publications. New Delhi.
3. Rosedar, S.R.A. 2016. *Intellectual Property Rights*. Lexis Nexis (2nd Ed.), Nagpur.

WEB REFERENCES/MOOC'S:

1. https://www.legalbites.in/intellectual-property-rights/
2. https://www.youtube.com/watch?v=hHQWCFE0J84
3. https://www.youtube.com/watch?v=OtsGM3zoz0I

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Phone No. 08645 - 350200; www.klef.ac.in; www.klef.edu.in; www.kluniversity.in
Admin Off: 29-36-38, Museum Road, Governorpet, Vijayawada - 520 002. Ph: +91 - 866 - 3500122, 2577715, 2576129.

Semester	:	**Sixth**
Course	:	**Principles of Seed Technology**
Course Code	:	**20GPBR314**
L-T-P structure	:	**2-0-3-0**
Course Credits	:	**3(2+1)**
Course Coordinator	:	
Course Instructors	:	

MAPPING OF COURSE OUTCOMES WITH PO/PSO

COURSE OUTCOMES (CO):

CO NO.	COURSE OUTCOMES (CO)	PO	BTL
THEORY			
CO1	Understand the basic knowledge about the seed and seed technology, seed quality parameters, Loss of genetic purity and its maintenance. Study about the history and development of seed industry and their functions.	1,2,5	1
CO2	Explain the seed certification programme in different crops like cereals, millets, oilseeds, pulses and fibres and farming methods along with agricultural practices	6	2
CO3	Assign the organic seed production strategies, identify the problems and management strategies. To be well versed with different methodologies about GoT, GMO detection through molecular and conventional approaches both on lab and field level. Study of seed processing parameters inclusive of seed drying, seed cleaning, coating, packaging, storage and marketing.	3,4,7,9	3
CO4	Understand the knowledge about the seed act, central seed committee, regulation of notified varieties and seed testing parameters for quality assessment. Also, identification of good quality seeds through seed testing.	5,8,10	2
PRACTICAL			
CO5	Apply the seed production in cereals, pulses, oilseeds on the field level. Seed purity assessment both on field and lab level. GoT analysis through conventional and molecular approaches for varietal identification. Industrial visit to seed testing laboratories, seed processing plants and seed production field.	4,7,9,11	3

COURSE OBJECTIVE:

1. To strengthen undergraduate student in the field of seed science & technology.
2. To impart training for entrepreneurship programme.
3. To initiate basic research related to genetic purity, seed health and seed storage.

SYLLABUS

THEORY

CO1: Introduction to seed and seed technology - Definitions and importance - Roles and goals of seed technology - Differences between scientifically produced seed and grain used as seed. Seed quality - Definition, characters of good quality seed - Different classes of seed -Seed generation systems - Seed multiplication ratios - Seed replacement rate. Deterioration of crop varieties - Factors responsible for loss of genetic purity Safeguards for maintenance of genetic purity. Maintenance of genetic purity during seed production in self-pollinated and cross-pollinated crops. History and development of seed industry- seed production organizations-National Seed Corporation (NSC) - Andhra Pradesh State Seed Development Corporation (APSSDC) - Andhra Pradesh State Seed Certification Agency (APSSCA) and their functions.

CO2: Seed certification - History of seed certification - Procedure for seed certification and field inspection- Recognition of seed certification agencies of foreign countries. Foundation and certified seed production of varieties and hybrids in rice. Foundation and certified seed production of varieties and hybrids in maize. Foundation and certified seed production of varieties and hybrids in sorghum and pearl millet. Foundation and certified seed production of varieties in groundnut, sesamum and varieties hybrids in sunflower and castor. Foundation and certified seed production of varieties in black gram, green gram and bengal gram and varieties and hybrids in red gram. Foundation and certified seed production of varieties and hybrids in cotton. Foundation and certified seed production of varieties and hybrids in mesta and sun hemp.

CO3: Organic seed production - Importance - Problems and perspectives for production of quality seeds. Varietal Identification through Grow Out Test - Electrophoresis, molecular and biochemical tests. Detection of genetically modified crops- Transgene contamination in non-GM crops, GM crops and organic seed production. Planning, layout and establishment of seed processing plant - Factors to be considered in planning and designing a seed processing plant - Types of layouts. Seed drying, seed processing and their steps, seed drying - Methods of seed drying- Sun drying - Forced air drying - Principle of forced air drying -Moisture equilibrium between seed and air. Drying zones in seed bin drying - Forced air-drying method- Heated air drying system - Building requirements - Types of air distribution system and seed drying - Multiple bin storages. Selection of crop dryers and systems of heated air drying - Recommended temperature and depth for heated air drying of various crop seeds in bin - Management of seed drying operations. Seed cleaning -Pre cleaning and preconditioning equipment's - Principle and method of seed cleaning - Air screen machine - Principle of cleaning - Parts of air screen cleaner. Upgrading the quality of cleaned seeds - Different upgrading machines, their principles of operation and uses. Seed treatment, its importance- Types of seed treatment and their benefits and method of application - Pre sowing treatments - Equipment's used for seed treatment. Seed coating - Seed pelleting and seed invigoration -Precautions to be taken during seed treatment. Seed packaging - Operations in packaging - Equipment's used for packaging of seeds- Types of packing material and packing size. Seed storage- Categories of seeds - Orthodox and recalcitrant seeds - Factors affecting seed longevity in storage and conditions required for good storage - General principles of seed storage, general principles, stages and factors affecting seed longevity during storage, measures for pest and disease control during storage. Seed marketing, structure and organization, sales generation activities, promotional media, factors effecting seed marketing - Role of WTO and OECD in seed marketing.

CO4: Seed Act - Main features of the Seed Act, 1966 and Seed Act enforcement - Duties and powers of seed inspector - Offences and penalties - Seeds Control Order 1983- feature s of New Seed Bill,

2004. Central Seed Committee-Central Seed Certification Board-State Seed Certification Agency - Central Seed Testing Laboratory - State Seed Testing Laboratory - Appellate Authority. Notification of standards and procedures - Notification of variety - Regulation of sale of notified varieties - Requirements for sale of seed. Seed testing for quality assessment, seed testing - Objectives of seed testing - International Seed Testing Association (ISTA) and - Establishment of Seed Testing Laboratory (STL) - Seed testing procedures for quality assessment.

PRACTICAL

CO5: Seed production in cereals (Wheat, Rice, Maize, Sorghum and Bajra). Seed production in pulses (Red gram, Black gram, Green gram and Bengal gram). Seed production in oilseeds (Groundnut, Sesame, Sunflower and Castor). Seed certification - Procedure, field inspection - preparation of field inspection report. Seed sampling - Principles and procedures. Physical purity analysis of field crops and vegetable crops. Germination analysis of field crops and vegetable crops. Seed moisture tests of field crops and vegetable crops. Seed viability test of field crops and vegetable crops. Seed dormancy- Types of dormancy- methods of breaking dormancy. Seed vigour tests of field crops and vegetable crops. Seed health testing of field crops and vegetable crops. Grow out test (GOT) and electrophoresis for varietal identification. Visit to seed testing laboratories (STLs). Visit to seed processing plant. Visit to seed production farm.

REFERENCE BOOKS:

1. Agarwal, P.K. 1994. *Principles of Seed technology.* ICAR, New Delhi.
2. Agarwal, P.K. and Dadlani, M. 1986. *Techniques in Seed Science and Technology.* South Asian Publishers, New Delhi.
3. Agarwal, R.L. 1995. *Seed Technology.* Oxford and IBH Publication Co., New Delhi.
4. Dhirendra Khare and Mohan S. Bhale. 2007. *Seed Technology.* Scientific Publishers (India), Jodhpur.
5. Thomson, J.R. 1979. *An introduction of Seed Technology.* Leonard Hill, London.

WEB REFERENCES/MOOC'S:

1. http://ecoursesonline.iasri.res.in/mod/page/view.php?id=17467
2. https://onlinecourses.swayam2.ac.in/cec20_ag03/preview
3. http://eagri.org/eagri50/GPBR112/index.html

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Semester	:	
Course Name	:	**Commercial Plant Breeding**
Course Code	:	**20ELCT 315**
L-T-P structure	:	**1-0-2-0**
Course Credits	:	**3(1+2)**
Course Coordinator	:	
Course Instructors	:	

MAPPING OF COURSE OUTCOMES WITH PO/PSO

COURSE OUTCOMES (CO):

CO NO.	COURSE OUTCOMES (CO)	PO/PSO	BTL
THEORY			
CO1	Memorize the basic knowledge of line development and genetic purity testing of hybrids.	1,2, 10	1
CO2	Understand the hybrid seed production of different crops.	1,3	2
CO3	Employ the biotechnological tools for line and cultivar development.	6,8, 9	3
CO4	Observe and understand about the IPR in plant breeding and seed production techniques for self- and cross-pollinated crops.	2,4, 5	2
PRACTICAL			
CO5	Apply knowledge of different crossing techniques, germplasm purification, maintenance and development on the field level. Understand the seed production techniques, genetic purity testing methods and seed processing and storage parameters along with the visit to public and private sector processing and production plants.	1,2, 7,8, 11	2, 3

COURSE OBJECTIVE:

1. To impart knowledge to the students about the crossing techniques for both self- and cross-pollinated crops
2. To build knowledge about the germplasm maintenance, hybrid seed production techniques and its constraints, genetic purity testing of hybrid seed.
3. To enhance the skill about seed processing and storage parameters though visit to public and private sector seed industries. Also, memorize the students about the application of filing IPR activities in hybrid breeding program.

SYLLABUS

THEORY

CO1: Types of crops and modes of plant reproduction. Line development and maintenance breeding in self- and cross-pollinated crops (A/B/R and two-line system) for development of hybrids and seed production. Genetic purity test of commercial hybrids.

CO2: Advances in hybrid seed production of rice, maize, sorghum, pearl millet, castor, sunflower, cotton and pigeon pea. Quality seed production of vegetable crops under open and protected environment.

CO3: Alternative strategies for the development of the line and cultivars: haploid inducer, tissue culture techniques and biotechnological tools.

CO4: IPR issues in commercial plant breeding: DUS testing and registration of varieties under PPV & FR Act. Variety testing, release and notification systems in India.

PRACTICAL

CO5: Practical study of floral biology and crossing techniques for self- and cross-pollinated crops. Seed production techniques for A/B/R line. CMS based hybrid seed production techniques. Principles and techniques of seed production, types of seeds, quality testing in self- and cross-pollinated crops. Understanding the difficulties in hybrid seed production. Tools and techniques for optimizing hybrid seed production. Concept of rouging in seed production plot. Concept of line and its multiplication in hybrid seed production. Line purification and role of pollinators of hybrid seed production. Hybrid seed production techniques for different crops. Sampling and analytical procedures for purity testing and detection of spurious seed. Seed drying. Seed storage structure in quality seed management. Screening techniques during seed processing *viz.*, grading and packaging. Visit to public and private seed production and processing plants.

REFERENCE BOOKS:

1. Agarwal, R.L. 2015. *Seed Technology*. Oxford and IBH Publication Co., New Delhi.
2. Khare, Dhirendra and Bhala, M.S. 2014. *Seed Technology second revised edition*. Scientific Publishers. Jodhpur.
3. Phundan Singh, 2014. *Essentials of Plant Breeding*. Kalyani Publishers, New Delhi.
4. Singh, B.D. 2015. *Plant Breeding: Principles and Methods*. Kalyani Publishers, New Delhi.

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2. https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=&cad=rja&uact=8&ved=2ahUKEwj6usnGvI30AhXGbSsKHVfyCt0QFnoECAwQAQ&url=http%3A%2F%2Fwww.jnkvv.org%2FPDF%2F110420201046 33Lakhani%2520JP%2520_Hybrid%2520seed%2520production%2520Final.pdf.pdf&usg=AOvVaw1sh0O9uG7G4QFjyJ5IfO4Q
3. https://www.youtube.com/watch?v=6TvYhv4XG8c
4. https://www.youtube.com/watch?v=pu8bd1BY5b4
5. https://www.youtube.com/watch?v=BoJUMij_ip4

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COURSE HANDOUT FOR FUNDAMENTALS OF SOIL SCIENCE FOR ALL FOUR-YEAR BSc AGRICULTURE (Hons) PROGRAM

20SSAC121 – Fundamentals of Soil Science

L-T-P-S	: 2-0-3-0
Credits	: 3.5
Contact Hours	: 4
Pre-requisite	: NIL

Mapping of Course outcomes with PO/PSO:

Co#	Course Outcome	PO/PSO	BTL
CO1	Understand the basic concepts of Rocks and Minerals and their association with the protolith and Soil Profile_	1,4	2
CO2	Understand the physical soil properties and water movement in soil	1,4	2
CO3	Understand chemical properties of soil and colloids	1,4	2
CO4	Understand soil biology, and soil group of India	1,4	2
CO5	To Understand/Determination phase and chemical properties of soil through experiments	2	3

Course Objective:

The objective of the course is to provide the student with a formalized way to build their fundamental knowledge and skills within the different areas of soil science to enhance their professional skills and/or to prepare to take the Fundamentals of Soil Science Exam.

Syllabus:

Theory

CO1: Soil as a natural body, Pedological and edaphological concepts of soil; Soil genesis: soil forming rocks and minerals; weathering, processes and factors of soil formation; Soil Profile, components of soil

CO2: Soil physical properties: Soil-texture, structure, density and porosity, Soil colour, consistence and plasticity; Elementary knowledge of soil taxonomy classification and soils of India; Soil water retention, movement and availability; soil air, composition, gaseous exchange, problem and plant growth

CO3: Source, amount and flow of heat in soil; soil temperature and plant growth; Soil reaction-pH, soil acidity and alkalinity, buffering, effect of pH on nutrient availability; Soil colloids - inorganic and organic; silicate clays: constitution and properties; sources of charge ion exchange, cation exchange capacity, base saturation

CO4: Soil organic matter: composition, properties and its influence on soil properties; humic substances - nature and properties; soil organisms: macro and microorganisms, their beneficial and

harmful effects; Soil pollution - behavior of pesticides and inorganic contaminants, prevention and mitigation of soil pollution.

Practical

CO5: Study of soil profile in field. Study of soil sampling tools, collection of representative soil sample, its processing and storage. Determination of soil density, moisture content and porosity. Determination of soil texture by feel and Bouyoucos Methods. Studies of capillary rise phenomenon of water in soil column and water movement in soil, Infiltration rate. Determination of soil pH and electrical conductivity. Determination of cation exchange capacity of soil. Study of soil map. Determination of soil colour. Demonstration of heat transfer in soil. Estimation of organic matter content of soil.

Reference Books:

1. Indian Society of Soil Science. 2012. Fundamentals of Soil Science, IARI, New Delhi.
2. Das, D. K .2015. Introductory Soil Science, 4th Edition, Kalyani Publishers, New Delhi
3. Sehgal, J. 2015. A Textbook of Pedology – Concepts and Applications, Kalyani Publishers, New Delhi.

Web references/MOOC's:

2. https://www.soils.org/files/education/fundamentals-in-soil-science-self-paced-syllabus.pdf
3. https://www.youtube.com/watch?v=MMRWsuBkAII&ab_channel=KHANSIRKNOWLEDGE
4. https://www.youtube.com/watch?v=YYhjm0B6mn4&ab_channel=AgricultureRSRajput , Lecture Series

COURSE HANDOUT FOR ENTOMOLOGY COURSES FOR ALL FOUR-YEAR BSc AGRICULTURE (Hons) PROGRAM

Fundamentals of Entomology

Semester	:	**Second**
Course Name	:	**Fundamentals of Entomology I**
Course Code	:	**20ENTO131**
L-T-P structure	:	**2-0-3-0**
Course Credits	:	**3(2+1)**
Course Coordinator	:	**Dr.M.Gayathri**
Course Instructors	:	

MAPPING OF COURSE OUTCOMES WITH PO/PSO
COURSE OUTCOMES (CO):

CO No:	CO	PO	BTL
1	Understand various morphological structures like insect body segmentation, different parts of head, thorax and abdomen along with modifications	3	2

2	Understand various morphological structures like insect legs, wings, sensory organs, metamorphosis, digestive, circulatory and excretory systems	3	2
3	Understand the nervous, reproductory, endocrine systems in insects and classification of Orders viz., Orthoptera, Dictyoptera and Isoptera	3	2
4	Understand systematic arrangement of Hemiptera, Lepidopteta, Coleoptera and Diptera	3	2
5	Apply the methods of collection and preservation of insects, observe external features of insects, study the mouthparts, digestive system and reproductive system of insects by dissection and observation and identification of different insects of some important families	2	3

COURSE OBJECTIVE:

1. To gain knowledge on Insect morphology
2. To gain knowledge to study taxonomy of insects.
3. To impart knowledge about the basic structure of an insect, different physiological systems and phylum Arthropoda classification
4. To gain basic knowledge about the different body parts, systems and classification of insects.

References

1. Chapman, R.F. 1988. *Insects*: *Structure and Function*. Cambridge Univ. Press, UK.
2. Charles A Triplehom and Norman F. Johnson 2005 Borror and De Long's *Introductionto the Study of Insects* Thomson Brooks/Cole Publishing. U.S.A.
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5. Snodgrass, R.E. 2001. *Principles of Insect Morphology*. CBS Publishers & Distributors,Delhi.

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ENTO 231-Fundamentals of Entomology II – 2(1+1)

Semester	:	**Third**
Course Name	:	**Fundamentals of Entomology II**
Course Code	:	**20 ENTO231**
L-T-P structure	:	**1-0-3-0**
Course Credits	:	**2(1+1)**
Course Coordinator	:	**Dr.M.Gayathri**
Course Instructors	:	

MAPPING OF COURSE OUTCOMES WITH PO/PSO
COURSE OUTCOMES (CO):

CO No:	CO	PO	BTL
1	Understand various abiotic and biotic factors of insect ecology	3	2
2	Acquainted with the concepts, components and tools of Integrated Pest Management	3	2
3	Acquainted with the mechanical, physical, biological and microbial control of insects	3	2
4	**Awareness of** recent formulations and application methods of chemical control of insects	2	3
5	Apply of sampling techniques, calculations of insecticides doses, mass multiplication of biological agents and identification of non-insect pests	2	3

COURSE OBJECTIVE:

1. To gain knowledge on Insect Ecology
2. To gain knowledge Pest surveillance and Pest forecasting
3. To impart knowledge about the concepts of Integrated pest management

SYLLABUS
Theory

Insect Ecology: Introduction, Environment and its components. Effect of abiotic factors–temperature, moisture, humidity, rainfall, light, atmospheric pressure and air currents. Effect of biotic factors – food competition, natural and environmental resistance. Concepts of Balance of life in nature, biotic potential and environmental resistance and causes for outbreak of pests in agro-ecosystem. Pest surveillance and pest forecasting. Categories of pests. IPM: Concepts, Host plant resistance,

components/Tools of IPM: Cultural, Mechanical, Physical, Legislative, Biological (Important parasites, predators, transgenic plants, pathogens such as bacteria, fungi, EPNs and viruses). Methods of control: Chemical control-importance, hazards and limitations. Classification of insecticides, toxicity of insecticides and formulations of insecticides. Recent methods of pest control, repellents, antifeedants, hormones, attractants, gamma radiation and genetic control. Insecticides Act 1968-Important provisions. Application techniques of spray fluids. Phytotoxicity of insecticides. Symptoms of poisoning, first aid and antidotes. Beneficial insects: Important species of pollinators, weed killers and scavengers and their importance

Practical

Study of distribution patterns of insects in crop ecosystems - Sampling techniques for the estimation of insect population and damage - Pest surveillance through light traps, pheromone traps and forecasting of pest incidence - Calculation of doses/ concentrations of different insecticidal formulations - Acquaintance of insecticide formulations - 74 Compatibility of pesticides with other agrochemicals and phytotoxicity of insecticides – Acquaintance of mass multiplication techniques of important predators :Cheilomenes, Chrysoperla and Cryptolaemus. Important parasitoids: Egg, larval and pupal parasitoids viz., Trichogramma, Apanteles and Tetrastichus. Important Entomopathogenic Fungi: Beauveria bassiana and Nucleo Polyhedro Virus (NPV) on Helicoverpa and Spodoptera. Study of insect pollinators, weed killers and scavengers - Identification of major non-insect pestsviz., birds, rodents, crabs, snails, slugs and mammalians. House hold and veterinary insect pests.

References

1. Vasantharaj David, B. and Rama Murthy V.V. 2016. Elements of Economic Entomology, Popular Book Depot, Coimbatore.

2. Vasantharaj David, B and Aanathakrishnan, T.N. 2006. General and Applied Entomology. Tata McGraw-Hill Publishing House, New Delhi.

3. Metcalf, R.L. and Luckman, W.H. 1982. Introduction to Insect Pest Management. Wiley Inter Science Publishing, New York.

4. Atwal, A. S. and Bains, S.S. 1989. Applied Animal Ecology. Kalyani Publishers, New Delhi

5. Yazdani,S.S. and Agarwal,M.L.1979. Elements of Insect Ecology. Narosa Publishing House, New Delhi

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ENTO331- PESTS OF FIELD CROPS, STORED GRAIN PESTS AND THEIR MANAGEMENT-II 3 (2+1)

Course code- 20ENTO331

Semester	:	**Fifth**
Course Name	:	**PESTS OF FIELD CROPS, STORED GRAIN PESTS AND THEIR MANAGEMENT**
Course Code	:	**20 ENTO 331**
L-T-P structure	:	**2-0-3-0**
Course Credits	:	**3(2+1)**
Course Coordinator	:	**Dr.M.Gayathri**
Course Instructors	:	

Course Outcomes (CO):

CO No:	CO	PO	BTL
1	Study of Economic Entomology, Rice and Sorghum pests	3	2
2	Acquainted with the pests of Sugarcane, cotton and other fiber crops	3	2
3	Acquainted with the pests of oil seeds and pulses	3	2
4	Awareness of stored grain pests and their management	2	3
5	Evaluation of crop pests and stored grain pests damage	5	3

COURSE OBJECTIVE:

1. To gain knowledge on different insects causing damage to Agricultural crops
2. To gain knowledge on stored grain pests
3. To diagnose the symptoms of damage caused by different insect and non pests
4. To apply the suitable management practices for different insect and non insect pests

SYLLABUS

Theory: General account on nature and type of damage by different arthropod pests. Scientific name, order, family, host range, distribution, biology and bionomics, nature of damage, and management of major pests and scientific name, order, family, host range, distribution, nature of damage and control practices for other important arthropod pests of various field crops. Mites, birds, nematodes and rodent pests of field crops and their management. Locust management. Factors affecting losses of stored grain and role of physical, biological, mechanical and chemical factors in deterioration of grain. Insect pests, mites, rodents, birds and microorganisms associated with stored grain and their

management. Storage structures and methods of grain storage and fundamental principles of grain store management.

Practical: Identification of different types of damage. Identification and study of life cycle and seasonal history of various insect pests attacking different crops and their produce: (a) Field Crops:. Identification of mites, birds and rodent pests of crops. Identification of insect pests and Mites associated with stored grain. Determination of insect infestation by different methods. Assessment of losses due to insects. Calculations on the doses of insecticides. Pesticide application techniques. Fumigation of grain store / godown. Identification of rodents and rodent control operations in godowns. Identification of birds and bird control operations in godowns. Determination of moisture content of grain. Methods of grain sampling under storage condition. Visit to Indian Storage, Management and Research Institute, Hapur and Quality Laboratory, Department of Food., Delhi. Visit to nearest FCI/CWC godowns.

References:

1. Vasantharaj David, B. and Rama Murthy V.V. 2016. Elements of Economic Entomology, Popular Book Depot, Coimbatore. 80
2. Vasantharaj David, B and Aanathakrishnan, T.N. 2006. General and Applied Entomology. Tata McGraw-Hill Publishing House, New Delhi.
3. Nair MRGK. 1986. Insects and Mites of crops in India. Indian Council of Agricultural Research New Delhi.
4. Ramakrishna Ayyar, T.V. 1963. Handbook of Economic Entomology for South India. Government Press, Madras.
5. Dennis S Hill 1987 Agricultural Insect Pests of tropics and their control, Cambridge Universtiy Press , New York
6. Upadhyaya K.P. and Kusum Dwivedi. 1996. A Textbook of Plant Nematology. Aman Publishing House, Meerut. 7. Khare, S.P. 1993. Stored Grain Pests and their Management. Kalyani Publishers

ENTO 332 3(2+1) PESTS OF HORTICULTURAL CROPS AND THEIR MANAGEMENT AND BENEFICIAL INSECTS

Semester	**: Sixth**
Course Name	**: Pests of Horticultural crops and beneficial insects**
Course Code	**: 20 ENTO332**
L-T-P structure	**: 2-0-3-0**
Course Credits	**: 3(2+1)**
Course Coordinator	**: Dr.M.Gayathri**
Course Instructors	**:**

Course Outcomes (CO):

CO No:	CO	PO	BTL
1	Study of Vegetable crop pests	3	2
2	Acquainted with the pests of Fruit crops pests		2

		3	
3	Acquainted with the pests of Plantation crops	3	2
4	Awareness of Beneficial insects and their economic importance	2	3

COURSE OBJECTIVE:

1. To gain knowledge on different insects causing damage to Horticultural crops
2. To gain knowledge on Beneficial insects
3. To diagnose the symptoms of damage caused by different pests
4. To apply the suitable management practices for different insect and non insect pests

SYLLABUS

Theory

Theory General account on nature and type of damage by different arthropod pests. Scientific name, order, family, host range, distribution, biology and bionomics, nature of damage, and management of major pests and scientific names, order, family, host range, distribution, nature of damage and control practices for other important arthropod pests of various vegetable crops, fruit crops, plantation crops, ornamental crops, narcotics, spices and condiments. Types of silkworm, voltinism and biology of silkworm. Mulberry cultivation, mulberry varieties, methods of harvesting and preservation of leaves. Rearingof mulberry silkworm, rearing appliances, mounting and harvesting of cocoons. Pests and diseases of silkworm, management, and methods of disinfection. Importance of beneficial insects, bee keeping, pollinating plants and their cycle, bee biology, commercial methods of rearing, equipment used and seasonal management. Bee pasturage, bee foraging and communication. Insect pests and diseases of honey bee. Species of lac insect, morphology, biology, host plant and lac production – Processing of lac - seed lac, button lac, shellac and lac- products. Identification of major parasitoids and predators commonly used in biological control. Insect orders bearing predators and parasitoids used in pest control and their mass multiplication techniques. Important species of pollinators, weed killers and scavengers and their importance.

Practical

Identification of different types of damage. Identification and study of life cycle and seasonal history of various insect pests attacking horticultural crops - vegetable crops, fruit crops, plantation gardens, narcotics, spices & condiments. Visit to orchards and gardens. Mulberry cultivation, mulberry varieties and methods of harvesting and preservation of leaves. Types of silkworm, voltinism and biology and rearing of silkworm and equipment. Honeybee species and castes of bees. Beekeeping appliances and seasonal management. Bee enemies and diseases. Bee pasturage, bee foraging and communication. Species of lacinsect, host plant identification. Identification of other important pollinators, weed killers and scavengers. Visit to research and training institutions devoted to sericulture, beekeeping, lac culture and natural enemies.

References

1. Vasantharaj David, B. and V.V. Rama Murthy (2016). Elements of Economic Entomology, Popular Book Depot, Coimbatore. 85
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. Ganga , G and Sulochana Chetty, 1997. Introduction to Sericulture, Oxford and IBH publishing Co. Pvt. Ltd., New Delhi
5. Hisao Aragu 1994. Principles of Sericulture, Oxford and IBH publishing Co. Pvt. Ltd., New Delhi.
6. Singh, S.1975. Bee Keeping in India - Indian Council of Agriculture research, New Delhi.

COURSE HANDOUT FOR AGRICULTURAL ECONOMICS FOR ALL FOUR-YEAR B.Sc. AGRICULTURE (Hons) PROGRAM

Semester	:	**First**
Course Name	:	**Fundamentals of Economics**
Course Code	:	**AECO141**
L-T-P structure	:	**3-0-0-0**
Course Credits	:	**3(3+0)**
Course Coordinator	:	
Course Instructors	:	

MAPPING OF COURSE OUTCOMES WITH PO/PSO

COURSE OUTCOMES (CO):

CO NO.	COURSE OUTCOMES (CO)	PO/PSO	BTL
THEORY			
CO1	understand the nature, scope and subject matter of economics	PO7	2
CO2	understand the consumer and producer's behaviour	PO8	2
CO3	understand the different market forms, factor pricing and public finance	PO10	2
CO4	understand the concepts associated with national income, population, banking and economic system	PO5	2

COURSE OBJECTIVE:

1. To impart knowledge to the students on the nature, scope and subject matter of economics
2. To make students understand about consumer and producer's behaviour
3. To gain insights about market forms, factor pricing, public finance, national income, population and banking system

SYLLABUS

THEORY

CO1: Introduction to Economics– Economic activity and concept of economy and its functions, basic economic problems, three main economic actors-households, firms, governments as basic decision-making units. Economics - Meaning, definitions, its importance as a subject to science students. Scope of study of economics as a science -Subject matter of economics – Traditional approach – Consumption, production, exchange, distribution and public finance/public policy - Modern Approach – Microeconomics and macroeconomics. Methods of economic investigation – Deduction and induction approaches, positive and normative analysis - Nature of economic theory - Rationality assumption, economic laws as generalization of human behaviour. Basic concepts: goods and

services - Characteristics and classification, scarcity, choice, decision making, wants, substitutes and complements - Utility – Cardinal and ordinal approaches, forms of utility, marginal utility. Cost and price, value and wealth and their characteristics, capital, income, investment, welfare, efficiency, equilibrium and firm. Demand - Meaning, law of demand, demand schedule and demand curve characteristics, determinants, types of demand - Income demand, price demand, cross demand - Product demand, firm demand, market demand. Market dynamics due to changes/ shifts in demand and prices - Contraction and extension, increase and decrease in demand. Law of diminishing marginal utility – Statement, assumptions of law, explanation, limitations of the law - Importance and applications. Law of equi-marginal utility – Meaning, assumptions, explanation of the law - Practical importance and applications, limitations. Consumer's surplus – Meaning, assumptions, explanation with examples, difficulties in measuring, consumer's surplus - Importance and applications - Engels law of family expenditure. Indifference curve analysis - Indifference curves - Meaning, basic assumptions, properties and their importance in economics.

CO2: Budget line and its properties - Consumer's equilibrium - Graphical and algebraic expressions and its importance. Elasticity of demand – Meaning, elastic and inelastic demand, measurement of elasticity of demand - Types of elasticity of demand - Price elasticity, income elasticity and cross elasticity of demand. Kinds of elasticity of demand - Perfectly elastic, perfectly inelastic, relatively elastic, relatively inelastic, unitary elastic demand - Factors affecting elasticity of demand, practical importance of elasticity of demand. Production - Meaning of production process, creation of utility, factors of production and input - output relationship and production function – Meaning. Laws of returns - Increasing, decreasing and constant laws of returns - Meaning and explanation with examples. Cost - Seven production costs - Meaning and formulas, cost and output relationships - short run and long run cost curves Supply – Meaning, definition, law of supply, supply schedule, supply curve and properties, determinants of supply - Market dynamics due to changes/ shifts in supply and prices - Increase and decrease in supply, contraction and extension of supply. Elasticity of supply and its measurement - Kinds of elasticity of supply – Perfectly elastic, perfectly inelastic, relatively elastic, relatively inelastic and unitary elastic - Factors affecting elasticity of supply. Markets and market structure – Meaning, classification of markets based on market structure - Competition and its meaning, basic features of perfectly competitive and imperfect competitive markets. Characteristics of monopolistic competition, monopoly, duoploy, oligopoly, monopsony, duopsony and oligopsony with examples. Price determination under perfect competition – Equilibrium analysis – Numerical and graphical explanation.

CO3: Distribution theory - Meaning, factor market - Concepts of rent - Meaning, types of rent - Ricardian theory of rent. Wages - Meaning, nominal and real wages, working population in India – Labour participation rate, employment rate, unemployment rate - Interest- Meaning of interest and interest rate - Profit and income - Meaning, difference between income and profit. Pricing of factors of production - Modern theory of distribution. Public finance/ Public policy – Meaning, role and importance of public finance/Public policy - Functions of the government – Differences between public finance and private finance - Public revenue - Meaning, major and minor sources of public revenue. Tax – Meaning - Classification – Direct and indirect taxes, methods of taxation - Proportional, progressive, regressive and digressive taxation, agricultural taxation - VAT and GST. Canons of taxation – Adam Smith's canons of taxation – Equality, economy, certainty and convenience – Other canons of taxation. Public expenditure – Meaning, need for public expenditure - Principles of public expenditure – Budget – Meaning - Balanced budget and deficit budget - Fiscal policy- Meaning and its policy instruments. National income accounting system – Meaning and importance, circular flow in the economy. Concepts of national income accounting - Gross domestic

product, gross national product, net national product, net domestic product- National income at factor cost, personal income, disposable income, per capita income. Approaches to measurement of national income – Product method, income method, expenditure method and value-added method, difficulties in measurement. Trends in contribution of different sectors to GDP - Indian economy in the globalised world economy. Importance of population in the economy - Malthusian theory, escaping from the Malthusian stagnation - Innovations, technological transition and economic growth.

CO4: Money - Meaning, evolution of money, functions of money, the money market - Types of demand and supply of money in the economy. Credit - Meaning of credit, borrowing and lending, investments and their role in the modern economy - Credit controls and credit policy. Role of banking in the modern economy, functions of central bank and commercial banks, monetary policy and its instruments. Inflation – Meaning, definition, deflation - Meaning, causes of inflation – Demand pull and cost push inflation. Types of inflation - Comprehensive and sporadic inflation – Suppressed and repressed inflation – Creeping, walking, running and galloping inflation – Mark up inflation. General price index, wholesale price index, consumer price index - Rate of inflation – Measurement. Other causes of inflation – Remedial measures – Monetary and fiscal measures. Economic system - Meaning, importance of study of economy in systems approach- Types of economic systems. Capitalism- Meaning and its characteristic features, socialism and its characteristic features - Mixed economies and their characteristic features. Economic planning - Meaning, importance of planning in management of resources and institutions in the economy, elements of economic planning. Brief history of planning system in India - Annual plans, five year plans meaning and objectives, role of planning commission of India and NITI Ayog.

REFERENCE BOOKS:

1. Dewett, K.K. and Varma, J.D. 2003. *Elementary Economic Theory*. S. Chand and Co., New Delhi.
2. Dewett, K.K and Chand, A. 2009. *Modern Economic Theory*. S.Chand and Co., New Delhi
3. Paul A. Samuelson and Nordhus. 2010. *Economics*. 19th Edition, Tata-Mc Graw Hill Education, New Delhi.
4. Jhingan, M.L.1990. *Advanced Economic Theory*. Vikas Publishing House, New Delhi
5. Koutsoyiannis. 2015. *Modern Microeconomics*. Tata Mac-Graw Hill Publishers, New Delhi
6. *The Economy* 2016

WEB REFERENCES/MOOC'S:

1. www.core-econ.org
2. https://www.youtube.com/watch?v=C0HO9mVawXs&ab_channel=cec
3. https://www.youtube.com/watch?v=_OkTw766oCs&ab_channel=MITOpenCourseWare
4. https://www.economicsnetwork.ac.uk/teaching/Video%20and%20Audio%20Lectures/Principles%20of%20Microeconomics

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Semester	:	**3rd**
Course Name	:	**Agricultural Finance and Co-operation**
Course Code	:	**20AECO241**
L-T-P structure	:	**1-0-1-0**
Course Credits	:	**2(1+1)**
Course Coordinator	:	
Course Instructors	:	

MAPPING OF COURSE OUTCOMES WITH PO/PSO

COURSE OUTCOMES (CO):

CO NO.	COURSE OUTCOMES (CO)	PO/PSO	BTL
THEORY			
CO1	understand the importance of credit in agriculture and the criteria to avail credit	PO10	2
CO2	recognize the source of credit, crop loan system, and financial inclusion		2
CO3	identify the different schemes for financing weaker sections, also the higher financing agencies present in India and world along with crop insurance schemes		2
CO4	understand the agricultural project and its cycle, cooperation, and its history along with cooperative institutions in India		2
PRACTICAL			
CO5	analyzing the progress of priority sector lending, working out different repayment plans and prepare balance sheet along with income statement		3

COURSE OBJECTIVE:

1. To impart knowledge to the students on the importance of credit in agriculture and different sources of credit along with conditions to obtain it
2. To build knowledge about different schemes available for financing along with crop insurance
3. To gain insights about agricultural project and cycle along with cooperative system in agriculture

SYLLABUS

THEORY

CO1: Agricultural Finance - Meaning, definition, nature and scope - Significance – Micro and macro finance - Capital and credit problems, need and their importance in Agriculture. Credit - Meaning and definition - Classification of credit based on different criteria with examples. Credit analysis - Economic feasibility tests - 3 R's of credit analysis - Returns to investment- Repayment capacity - Meaning, causes of poor repayment capacity of farmers, suggestions to improve repayment capacity - Risk bearing ability - Meaning, sources of risk, means to strengthen RBA. Five Cs of credit – Character – Capacity – Capital - Condition and Common sense -Seven Ps of credit - Principle of Productive purpose - Principle of personality - Principle of productivity - Principle of phased disbursement - Principle of proper

utilization - Principle of payment and Principle of protection.

CO2: Social control and nationalization - Meaning, objectives and their importance-Privatization of commercial banks - Need for and importance of institutional sources and structure of agricultural lending from different sources. Lead bank scheme - Origin, objectives, functions -District credit plan – Regional Rural Banks (RRBs) - Origin, objectives, functions — RRBs in Andhra Pradesh. Crop loan system - Objectives, importance, features of crop loan system - Scale of finance - Meaning and estimation and role of district level consultative committee - Term loans – Objectives and meaning of unit costs, fixation of unit costs and NABARD guidelines. Financial inclusion - Meaning and importance - Micro finance - Meaning, importance, agencies providing microcredit banks, NBFCs, NGOs, and Govt. agencies - SHGs and their role in microfinance and bank linkages - Micro finance lending and control act in Andhra Pradesh - Objectives and important features.

CO3: Schemes for financing weaker sections - Differential interest rate (DIR) – Integrated rural development programme (IRDP) - Swarnajayanti gram swarozgar yojana (SGSY) - Self-help groups (SHGs) etc., Srinidhi, MUDRA. Higher financing agencies - Reserve Bank of India (RBI) - Objectives and functions and role in agricultural development and finance. National Bank for Agricultural and Rural Development (NABARD) - Origin, functions, activities and role in agricultural development. World Bank (WB) - Objectives and functions -World Bank group institutions – role and functions of International Bank for Reconstruction and Development (IBRD)- International Development Agency (IDA) - International Finance Corporation (IFC), MIGA, ISID. Crop insurance - Meaning and its advantages and limitations in application - Agricultural insurance company of India - Objectives and functions - Indemnity - Meaning, premiums and claims - Prime Minister's Fasal Bhima Yojana (PMFBY) - Salient features - Weather based crop insurance - Salient features and its importance.

CO4: Agricultural project - Meaning, characteristics of agril. projects, project cycle and explanation of different phases of project cycle - Basic guidelines for preparation of project reports. Co-operation - Meaning, Scope, importance and definition - Principles – Objectives of co-operation, significance of cooperatives in Indian agriculture. Brief history of cooperative movement development in India - Recent developments in Indian cooperative movement - short comings of Indian co-operative movement and remedies. Agricultural Cooperative institutions in India - co-operative credit structure in India and Andhra Pradesh – Objectives and functions of state level (APCOB), district level (DCCB) and Village level (PACS) cooperative societies - Functions of marketing, consumer societies, multi-purpose cooperatives, farmers' service cooperative societies, dairy cooperatives - Andhra Pradesh mutually aided Co-operative Societies Act (1995) - Role of International Cooperative Alliance (ICA), National cooperative Union of India (NCUI), National Cooperative Development Council (NCDC).

PRACTICAL

CO5: 1. Estimation of credit requirement of farm business – A case study.
2. Estimation of scale of finance - Unit costs and KCC.
3. Determination of most profitable level of capital use.
4. Analysis of progress and performance of priority sector lending by commercial banks, Cooperatives, RRBs and non-institutional sources using published data. Working out different repayment plans with examples.
5. Lump sum repayment /straight-end repayment - Variable or quasi variable repayment.

6. Amortized decreasing repayment plan and amortized even repayment plan.
7. Estimation of indemnity for crop insurance claims.
8. Visit and study of a commercial bank to acquire first-hand knowledge of their management, schemes and procedures of lending and sanction of loans.
9. Visit and study of a cooperative bank - PACS/ DCCB to acquire first-hand knowledge of their management, schemes and procedures of lending and sanction of loans.
10. Visit and study of a cooperative society - dairy/ consumers to acquire first-hand knowledge of their management, schemes and activities.
11. Preparation and analysis of balance sheet – A case study.
12. Preparation and analysis of income statement – A case study.
13. Appraisal of a loan proposal – A case study.
14 -16. Techno-economic parameters for preparation of projects - Preparation of bankable projects for various agricultural products and value-added products.

REFERENCE BOOKS:

1. Johil S.S. and C.V. Moore. 1970. *Essentials of Farm Financial Management*. Today and Tomorrow Printers and Publishers, New Delhi.
2. John, J. Hamptron.1983. *Financial Decision Making: Concepts, Problems and Cases, of India*. New Delhi.
3. Mamoria, C.B. and R.D. Saksena. 1973. *Co-operatives in India*. Kitab Mahal, Allahabad.
4. Mamoria, C.B. and Saxena. *Agricultural Problems in India*. Kitab Mahal, Allahabad.
5. Mukhi, H R. 1983. *Cooperation in India and Abroad*. New Heights Publishers, New Delhi.
6. Muniraj, R. 1987. *Farm Finance for Development*, Oxford & IBH Publishing Company Ltd., New Delhi.
7. Subba Reddy, S. and P. Raghuram. 2005. *Agricultural Finance and Management*. Oxford & Publishing Company Private Ltd., New Delhi.
8. Subba Reddy, S., Raghu Ram., P., Sastry, T.V.N and Bhavani Devi, I. 2016. *Agricultural Economics*. Oxford & IBH Publishing Company Private Ltd., New Delhi.
9. Pandey, U.K. *Agricultural Finance in India*.
10. William, G. Murray and Nelson Aarson, G. *Agricultural Finance*. The Iowa State University Press, Ames, Iowa state University press Ames, IOWA.

WEB REFERENCES/MOOC'S:

1. www.rbi.org
2. www.nabard.org
3. http://ecoursesonline.iasri.res.in/Courses/Agricultural%20Finance%20&%20Cooperation/AECO241/Start%20to%20read%20the%20Course.html

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COURSE HANDOUT FOR AGRICULTURAL ECONOMICS FOR ALL FOUR-YEAR B.Sc. AGRICULTURE (Hons) PROGRAM

Semester	:	**Fourth**
Course Name	:	**Agricultural marketing, trade and prices**
Course Code	:	**20AECO242**
L-T-P structure	:	**2-0-1-0**
Course Credits	:	**3(2+1)**
Course Coordinator	:	
Course Instructors	:	

MAPPING OF COURSE OUTCOMES WITH PO/PSO

COURSE OUTCOMES (CO):

CO NO.	COURSE OUTCOMES (CO)	PO/PSO	BTL
THEORY			
CO1	Understand the concept of market and its types, demand-supply of farm products, exchange functions, facilitating functions and market functionaries	PO9	3
CO2	Understanding the marketing channels, supply chain, marketing mix, product life cycle, pricing, market promotion, segmentation, and integration	PO10	3
CO3	Explain the marketing costs, margins, and price spread, regulated markets, APMC, cooperative marketing, types of risk in marketing, future trading and commodity exchanges	PO9	3
CO4	Describe the agricultural product price, CACP, MSP, international trade, WTO and its agreements, TRIPS and IPR in Indian agriculture	PO7	3
PRACTICAL			
CO5	Analyse elasticities and plot demand supply curve for agricultural commodities, study market arrival, prices, and comparative advantage, compute marketable and marketed surplus, construct index numbers, estimate costs, margins and price spread	PO11	3

COURSE OBJECTIVE:

1. To gain knowledge about market and its various functions
2. To gain basic knowledge regarding marketing channels, mix, segmentation and integration
3. To gain knowledge on the marketing costs, margin, along with future trading and commodity exchange
4. To impart knowledge on the various prices and WTO, its agreements

SYLLABUS

THEORY

CO1: Agricultural Marketing - Concepts and definitions of market, marketing, agricultural marketing - Components of market, dynamics of market structure. Classification and characteristics of each type of agricultural markets. Demand and supply of agri-commodities, factors affecting the demand and supply of farm products, producer's surplus - Meaning and types and producer's surplus of agri-commodities in India. Meaning of marketable surplus and marketed surplus, importance and their measurement. marketable surplus and marketed surplus of agri-commodities in India, factors affecting them. Marketing process and functions - Marketing process - Concentration, dispersion and equalization - Thompson's classification. Exchange functions – Buying and selling, methods - Physical functions – Storage, transportation and processing. Facilitating functions – Packing and packaging, branding, grading, standardization, FAQs for major crop produce, quality control and labeling - AGMARK, HACCP, FSSAI, CODEX - Need for codex certification and relevance. Market functionaries - Types and importance of agencies involved in agricultural marketing and their role - Producers, middlemen (merchant middlemen, agent middlemen, speculative middlemen, processors, facilitative middlemen).

CO2: Meaning and definition of marketing channels and supply chain management and their importance. Marketing mix - Meaning, 4Ps of marketing - Product, price, place and promotion - Their importance and characteristics in agriculture. Meaning and stages in PLC (Product Life Cycle) - Characteristics of PLC – Strategies in different stages of PLC. Pricing and promotion strategies - Pricing considerations and approaches – Cost based and competition-based pricing. Market promotion – Advertising, personal selling, sales promotion and publicity – Their meaning and merits and demerits. Market segmentation-Meaning and its importance, types of market segmentation and benefits. Market Integration - Meaning, definition - Marketing efficiency - Meaning, definition, measurement of marketing efficiency - Types of market integration and marketing efficiency.

CO3: Marketing costs, margins, and price spread - Meaning and measurement, factors affecting cost of marketing - Reasons for higher marketing costs of farm commodities-Ways of reducing marketing costs. Regulated markets-Definition - Important features of regulated markets - Functions, progress and defects. Model regulated market act, objectives and features - APMC Act in Andhra Pradesh-Objectives and features and functions Govt. interventions in agricultural marketing, their need, importance, and role Important market acts - Public sector institutions - CWC, SWC, FCI, & DMI – Objectives and functions. Cooperative marketing - Meaning and its need and importance, cooperative marketing agencies in India - NAFED, MARKFED – Objectives and functions and activities. Risk in marketing - Types of risk in marketing - Measures to minimize risks, speculation and hedging - Meaning, differences between speculation & hedging, advantages, disadvantages and process of speculation and hedging. An overview of futures trading in agricultural commodities - Forward/future markets-Meaning, advantages and disadvantages of forward markets. Commodity exchanges – Role and importance - Commodity exchanges in India -MCX,NCDX,NCMX,ACX, Safal - Role of regulatory bodies in futures markets - SEBI, etc, Contract farming - Meaning, procedures and advantages - Contract farming act in Andhra Pradesh.

CO4: Meaning and functions of price - Characteristics of agricultural product prices - Agricultural price stabilization - Need for agricultural price policy - Role of Commission for Agricultural Costs and Prices (CACP) - Meaning of administered prices - Minimum support price, procurement price

and issue price, levy price. Concept of International Trade and its importance in globalised world economies - Free trade and protectionism - Meaning, pros and cons of free trade and protectionism. Theory of absolute and comparative advantage and their importance international trade. Trends, present status and prospects of Indian agri-commodities trade in
international trade. WTO - Genesis, objectives, functions and principles of multilateral trade. WTO agreements - Agreement on Agriculture (AoA) - Market access, Aggregate Measures of Support (AMS), export subsidies, sanitary and phyto santitary measures (SPS) and their implications and impact on Indian agriculture. TRIPS and intellectual property rights and their implications to Indian agriculture - Meaning of patents, copy rights, trademarks, geographical indications, industrial designs, trade secrets, integrated circuits, and plant varieties protection.

PRACTICAL

CO5: 1. Plotting and study of demand and supply curves for major agricultural commodities.
2. Calculation of elasticities for important agricultural commodities.
3. Study of relationship between market arrivals and prices of some selected commodities.
4. Computation of marketable and marketed surplus of important commodities.
5. Study of price behavior over time for some selected commodities.
6 &7. Construction of index numbers- moving averages -General PI , WPI, CPI.
8 & 9. Visit to a local market to study various marketing functions performed by different agencies, identification of marketing channels for selected commodities, collection of data regarding marketing costs.
10 Estimation and calculation of marketing costs, margins and price spread and presentation of report in the class.
11 Visit to SWC/CWC to study their objectives, role, organization, functioning and performance.
12 Visit to FCI and study its objectives, role, organization and functioning and performance.
13 Visit to cooperative marketing society – DCMS/ MARKFED, etc. to study their objectives, role, organization, and functioning.
14 -16. Study of comparative advantage of different agricultural commodities of India in International trade.

REFERENCE BOOKS:

1. S S Acharya and N L Agarwal. 2012. *Agricultural Marketing in India*. Oxford & IBH Publications Co. Pvt. Ltd., New Delhi.
2. S S Acharya and N L Agarwal. *Agricultural Price: Analysis and Policy*. Oxford & IBH Publications Co. Pvt Ltd., New Delhi.
3. Subba Reddy, S., P.Raghu Ram., Sastry, T.V.N and Bhavani Devi, I. 2016. *Agricultural Economics*. Oxford & IBH Publishing Company Private Ltd., New Delhi,
4. Kahlon, A.S and Tyagi.D S. 1983. *Agricultural Price Policy in India*. Allied Publishers Pvt. Ltd., New Delhi.
5. Mamoria, C.B. and Joshi. R L.1995. *Principles and Practices of Marketing in India*. Kitab Mahal, Allahabad
6. Philip Kotler, Kevin Lane Keller, Abraham Koshy and Mithileswar Jha. 2009. *Marketing Management: A South Asian Perspective*. International 13th edition. Pearson Prentice Hall

WEB REFERENCES/MOOC'S:

1. www.wto.org
2. www.agricoop.nic.in

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COURSE HANDOUT FOR AGRICULTURAL ECONOMICS FOR ALL FOUR-YEAR B.Sc. AGRICULTURE (Hons) PROGRAM

Semester	**: Sixth**
Course Name	**: FARM MANAGEMENT, PRODUCTION AND RESOURCE ECONOMICS**
Course Code	**: 20AECO341**
L-T-P structure	**: 1-0-1-0**
Course Credits	**: 2(1+1)**
Course Coordinator	**:**
Course Instructors	**:**

MAPPING OF COURSE OUTCOMES WITH PO/PSO

COURSE OUTCOMES (CO):

CO NO.	COURSE OUTCOMES (CO)	PO/PSO	BTL
THEORY			
CO1	Understand about farm management, systems of farming, production function, factor-product relationship	PO6	2
CO2	Determine the optimum input and output, factor-factor and product-product relationship and study about different enterprises	PO7	2
CO3	Remember the meaning of cost and its function, cost-output relationship, farm inventory, farm planning and budgeting and linear programming	PO10	2
CO4	Understand the concepts like risk and uncertainty in agriculture, economy and environmental linkages, environmental costs of economic growth, India's environmental policy	PO9	2
PRACTICAL			
CO5	Computing depreciation cost, profitable level, least cost combination, opportunity cost, apply cost principles, farm business analysis, budget preparation, collect and analyse data on natural resource in India	PO11	3

COURSE OBJECTIVE:

1. To impart knowledge to the students about importance of farm management
2. To build knowledge about cost minimization and profit maximization
3. To gain insights about risk and uncertainty involved in agriculture and measures to minimize them

SYLLABUS

THEORY

CO1: Meaning and concept of farm management, definitions, objectives and relationship with other sciences - Importance of study of farm management - Farm management problems in India. Meaning and definitions of types and systems of farming and their characteristics - Changing structure of land

holdings in India - Characteristics of small, marginal and tenant farm holdings. Concept of production function and its types, use of production function in decision -Making on a farm - Seven principles of farm management. Factor - Product relationship – Law of variable proportions – Definition, graphical and arithmetical explanation with the help of an example.

CO2: Determination of optimum input and optimum output and decision rules. Factor-Factor relationship, resources and types - Substitutes and complements, variable and fixed resources - Iso-quants - Iso-cost lines - Meaning and characteristics- Principle of least cost combination/ Principle of factor substitution – Explanation and decision rules. Product-Product relationship - Iso- product curves and Iso-revenue lines – Meaning and characteristics - Principle of optimum product combination - Law of equimarginal returns/ principles of opportunity cost, decision rules. Types of enterprises and their characteristics - Principle of comparative advantage.

CO3: Meaning and concept of cost, cost function /cost-output relationship - Types of production costs and their interrelationship - Importance of costs in managing farm business - Minimum loss principle (Cost Principle) and decision rules – Time comparison principle – compounding and discounting. Farm inventory - Meaning and importance of taking inventory on farm business - Different methods of appraisal and valuation of farm resources and products. Farm planning and budgeting - Meaning and importance, partial budgeting, enterprise budgeting and complete budgeting, steps in farm planning and budgeting. Linear programming-Meaning - Definition, LP mathematical model specification, importance in farm decision making, basic assumptions, limitations.

CO4: Concepts of risk and uncertainty in agriculture production, nature and sources of risks and uncertainty and management strategies. Economy and environmental linkages - How economic activity affects life on a planet with limited resources and a fragile environment - Concepts of natural resource economics - Ecological equilibrium, direct use value and indirect use value, willingness to accept and willingness to pay, contingent valuation, opportunity cost, discounting, societal cost - benefit analysis, consumer surplus, carbon sequestration- Unique properties of natural resources. Environmental costs of economic growth - Sustainable development - Positive and negative externalities in agriculture - Inefficiency and welfare loss, solutions. Important issues in economics and management of common property resources of land, water, pasture and forest resources etc. - India's environmental policy.

PRACTICAL

CO5: 1 & 2. Different methods Computation of depreciation cost of farm assets.
3. Determination of most profitable level of inputs use and output in farm production process.
4. Determination of least cost combination of inputs
5. Application of equi-marginal returns/opportunity cost principle in allocation of farm resources.
6. Selection of most profitable enterprise combination.
7 & 8. Farm holding surveys.
9.& 10. Application of cost principles - CACP concepts in the estimation of cost of mono cropping and poly cropping and livestock enterprises.
11. Farm business analysis - Estimation of different farm income measures, technical and economic efficiency measures and breakeven analysis.
12. Preparation of partial budgets and enterprise budgets.
13. Visit to college farm and study different farm records and accounts and prepare profit and loss account.

14 -16. Collection and analysis of data on various natural resources in India - Land - Changes in land use pattern, forests – Water - Changes in ground water and surface water resources - Changes in labour resources - Agricultural workers -Pollution and green gas emissions - Biodiversity, etc.

REFERENCE BOOKS:

1. Bishop, C.E. and W. D. Tousaint. 1958. *Introduction to Agricultural Economic Analysis*. John Wiley and Sons, London.
2 Heady, Earl O. 1964. *Economics of Agricultural Production and Resource Use*. Prentice Hall of India, Private Limited, New Delhi
3 S.S. Johl, J.R. Kapur. 2006. *Fundamentals of Farm Business Management*.
4 Kalyani Publishers, New Delhi.
5 Kahlon, A.S. and Karam Singh. 1965. *Principles of Farm Business Management*. Kalyani Publishers, New Delhi.
6 Raju, V.T. and D.V.S. Rao. 2006. *Economics of Farm Production and Management*. Oxford & IBH Publishing Co. Pvt. Limited, New Delhi

WEB REFERENCES/MOOC'S:

1. www.core_economics.org

Semester :

Course Name	**: AGRIBUSINESS MANAGEMENT**
Course Code	**: 20ELCT342**
L-T-P structure	**: 2-0-1-0**
Course Credits	**: 3(2+1)**
Course Coordinator	**:**
Course Instructors	**:**

MAPPING OF COURSE OUTCOMES WITH PO/PSO

COURSE OUTCOMES (CO):

CO NO.	COURSE OUTCOMES (CO)	PO/PSO	BTL
THEORY			
CO1	Understand about agribusiness, management, and functions, organizing, directing, and decision making	PO10	2
CO2	Know about the HR functions and role, training and development, production management, marketing management in ABM, develop market strategies	PO10	2
CO3	Understand about market segmentation, product concept, packaging, selling, advertising, market research, capital management, financial management	PO10	2
CO4	Work out the concepts like liquidity and leverage ratios, remember strategic management, agro-based industries, project and its cycles, project appraisal evaluation techniques	PO10	2

PRACTICAL			
CO5	Analyzing balance sheet, profit loss statement, break-even analysis, financial ratios, compounding and discounting techniques, and prepare business plans	PO10	3

COURSE OBJECTIVE:

1. To provide knowledge about agribusiness management along with its functions and setup
2. To familiarize about human resource and their role in agribusiness
3. To gain insights about various market concepts, process and channels, project

SYLLABUS

THEORY

CO1: Agribusiness – Meaning, scope and structure and dimensions (Agricultural input sector - Agricultural production sector - Agricultural processing sector and Marketing and trade sector) - Importance of agribusiness in Indian economy, - Distinctive features of agribusiness Management – Definitions and concepts - Pipeline diagram – Agribusiness Management – Meaning and definitions and salient features. Management functions – Wheel diagram, planning, its importance - Types of plans - Structure of planning - Goals or objectives - Strategies, policies, procedures, rules, programmes – Characteristics of good plan - Steps in
planning. Organizing– Meaning, purpose, staffing – Definition - Staffing process. Directing – Motivation – Ordering – Leading – Supervision, coordination, communication and control – Meaning and definitions, purpose. Decision making – Organizational culture – Management of organizational conflicts – Managing change – Leadership styles – Group dynamics – Motivation.

CO2: Managing human resources in agribusinesses - HR Functions - Role of HR managers – Human resource planning. Human resource training and development – Participative management, labour management relations, conflict management. Production management - Production, plant layout and material handling, operations planning and control - Inventory management - Inventory – Meaning – Definition – Objectives of inventories - Quality management production control – Scheduling methods (Networking methods – PERT & CPM) – Quality Control Marketing management in agribusiness – New product development,
consumer behavior and the buying process. Developing marketing strategies - Four P's of marketing and planning, marketing mix.

CO3: Market segmentation - Meaning, types, and importance. Product concept – Product line and mix - Branding agricultural products. Packaging, its functions - Physical distribution. Selling, advertising, marketing research, marketing extension, rural retailing supply chain management for agribusiness. Capital management in agribusiness – Fixed capital and working capital - Meaning, types, operating cycle and working capital importance. Financial management – Importance of financial statements – Balance sheet and profit and loss statement, cash flow statement - Meaning, components and formats of financial statements.

CO4: Analysing financial statements – Liquidity ratios – Leverage ratios – Activity ratios – Turnover ratios – Profitability ratios Strategic management – Meaning, concept and scope – External and internal environmental factors influencing strategy – Scanning the external and internal environment – Strategy formulation - SWOT analysis of agribusiness enterprise. Agro based industries –

Importance, need – Institutional arrangements for the promotion of agro-based industries – Procedure to be followed to set up agrobased industries – Constraints in establishing agro-based industries. Project – Meaning – Definition – Project cycle – Guidelines for preparation of project reports. Project appraisal and evaluation techniques – Undiscounted measures and decision rules - PBP ROR, and discounted measures and decision rules – NPW, BCR, IRR, N/K ratio, Sensitivity analysis.

PRACTICAL

CO5: 1. Balance sheet analysis.
2. Analysis of profit and loss statement.
3. Break even analysis/ Cost volume profit analysis.
4.& 5. Financial ratio analysis.
6. Development of business performance tracking system.
7. Compounding and discounting techniques.
8. Project appraisal techniques – I Undiscounted measures -PBP, ROR
9 &10. Project appraisal techniques – II Discounted measures NPW, BCR
11 &12. Project appraisal techniques – III - IRR N/K Ratio & PI and sensitivity analysis
13. Preparing business plans.
14. Case study -1 : Visit and study of profile of Agro-based industries.
15 &16. Case study -2: Formulation of project feasibility report of agribusiness enterprise.

REFERENCE BOOKS:

1. Aswathappa, K and Sridhar K. *Production and Operations Management*.
2. David Downey, and John Ericson. *Agribusiness Management*
3. Gitteger Price, J.1989. *Economic Analysis of Agricultural Projects*. John Hopkins University Press, London.
4. Harsh, S.B. Conner, U.J. and Schwab G.D. 1981. *Management of the Farm Business*. Prentice Hall Inc., New Jersey, USA.
5. Joseph, L. Massie.1995. *Essentials of Management*. Prentice Hall of India Pvt. Ltd., New Delhi.
6. Omri Rawlins, N. 1980. *Introduction to Agribusiness*. Prentice Hall of India Pvt. Ltd., New Delhi
7. Pandey, I M. *Financial management*
8. Philip Kotler, Kevin Lane Keller, Abraham Koshy and Mithileswar Jha. 2009. *Marketing Management: A South Asian Perspective*. International 13th edition. Pearson Prentice Hall.

WEB REFERENCES/MOOC'S:

1. https://www.youtube.com/watch?v=Aij5x7Mf61s&ab_channel=PGDiplomainAEMMANAGE
2. https://www.youtube.com/watch?v=DUSE7FkD_Ug&ab_channel=AgriculturalDevelopmentTrustBaramati

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20AENG 151 - SOIL AND WATER CONSERVATION ENGINEERING

L-T-P-S	**1-0-3-0**
Credits	**2**
Contact Hours	**4**
Pre-requisite	**Nil**

Syllabus

Theory

Introduction to soil and water conservation - Causes of soil erosion - Definition and agents of soil erosion - Water erosion - Forms of water erosion - Gully classification and control measures - Soil loss estimation by Universal Soil Loss Equation - Soil loss measurement techniques - Principles of erosion control - Introduction to contouring Strip cropping - Contour bund - Graded bund and bench terracing - Grassed water ways and their design - Water harvesting and its techniques - Wind erosion - Mechanics of wind erosion - Types of soil movement - Principles of wind erosion control and its control measures.

Introduction to irrigation - Irrigation project classification - Methods of microirrigation - Importance of irrigation water measurements – Volumetric area velocity Discharge methods - Weirs – Orifice – Flumes - Types of wells - Water lifting devices Classification of pumps – capacity – Power - Discharge calculations - Open channel hydraulics - Discharge calculations - Underground pipeline systems - Functional components of micro irrigation systems and its design like drip - Sprinkler etc. - Water harvesting - Lining of ponds – Tanks - Canals.

Practical

General status of soil conservation in India - Calculation of erosion index - Estimation of soil loss - Measurement of soil loss - Preparation of contour maps - Design of grassed water ways -Design of contour bunds - Design of graded bunds - Design of bench terracing system - Problem on wind erosion - Discharge measurements - Irrigation pumps Different pumps and structural differences - Design of farm ponds - Lining of ponds Irrigation tank - Water management.

CO No:	CO	PO	BTL
CO1	**Understand** the concepts of soil, water, and wind erosion along with their various conservation practices	1,4	2
CO2	**Comprehend** about terraces, contours, and grasses waterways in order to prevent erosion at different grades of slopy land	2, 7	2
CO3	**Characterize** the concepts of irrigation water measurement and various	1,4	2

	irrigation methods - micro-irrigation, underground pipeline system.		
CO4	**Understand** the water conservation structure, and the systems associated with wells to drive water out of them to irrigate the agricultural land	1,5	2
CO5	**Apply** the solutions to the real-life problems through laboratories' work.	1,4, 8	3

Course Objective:

Course Objectives

The objectives of this course are to:

1. Teach the students about causes and agents of soil, wind and water erosion along with various estimation methods of soil loss.
2. Impart the knowledge of soil and water conservation with various management methods such as terracing and bunding, in order to minimize the soil and water losses.
3. Teach them about bench terraces, contour bunds and grassed water ways.
4. Instruct the students of irrigation water measurement, and various irrigation methods, and to equip them about functional components and working principles of underground pipeline systems and micro irrigation systems.
5. Teach them about types of wells, pumping system to lift the water, and the power supply require to run the pumps.

Reference Books:

1. R. Suresh, Soil and Water Conservation Engineering, Standard Publishers Distributors, Delhi.

2. Ghanshyam Das., 2012. *Hydrology and Soil Conservation Engineering, including Watershed Management.* Second edition, PHI Learning Private Limited, New Delhi - 110001

3. Murthy, V. V.N., 2004. *Land and Water Management Engineering.* Kalayani Publishers, New Delhi

4. Michael A.M., 2007. *Irrigation Theory and Practice.* Second edition. Vikas Publishing House Pvt. Ltd.

5. Mal, B. C. 1995. *Introduction to Soil and Water Conservation Engineering*. Kalayani Publishers, Rajinder Nagar, Ludhiana

6. Kanetakar, T. P. 1993. *Surveying and Leveling*. Pune Vidyarthi Griha, Prakashan, Pune

Web Refetences/Moocs:

1. https://nptel.ac.in/courses/126/105/126105012/

20 AENG251- FARM MACHINERY AND POWER

L-T-P-S	**1-0-3-0**
Credits	**2**
Contact Hours	**4**
Pre-requisite	**Nil**

Syllabus

Theory

Status of farm power in India - Sources of farm power - I.C. engines - Working principles of I C engines - Comparison of two stroke and four stroke cycle engines Study of different components of I.C. engine - I.C. engine terminology and solved problems - Familiarization with different systems of I.C. engines - Air cleaning – Cooling - Lubrication - Fuel supply and hydraulic control system of a tractor - Familiarization with power transmission system – Clutch - Gear box - Differential and final drive of a tractor - Tractor types - Cost analysis of tractor power and attached implement Familiarization with primary and secondary tillage implements -Implements for hill agriculture - Implements for intercultural operations - Familiarization with sowing and planting equipment - Calibration of a seed drill and solved examples - Familiarization with plant protection equipment - Familiarization with harvesting and threshing equipment.

Practical

Study of different components of I.C. engine - To study air cleaning and cooling system of engine - Familiarization with clutch – Transmission - Differential and final drive of a tractor - Familiarization with lubrication and fuel supply system of engine Familiarization with brake – Steering - Hydraulic control system of engine - Learning of tractor driving - Familiarization with operation of power tiller - Implements for hill agriculture - Familiarization with different types of primary and secondary tillage implements - Mould plough - Disc plough and disc harrow - Familiarization with seedcum-fertilizer drills their seed metering mechanism and calibration - Planters and transplanter - Familiarization with different types of sprayers and dusters - Familiarization with different inter-cultivation equipment - Familiarization with harvesting and threshing machinery.

CO No:	CO	PO	BTL
CO1	**Understand** the working principles of IC engines with its different components and terminologies	1,3	2
CO2	**Characterize** the primary and secondary tillage implements with its functions, constructions and maintenance	1, 5	2
CO3	**Comprehend** the details of harrows, sowing equipment, and harvesting equipment	2,8	2
CO4	**Understand** the systems of tractor mounted equipments for land development and soil conservation.	1,3,7	2
CO5	**Apply** the field equipments knowledge into the agricultural field.	1,4, 8	3

Course Objective:

The objectives of this course are to:

1. Teach the students about farm machineries and equipments to be used in the agricultural field.
2. Impart the knowledge of working principle of various components of farm machineries.

Reference Books:

1. Jagadishwar Sahay - Elements of Agricultural Engineering.
2. Surendra Singh. Farm Machinery - Principles and Applications. ICAR Publication.
3. S.C.Jain and C.R.Rai. Farm Tractor – Maintenance and Repair. Standard Publishers, 1705-B, Nai Sarak, Delhi – 110006
4. Ojha, T. P. and Michael, A.M. Principles of Agricultural Engineering. Vol. I, Jain Brothers, 16/893, East Park Road, Karol Bagh, New Delhi – 110005

Web Refetences/Moocs:

1. https://nptel.ac.in/courses/126/105/126105009/

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20 AENG252- RENEWABLE ENERGY AND GREEN TECHNOLOGY

L-T-P-S	**1-0-3-0**
Credits	**2**
Contact Hours	**4**
Pre-requisite	**Nil**

Syllabus

Theory

Classification of energy sources - Contribution of non-conventional energy sources in agricultural sector - Familiarization with biomass utilization for biofuel production and its application - Familiarization with types of biogas plants and gasifiers – Biogas Bio-alcohol - Biodiesel and bio oil production and their utilization as bioenergy resource - Introduction of solar energy - Collection and its 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 its application Introduction of wind energy and their application.

Practical

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

CO No:	CO	PO	BTL
CO1	**Understand** the classification of biogas plant with to produce the energy from biogas	2, 6, 11	2
CO2	**Characterize** the gasifiers, solar energy and solar appliances	3, 10	2
CO3	**Comprehend** the solar heating and cooling, photovoltaic system, and wind energy	1,10	2

CO4	**Understand** the details of wind mills, biofuels, biodiesel production and ethanol from agriculture produce.	1,5	2
CO5	**Apply** the lab experiments knowledge by performing various experiments in renewable energy.	1,4, 8	3

Course Objective:

The objectives of this course are to:

1. Teach the students about renewable energy and instruments used for that purpose.
2. Impart the knowledge of function of various renewable energy instruments.

Reference Books:

1. Rai, G.D. 2004. Non-conventional Energy Sources. Khanna Publishers, New Delhi.
2. Rajput, R. K. 2012. Non-conventional Energy Sources. S. Chand Publishers.
3. Ojha, T.P. and Michael, A.M. Principles of Agricultural Engineering. Vol. I, Jain Brothers, New Delhi.
4. Rathore, N.S., Mathur, A.N. and Kothari, S. Alternate Sources of Energy. ICAR Publication.
5. Chakravarty,A. and Amalendu Chakraverty. 1989 Biotechnology and Other Alternative Technologies for Utilization of Biomass-Agricultural Wastes. 1st edition, Oxford and IBH. Publishers, New Delhi.

Web Refetences/Moocs:

1. https://nptel.ac.in/courses/121/106/121106014/

20AENG351- PROTECTED CULTIVATION AND POST HARVEST TECHNOLOGY (SECONDARY AGRICULTURE)

L-T-P-S	**1-0-3-0**
Credits	**2**
Contact Hours	**4**
Pre-requisite	**Nil**

Syllabus

Theory

Greenhouse technology – Introduction - Types of greenhouses - Plant response to greenhouse environment - Planning and design of greenhouses - Design criteria of green house for cooling and heating purposes - Green house equipments - Materials of construction for traditional and low cost green houses - Irrigation systems used in greenhouses - Typical applications - Passive solar greenhouse - Hot air greenhouse heating systems - Greenhouse drying - Cost estimation and economic analysis.

Important engineering properties such as physical - Thermal and aerodynamic properties of cereals - Pulses and oilseeds - Their application in PHT equipment design and operation - Drying and dehydration - Moisture measurement – EMC - Drying theory - Various drying methods - Commercial grain dryer (deep bed dryer, flat bed dryer, tray dryer, fluidized bed dryer, re-circulatory dryer and solar dryer) - Material handling equipment - Screw conveyer and bucket elevator - Their principle - Working and Selection - Primary processing of cereals, pulses and oilseed, like cleaning, grading, packaging etc.

Practical

Study of different type of greenhouses based on shape - Determine the rate of air exchange in an active summer winter cooling system - Determination of drying rate of agricultural products inside greenhouse - Study of greenhouse equipment - Visit to various post harvest laboratories - Determination of moisture content of various grains by oven drying & infrared moisture methods - Determination of engineering properties (shape and size, bulk density and porosity of biomaterials) - Determination of moisture content of various grains by moisture meter - Exposure to primary processing equipment like dalmills, graders, cold storages etc. - Field visit to seed processing plant.

CO No:	CO	PO	BTL
CO1	Understand the greenhouse gases with it's type, shape and response to the environment	2, 6, 11	2
CO2	Comprehend the planning and construction of greenhouse gas chamber	3, 10	2
CO3	Understand the details of post-harvest equipment used in grains processing after harvest from the field	1,10	2
CO4	Characterize the drying, moisture measurement and handling and grains during post-harvest operation.	1,5	2
CO5	Apply the greenhouse gas chamber and food processing operations from the lab to land condition	1,4, 8	3

Course Objective:

The objectives of this course are to:

1. Teach the students about greenhouse chamber and it's installation process.
2. Impart the knowledge of post-harvest steps of food products.

Reference Books:

1.Radha Manohar, K and Igathinathane. C. Greenhouse Technology and Management, 2nd Edition, BS Publications.

2.Tiwari, G.N. Greenhouse Technology for Controlled Environment. Narosa Publishing house Pvt.Ltd.

3.Singh Brahma and Balraj Singh., 2014. Advances in Protected Cultivation, New India Publishing Company.

4.Sahay, K.M. and Singh, K.K. 1994. Unit operations of Agricultural Processing. Vikas Publishing house Pvt. Ltd. New Delhi.

5.Chakraverty, A. Post Harvest Technology of cereals, pulses and oilseeds. Oxford & IBH publishing Co. Ltd., New Delhi.

6.Ojha, T.P and Michael, A.M. Principles of Agricultural Engineering, Vol. I, Jain Brothers, Karol Bag, New Delhi.

Web Refetences/Moocs:

1. https://nptel.ac.in/courses/126/105/126105011

Semester	:	**Second**
Course Name	:	**Fundamentals of Crop Physiology**
Course Code	:	**20 CPHY162**
L-T-P structure	:	**2-0-3-0**
Course Credits	:	**3(2+1)**
Course Coordinator	:	**Dr. Atul Singh**
Course Instructors	:	**Mr. K. Veera Bhadra Rao**

COURSE OUTCOMES (CO):

CO NO.	COURSE OUTCOMES (CO)	PO	BTL
THEORY			
CO1	To understand the basic knowledge and history of crop physiology it's important in agriculture, cell overview, seed germination and metabolic changes during seed development and plant Growth and its Development. Impart an insight into the various plant water relations.	1,34	3
CO2	Take students to higher levels of learning about the Rate of transpiration and Water use efficiency in C3, C4 and CAM plants. Assimilation of mineral nutrients in crop plant and also about photosynthesis and its reaction centre in crop plant	2,5,6	3
CO3	Understand the mechanism of various metabolic processes in crop. The factor affecting photosynthesis, Respiration, Biosynthesis of fatty acids in plastids, Physiology of flowering, vernalizationin, Occurrence of auxin, transport of auxin, biosynthesis of auxin and its mode of action.	5,8,9	3
CO4	Acquire basic knowledge about growth and development in plants like Auxin, Gibberellins, Cytokinins, Abscisic acid and Ethylene. They learn about senescence, abscission and post-harvest physiology	4,7,10,	3
PRACTICAL			
CO5	Practical study of Seed vigour and viability tests, seed germination, leaf area measurement, Growth analysis, measurement of water status in plants, leaf anatomy of C3 and C4 plants and the students has developed their skills and techniques related to crop physiology. So that they can design their own experiments.	4,9,10,11	3

Course Objective:

1. To study the plant processes responsible for the growth, development, and their production of economic yield by the crop plants.
2. To build knowledge and revealing the dependence of the life processes on environmental conditions.
3. To enhance the theoretical basis for increasing of total productivity of plants, improving their nutritional value, and raising the quality of crop.

SYLLABUS

THEORY

CO1: Introduction to Crop Physiology and its importance in Agriculture. Plant cell - The endomembrane system - Plasma membrane, endoplasmic reticulum, nuclear envelope, golgi apparatus, vacuole and endosomes - Structure and functional characteristics - Plastids, mitochondria, oil bodies, peroxisomes and glyoxysomes - Structure and functions. Metabolic changes during seed development - Seed viability and seed vigor - Tests of viability and vigor- Physiological maturity, harvestable maturity- Indices of physiological maturity in crops - Seed germination - Metabolic

changes during seed germination. Growth and Development - Definition - Growth analysis - Growth parameters - Definitions and mathematical formulae Absorption of water - Diffusion and osmosis - water potential and its components - Importance of water potential - Active and passive uptake of water - Stomata! complex - Transpiration - Water use efficiency.

CO2: Water use efficiency of C3, C4 and CAM plants - Water requirement/ Transpiration ratioFactors affecting WUE. Mineral nutrition of plants - Essential mineral elements - Criteria of essentiality of mineral elements - Mengel's classification of mineral nutrients - Nutrient uptake mechanisms - Functional roles of N, P, K, S Ca and Mg - Functional roles of Fe, Mn, Cu, Zn, B, Mo, Cl, Na, Co and Si -Deficiency symptoms of macro and micro nutrients. Assimilation of mineral nutrients - Nitrate assimilation - Ammonium assimilation in plants - Biological nitrogen fixation - Free-living and symbiotic bacteria - Nodule formation - Nitrogenase enzyme complex. Photosynthesis - Reactions of photosynthesis - Energy synthesis - Principle of light absorption by plants - Light reactions.

CO3: Cyclic and non cyclic photophosphorylation - CO2 fixation - C3 and C4 pathways - Significance of C4 pathway - CAM pathway and its significance - Photorespiration and its significance - Photosynthetic efficiency of C3, C4 and CAM plants - Factors affecting photosynthesis (light, CO2, temp and water stress) - Relationship of photosynthesis and crop productivity. Respiration - Energy balance - Significance of respiration - Oxidative Pentose Phosphate Pathway (OPPP) and its significance - Growth respiration and maintenance respiration - Alternate respiration - Salt respiration - Wound respi ration. Lipid metabolism - Biosynthesis of fatty acids in plastids - Functions of lipids - Significance of lipids in plant metabolism. Physiology of flowering - Photoperiosism and flowering - Importance of photoperiodism - Classification of plants based on photoperiodic responses Perception of photoperiodic stimulus - Biological clock - Phytochrome - Flowering hormones -Vernalization and flowering - importance of vernalization in agriculture. Plant growth regulators - Auxins - Occurrence, transport, biosynthesis, mode of action and physiological roles.

CO4: Commercial uses.- Gibberellins - occurrence, transport, biosynthesis, mode of action and physiological roles - Commercial uses - Cytokinins - Occurrence, transport, biosynthesis, mode of action and physiological roles - commercial uses - ABA - Occurrence, transport, biosynthesis, mode of action and physiological roles - Commercial uses - Ethylene - Ocurrence, transport, biosynthesis, mode of action and physiological roles - Commercial uses. Senescence and abscission - Definition - Classification of senescence - Physiological and biochemical changes that occur during senescence - Prevention of leaf and flower senescence - Abscission and its relationship with senescence. Post harvest physiology - Dormancy - Types of dormancy - Advantages and disadvantages of dormancy - Causes of dormancy - Remedial measures for breaking seed dormancy - Fruit ripening - Climacteric and non climacteric fruits - Metabolic changes during fruit ripening - Hormonal regulation of fruit ripening - Ripening induction and ripening inhibition - Use of hormones in increasing vase life of flowers.

PRACTICAL

CO5: Solutions- Preparation, Seed vigor and viability tests, optimum conditions for seed germination, leaf area measurement, Growth analysis, Measurement of water status in plants, Measurement of water potential, Measurement of Stomata! frequency and index photosynthetic

pigments- Absorption spectrum, Leaf anatomy of C3 and C4 plant s, Measurement of photosynthesis - Hill's reaction, Measurement of photosynthesis by IRGA, Effect of plant growth regulators on plant growth. Diagnosis of nutrient deficiency symptoms in crops, Yield analysis

REFERENCES

1. Taiz, L. and Zeiger, E. 2010. Plant Physiology 5t h edition, Sinauer Associates, Sunderland, MA, USA.
2. Gardner, F.P., Pearce, R.B., and Mitchell, R.L. 1985. Physiology of Crop Plants. Scientific Publishers, Jodhpur.
3. Noggle, G.R. and Fritz, G.J., 1983. Introductory Plant Physiology. 2nd Edition. Prentice Hall Publishers, New Jersey, USA.

Semester	:	**Third**
Course Name	:	**Eco-physiology**
Course Code	:	**20CPHY261**
L-T-P structure	:	**1-0-3-0**
Course Credits	:	**2(1+1)**
Course Coordinator	:	**Dr. Atul singh**
Course Instructors	:	**Mr. K. Veera Bhadra Rao**

COURSE OUTCOMES (CO):

CO NO.	COURSE OUTCOMES (CO)	PO	BTL
THEORY			
CO1	Basic principles of Ecosystem, structure, components, types of ecosystem, types of food chains, pathways of energy in the biosphere and Agro-climatic zones of India – Crop distribution in India and Andhra Pradesh.	1,2	3
CO2	~~Basic processes in physiology and their environments Edaphic factors and~~ their Classification, Physiographic factors of Land, and Biotic and abiotic Factor affecting in Plants	3,5,6	3
CO3	~~Physiological approaches for climate resilient in agriculture~~ of Allopathy and Phyto-remediation in agriculture . Knowledge	7,8	3
CO4	The impact of different Pollution, Global warming, Controlled environment and Effects on crop yields and limitations.	4,9, 10	3
PRACTICAL			
CO5	~~To study Hydrophytes, Mesophytes, Xerophytes and the effects of light~~ and shade on crop growth, competition in crop plants and soil pollution on crop growth,	4,5,9, 11	3

Course Objective:

1. To study the importance in agriculture, horticulture and Sub divisions of biosphere of the ecosystem.
2. To build knowledge and approaches for climate resilient in agriculture
3. To observe the impact of pollution on physiological stage of plants and its Management.

SYLLABUS
THEORY

CO1: Ecophysiology - Introduction - Definition - Importance in agriculture and horticulture - Ecosystem - Definition of ecosystem, ecotypes and ecads - Biosphere and ecosystem - Sub divisions of biosphere - Pathways of energy in the biosphere - Concept of ecosystem - Components of ecosystem - Basic structure of ecosystem. Different types of ecosystem - Freshwater, marine, forest and crop ecosystem - Energy in ecosystem - Productivity - Primary production - Secondary production- Types of food chains. Global climates and crop distribution - Influence of climate on crop distribution (rice, wheat, maize, sorghum and sugarcane) - Important climatic regions of the world - Agro-climatic zones of India - Crop distribution in India and Andhra Pradesh. Environment - Definition - Components - Biotic and abiotic environments - Biotic environment - Biotic factors and anthropic factors - Abiotic environment - Climatic, edaphic, physiographic and pyric factors - Climatic factors - Radiation - Effect of radiation on plant functions -Classification of ultraviolet (UV) radiation - Effects of UV-B radiation.

CO2: Abiotic environment - Climatic factors - Precipitation - Forms of precipitation - Effect of water deficit and water logging on plant processes - Temperature - Cardinal temperature - Effects of temperature on plant processes - Temperature injuries - High temperature and low temperature stress - Classification of plants based on heat resistance and cold resistance - Heat units. Edaphic factors - Classification of plants based on adaptation to different soil types - Halophytes and salt stress tolerance mechanisms. Physiographic factors - Altitude of the place, steepness of the slope, direction of mountain chain and exposure of the slope to light and wind- Effects of topographic factors on vegetation - Wind effect on physiological processes - Pyric factors - sources and type of fires - Effects of fire on vegetation and environment - management of fires and rejuvenation of crops.Biotic factors - Herbivores (grazing effect), symbiosis (Mycorrhiza and Rhizobium associations), insectivorous plants, epiphytism and parasites - Anthropic factors-Industrialization - Shifting cultivation –

CO3: Crop improvement. Physiological approaches for climate resilient agriculture. Competition - Ecological succession - Dominance and subordination - Types of competition - Inter-specific, intra-specific and intra-plant competition - Monoculture and polyculture - Multistoried cropping system - Mutual shading. Allelopathy - Definition - Concept - Sources of allelopathic chemicals in crop and weed species - Natural products identified as allelopathic chemicals - Mode of action - Scope for allelopathy. Phyto-remediation - Definition - Concept - Applications in agriculture and industry.

CO4: Pollution - Air pollution - Sources - Physiological effects on plants and its Management - Water pollution - Sources - physiological effects on plants and its Management - Soil pollution - Sources - Physiological effects on plants and its Management. Global warming - Greenhouse effect - Causes of global warming - Methane, carbon dioxide, chloro fluoro carbons' (CFC), nitrous oxide (NO) gas and ozone - Impact of global warming on climate and agricultural productivity - Measures to reduce

build-up of greenhouse gases. Controlled environment - Purposes - Types - Designs of structure - Commercial applications. Carbon dioxide fertilization - Definition - Concept - Importance - Sources -Methods of CO fertilization - Effects on crop yields and limitations - Ecophysiological models - Concept - Models for different environmental management.

PRACTICAL

CO5: Morphological and anatomical adaptations of plants grown in for different ecological habitation, Morphological and anatomical adaptations of crop plants grown in for different abiotic stresses and controlled environment

Semester	**: Fifth**
Course	**: Environmental studies and disaster management**
Course Code	**: 20 CPHY 361**
L-T-P structure	**: 1-0-3-0**
Course Credits	**: 2(1+1)**
Course Coordinator	**: Dr. Atul Singh**
Course Instructors	**: Mr. K. Veera Bhadra Rao**

COURSE OUTCOMES (CO):

CO NO.	COURSE OUTCOMES (CO)	PO	BTL
THEORY			
CO1	Understand the basic knowledge about the Environmental studies - Natural resources – Renewable and non-renewable resources, Water resources – Sources, uses and over utilization of surface and groundwater - Dams – Benefits and problems, Food resources – Food sources, world food problems and food security	1,2	3
CO2	Gain knowledge and expertise in different Energy resources – Renewable and non-renewable energy sources, Land resources – Land degradation, desertification and land use planning, Biodiversity – Definition – Types of biodiversity – Bio-geographical classification in India, Threats to biodiversity – Habitat loss – Poaching of wildlife – Man-wild life conflicts.	4,6	3
CO3	Develop and understand the knowledge regarding the Environmental, Causes, effects and control measures of soil pollution, Causes, effects and control measures of thermal, marine and noise pollution, Solid waste management – Need of waste management – Types of solid waste – Management processing technologies.	2,3,8	3
CO4	Analyse and gain knowledge about the Disaster management - Natural Disasters, Man-made disasters – Nuclear disasters, chemical disasters, biological disasters, International strategy for disaster reduction - Concept of disaster management - National disaster management framework - Financial arrangements - Role of NGOs, community based organizations and media, Central, state, district and local administration, Social issues	4, 5, 7,11	3

	and the environment – Unsustainable to sustainable development – The Environment Protection Act, Human immuno-deficiency virus (HIV)/ Acquired Immunodeficiency Syndrome (AIDS) – Role of information technology on environment and human health.		
PRACTICAL			
CO5	Practical study of Collection, processing and storage of effluent samples and Determination of chemical oxygen demand in waste water sample also how to Estimation of dissolved oxygen in waste water sample and Assessment of chlorophyll content in plants and gain knowledge about the parentage of released varieties and about the specialized characters in various crops.	4,6, 8, 9, 10	3

Course Objective:

1. To study the natural resources of the forest and their bio-geographical classification in India
2. To build knowledge environmental pollution and tolerable limits for toxic gases in air and management processing technologies.
3. To develop the framework of national and international disaster management, role of NGOs, community-based organizations.

SYLLABUS
THEORY

CO1: Environmental studies - Definition - Scope and importance, need for public awareness, people and institutions in environment. Natural resources - Renewable and non-renewable resources - Forest Resources-Functions of forests - Causes and consequences of deforestation. Water resources - Sources, uses and over utilization of surface and groundwater - Dams - Benefits and problems - Sustainable management of water. Food resources - Food sources, world food problems and food security.

CO2: Energy resources - Renewable and non-renewable energy sources and their impacton environment. Land resources - Land degradation, desertification, and land use planning - Role of an individual in conservation of natural resources. Biodiversity - Definition - Types of biodiversity - Bio-geographical classification in India - Methods of measuring biodiversity - Biodiversity Act - Functions of National Biodiversity Board. Threats to biodiversity - Habitat loss - Poaching of wildlife - Man-wild life conflicts - Conservation of biodiversity - In situ and ex situ.

CO3: Environmental pollution - Causes, effects and control measures of air and water pollution - Tolerable limits for toxic gases in air. Causes, effects and control measures of soil pollution - Bioremediation - Tolerable limits for heavy metals in soil. Causes, effects and control measures of thermal, marine and noise pollution, nuclear hazards. Solid waste management - Need of waste management - Types of solid waste - Management processing technologies.

CO4: Disaster management - Natural Disasters - Meaning and nature of natural disasters, types and effects - 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 strategy for disaster reduction - Concept of disaster management - National disaster management framework - Financial arrangements - Role of NGOs, community-based organizations and media, Central, state, district and local administration, Armed forces, police and other organizations in disaster response. Social issues and the environment - Unsustainable to sustainable development - The Environment Protection Act - The air (prevention and control of pollution) act- The water (prevention and control of pollution) act - The wildlife protection act- Forest conservation act. Woman and child welfare - Human immuno-deficiency virus (HIV)/ Acquired Immuno deficiency Syndrome (AIDS) - Role of information technology on environment and human health.

PRACTICAL
CO5:

Collection, processing and storage of effluent samples, Estimation of total dissolved solids, Hardness, dissolved oxygen, BOD and COD in waste water sample, heavy metals analysis in sludge and waste water sample, Determination of sound level, Air analysis for particulate matter, Estimation of species abundance of plants, Measurement of chlorophyll, Transpiration and water balance in plants under polluted conditions, Visit to a local polluted site, in-situ or ex-situ conservation center/ Environmental Education Centre/ Social Service Organization, ICT in Environmental Science.

Semester	**:**
Course Name	**: Micro-propagation technologies**
Course Code	**: 20 ELCT 362**
L-T-P structure	**: 2-0-3-0**
Course Credits	**: 3(2+1)**
Course Coordinator	**:**
Course Instructors	**:**

COURSE OUTCOMES (CO):

CO NO.	COURSE OUTCOMES (CO)	PO	BTL
THEORY			
CO1	To understand the basic knowledge and history of vitro culture, micropropagation, totipotency, dedifferentiation, and Historical milestones in tissue culture techniques and also Techniques of sterilization/ asepsis for glass and metal ware, liquids both thermostable and thermolabile, disposal of remnants of culture.	1,3,4	3

CO2	Take students to higher levels of learning about Pathways of regeneration of plants – Organogenesis direct and indirect and factors affecting organogenesis – Somatic embryogenesis and factors affecting somatic embryogenesis - Differences between gametic and somatic embryos.	2,5,6	3
CO3	Understand the mechanism and Pathways of regeneration of plants – Organogenesis direct and indirect and factors affecting organogenesis and Somatic embryogenesis and factors affecting somatic embryogenesis. .	5,8,9	3
CO4	Acquire basic knowledge about Advancements and future prospects of in vitro culture and Techniques of single cell culture, suspension cultures - Selection of somaclonal variants for crop improvement – Advancements and future prospects invitro culture – Production of secondary metabolites through cell culture techniques.	4,7,10,	3
PRACTICAL			
CO5	Practical study of Seed vigour and viability tests, seed germination, leaf area measurement, Growth analysis, measurement of water status in plants, leaf anatomy of C3 and C4 plants and the students has developed their skills and techniques related to crop physiology. So that they can design their own experiments.	4,9,10,11	3

Course Objective:

1. To impart advanced training in plant tissue culture technology.
2. To develop a basic understanding of the principles of plant tissue culture and the basic knowledge on entrepreneurial skills required to run a small-scale commercial nursery.
3. To educate the students about various techniques in plant tissue culture and development of job-oriented skill of student to work in commercial plant tissue culture laboratories.

SYLLABUS
THEORY

CO1: Meaning and concept of in vitro culture, micropropagation, totipotency, dedifferentiation, Historical milestones in tissue culture techniques. Applications, advantages and limitations of tissue culture techniques. Tissue culture methodology – Different types of media – Environmental requirements of tissue culture unit – Techniques of sterilization/ asepsis for glass and metal ware, liquids both thermostable and thermolabile, disposal of remnants of culture.

CO2 Components of the tissue culture media – Inorganic nutrients, vitamins, amino acids and other organic supplements, carbon source, hormones/ plant growth regulators, pH of the media, gelling

agents. Components of the tissue culture media - Carbon source, hormones/ plant growth regulators, pH of the media, gelling agents. Preparation of media – Stocks and working media, preparation and storage. Genetic control of regeneration.

CO3 Pathways of regeneration of plants – Organogenesis direct and indirect and factors affecting organogenesis – Somatic embryogenesis and factors affecting somatic embryogenesis - Differences between gametic and somatic embryos. Synthetic seeds – Concept, necessity, procedure and requirements of synthetic seeds Clonal propagation.

CO4 Definition, stages of micropropagation- Auxillary bud proliferation, shoot tip and meristem culture –Factors affecting micropropagation –Applications and limitations. 15& 16 Advancements and future prospects of in vitro culture – Techniques of single cell culture, suspension cultures - Selection of somaclonal variants for crop improvement –Advancements and future prospects invitro culture – Production of secondary metabolites through cell culture techniques.

PRACTICAL

CO5: Laboratory organization, Sterilization techniques for explants, glassware, plasticwares, labwares and working platform. Preparation of stocks and working solution. Preparation and sterilization of growth regulators. Preparation of working medium and Experimentation on determining optimum concentration of growth regulators. Callus induction and regeneration of whole plants from different parts of plants. Direct regeneration into whole plants using bud, node and other tissues. Induction of somatic embryos. Experiments of synthetic seeds production and testing storability and germination efficiency.

References

1. Gamborg, O.L. and Phillips, G.C. 1995. Plant Cell Tissue Organ Culture: Fundamental Methods. Springer, Berlin.
2. Keshavachandran, R. and Peter, K.V. 2008. Pant Biotechnology: Methods in Tissue Culture and Gene Transfer. Universities Press, Hyderabad.
3. Smith, R.H., 2013. Plant Tissue Culture: Techniques and Experiments. 3rd ed. Academic Press, San Diego, CA, USA.
4. Bhojwani, S.S. and Razdan, M.K. 1996. Plant Tissue Culture, Theory and Practice. Elsevier, Netherlands.
5. Bhojwani, S.S. and Dantu, P.K. 2013. Pant Tissue Culture: An Introductory Text. Springer, India, New Delhi.

20PATH171- Fundamentals of Plant Pathology

Course Code: 20PATH171
L-T-P-S structure: 2-0-3-0
Course Credits: (2+1)
Contact hour: 5
Pre-Requisite: Nil

Mapping of course outcome PO/PSO

CO NO.	COURSE OUCOMES (CO)	PO	BTL
THEORY			
CO1	Understand the basic knowledge on the introduction of plant pathology, objective of plant pathology, history of plant diseases, plant pathogens, plant diseases, symptoms and disorders. Important plant diseases caused by fungi, bacteria, virus, spiroplasm etc. general characteristic features of plant parasitic organisms its physiological and morphological traits, its taxonomical classification.	2,3	2
CO2	Understand the major characteristic features of the Kingdom Fungi, Phylum Chytridiomycota, Phylum Zygomycota, Phylum Ascomycota, Phylum Basidiomycota, Kingdom Chromista, Protozoa.	2,3	2
CO3	Develop and understand the Phylum Basidiomycota, Sub phylum, Kingdom Chromista, their classification and different characteristic features.	2,3	2
CO4	Gain knowledge about characteristic features of Kingdom Protozoa, Characteristics features of (prokaryotes) plant pathogenic bacteria, classifications, and identification. Phylum Firmicutes, Virus and viroid, its important characteristic plant virus and viroid, classification, and taxonomy. To know about the Nematodes, importance in agriculture, general characteristics and diseases caused by plant parasitic nematodes.	2,3	2
PRACTICAL			
CO5	Practical study on Microscopy, morphological identification of different fungi, disease symptoms caused by pathogen. Phypathogenic bacteria isolation and its characteristics, transmission of plant virus and plant parasitic nematodes.	1,2,3,8	3

COURSE OBJECTIVE:

1. Aim to know about the importance and scope of plant pathology. Study on various types of plant diseases, etiology and mechanism of disease development by pathogen, general characteristics etc.
2. Aim to understand the different characteristic features of kingdom fungi and its classification.
3. To study on the prokaryotes, bacterial classification, viruses, viroids, nematodes and its importance in agriculture etc.

SYLLABUS:

1. Introduction to plant diseases, scope and objectives of Plant Pathology. Important plant pathogenic organisms, different groups: fungi, bacteria, fastidious vesicular bacteria, phytoplasmas, spiroplasmas, viruses, viroids, etc.
2. Nomenclature, Binomial system of nomenclature, rules of nomenclature, classification of fungi. Key to divisions, sub-divisions, orders and classes.
3. Bacteria and mollicutes: general morphological characters. Basic methods of classification and reproduction. Viruses: nature, architecture, multiplication and transmission. Study of phanerogamic plant parasites.

4. Nematodes: General morphology and reproduction, classification, symptoms and nature of damage caused by plant nematodes (Heterodera, Meloidogyne, Anguina etc.) Practical Microscopy, General study of different structures of fungi. Study of symptoms of various plant diseases.

REFERENCE:

1. Dube, H. C. 2013. An Introduction to Fungi.4th (Edition). Scientific Publishers, Jodhpur, India. (major text book)

2. Webster, J. 1989. Introduction to fungi. Cambridge Univ. Press (for life cycles of Fungi)

3. Dasgupta, M. K. 1987. Principles of Plant Pathology. Allied Publ. Pvt Ltd. p985. (for rust life cycles)

4. Students are also advised to refer Introductory Mycology by Alexopoulus, Mims and Blackwell (4th Edition) for Fungi.

5. For Bacteria, Viruses, Viroids, Phanerogamic Plant Parasites, Nematodes 6. Agrios, G. N. 2006. Plant Pathology. Elsevier Publishers, New Delhi.

WEB REFERENCE:

1. Introduction to Plant Pathology [Year-1] - YouTube
2. Phylum: Basidiomycota, Part-1 (Introduction) - YouTube
3. The Life Cycle of Wheat Stem Rust - YouTube
4. The Life Cycle of Wheat Stem Rust - YouTube
5. Comparison between Rusts and Smuts.. - YouTube
6. Comparison of smut and bunt Fungi - YouTube
7. Development of Basidium and Basidiospores - YouTube
8. Types of Ascocarps in phylum Ascomycota - YouTube
9. Sexual Reproduction in Fungi - YouTube
10. Asexual reproduction in fungi - YouTube
11. Plant Viruses Introduction - YouTube
12. ICAR-JRF 20-21 : Introduction to Nematology :By Chaitra Bhat, JRF 8, SRF 2, IARI PH.D. 1st Rank: - YouTube
13. ICAR JRF: Order: Peronosporales & Downy mildew fungi: Plant Pathology: AgriToppers classes: IARI - YouTube

20PATH271 Fundamentals of Plant Pathology II

Course Code: 20PATH271

Course Credits: 2(1+1)
Contact hour: 4
Pre-Requisite: Nil

Mapping of course outcome PO/PSO

CO NO.	COURSE OUCOMES (CO)	PO	BTL
THEORY			
CO1	**Understand** the history of plant pathology, terms and concept of plant pathology, survival of plant pathogens, dispersal of plant pathogens.	1,3	2
CO2	**Understand** the phenomenon of infection, pathogenesis, toxins, defense mechanisms in plant.	1,3	2
CO3	**Develop and understand** biochemical defense mechanism, general principles of plant disease management, eradication-cultural methods, physical methods of eradication	1,3	2
CO4	**Gain knowledge** about important fungal and bacterial biocontrol agents, contact and systemic fungicides, contact and systemic fungicides, mode of action and formulations of fungicides, introduction to botanicals and other non-chemical preparations etc.	1,3	2
PRACTICAL			
CO5	**Practical study** on various laboratory equipments, preparation of media, isolation and Koch's postulates. Study of fungicides and their formulations. Methods of pesticide application. Calculation of fungicide sprays concentrations. Bioassay of fungicides, Bio-control of plant pathogens, Preparation of non-chemicals and botanicals against disease management.	1,2,3,8	3

COURSE OBJECTIVE:

1. Aim to understand the history of plant pathology, Terminology, and concept of plant pathology. Plant diseases and its classification.
2. Aim to know about Principles and methods of plant disease management. Chemical combination, classification, mode of action and formulations of fungicides and antibiotics.

SYLLABUS:

History of Plant Pathology, terminology, and concepts in Plant Pathology. Causes plant diseases, classification of plant diseases. Principles and methods of plant disease management. Nature, chemical combination, classification, mode of action and formulations of fungicides and antibiotics. **Practical:** Acquaintance with various laboratory equipments, preparation of media, isolation and Koch's postulates. Study of fungicides and their formulations. Methods of pesticide application and their safe use. Calculation of fungicide sprays concentrations. Bioassay of fungicides, Bio-control of plant pathogens, Incubation of *Trichoderma,* Pesticide equipments, Preparation of non-chemicals and botanicals against disease management (Panchagavy, botanical extracts, Bijamrita, Panchapatra kashayam)

REFERENCE:

1. Agrios, G.N. 2005.Plant Pathology. Elsevier Academic Press, New York.

2. Chaube, H.S. and Ramji Singh. 2001. Introductory Plant Pathology. International Book Distribution Co., Lucknow. 136

3. Mehrotra, R.S. 1980. Plant Pathology. Tata McGraw-Hill Publishing Co. Ltd., New Delhi.

4. Singh, R.S. 2002. Introduction to Principles of Plant Pathology. Oxford & IBH Publ. Co. Pvt. Ltd., New Delhi.

5. Vidyasekharan, P. 1993. Principles of Plant Pathology. CBS Publishers and Distributors, New Delhi.

WEB REFERENCE:

1. History of Plant Pathology [Year-1] - YouTube
2. Plant Disease Management Lecture - YouTube
3. FRAC | Home
4. Introduction to Plant Pathology - YouTube

20 PATH371-Diseases of Field and Horticultural Crops and their Management - I

Course Code: 20PATH371
L-T-P-S structure: 2-0-3-0
Course Credits: 3(2+1)
Contact hour: 5
Pre-Requisite: Nil

Mapping of course outcome PO/PSO

CO NO.	COURSE OUCOMES (CO)	PO	BTL
THEORY			
CO1	**Understand** the symptom, etiology, disease cycle and management of major diseases of the crops Rice, Wheat, Sorghum.	2,3	2
CO2	**Understand** the symptom, etiology, disease cycle and management of major diseases of the crops Sorghum, Maize, Bajra, Ragi, Cotton, Sugarcane.	2,3	2
CO3	**Develop and understand** the symptom, etiology, disease cycle and management of major diseases of the crops Sugarcane, Tobacco, Groundnut, Sesamum, Castor, Sunflower.	2,3	2
CO4	**Gain knowledge** about the symptom, etiology, disease cycle and management of major diseases of the crops Safflower, Mustard, Red gram, Bengal gram, Black gram and Green gram, Soybean, Cowpea.	2,3	2
PRACTICAL			
CO5	Practical study on identification and histopathological studies of selected diseases of field crops covered in theory. Field visit for the diagnosis of field problems. Collection and preservation of plant diseased specimens for Herbarium.	1,2,3,8	3

COURSE OBJECTIVE:

1. Aim to know about symptoms, etiology, disease cycle and management of major diseases of cereals crops, etc.
2. Aim to know about symptoms, etiology, disease cycle and management of major diseases of oil crops, pulses crop etc.

SYLLABUS:

Symptoms, etiology, disease cycle and management of major diseases of following crops: Rice: blast, brown spot, Sheath rot, stem rot, narrow brown leaf spot, sheath blight, false smut, bacterial leaf blight, Bacterial leaf streak, tungro and Khaira; Wheat: rusts, loose smut, karnal bunt, powdery mildew, alternaria blight, and ear cockle; Sorghum: anthracnose, rust, ergot, grain mold , leaf blight, smuts, Charcoal rot, downy mildew, and Striga; Maize: stalk rots, downy mildew, leaf spots, banded leaf and sheath blight and blights; Bajra :downy mildew, ergot, rust and smut; Castor: Phytophthora blight, grey mold, root rot, bacterial leaf spot, seedling blight, rust and wilt; Sunflower: Downy mildew, powdery mildew head rot, rust, mosaic, necrosis, Sclerotinia stem rot and Alternaria blight; Safflower : wilt, Alternaria leaf spot, mosaic and rust; Mustard: Alternaria blight, white rust, downy mildew, powdery mildew and Sclerotinia stem rot; Pigeonpea: Phytophthora blight, wilt and sterility mosaic, bacterial leaf spot; Gram: rust, dry root rot, wilt, grey mould and Ascochyta blight; black & green gram: Cercospora, Corynospora leaf spot, bacterial leaf spot, angular black spot, anthracnose, powdery mildew, rust, web blight ,yellow mosaic, leaf crinckle and cuscuta; Pea: downy mildew, powdery mildew and rust; Soybean: Rhizoctonia blight, bacterial spot, seed and seedling rot, rust and mosaic; Lentil: rust and wilt; **Practical** Identification and histopathological studies of selected diseases of field crops covered in theory. Field visit for the diagnosis of field problems. Collection and preservation of plant diseased specimens for Herbarium.

REFERENCE

1. Rangaswami, Gand K.Mahadevan. 2001. Diseases of crop plants in India. Prentice Hall of India Pvt.Ltd, New Delhi. 2. Singh, R.S. 2005. Plant Diseases. Oxford & IBH Publications, New Delhi

WEB REFERENCE:

1. The Life Cycle of Wheat Stem Rust - YouTube
2. The Life Cycle of Wheat Stem Rust - YouTube
3. Introduction To Plant Diseases - YouTube
4. Intro To Bacterial Pathogens - YouTube
5. Plant Disease | Plant | Biology | FuseSchool - YouTube

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20PATH372- Desease of field and horticulture crops and their management II

L-T-P-S structure: 1-0-3-0
Course Credits: 2(1+1)
Contact hour: 4
Pre-Requisite: Nil

Mapping of course outcome PO/PSO

CO NO.	COURSE OUCOMES (CO)	PO	BTL
THEORY			
CO1	Understand the etiology, symptoms, host-parasite relationship and specific management practices of the following horticultural crop diseases are citrus diseases, Mango diseases, Guava, Papaya, Ber and sapota diseases	2,3	2
CO2	Understand the etiology, symptoms, host-parasite relationship and specific management practices of the following horticultural crop diseases are Grapevine diseases, Apple and peach diseases, chillies diseases, Brinjal and Okra diseases.	2,3	2
CO3	Develop and understand the etiology, symptoms, host-parasite relationship and specific management practices of the following horticultural crops diseases are Potato diseases, Tomato diseases, Crucifers and cucurbits diseases.	2,3	2
CO4	Gain and understand the knowledge etiology, symptoms, host-parasite relationship and specific management practices of the following horticultural crops diseases are Beans, Colocasia and Coriander diseases, Coconut and oil palm diseases, Turmeric, ginger, mulberry diseases, Rose diseases.	2,3	2
PRACTICAL			
CO5	Practical study on various laboratory identification and histopathological studies of selected diseases of horticultural crops covered in theory. Field visit for the diagnosis of field problems. Collection and preservation of plant diseased specimens for herbarium.	1,2,3,8	3

COURSE OBJECTIVE:

1. Aim to study on symptoms, etiology, disease cycle and management of following diseases of vegetable crops, fruits crop, Plantation crops etc.

SYLLABUS:

Symptoms, etiology, disease cycle and management of following diseases: Citrus: canker, gummosis, felt, tristeza and greening; Mango: anthracnose, malformation, bacterial blight, powdery mildew, sooty

mould, red rust and Loranthus; Guava: wilt and anthracnose; Papaya: foot rot, anthracnose, leaf curl and mosaic and powdery mildew,Ber: Powdery mildew; Sapota: Flat limb,;Banana: Panama wilt, bacterial wilt, Erwinia rhizome rot, Sigatoka, bunchy top, banana mosaic and banana bract mosaic; Pomegranate: Anthracnose and bacterial blight; Grape vine: downy mildew, Powdery mildew, anthracnose, alternaria leaf spot and rust; Apple: scab, powdery mildew, fire 133 blight and crown gall; Peach: leaf curl ; Strawberry: leaf spot Chillies: Damping off, anthracnose and fruit rot, wilt, powdery mildew, Choanephora blight cercospora leaf spot, bacterial leaf spot, mosaic complex and leaf curl; Brinjal: Phomopsis blight and fruit rot, bacterial wilt, Sclerotinia blight and little leaf; Okra:Cercospora leaf spot, powdery mildew and Yellow Vein Mosaic; Potato: early and late blight, black scurf, common scab,wart, black leg, brown rot, leaf roll, mosaics, potato spindle tuber; Tomato: damping off, wilt, early and late blight, buck eye rot and leaf curl, Septoria leaf spot, bacterial canker, root knot, Tomato spotted wilt and mosaic; Cruciferous vegetables: Club root, white rust, Downy mildew, powdery mildew, Alternaria leaf spot and black rot; Cucurbits: downy mildew, powdery mildew, Cercospora leaf spot, wilt and CMV; Betelvine: Root and stem rot, Sclerotial wilt,Fusarial wilt, Anthracnose; Onion and garlic: Smudge, smut,purple blotch, and Stemphylium blight; Beans: anthracnose, rust, yellow mosaic, Bean common mosaic virus and bacterial blight; Colocasia: Phytophthora blight; Coriander: stem gall; Coconut: Stem bleeding, Ganoderma wilt, bud rot, grey blight and tatipaka; Oilpalm: Bunchrot and spear rot ; Tea: blister blight; Coffee: rust; Turmeric: leaf spot, leaf blotch, rhizome rot; Ginger: rhizome rot/soft rot, leaf spot; Mulberry:powdery mildew; Rose: dieback, powdery mildew and black leaf spot; Marigold: Botrytis blight; Chrysanthemum: wilt, stunt, septoria blotch;.Jasmine: rust; Crossandra : wil

Practical Identification and histopathological studies of selected diseases of horticultural crops covered in theory. Field visit for the diagnosis of field problems. Collection and preservation of plant diseased specimens for herbarium.

REFERENCE:

1. Rangaswami, G & Mahadevan, K.2001. Diseases of crop plants in India, Prentice Hall of India Pvt.Ltd, New Delhi.

2. Singh, R.S.2005. Plant Diseases. Oxford & IBH Publications, New Delhi

3. Pathak, V.N.2001. Diseases of Fruit crops. Oxford & IBH Publications, New Delhi

4. Singh, R.S.1999. Diseases of Vegetable crops. Oxford & IBH Publications, New Delhi

5. Chaube, H.S and V.S. Pundhir, 2012. Crop Diseases & Their Management. PHI Pvt.Ltd, New Delh

WEB REFERENCE:

1. Guidelines for Diagnosing Plant Problems - YouTube
2. Detecting Plant Diseases in the Lab - YouTube
3. Plant Disease | Plant | Biology | FuseSchool - YouTube

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20PATH 373- Principles of Integrated Pest and Disease management

Course Code: 20PATH373
L-T-P-S structure: 1-0-3-0
Course Credits: 2(1+1)
Contact hour: 4
Pre-Requisite: Nil

Mapping of course outcome PO/PSO

CO NO.	COURSE OUCOMES (CO)	PO	BTL
THEORY			
CO1	Understand the insect pests and diseases, IPM: Introduction, history, importance, concepts, principles and tools of IPM. Economic importance of insect pests, diseases and pest risk analysis. Methods of detection and diagnosis of insect pest and diseases. Calculation and dynamics of economic injury level and importance of Economic threshold level.	2,3	2
CO2	Understand the methods of control: Host plant resistance, cultural, mechanical, physical, legislative, biological and chemical control.	2,3	2
CO3	Develop and understand ecological management of crop environment. Introduction to conventional pesticides for the insect pests and disease management	2,3	2
CO4	Gain knowledge survey, surveillance and forecasting of Insect pest and diseases. Development and validation of IPM module. Implementation and impact of IPM (IPM module for Insect pest and disease. Safety issues in pesticide uses. Political, social and legal implication of IPM. Case histories of important IPM programmes.	2,3	2
PRACTICAL			
CO5	Practical study on various laboratory Methods of diagnosis and detection of various insect pests, and plant diseases, Methods of insect pests and plant disease measurement, Assessment of crop yield losses, calculations based on economics of IPM, Identification of biocontrol agents, different predators and natural enemies. Mass multiplication of *Trichoderma*, 136 Pseudomonas, *Trichogramma*, NPV etc. Identification and nature of damage of important insect pests and diseases and their management. Crop (agro-ecosystem) dynamics of a selected insect pest and diseases. Plan & assess preventive strategies (IPM module) and decision making. crop monitoring attacked by insect, pest and diseases. Awareness campaign at farmers fields.	1,2,3,8	3

COURSE OBJECTIVE:

1. Aim to understand IPM: Introduction, history, importance, concepts, principles and tools of IPM. Economic importance of insect pests, diseases and pest risk analysis. Methods of detection and diagnosis of insect pest and diseases, etc

2. Aim to know the conventional pesticides for the insect pests and disease management. Development and validation of IPM module. Implementation and impact of IPM (IPM module for Insect pest and disease. Safety issues in pesticide uses. Political, social and legal implication of IPM, etc

SYLLABUS:

Categories of insect pests and diseases, IPM: Introduction, history, importance, concepts, principles and tools of IPM. Economic importance of insect pests, diseases and pest risk analysis. Methods of detection and diagnosis of insect pest and diseases. Calculation and dynamics of economic injury level and importance of Economic threshold level. Methods of control: Host plant resistance, cultural, mechanical, physical, legislative, biological and chemical control. Ecological management of crop environment. Introduction to conventional pesticides for the insect pests and disease management. Survey, surveillance and forecasting of Insect pest and diseases. Development and validation of IPM module. Implementation and impact of IPM (IPM module for Insect pest and disease. Safety issues in pesticide uses. Political, social and legal implication of IPM. Case histories of important IPM programmes. **Practical -** Methods of diagnosis and detection of various insect pests, and plant diseases, Methods of insect pests and plant disease measurement, Assessment of crop yield losses, calculations based on economics of IPM, Identification of biocontrol agents, different predators and natural enemies. Mass multiplication of Trichoderma, 136 Pseudomonas, Trichogramma, NPV etc. Identification and nature of damage of important insect pests and diseases and their management. Crop (agro-ecosystem) dynamics of a selected insect pest and diseases. Plan & assess preventive strategies (IPM module) and decision making. crop monitoring attacked by insect, pest and diseases . Awareness campaign at farmers fields.

REFERENCE:

1. Dhaliwal, G. S. and Ramesh Arora 2001. Integrated pest management: Concepts and approaches, Kalyani Publishers Ludhiana.

2. Metcalf, R. L .and Luckman, W. H. 1982. Introduction to insect pest management. Wiley inter science publishing, New York.

3. Larry P Pedigo 1991. Entomology and pest management, Prentice Hall of India Private Ltd., New Delhi.

4. Venugopala Rao, N., Umamaheswari, T., Rajendraprasad, P., Naidu, V.G and Savithri, P. 2004. Integrated Insect Pest Management. Agrobios (India) Limited, Jodhpur.

5. Chaube, H.S. and Ramji Singh. 2001. Introductory Plant Pathology. International Book Distribution Co., Lucknow. 136.

6. Mehrotra, R.S. 1980. Plant Pathology. Tata McGraw-Hill Publishing Co. Ltd., New Delhi.

7. Singh, R.S. 2002. Introduction to Principles of Plant Pathology. Oxford & IBH Publ. Co.P. Ltd., New Delhi.

8. Vidyasekharan, P. 1993. Principles of Plant Pathology. CBS Publishers and Distributors, New Delhi.

9. Y. L. Nene and P.N. Thaplial, 1993., Fungicides in Plant Disease Control. Oxford and IBH Publishing Co

WEB REFERENCE:

1. Guidelines for Diagnosing Plant Problems - YouTube
2. Detecting Plant Diseases in the Lab - YouTube
3. What is Integrated Pest Management (IPM)? How it works and why it's important - YouTube
4. Area-wide Integrated Pest Management (AW-IPM) - YouTube
5. Introduction to Integrated Pest Management - YouTube

20HORT181: Fundamentals of Horticulture

L-T-P-S	1-0-3-0
Credits	2
Contact hours	4
Prerequisites	NIL

Mapping of Course Outcomes with PO/PSO

CO NO	Course Outcome (CO) PO/PSO	PO/PSO	Blooms Taxonomy l (BTL)
CO1	Understand the scope and importance of horticulture, divisions of horticulture, classification of horticultural crops, climate and soil requirements	PO1,PO3	2
CO2	Application of propagation methods and orchard establishment	PO3	3
CO3	Apply knowledge of aspects of orchard management viz training, pruning, management of juvenility, flower bud differentiation and unfruitfulness problems in addition to vegetable and ornamental gardens.	PO3	3
CO4	Apply knowledge of fertiliser and irrigation management schedules in addition to lawn making and use of growth regulators	PO3	3
CO5	Implement basic plant propagation and irrigation methods	PO1,PO3	4

Syllabus:

Theory

Horticulture-Its definition and branches, Importance and scope of horticulture, Horticultural and botanical classification, Climate and soil for horticultural crops, Plant propagation-methods (sexual & asexual), propagating structures; separation,

division, grafting, budding, layering), High density planting; Use of rootstocks; Orchard establishment; (Principles & Layout) Principles and methods of training and pruning, Juvenility and flower bud differentiation; Unfruitfulness; pollination, pollinizers and pollinators; fertilization and parthenocarpy; Vegetable gardens & ornamental garden types and parts; Lawn making, Use of plant bio-regulators in horticulture, Irrigation methods in horticulture crops, Fertilizers application-methods.

Practical

Identification of garden tools, Identification of horticultural crops, Preparation of seed bed/nursery bed, Practice of sexual and asexual methods of propagation, Layout and planting of orchard plants, Training and pruning of fruit trees, Transplanting and care of vegetable seedlings, Making of herbaceous and shrubbery borders, Preparation of potting mixture, potting and repotting, Fertilizer application in different crops, Visits to commercial nurseries/orchard.

References:

1. Chadha, K.L. 2001. Handbook of Horticulture. ICAR, New Delhi.
2. Jitendra Singh, 2012. Basic Horticulture. Kalyani Publishers. New Delhi.
3. Randhawa, G.S. and Mukhopadhyaya, A. 1994. Floriculture in India. Allied Publishers Pvt. Ltd., New Delhi
4. Kumar, N. 1997. Introduction to Horticulture. Rajyalakshmi Publications, Nagorcoil, Tamilnadu.

Video links:

1. https://www.youtube.com/watch?v=rgc2UnxJhNI
2. https://www.youtube.com/watch?v=QALxEt6OFpc
3. https://www.youtube.com/watch?v=THTo6xPCF8A
4. https://www.youtube.com/watch?v=e-wO-LqEQb4

20HORT182: Production Technology for Fruits and plantation crops

L-T-P-S	1-0-3-0
Credits	2
Contact hours	4
Prerequisites	NIL

Mapping of Course Outcomes with PO/PSO

O No:	CO	PO	Btl
1	understand the basics of fruit and plantation crop industry	1,3	3

2	Apply principles of crop production of major fruit crops	1,3	3
3	Apply principles of crop production of minor fruit crops and plantation crops	1,3	3
4	Apply principles of crop production of cashew, tea, coffee and rubber	1,4	3
5	Hands on approach on identification of suitable crop varirties, pests and diseases in fruit crops	1,3	3

Theory

Importance and scope of fruit and plantation crop industry in India; Production technologies for the cultivation of major fruits-Mango, Banana, Citrus, Grape, Guava & Litchi, Papaya, Apple, Pear, Peach , Minor fruits- Pineapple, Pomegranate, Jackfruit, Strawberry, Nut crops (Almond & Walnut), Plantation crops-Coconut, Areca nut, Cashew, Tea, Coffee & Rubber.

Practical

Seed propagation, Scarification and stratification of seeds, Propagation methods for fruit and plantation crops including Micro-propagation, Description and identification of fruit, Preparation of plant bio regulators and their uses, Pests, diseases and physiological disorders of above fruit and plantation crops, Visit to commercial orchard.

References:

1. Bose, T.K. and Mitra, S.K. 1990. Fruits – Tropical and Sub-tropical. Naya Prakashan, Calcutta.
2. Chattopadhya, P. K. Year.Text Book on Pomology (Fundamentals of Fruit Growing). Kalyani Publishers, Ludhiana.
3. Bijendra Singh. 2012. Horticulture at a Glance. Kalyani Publishers, Ludhiana
4. Parthasarathy, V. A., P.K.Chattopadhyay and Bose, T.K. 2006. Plantation Crops. Vol I and II. Parthasankar basu Naya Udyog, Kolkata.
5. Kumar, N., Abdul Khader, J.B.M, Rangaswamy, P. and Irulappan, I. 2004. Introduction to Spices, Plantation crops, Medicinal and Aromatic Crops. Oxford and IBH publishing Co, New Delhi.

Video links:

1. https://www.youtube.com/watch?v=sexoTj5WjKk
2. https://www.youtube.com/watch?v=cnvXlx0fA5o

3. https://www.youtube.com/watch?v=x_Wbl4Hf7ew
4. https://www.youtube.com/watch?v=kXOTs4an5Ms

https://www.youtube.com/watch?v=8fC9QGsWbZg

20HORT281: Production Technology for Vegetables and Spices

L-T-P-S	1-0-3-0
Credits	2
Contact hours	4
Prerequisites	NIL

Mapping of Course Outcomes with PO/PSO

CO No:	CO	PO	Btl
1	Apply the production practices of Tomato, Brinjal & Chilli, Okra & Leafy vegetables	1,3	3
2	Apply the production practices and their management of melons	1,3	3
3	Apply the constraints in productions aspects of root and bulb crops.	1,3	3
4	Apply the scope, importance and future perspective of spices.	1,4	3
5	Demonstrating the seed extraction, nursery raising, direct seed sowing and transplanting, Harvesting & preparation for market, of vegetables and spices cultivation	1,3	3

Theory

Importance of vegetables & spices in human nutrition and national economy, Tomato- origin, area, production, improved varieties and cultivation practices such as time of sowing, sowing, transplanting techniques, planting distance, fertilizer requirements, irrigation, weed management, harvesting, storage, physiological disorders, disease and pest control and seed production Brinjal & Chilli, Okra & Leafy vegetables, Cucurbits – Cucumber & Melons , Gourds - Ridge gourd, Bitter gourd, Bottle gourd Snake gourd, Cole crops- Cabbage & Cauliflower, Peas & beans (Cluster bean, French bean. Dolichos), Root crops (carrot & radish), Tapioca & sweet potato, Perennial vegetables – drumstick & curry leaf, Bulb crops – onion & garlic, Black pepper, Cardamom, Ginger & turmeric, Coriander, Cumin & Fenugreek

Practical

Identification of vegetables & spices crops and their seeds. Nursery raising, Direct seed sowing and transplanting, Study of morphological characters of different vegetables & spices, Fertilizers applications, Raising of nursery of vegetables & spices, Vegetables & **spices seed** extraction, Harvesting & preparation for market, Economics of vegetables and spices cultivation.

References:

1. Pranab Hazra, A. Chattopadhyay, K. Karmakar and S. Dutta. 2010. Modern Technology in Vegetable Production. New India Publishing Agency, New Delhi.
2. Neeraj Pratap Singh, .2007. Basic Concepts of Vegetable Science. International Book Distributing Co. New Delhi. Academic Press, New Delhi.
3. Nempal Singh, Singh, D.K., Singh, Y.K. and Virendra Kumar. 2006. Vegetable Seed Production Technology. International Book Distributing Co. Lucknow.
4. Prem Singh Arya and S. Prakash 2002. Vegetables Growing in India. Kalyani publishers, New Delhi
5. Bose, T. K, Kabir, J., Maity T. K., Parthasarathy V. A., and Som M. G., 2002. Vegetable Crops Vol. II & III Naya Prokash, Kolkata.
6. Shanmugavelu, K.G., N. Kumar and K.V. Peter 2005. Production Technology of Spices and Plantation Crops. Agrobios (India), Jodhpur.

Video links:

5. https://www.youtube.com/watch?v=sexoTj5WjKk

6. https://www.youtube.com/watch?v=cnvXlx0fA5o
7. https://www.youtube.com/watch?v=x_Wbl4Hf7ew
8. https://www.youtube.com/watch?v=kXOTs4an5Ms
9. https://www.youtube.com/watch?v=8fC9QGsWbZg

20HORT282: Production Technology for Ornamental Crops, Medicinal and Aromatic Plants and Landscaping

L-T-P-S	1-0-3-0
Credits	2
Prerequisites	4
	NIL

Mapping of Course Outcomes with PO/PSO

CO No:	CO	PO	Btl

1	Understand the importance and scope of ornamental crops and landscaping	1,11	2
2	Apply the production practices of commercial flowers in protected cultivation.	3,4	3
3	Apply the scope, importance and future prospectus in cultivation of medicinal and aromatic plants.	1,11	3
4	Apply the techniques of processing and value addition in ornamental crops and MAPs produce	1,2	3
5	Apply nursery techniques *viz.* bed preparation, seed sowing, training and pruning, harvesting and post- harvest handling of cut and loose flowers.	4	3

Theory

Importance and scope of ornamental crops, medicinal and aromatic plants and landscaping. Principles of landscaping, Landscape uses of trees, shrubs and climbers, Production technology of important cut flowers like rose, gerbera, carnation, lilium and orchids under protected conditions and gladiolus & tuberose, chrysanthemum under open conditions. Package of practices for loose flowers like marigold and jasmine under open conditions. Production technology of important medicinal plants like asparagus, aloe, costus, periwinkle, isabgol and Aromatic plants like mint, lemongrass, citronella, Palmarosa, Ocimum, Geranium, Vetiver. Processing and value addition in ornamental crops and MAPs produce.

Practical

Identification of Ornamental plants, Identification of Medicinal and Aromatic Plants. Nursery bed preparation and seed sowing, Training and pruning of Ornamental plants, Planning and layout of garden, Bed preparation and planting of MAP, Protected structures

References:

7. Pranab Hazra, A. Chattopadhyay, K. Karmakar and S. Dutta. 2010. Modern Technology in Vegetable Production. New India Publishing Agency, New Delhi.
8. Neeraj Pratap Singh, .2007. Basic Concepts of Vegetable Science. International Book Distributing Co. New Delhi. Academic Press, New Delhi.
9. Nempal Singh, Singh, D.K., Singh, Y.K. and Virendra Kumar. 2006. Vegetable Seed Production Technology. International Book Distributing Co. Lucknow.
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and Plantation Crops. Agrobios (India), Jodhpur.

Video links:

10. https://www.youtube.com/watch?v=sexoTj5WjKk
11. https://www.youtube.com/watch?v=cnvXlx0fA5o
12. https://www.youtube.com/watch?v=x_Wbl4Hf7ew
13. https://www.youtube.com/watch?v=kXOTs4an5Ms
14. https://www.youtube.com/watch?v=8fC9QGsWbZg

20HORT381: Post-Harvest Management and value Addition of Fruits and Vegetables

L-T-P-S	1-0-3-0
Credits	2
Contact hours	4
Prerequisites	NIL

CO No:	CO	PO	BTL
1	To interpret the scope and importance of post-harvest technology of fruits and vegetables	3	2
2	To explain about the important disease, disorders and factors responsible for post-harvest losses in fruits and vegetables.	11	2
3	To understand post-harvest handling, different methods storage, principles and methods of preservation.	3	2
4	To gain knowledge on processing, value addition and packaging of fruits and vegetables	3	2
5	Demonstration of chilling and freezing injury in vegetables and fruits, Extraction and preservation of pulps and juices, Preparation of products, quality control	3	3

Theory

Importance 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; Role of ethylene; Post harvest disease and disorders; Heat, chilling and freezing injury; Harvesting and field handling; Storage (ZECC, cold storage, CA, MA, and hypobaric); Value addition concept; Principles and methods of preservation; Intermediate moisture food- Jam, jelly, marmalade, preserve, candy – Concepts and Standards; Fermented and non- fermented beverages. Tomato products- Concepts and Standards; Drying/ Dehydration of fruits and vegetables – Concept and methods, osmotic drying. Canning -– Concepts and Standards, Packaging of products.

Practical

Applications of different types of packaging containers for shelf life extension, Effect of temperature on shelf life and quality of produce, Demonstration of chilling and freezing injury in vegetables and fruits, Extraction and preservation of pulps and juices, Preparation of jam, Preparation of Jelly, Preparation of RTS, Preparation of Nectar, Preparation of Squash, Osmotically dried products, Fruit bar and Candy and Tomato products, Canned products, Quality evaluation of products — physico-chemical and sensory, Visit to processing unit/ industry

References

1. Rathore, N.S., Mathur, G.K., Chasta, S.S. 2012. *Post-harvest Management and Processing of Fruits and Vegetables.* ICAR, New Delhi.
2. Srivastava, R.P. and Sanjeev Kumar. 2002. *Fruit and Vegetable Preservation: Principles and Practices.* International Book Distribution Company, Lucknow.
3. Giridharilal, G.S., Siddappa and Tondon, G.L. 2007. *Preservation of Fruits and Vegetables*. ICAR, New Delhi.
4. Mitra, S.K. 2005. *Post Harvest Physiology and Storage of Tropical and Subtropical Fruits*. CABI Publishers, Kolkatta.

Video links:

https://www.youtube.com/watch?v=6oF_Pz9DGcs

https://www.youtube.com/watch?v=zThmD6nrrRA

https://www.youtube.com/watch?v=TAEfoh4obnc

https://www.youtube.com/watch?v=CvB_Ma62YAs

ELCT 283: Hi-Tech Horticulture

L-T-P-S	2-0-3-0
Credits	3
Contact hours	5
Prerequisites	NIL

Mapping of Course Outcomes with PO/PSO

CO NO	Course Outcome (CO) PO/PSO	PO/PSO	Blooms Taxonomy Level (BTL)
CO1	Understand the scope and importance of hi-horticulture, Micro propagation, Nursery management, Mechanization, Protected cultivation	PO1, PO3	2
CO2	Application of Greenhouse technologies, Micro irrigation systems, Canopy management,	PO3	3
CO3	Apply knowledge of High Density orcharding, Precision farming, Remote sensing, Geographical Information System, Differential Global Positioning System.	PO3	3
CO4	Apply knowledge of Variable Rate applicator, Precision farming, Mechanized harvesting of produce, Green food production	PO3	3
CO5	Implement basic knowledge on nursery and greenhouse management	PO1, PO3	4

Syllabus:

Theory

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

Practical

Types of Polyhouses and shade net houses, intercultural operations, tools and equipments identification and application, micro propagation, nursery-portrays, microirrigation, EC, pH-based fertilizer scheduling, canopy management, visit to hi-tech orchard/nursery.

References:

1. Prasad, S. And Kumar, U. 2012. Greenhouse Management of Horticultural Crops. 2nd
2. Singh, H.P., Singh, G., Samuel, J.C., and Pathak, R.K. 2003. Precision Farming in Horticulture. NCPAH, MOA, PFDC, CISH, Lucknow.
3. Srivasthava, K.K. 2007. Canopy Management of Fruit Crops. International book
4. distributing co., Lucknow
5. Sahu, K.C. 2008. Textbook of Remote Sensing and Geographical Information Systems. Atlantic publishers & Distributors

Video links:

https://www.youtube.com/watch?v=gs8tkUK4y2o
https://www.youtube.com/watch?v=YFWxdjFGNV4
https://www.youtube.com/watch?v=W-EvuYmS5sM
https://www.youtube.com/watch?v=AGcYApKfHuY

ELCT 382: Landscaping

L-T-P-S	2-0-3-0
Credits	3
Contact hours	5
Prerequisites	NIL

Mapping of Course Outcomes with PO/PSO

CO NO	Course Outcome (CO)	PO/PSO	Blooms Taxonomy Level (BTL)
CO1	Understand the scope and importance landscaping and its principle, Garden types, Terrace gardening, Vertical gardening	PO1, PO3	2
CO2	Application of Garden components or features in Arches and Pergolas, Garden adornments, Lawn making, Turfing	PO3	3

CO3	Apply knowledge on Gardens for special purposes- Trees, Shrubs, Herbaceous perennials, Climber and creepers, Ornamental grasses	PO3	3
CO4	Apply knowledge on Cacti, Bio-aesthetic Planning, Landscaping of urban and rural areas, Landscaping of schools, Bonsai, Computer Aided Designs	PO3	3
CO5	Implement basic knowledge on landscaping and designing	PO1, PO3	4

Syllabus:

Theory

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

Practical

Identification of trees, shrubs, annuals, pot plants; Propagation of trees, shrubs and annuals, care and maintenance of plants, potting and repotting, identification of tools and implements used in landscape design, training and pruning of plants for special effects, lawn establishment and maintenance, layout of formal gardens, informal gardens, special type of gardens (sunken garden, terrace garden, rock garden) and designing of conservatory and lath house. Use of computer software, visit to important gardens/ parks/ institutes.

References:

1. Bhattacharjee, S. K. 2004. Landscape Gardening and Design with plants. Aavishkar Publishers and Distributers,
2. Bose, T.K. 1999. Floriculture and Landscaping. Naya Prakash, Kolkatta.
3. Chadha K.L and Choudhary, B. *Ornamental Horticulture in India*. ICAR, New Delhi.
4. Randhawa, G.S. and Mukhopadhyaya, A. 1998. Floriculture in India. Allied Publishers Pvt. Ltd., New Delhi
5. Bose T.K., B. Chowdhury and S.P. Sharma 2001. Tropical garden plants in colour. Horticulture and Allied Publishers, Kolkata.

Video links:

https://www.youtube.com/watch?v=e-wO-LqEQb4

https://www.youtube.com/watch?v=638PZqS7H-g

https://www.youtube.com/watch?v=CC-rBOPbS00
https://www.youtube.com/watch?v=CB_rXABU8DI

ELCT 383: Protected Cultivation

L-T-P-S	2-0-3-0
Credits	3
Contact hours	5
Prerequisites	NIL

Mapping of Course Outcomes with PO/PSO

CO NO	Course Outcome (CO)	PO/PSO	Blooms Taxonomy Level (BTL)
CO1	Understand the scope and importance Protected cultivation, green houses, Greenhouse design, Cladding material involved in greenhouse, Environment control	PO1, PO3	2
CO2	Application of Soil preparation and management, Types of benches and containers, Irrigation management, Automation	PO3	3
CO3	Apply knowledge on ~~Fertilizer requirement of~~ Carnation, Chrysanthemum, Gerbera, Orchids, Anthurium, Tulip Apply knowledge on cultivation of Tomato, Bell pepper,	PO3	3
CO4	Cucumber, Strawberry, Pot plants, Off-season production of flowers and vegetables, Disease management in green houses	PO3	3
CO5	Implement basic knowledge on protected cultivation of commercial crops	PO1, PO3	4

Syllabus:

Theory

Protected cultivation- importance and scope, Status of protected cultivation in India and World types of protected structure based on site and climate. Cladding material
involved in greenhouse/ poly house. Greenhouse design, environment control, artificial lights, Automation. Soil preparation and management, Substrate management. Types of benches and containers. Irrigation and fertigation management. Propagation and production of quality planting material of horticultural crops. Greenhouse cultivation of important horticultural crops – rose,

carnation, chrysanthemum, gerbera, orchid anthurium, lilium, tulip, tomato, bell pepper, cucumber, strawberry, pot plants, etc Cultivation of economically important medicinal and aromatic plants. Off-season production of flowers and vegetables. Insect pest and disease management

Practical

Raising of seedlings and saplings under protected conditions, use of protrays in quality planting material production, Bed preparation and planting of crop for production, Intercultural operations, Soil EC and pH measurement, Regulation of irrigation and fertilizers through drip, fogging ad misting.

References:

1. Vilas M. Salone and Ajay K. Sharma.2012. *Greenhouse Technology and Applications*. Agrotech Publishers. New Delhi
2. S. Prasad and U. Kumar. 2012. Greenhouse Management of Horticultural Crops.
   Second edition, Agrobios. New Delhi
3. Joe.J.Hanan. 1998. Green houses: Advanced Technology for Protected Horticulture, CRC Press, LLC. Florida.
4. K.Radha Manohar and C. Igathinathane, 2013. Greenhouse Technology and Management BS Publications.
5. Paul V. Nelson. 1991. Green House Operation and Management. Ball publishing
   USA.

Video links:

1. https://www.youtube.com/watch?v=DJ68AcpTKcA
2. https://www.youtube.com/watch?v=mdOaT4IxjDY
3. https://www.youtube.com/watch?v=thOkBGTtiUU
4. https://www.youtube.com/watch?v=kT73Zm4Xk1U

Semester	:	**First semester**
Course Name	:	**Human Values & Ethics (non gradial)**
Course Code	:	**20AEXT190**
L-T-P structure	:	**1-0-0-0**
Course Credits	:	**1(1+0)**
Course Coordinator	:	
Course Instructors	:	

MAPPING OF COURSE OUTCOMES WITH PO/PSO

COURSE OUTCOMES (CO): CO NO.	COURSE OUTCOMES (CO)	PO/PSO	BTL

THEORY			
CO1	Understand the significance of value inputs in a classroom and start applying them in their life and profession.	1, 8	2
CO2	Discuss about the Positive spirit, and Ethics, for the humans and Sensitization towards others particularly senior citizens, developmentally challenged and gender	1, 5, 8	2
CO3	Discuss the basic principles and practices of Positive attitude and scientific temper. Teamwork and volunteering. Rights and responsibilities, Road safety.	1, 8	2
CO4	Explain the Human relations and family harmony, modern challenges and value conflict, other social evils. Developing personal code of conduct (SWOT/SWOC/SNAC Analysis).	1, 7	2

COURSE OBJECTIVE:

1. To impart knowledge to the students on the nutrition education is to get consumers to eat a diet that promotes health and decreases the risk of nutrition-related diseases.
2. To build knowledge on food preservation techniques.

SYLLABUS

THEORY

CO1: 1. Universal human aspirations, happiness and prosperity
2. Human values and ethics - Concept, definition, significance, and sources - Fundamental values - Right conduct, peace, truth, love, and non-violence.
3. Principles and philosophy – Self exploration, self-awareness, self-satisfaction, decision making, motivation, sensitivity, success, selfless service.
4. Case study of ethical lives.

CO2: 5. Positive spirit, body, mind and soul - Attachment and detachment.
6. Spirituality and spirituality quotient.
7. Examinations.
8. Ethics - Professional, environmental, ICT - Sensitization towards others particularly senior citizens, developmentally challenged and gender.

CO3: Positive attitude and scientific temper, team work and volunteering, rights and responsibilities of the young people towards the society and importance of road safety.

CO4: Human relations and family harmony, modern challenges and value conflict. Sensitization against drug abuse and other social evils. Developing personal code of conduct (SWOT/SWOC/SNAC Analysis). Management of anger and stress.

REFERENCE BOOKS:

1. Gaur RR, Sanga lR and Bagaria GP. 2011. *A Foundation Course in Human Values and Professional Ethics*. Excel Books.
2. Mathur SS. 2010. *Education for Values, Environment and Human Rights*. RSA International.
3. Sharma RA. 2011. *Human Values and Education - Axiology, Inculcation and Research*. R. Lall Book Depot.
4. Sharma RP and Sharma M. 2011. *Value Education and Professional Ethics*. Kanishka

Publishers.
5. Srivastava S. 2011. *Human Values and Professional Ethics*. S K Kataria and Sons.
6. Srivastava S. 2011. *Environmental Science*. S K Kataria & Sons.
7. Tripathi A.N. 2009. *Human Values*. New Age International (P) Ltd Publishers.
8. R.S. Nagarajan. *Textbook on Professional Ethics & Human Values.*
9. D.R. Kiran. *Professional Ethics & Human Values*
10. Veerendra Kumar. *Human Values and Professional Ethics.*
11. M.Govindarajan. *Engineering Ethics.*

WEB REFERENCES/MOOC'S:

1. https://www.youtube.com/watch?v=8dLqGLKr3t8
2. https://www.youtube.com/watch?v=8dLqGLKr3t8&list=RDLV8dLqGLKr3t8&start_radio=1&rv=8dLqGLKr3t8&t=68
3. https://www.youtube.com/watch?v=Eaf5DElwhso

COURSE HANDOUT FOR RURAL SOCIOLOGY & EDUCATIONAL PSYCHOLOGY
ALL FOUR-YEAR BSc AGRICULTURE (Hons) PROGRAM

Semester	:	**First semester**
Course Name	:	**R ral S i l g and Ed a i nal P h l g**
Course Code	:	**20AEXT191**
L-T-P structure	:	**1-0-3-0**
Course Credits	:	**2(1+1)**
Course Coordinator	:	**M. Padmavathy**
Course Instructors	:	

MAPPING OF COURSE OUTCOMES WITH PO/PSO

COURSE OUTCOMES (CO):

CO NO.	COURSE OUTCOMES (CO)	PO/PSO	BTL
THEORY			
CO1	Evaluate the knowledge of rural sociology its importance and characteristics of Indian rural society, social groups, social stratification, in agricultural extension	1, 8	4
CO2	Explain the concept of educational psychology, intelligence, perceptions, in agricultural extension	1, 5	4
CO3	Apply the knowledge of culture, social values, social institutions, and social change, social control and attitudes, leadership and training in Agricultural Extension	1, 5, 6, 7 8	4
CO4	Apply educational psychological methods to assess farmer's personality and understand different types of emotions, frustration determinants, and motivate them by different teaching learning methods, to bring in a behavioural change	1, 5, 6, 7 8	4
PRACTICAL			

CO5	Apply and understand the Rural sociology and educational psychology for practical purpose	8	4

COURSE OBJECTIVE:

1. To Impart Knowledge to the Students on Sociological and Psychological aspects of rural people.
2. To acquaintain with some important features of rural sociology
3. To explain the structure and functioning of rural societies in India
4. To discuss the role of human behavior in effecting constructive changes for rural development
5. To impart knowledge on education psychology for the development of rural people

SYLLABUS

THEORY
CO1:

Sociology and Rural Sociology - Meaning, definition, scope, its significance in Agricultural Extension - Importance of Rural Sociology in Agricultural Extension and their interrelationship. Indian rural society - Characteristics, differences and relationship between rural and urban society. Social group(s) – Meaning, definition, classification, factors to be considered in formation of groups - Role of social groups in Agricultural Extension. Social Stratification – Meaning, definition, bases and forms of social stratification, characteristics and differences between class system and caste system.

CO2:

Different cultural concepts - Culture, tradition, customs, folkways, mores, taboos, ritual - Definition, meaning, concept and examples and their role in Agricultural Extension. Social values - Meaning, definition and types; social control - Meaning, definition, need of social control and means of social control and attitudes - Types and their role in Agricultural Extension. Social institution – Types – Family, education, religious, economic (Co-operative society) & political (Panchayat) - Characteristics, functions and their importance/ role in Agricultural Extension. Social change - Meaning, definition, nature of social change, dimensions of social change and factors of social change & development.

CO3: Psychology and educational psychology - Meaning, definition, scope and its importance in Agricultural Extension – Behavior - Cognitive, affective and psychomotor domains. Intelligence - Meaning, types, factors and importance in Agricultural Extension. Perception - Meaning, types, factors and importance in Agricultural Extension. Emotions and frustration - Meaning, types, factors and importance in Agricultural Extension.

CO4: Personality - Meaning, definition, types, factors influencing personality and importance in Agricultural Extension. Motivation - Meaning, types of motives, theories of motivation and importance of motivation in Agricultural Extension. Teaching, learning, learning experience, learning situation - Meaning and definition, elements of learning situation and its characteristics. Principles of learning, their implications in teaching and steps in extension teaching.

PRACTICAL
CO5: 1. Visit to village to study the characteristics of rural society and rural stratification.
2. Visit to village to study the social groups.
3. Visit to village to study the village institution – School
4. Visit to village to study the village institution – Cooperative society/ Bank.

5. Visit to village to study the village institution – Gram Panchayat.
6. Visit to village to study the social organization - Youth Club/ Rytu Mitra group.
7. Visit to village to study the social organization - Milk Co-operative centre/ Dairy unit.
8. Visit to village to study the social organization - Water User Association/ Self Help Group.
9&10 Visit to a village to list out the customs - Folkways, mores, taboos, rituals and social values - Simulated exercises on perception of students.
11. Simulated exercises for positive and negative emotions of students.
12. Nature of learner's behavior in motivation.
13.&14. Administering psychological tests to assess personality types of human beings. Experiment: 1. Eysenk personality inventory Administering psychological tests to assess personality types of human beings. 2. Edward's personality inventory.
15. To study the types of intelligence among students.
16. Creating a learning situation under village conditions with a selected technology

REFERENCE BOOKS:

1. Adivi Reddy, A. 2006. *Extension Education*. Sree Lakshmi Press, Bapatla
2. Chitamber, J. B. 1997. *Introductory Rural Sociology*. Wiley Eastern Limited, New Delhi
3. Daivadeenam, P. 2006. *Educational Psychology in Agriculture*. Agrotech Publishing Academy, Udaipur
4. Mangal, S. K. 2000. *Educational Psychology*. Prakash Brothers, Ludhiana.
5. Ray, G. L. 2006. *Extension Communication and Management*. Naya Prokash/ Kalyani Publishers, Ludhiana
6. VidyaBhushan and Sach Dev. D. R. 1998. *An Introduction to Rural Sociology*. Kitab Mahal Agencies Allahabad

WEB REFERENCES/MOOC'S:

1. https://www.youtube.com/watch?v=aGahvcb0Tx8
2. https://www.youtube.com/watch?v=upeGGJYDjGk
3. https://www.youtube.com/watch?v=69dqe1fMpvQ
4. https://www.youtube.com/watch?v=y8yCJ9J-FQs
5. https://nptel.ac.in/courses/109/104/109104047/#

Semester	:	**First semester**
Course Name	:	**u da e ta s of ag icu tu a e te sio**
Course Code	:	**20AEXT291**
L-T-P structure	:	**2-0-3-0**
Course Credits	:	**3 (2+1)**
Course Coordinator	:	
Course Instructors	:	

MAPPING OF COURSE OUTCOMES WITH PO/PSO

COURSE OUTCOMES (CO):

CO NO.	COURSE OUTCOMES (CO)	PO/PSO	BTL

THEORY			
CO1	Understand the term Education; Extension Programme planning Meaning, Process, Principles and Steps in Programme Development Agricultural developmental programs launched by different organisations in India	8	4
CO2	Analyse the Agricultural developental programs and new trends in Agricultural Extension, and community development and Rural development in India	7,8	4
CO3	Analyse the Panchayat Raj system, poverty allivation programs, women development programs, PRA, rural leadership and training and administration of extension in rural areas	7 8	4
CO4	Explain the transfer of technology, training of farmers, Extension teaching methods, functions of communication methods, Agriculture journalism, Diffusion and adoption of innovation and its characteristics.	8, 9	4
PRACTICAL			
CO5	Use different types of extension teaching methods evaluation and visits relevent to the course under practical work.	5	4

COURSE OBJECTIVE:

1. The basic objectives of the extension education are the overall development of the rural people.
2. To bring about desirable changes in the human behavior, which includes change in knowledge, skill and attitude.
3. The dissemination of useful and practical information relating to agriculture, including improved seeds, fertilizers, implements, pesticides, improved cultural practices, dairying, poultry nutrition etc.
4. To make the people aware that agriculture is a profit table profession.
5. To create an environment for rural people so that they can show their talent, leadership and efficiency.
6. To provide appropriate solution of the farmer's problems.
7. To bring the scientist closer to the farmers.

SYLLABUS

THEORY
CO1:

Education - Meaning, definition and Types – Formal, non-formal and informal education. Extension Education – Meaning, definition, concepts - Characteristics, scope and process. Objectives and principles of extension education. Extension programme planning – Meaning, process, principles. Extension programme planning – Steps in programme development. Extension systems in India. Extension efforts in pre-independence era – Sriniketan, Marthandam, Sevagram, Firka Development Scheme, Gurgaon Experiment, etc. Extension efforts in post-independence era - Etawah pilot project, Nilokheri experiment etc. Extension/Agriculture development programme launched by ICAR/Govt. of India – IADP, IAAP and HYVP.

CO2:

Extension / Agriculture development programme launched by ICAR / Govt. of India – SFDA, MFAL and T & V System. Extension / Agriculture development programme launched by ICAR / Govt.

of India, KVK, ORP and ND. IVLP.Extension / Agriculture development programmes launched by ICAR / Govt. of India – NATP, ATMA, SREP, ATIC. NAIP. New trends in agriculture extension – Privatization extension and cyber extension / e-extension. New trends in agriculture extension – Market led extension, farmer-led extension, expert systems, etc. Community development – Meaning, definition, concept and principles - Philology of C.D. Rural development - Meaning, definitions, concept, characteristics, objectives, importance and problems in rural development. Rural development launched by Govt. of India – National Extension Service (NES), Panchayat Raj Systems/ Democratic Decentralization and Panchayat Raj – Need.

CO3: Rural development launched by Govt. of India – Three tiers of Panchayat Raj system – Powers, functions and organization set up -Mandal system in Andhra Pradesh. Social justice and poverty alleviation programmes – ITDA, IWDP and NERP. Social justice and poverty alleviation programmes – IRDP, JRY, SGRY, SGSY and MGNREGP. Women development programmes – ICDS, DWCRA, RMK, MSY, ANTWA and IKP. Participatory Rural Appraisal (PRA) Rural leadership - Meaning, definition and concept, types of leaders in rural context, roles of leaders and different methods in selection of a leader. Training of leaders – Lay and professional leaders, advantages and limitations in
using local leaders in Agricultural Extension. Extension administration - Meaning, definition and concept, principles and functions - Monitoring and evaluation – Meaning, definition and concept,
objectives - Types and importance and monitoring and evaluation of extension programmes.

CO4: Transfer of technology - Concept and models and capacity building of extension personnel farmers – Training – Meaning, definition, types of training – Pre-Service training - In-service, orientation, induction training, refresher training and training for professional qualification. Training of farmers, farm women and rural youth – Farmers' Training Centre (FTC) - Objectives – Training organized - District Agricultural Advisory and Transfer of Technology Centre (DAATTC) – Objectives. Extension teaching methods - Meaning, classification, individual, group and mass contact methods, media mix strategies and communication - Meaning and definition Functions of communication, models – Aristotle, Shannon, Weaver, Berlo,Schramm, J.P. Leagans, Rogers and Shoemaker, Litterer, Westley – Macleans and barriers to communication. Agriculture journalism – Meaning – Scope – Importance - Characteristics of News – Factors determining the News value – Types of News and sources of News. Diffusion and adoption of innovation - Meaning, definition, concepts and process and stages and Models of adoption process – Five (5) and Seven (7) stage models - Attributes of innovation – Relative advantage, compatibility, complexity, trialability – obsrevability and predictability. Innovation – Decision process – Meaning – Stages (Knowledge, persuasion, decision, implementation andconfirmation) - Decision process – Meaning – Stages (Knowledge, persuasion, decision, implementation and confirmation) – Concepts - Dissonance – Rejection – Active rejection and passive rejection – Discontinuance – Replacement and disenchantment discontinuance – Over adoption – Rate of adoption and innovativeness. Adopter categories and their characteristics - Factors influencing adoption process – Social, personal and situational.

PRACTICAL

CO5:

1 Audio-visual aids – Meaning, importance and classification - Selection, planning, preparation, evaluation, presentation and use of audio-visual aids – Charts.

2. Selection, planning, preparation, evaluation, presentation and use of audio-visual aids – Charts, posters, flip charts, flash cards, plannel graphs.

3. Selection, planning, preparation, evaluation, presentation and use of audio-visual aids – Power point slides.

4. Planning and preparation of extension literature – Leaflet, folder, pamphlet, booklet, news stories and success stories.

5. Handling and use of audio visual equipments such as public address equipment (PAE) system and still camera and digital camera and Liquid Crystal Display (LCD) Projector.

6. Group discussion – Simulated exercise.

7. Visit to a village to study on going rural development and agricultural developmental programmes.

8. To study and familiarize university extension system.
9. Visit to KVK.
10. Visit to Farmers' Training Centre (FTC).
11. Visit to District Agricultural Advisory and Transfer of Technology Centre (DAATTC).
12. Visit to study organization and functioning of DRDA, DWMA, ATMA, JDA Office and other development departments at district level.
13. Visit to a village to exercise PRA techniques.
14. Visit to community radio and television studio for understanding the process of programme production, Script writing.
15. Developing script for radio.
16. Developing script for television.

REFERENCE BOOKS:

1. Adivi Reddy, A. 2006. *Extension Eduation*. Sree Lakshmi Press, Bapatla.
2. Dahama, O.P. and Bhatnagar, O.P. 1999. *Extension and Communication for Development*. Oxford & IBH Private Limited, New Delhi/Mumbai.
3. Ganesh, R., Mohammad Iqbal and Ananda Raja. 2003. *Reaching the Unreached - Basics of Extension Education*. Associate Publishing Company, New Delhi.
4. Jalihal, K.A. and Veerabhadraiah, V. 2007. *Fundamentals of Extension Education and Management in Extension*. Concept Publishing House, New Delhi.
5. Ray, G.L. 2006. *Extension Communication and Management*. NayaProkash/Kalyani Publishers, Kalkatta/Ludhiana.

WEB REFERENCES/MOOC'S:

1. https://nptel.ac.in/courses/126105014/
2. https://www.youtube.com/watch?v=aGahvcb0Tx8
3. https://www.youtube.com/watch?v=upeGGJYDjGk
4. https://www.youtube.com/watch?v=69dqe1fMpvQ
5. https://www.youtube.com/watch?v=y8yCJ9J-FQs
6. https://nptel.ac.in/courses/109/104/109104047/#

Semester	:	**First semester**
Course Name	:	**Entrepreneurship Development and Business Communication**
Course Code	:	**20AEXT292**
L-T-P structure	:	**2-0-3-0**
Course Credits	:	**3 (2+1)**
Course Coordinator	:	
Course Instructors	:	

MAPPING OF COURSE OUTCOMES WITH PO/PSO

COURSE OUTCOMES (CO):

CO NO.	COURSE OUTCOMES (CO)	PO/PSO	BTL
THEORY			

CO1	Analyze the business environment in order to identify business opportunities, and learn the basic terms entrepreneurship developmental programs	8, 9, 10, 11	4
CO2	Explain the Generation, incubation and commercialization of business ideas and SWOT analysis and government policies for the rural economic development. And identify the elements of success of entrepreneurial ventures,	8, 9, 10, 11	4
CO3	Consider the legal and financial conditions for starting a business venture, and stems in establishment of MSME management	8, 9, 10, 11	4
CO4	Evaluate the effectiveness of different entrepreneurial strategies, program planning, marketing skills and assessment of entrepreneurial skills.	8, 9, 10, 11	4
PRACTICAL			
CO5	Specify the basic performance indicators of entrepreneurial activity, Field visits to study any one Agri - based industries/ business – Strengths, Weaknesses, Opportunities and Threats (SWOT) analysis. And go to the visit to different industries to understand the business skills under practical work	10, 11	4

COURSE OBJECTIVE:

1. The basic objectives of the extension education are the overall development of the rural people.
2. To bring about desirable changes in the human behavior, which includes change in knowledge, skill and attitude.
3. The dissemination of useful and practical information relating to agriculture, including improved seeds, fertilizers, implements, pesticides, improved cultural practices, dairying, poultry nutrition etc.
4. To make the people aware that agriculture is a profit table profession.
5. To create an environment for rural people so that they can show their talent, leadership and efficiency.
6. To provide appropriate solution of the farmer's problems.
7. To bring the scientist closer to the farmers.

SYLLABUS
THEORY
CO1:

Concept of entrepreneur, entrepreneurship - Distinction between an entrepreneur and a manager - Management - Management functions – Planning- Organizing - Directing - Motivation - Ordering - Leading – Supervision - Communication and Control. Characteristics of entrepreneurs - Opportunities for entrepreneurship and rural entrepreneurship - Types of entrepreneurs and functions of entrepreneurship. Agri – entrepreneurship - Concept, need and scope - Assessing overall business environment in Indian economy and globalization and the emerging business entrepreneurial environment. Entrepreneurship development programmes (EDPs) – Objectives, phases, problems of EDPs - Entrepreneurial behavior and role of achievement - Motivation, factors affecting entrepreneurship development.

CO2:

Generation, incubation and commercialization of business ideas – Environment scanning and opportunity identification - Researching/ Managing competition - Ways to define possible Competitors. Globalization and the emerging business entrepreneurial environment - Role of ED in economic development of a country - Overview of Indian social, political systems and their implications for decision making by individual entrepreneurs. SWOT Analysis - Concept, meaning and advantages.

Government policies, incentives, programmes and schemes for entrepreneurship development - Export and import policies relevant to Indian Agriculture sector.

CO3:

Institutional support - Financial Institutions and other agencies in entrepreneurship development Venture capital (VC), contract farming (CF) and joint ventures (JV) - Public-private partnerships (PPP). Overview of agricultural input industry – Seed, fertilizer, pesticides, farm machinery and agricultural food processing industry. Steps in establishment of MSME Enterprise - Planning of an enterprise – Project identification - Selection of the product/ services - Selection of form of ownership - Registration, selection of site, capital sources, acquisition of manufacturing know how, packaging and distribution.

CO4:

Project planning - Formulation and project report - Meaning - Importance - Components and preparation. Supply chain management - Meaning, advantages, stages and process and total quality management. Marketing management - Market types - Marketing assistance - Market strategies - Definition of business - Stakeholders in business - Stages of Indian business - Importance of agribusiness in Indian economy -Social responsibility of business - Morals and ethics in enterprise management. Assessment of entrepreneurship skills - Business leadership skills - Communication skills for entrepreneurship development – Developing organizational skill - Developing managerial skills - Problem solving skill and time management skills.

PRACTICAL

CO5:

1. Field visits to study any one Agri - based industries/ business – Strengths, Weaknesses, Opportunities and Threats (SWOT) analysis.
2. Field visits to study the constraints in setting up of agro based industries - Formulation of project feasibility reports and industrial and agri-business houses.
3. Field visits to study the formulation of project feasibility reports.
4. Field visits to study the industrial and agri-business houses.
5. Field visits to study the characteristics of successful entrepreneurs.
6. Field visits to study the any one of the Local Financial Institutions to study the MSME Policies.
7. Field visits to study the Entrepreneurial Development Institute to study the Process of Entrepreneurship Development.
8. Field visits to the local Public - Private Enterprises to study the Enterprise Establishment and Management Process.
9. Field visit to the local Public - Private Enterprises to study the Assessing entrepreneurial potential problem-solving ability.
10. Field visits to the local Public - Private Enterprises to study the managerial skills and achievement motivation.
11. Practicing exercise in creativity and time audit.
12. Practicing exercise in preparation of business plan and proposal writing.
13. Visit to nearest Agri - Clinic and Agri - Business Centre's if any.
14. Power Point Presentation of Assignments - Session I
15. Power Point Presentation of Assignments - Session II
16. Power Point Presentation of Assignments - Session III

References Books

1 Anil Kumar, S., Poornima, S. C., Mini, K., Abraham andJayashree, K. 2003. *Entrepreneurship Development*. New Age International Publishers, New Delhi
2 Bhaskaran, S. 2014. *Entrepreneurship Development & Management*. Aman

Publishing House, Meerut
3 Gupta, C.B. 2001. *Management: Theory and Practice*. Sultan Chand and Sons, New Delhi
4 Indu Grover 2008. *Handbook on Empowerment and Entrepreneurship*. Agrotech Publishing Academy, Udaipur
5 Khanka, S.S. 1999. *Entrepreneurship Development*. S. Chand and Co., New Delhi
6 Mary Coulter 2008. *Entrepreneurship in Action*. Prentice Hall of India Pvt. Ltd., New Delhi
7 Mohanty, S.K. 2009. *Fundamentals of Entrepreneurship*. Prentice Hall of India Pvt. Ltd., New Delhi
8 Prasad, R. 2003. *Entrepreneurship - Concepts and Cases*. I C F A I Publications, Hyderabad
9 SagarMondal and Ray, G. L. 2003. *Textbook of Entrepreneurship and Rural Development*. Kalyani Publishers,Ludhiana
10 Singh, D. 1995. *Effective Managerial Leadership*. Deep and Deep Publications, New Delhi
11 Vasanta Desai. 1997. *Small Scale Industries and Entrepreneurship*. Himalaya Publishing House, New Delhi
12 Vasanta Desai. 2000. *Dynamics of Entrepreneurial Development and Management*. Himalaya Publishing House, New Delhi

WEB REFERENCES/MOOC'S:

1. https://www.digimat.in/nptel/courses/video/110106141/L06.html
2. https://www.digimat.in/nptel/courses/video/126104004/L01.html
3. https://www.digimat.in/nptel/courses/video/110105054/L01.html

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Admin Off: 29-36-38, Museum Road, Governorpet, Vijayawada - 520 002. Ph: +91 - 866 -2577715, Fax: +91-866-2577717.

Semester	**: First semester**
Course Name	**: Co u icatio S i s a d e so a ity Development**
Course Code	**: 20AEXT391**
L-T-P structure	**: 2-0-3-0**
Course Credits	**: 3 (2+1)**
Course Coordinator	**:**
Course Instructors	**:**

MAPPING OF COURSE OUTCOMES WITH PO/PSO

COURSE OUTCOMES (CO):

CO NO.	COURSE OUTCOMES (CO)	PO/PSO	BTL
THEORY			

CO1	Analyze basic communication skills, voice modulation, while giving presentations to the public.	9	4
CO2	Analyze intercultural communication skills, Reading and comprehension of general and technical articles and precise writing - summarizing, abstracting, individual group presentations, human behaviour.	8,9	4
CO3	Analyze interpersonal communication skills and transactional analysis.	8, 9	4
CO4	Analyze public speaking communication skills, Negotiation skills, stress management and conflict management - Meaning, concept, steps and techniques, emotional intelligence, teamwork, and creativity.	8, 9	4
PRACTICAL			
CO5	Use the better communication methods for the better understanding of the rural people.	9	4

COURSE OBJECTIVE:

1. The students will be able to perform well on social ground.
2. To help the student to be creative, and analytical.
3. To develop their own specific skills.
4. Polishing manners to behave appropriately in professional circles.
5. Developing and maintaining optimistic nature.
6. Understanding the art of entertaining.

SYLLABUS

THEORY

CO1:

Communication - Meaning and process of communication, verbal and nonverbal communication. Communication skills - Structural and functional grammar. Listening and note taking, writing skills, oral presentation skills. Voice modulation basics and their usage for meaningful impact on people.

CO2:

Field diary and lab record; indexing, footnote and bibliographic procedures. Reading and comprehension of general and technical articles and precise writing - summarizing, abstracting; individual group presentations. Extempore, impromptu and prepared presentations, public speaking; group discussion - Organizing seminars and conferences. Human behaviour - Domains and components of behaviour.

CO3:

Personality and personality development - Meaning, scope, importance, factors influencing personality - Traits and type, approaches. Personality theories. Importance of wants, desires, needs, drives, motives, aspirations, interests, objectives and goals in personality development. Transactional analysis, - Importance, methods and strategies.

CO4:

Negotiation skills, stress management and conflict management - Meaning, concept, steps and techniques. Emotional intelligence - Meaning, concept and importance. Creativity - Meaning, concept, components and characteristics of creative people. Team work - Meaning, concept, characteristic features of effective teams, types of teams, factors affecting and role of team work.

PRACTICAL

CO5:

1. Communication - Meaning and process of communication.
2. Overview of non verbal communication skills, signs of body language.
3. Non verbal communication skills - Practicing conscious body postures and movements.
4. Overview of verbal communication skills.
5. Practicing listening and note taking and writing skills.
6. Practicing oral presentation skills.
7. Practicing writing of field diary and lab record - Indexing, footnote and bibliographic procedures.
8. Practicing reading and comprehension of general and technical articles.
9. Practicing precise writing, summarizing, abstracting.
10. Exercise on individual and group presentations.
11. Practicing of extempore, impromptu, impromptu presentation, public speaking.
12. Evaluative exercises on video recorded mock group discussions and interviews.
13. Practical exposure on organizing seminars and conferences.
14. Evaluative exercise on recorded video programme to build the confidence levels
15. Practical exercise on importance of team work.
16. Practical exercise on importance of time management

References Books

1. Dangi K.L., S.S. Sisoda, Pravesh Singh Chauhan and Yogita Ranavat. *A Text Book of Communication Skills*. Agrotech Publications.
2. Mangal S.K. 2016. *Essentials of Educational Psychology*. PHI Learning Private Ltd., New Delhi.
3. Nirajkumar. 1997. *A Genesis of Behavioural Science*. Gyan Publishing House, New Delhi.
4. Eric Berne. 1964. *Games People Play-The Psychology of Human Relationship*. Grove Press Publishers.
5. Thomas Anthony Harris. 1967. *I am Ok You are Ok*. Harper Publishers.
6. Scott Bill. 1981. *Skills of Negotiating*.
7. Goleman Daniel. 1995. *Emotional Intelligence*.
8. Ratan Reddy B and Supriya Reddy. *Soft Skills for Professional Excellence*.
9. Shivkhera. 2002. *You can win*. MacMillan Publishing Company. New Delhi
10. Shivaraman K. 2009. *Communication Skills*. APH publications.

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1. https://www.youtube.com/watch?v=U99ZMzL-HWU
2. https://nptel.ac.in/courses/109/104/109104107/
3. https://nptel.ac.in/courses/109/104/109104107/

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Admin Off: 29-36-38, Museum Road, Governorpet, Vijayawada - 520 002. Ph: +91 - 866 - 3500122, 2577715, 2576129.

Semester	:	**First**
Course	:	**Fundamental of Biochemistry and Biotechnology**
Course Code	:	**20BICM101**
L-T-P structure	:	**2-0-3-0**
Course Credits	:	**3(2+1)**
Course Coordinator	:	
Course Instructors	:	

MAPPING OF COURSE OUTCOMES WITH PO/PSO

COURSE OUTCOMES (CO):

CO NO.	COURSE OUTCOMES (CO)	PO/PSO	BTL
THEORY			
CO1	Memorize the knowledge on Carbohydrates, Lipids and Proteins	1	1
CO2	Understand the enzymes and nucleic acids functions.	4,6	2
CO3	Apply the metabolic pathways to plants.	2, 3,10	3
CO4	Apply the biotechnology in crop improvement.	5,7,8,9,11	3
PRACTICAL			
CO5	Apply the qualitative test for Carbohydrates, amino acids, and Nucleic acids.	4,7	3

COURSE OBJECTIVE:

The objective of the course is to introduce the fundamentals of plant biochemistry, applied technologies, and their potential in improving productivity. The course will provide exposure to contemporary technologies and successful implementation of the same for crop improvement.

SYLLABUS

THEORY

CO1: Introduction - Historical aspects of Biochemistry- Scope, impact and importance of Biochemistry in plant sciences -Properties of water - PH - Buffers. Carbohydrates- Classification - Structures - Monosacharides - Structural aspects- mutarotation - Reducing and oxidizing properties. Oligosaccharides and polysaccharides-Functions of carbohydrates. Lipids - Fatty acids - Structures and properties - Functions of lipids. Lipids - Classification - Storage lipids and membrane lipids - Saponification, hydrogenation, Iodine number and Acid value. Amino acids - Structures - Classification - Zwitterions – Titration. Peptides - Oligopeptides - Cyclic and acyclic peptides - Malformin, Glutathione, Gramicidin - Functions of peptides. Proteins -Importance - Classification - Properties of proteins -Isoelectric pH - Denaturation - Protein sequencing - Edman degradation method. Proteins - Structural organization - Primary, secondary, tertiary and quaternary structures and forces involved in stabilizing proteins.

CO2: Enzymes - Characteristics of enzymes - Chemical nature, speed, specificity, active site - activation energy - Mechanism of enzyme action. Classification of enzymes - Isoenzymes -

Multienzyme complex - Allosteric enzymes and coenzymes. Measurement of enzyme activity - Factors effecting enzyme activity - Enzyme Inhibition - MM & LB plots. Nucleic acids - Functions - Structures of nitrogen bases - Nucleosides - Nucleotides in RNA and DNA. Various types of DNA and RNA - Secondary structure of B-DNA and t-RNA.

CO3: Metabolism - Anabolism and Catabolism - Stages of respiration - Overall metabolic view of carbohydrates, proteins and lipids. Metabolism of carbohydrates - Glycolysis - Aerobic and anaerobic. Tricarboxylic Acid (TCA) cycle- Glyoxalate cycle - Electron transport chain. Metabolism of lipids -Biosynthesis of fatty acids and tri acyl glycerol. Catabolism of lipids a, B & y oxidation of fatty acids in brief and a oxidation in detail. Protein Biosynthesis and post translational modifications. Secondary metabolites - Terpenoids - Alkaloids - Phenolics – Importance

CO4: Biotechnology - Major - Concepts and importance - Applications of plant biotechnology. Introduction to plant tissue culture - History - Scientists - Terminology - Steps in general tissue culture - Types of sterilization and nutrient media - Types of cultures -Organ cultures, cell suspension culture, callus culture, pollen culture and their applications. Micropropagation - Procedure techniques - Organogenesis and embryogenesis-Problems - Advantages - Limitations. Anther culture - embryo culture - Ovule culture - Somatic embryogenesis - Synthetic seeds and its applications. Protoplast isolation and fusion - Somatic hybridization - Cybrids - Somaclonal variations and applications in crop improvement - Cryo preservation. Recombinant DNA methods - Introduction to genetic engineering - Definitions - Gene cloning - Vectors. Gene transfer methods - Indirect methods (Agrobacterium) and direct methods (physical-gene gun method; chemical-PEG mediated and other methods) with case studies / examples. Transgenic plants - Present status - Applications in crop improvement - Limitations - biotechnology regulations. Polymerase chain reaction (PCR) - Procedure and applications. Markers - Morphological, biochemical and molecular markers - RFLP, RAPD and SSR - Marker assisted selection for crop improvement.

PRACTICAL

CO5: Preparation of solutions, pH and buffers. Qualitative tests for carbohydrates. Qualitative tests amino acids. Estimation of amylase in rice. Estimation of reducing sugar/Total soluble sugars. Estimation of proteins by Lowrys method. Extraction of oil from oil seeds by soxhlet apparatus. Effect of PH, temperature and substrate concentration on enzyme action. Paper chromatography/ TLC demonstration for separation of amino acids. Sterilization techniques. Composition of various tissues culture media and preparation of stock solutions for MS nutrient medium. Callus induction from various explants. Micropropagation - Hardening and acclimatization. Demonstration of isolation of DNA and of gel electrophoresis technique. Demonstration of PCR Technique. Demonstration of DNA finger printing -RAPD and Restriction digestion.

REFERENCE BOOKS:

1. David L. Nelson, Michael M.Cox; W.H. Freeman. Lehninger *Principles of Biochemistry*, 6E
2. *Biochemistry*, Dr.U.Satyanarayana, Dr.U. Chakrapani, Books and Allied(P) Ltd, Kolkata
3. *Biochemistry*, S.N.Gupta, Rastogi Publications, First Edition, 2011
4. *Introduction to Plant Biotechnology* by HS Chawla (3rd Edition), Oxford & IBH Publishing Co. Pvt Ltd., New Delhi.

WEB REFERENCES/MOOC'S:

1.https://nptel.ac.in/courses/104/105/104105076/

2. https://agrigyan.in/bioch-311fundamentals-of-plant-biochemistry-sknau-notes/

3. https://www.youtube.com/watch?v=pUMZ9CM6m3o

4.https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=&cad=rja&uact=8&ved=2ahUKEwizrqDBofTzAhWuyzgGHTZ0AoMQFnoECAMQAQ&url=https%3A%2F%2Fwww.vnmkv.ac.in%2Fstudent-academic%2FStudy_Material_Practical_Manual_Fundamental_of_Plant_Biochemistry_Biotechnology.pdf&usg=AOvVaw0scYOx-WdaXrF7tSk9EKq5

Semester	**:**	
Course Name	**:**	**Principles of Food Science and Nutrition**
Course Code	**:**	**20BICM 300**
L-T-P structure	**:**	**2-0-0-0**
Course Credits	**:**	**2(2+0)**
Course Coordinator	**:**	
Course Instructors	**:**	

MAPPING OF COURSE OUTCOMES WITH PO/PSO

COURSE OUTCOMES (CO):

CO NO.	COURSE OUTCOMES (CO)	PO/PSO	BTL
THEORY			
CO1	Evaluate the information on food science and nutrition issues appearing in the popular press.	3, 7	3
CO2	Discuss the important pathogen and spoilage microorganism in foods, and preservation techniques	3, 7	3
CO3	Discuss basic principles and practices of cleaning and sanitation in food preparation operation	3, 7	3
CO4	Explain the malnutrition, energy metabolism, balanced diet, menu planning and new trends in food science and nutrition in maintaining health.	3, 7	3

COURSE OBJECTIVE:

4. To impart knowledge to the students on the nutrition education is **to get consumers to eat a diet that promotes health and decreases the risk of nutrition-related diseases**.
5. To build knowledge on food preservation techniques.

SYLLABUS

THEORY

CO1: Concepts of food science - Definitions of food, specific nutrients in foods and their functions - Physical characteristics of foods – Importance, Food physical characteristics - Density - Phase

change, pH, osmosis, surface, tension, colloidal systems. Food composition - Food chemistry - Water, solutions, water balances in body, clinical signs of water depletion, excessive water intake, recommended requirements, Carbohydrates - Structure, properties of sugars, starches, cellulose and hemicelluloses, pectin, gums. Proteins - Structure, amino-acids, properties. Fats and oils - Structure, functional aspects. Vitamins - Retinol, vitamin D, vitamin E, vitamin K, ascorbic acid, B-complex group Minerals, pigments, colours, flavours

.

CO2: Natural emulsifiers. Organic acids. Oxidants and antioxidants. Enzymes. Food microbiology - Morphology and fine structure of bacteria - Cultivation of bacteria, nutritional requirements - Nutritional classification of bacteria. Introduction to yeast, algae and protozoa and virus, general characteristics Microbial spoilage of foods - Factors affecting kinds, numbers, growth and survival of microorganisms in foods. Production of fermented foods - Production, purification and estimation of beer/ ethanol.

.

CO3: Preservation by heat treatment - Principle and equipment for blanching. Preservation by heat treatment - Canning, pasteurization, sterilization. Preservation by use of low temperature - Principle, methods, equipment Preservation by chemicals - Antioxidants, mould inhibitors, antibodies, acidulants, etc. Preservation by irradiation - Principle, methods, equipment. Preservation by fermentation - Principles, methods, equipment Preservation by drying, dehydration and concentration - Principle, methods, equipment. Food and nutrition - History of diet around the world - European diet.

CO4: Malnutrition (over and under nutrition), body cell, digestion and absorption, energy and calories, obesity and weight control. Nutritional disorders that can compromise health. Energy etabolism - arbohydrates, individual sugars, sugars and diabetes mellitus, glycemic response, dietary carbohydrates Energy metabolism - Fat, synthesis, control, biosynthesis, cellular degradation, peroxidation. Energy metabolism - Proteins, synthesis, catabolism, ammonia and urea. Balanced/modified diets, diet selection. Menu planning. New trends in food science and nutrition

REFERENCE BOOKS:

1. Sumati R. Mudambi, Shalini M. Rao and M.V. Rajagopal. 2006. *Food Science,* 2nd Ed. New Age International (P) Limited, New Delhi.
2. Martin Eastwood. 2003. *Principles of Human Nutrition.* Blackwell Science Ltd., Oxford.
3. Norman N. Potter. 1998. *Food Science,* 5th Ed. Springer Science+ Business Media, New york.
4. Michael J. Pelczar Jr., E.C.S. Chan and Noel R. Krieg. 1998. *Microbiology,* 5th Ed. Tata McGraw-Hill Education, New Delhi.
5. William C. Frazier and & Dennis C. Westfoff. 1987. *Food Microbiology,* 4th Ed. Tata McGraw-Hill Education, New Delhi.
6. L.E. Casida Jr. 1968. *Industrial Microbiology.* New AgeInternational Publishers, New Delhi.
7. P. Fellows. 2000. *Food Processing Technology: Principles and Practice,* 2nd Ed. CRC Press, Boca Raton, FL, USA.
8. Marcus Karel and Darvl B. Lund.2003. *Physical Principles of Food Preservation,* 2nd

Ed. Marcel Dekker, Inc., NY, USA.

9. Gerald Wiseman. 2002. *Nutrition and Health*. Taylor & Francis, London.

10. *An Introduction to Nutrition*, v. 1.0

WEB REFERENCES/MOOC'S:

1. https://nptel.ac.in/courses/126/105/126105015/
2. https://www.youtube.com/watch?v=_kf9yZR4ZnU
3. http://www.digimat.in/nptel/courses/video/126104004/L35.html
4. http://www.digimat.in/nptel/courses/video/126104004/L01.html
5. http://www.digimat.in/nptel/courses/video/126104004/L47.html

20LSPM201: Live Stock and Poultry Management

L-T-P-S	2-0-3-0
Credits	3
Contact hours	5
Prerequisites	NIL

MAPPING OF COURSE OUTCOMES WITH PO/PSO

COURSE OUTCOMES (CO):

CO No:	CO	PO	BTL
1	Understand the role and importance of live-stock	11	2
2	Apply principles of livestock rearing	10	2
3	Apply principles of Management of different types of cattle	10	2
4	Apply principles of Formulation of rations and feeding	10	2
5	Identification methods of farm animals and poultry and identification methods of farm animals and poultry	11	3

SYLLABUS

THEORY

Role of live-stock in the national economy. Reproduction in farm animals and poultry. Housing principles, space requirements for different species of livestock and poultry. Management of calves, growing heifers and milch animals. Management of sheep, goat and swine. Incubation, hatching and brooding. Management of growers and layers. Important Indian and exotic breeds of cattle, buffalo, sheep, goat, swine and poultry. Improvement of farm animals and poultry. Digestion in livestock and poultry. Classification of feedstuffs. Proximate principles of feed. Nutrients and their functions. Feed ingredients for ration for livestock and poultry. Feed supplements and feed additives. Feeding of live-stock and poultry. Introduction of live-stock and poultry diseases. Prevention (including vaccination schedule) and control of important diseases of livestock and poultry.

PRACTICAL

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

Video links

1. https://www.youtube.com/watch?v=FQMSDpMJAsM
2. https://www.youtube.com/watch?v=p_rtdPtdmAU
3. https://www.youtube.com/watch?v=Bb5KMny0QEQ

Semester	:	
Course Name	:	**Agricultural Microbiology**
Course Code	:	**20AMBE101**
L-T-P structure	:	**1-0-3-0**
Course Credits	:	**2(1+1)**
Course Coordinator	:	
Course Instructors	:	

MAPPING OF COURSE OUTCOMES WITH PO/PSO

COURSE OUTCOMES (CO):

CO NO.	COURSE OUTCOMES (CO)	PO/PSO	BTL
THEORY			
CO1	Explain the contributions of eminent scientists in microbial world, Role of microbes in fermentation, Protection against infection, applied aspects of Microbiology, morphological types of Bacteria	1,2, 3	3

CO2	Explain the Microbial Nutrition, Metabolic pathways, Cell Division, Bacterial genetics	1,2, 3	3
CO3	Explain the role of microbes in fertility of soils and plant growth, Nitrogen cycle, Nitrogen, PGPR Organisms in human welfare	1,2, 3	3
CO4	Explain the Types of fermentations, Bio-fertilizers Bio-pesticides, Bio-fuel Production- Biodegradation - Biogas, Bio-manures and Composting Technologies for the welfare of agricultural society	1,2, 3	3
PRACTICAL			
CO5	Use basic laboratory equipment, apparatus and procedures for the study of microorganisms and to isolate and recognize major groups of microorganisms.	1,2, 3 5	3

COURSE OBJECTIVE:

1. To gain knowledge of the role played by microorganisms in agriculture
2. To gain basic knowledge and skill in microbiological techniques
3. To gain knowledge on the biology of different groups of microorganisms of importance in agriculture.
4. To impart knowledge on the principles of Microbiology and role of microorganisms in improving agricultural production

SYLLABUS
THEORY

CO1:

Introduction- Definition- The hidden world of microbiology- How microbes evolved on earth- General classification of microbes-Microorganisms and principles of microbiology- Scope of microbiology.Brief History of microbiology - Spontaneous generation theory- Contributions of Antony VanLeeuwenhoekFrancesco Redi- Lazzaro Spallanzani- Franz Schulze- Schroder and Von Dusch- LouisPasteur- John Tyndall. Role of microbes in fermentation-Contributions of Cagnaird Latour-TheodorSchwann, F.Kutzing- Louis Pasteur - Germ theory of disease - Contribution of Hippocrates-Louis Pasteur-Robert Koch - Pure Culture Methods- Joseph ListerRobert Koch-Beijerinck-Winogradsky- FrancoisAppert- Schroder and Von DushJohn Tyndall. Protection against infection-Contributions of EdwardJenner- F. Loeffler- BehirngKitasasto- Louis Pasteur - Applied aspects of Microbiology- Agriculturalmicrobiology-Industrial microbiology-Food Microbiology - Medical microbiology – Water Microbiology -Geochemical Microbiology- Pollution microbiology – Air microbiology – Exo-Microbiology - Microbialbiotechnology. Morphological types of Bacteria , Bacteria cell Structure- External and internal cellstructures- Differences between Prokaryotes and Eukaryotes.

CO2:

Microbial Nutrition- Autotrophy -Chemoautotrophy- Photoautotrophy.6. Heterotrophy – Metabolic pathways-Glycolysis-HMP-ED-TCAcycle.7. Growth of Microorganisms - Cell Division - Growth cycle of bacteria [Lag phase, Log phase,Stationary and Death phase]- Generation time- Growth rate- Growth yield- Synchronous - Diauxic growth.8. Bacterial genetics- Genetic recombination- Transformation- ConjugationTransduction- Plasmids-Transposon.

CO3:

Role of microbes in fertility of soils and plant growth - Rhizosphere- Rhizoplane- Phyllosphere- Phylloplane - Microflora- Carbon cycle- Carbon dioxide fixation. Nitrogen cycle - Mineralisation- Immobilisation- Nitrification- Denitrification- Nitrogen Fixation - Phosphorus cycle, phosphorus solubilisation – Oxidation – Reduction - Sulphur Cycle-Oxidation and reduction. Biological nitrogen fixation - Symbiotic- Associative- Asymbiotic- Nitrogen fixation In *Azolla* - *Blue green algae* - Actinorhizal symbiosis - *Frankia*, Phosphate solubilizing microorganisms - *Bacillus* - *Pseudomonas*- *Mycorrhiza* for Phosphorous uptake. PGPR Organisms - *Bacillus – Pseudomonas – Azotobacter – Azospirillum – Rhizobium* -Microbes in human welfare.

CO4:

Types of fermentations - Batch - Batch fed- Continuous - Solid State Fermentations, Common microbial fermentations-Alcohol- Lactic acid- Butyric acid- Formic acid - Butanediol- Propionic Acid- Mixed Acid - Fermentation technology- Alcoholic beverages production. Biofertilizers (Bacterial-Cyanobacterial-Fungal) production technology- Silage Production Technology. Biopesticides- Viruses (*Nucleo polyhedrosis virus - Granular viruses*) – Bacteria (*Bacillus thuringiensis, Bacillus papilliae*) - fungi (*Beauveria - Verticillium*) – Protozoa (*Malameba locustae- Mattesia Spp*)-Mode of action. Biofuel Production- Biodegradation - Biogas, Biomanures and Composting Technologies.

PRACTICAL

CO5:

1. Introduction to microbiology laboratory and its equipments.
2. Microscope- Parts, principles of microscopy, resolving power and numerical aperture.
3. Micrometry-Measurement of size of microorganisms.
4. Methods of sterilization.
5. Bacterial staining procedures-Simple staining - Gram's staining and Endospore staining.
6. Nutritional media and their preparations.

7 & 8. Enumeration of microbial population in soil- Bacteria, fungi and actinomycetes.

9 Methods of isolation, purification and maintenance of microbial cultures.

10 Isolation of *Rhizobium* from legume root nodule.

11 Isolation of *Azotobacter.*

12 Isolation of phosphate solubilising bacteria/Phosphate solubilizing fungi PSB/PSF.

13 Isolation of *Azospirillum* from roots.

14 Staining and microscopic examination of biofertilizer organisms.

15 Isolation *of VAM* from soil by wet sieving and decantation technique.

16 Determination of *VAM* root colonization by staining the infected roots.

REFERENCE BOOKS:

1. *Microbiology*. Pelczar, J.r., M.J.E.C.S.Chan and Krieg, N.R. (5th Ed.) 2015. McGraw Hill Publishers, New York.
2. *Microbiology*. Prescott, L.M., Harley, J.P. and Klein, D.A. (9th Ed.) 2014. McGraw Hill Publishers, New York.
3. *Brock Biology of Microorganisms*.Madigan, M.,Martinko, J.M and Parker, J. (14Ed.) 2015. Prentice hall of India Pvt Ltd., New Delhi.
4. *Soil Microbiology*: Subba Rao, N.S. (4th Ed.) 2014. Oxford and IBH Publishing Company Pvt. Ltd., New Delhi.

5. *Microbiology A Laboratory Manual*: James, C and Natile, S. (10th Ed.) 2014. Pearson India Education Services Pvt. Ltd., South Asia.

6. *Experiments in Microbiology, Plant Pathology and Biotechnology*. Aneja, K.R.2011. New Age International (P) Ltd., Publishers, New Delhi

WEB REFERENCES/MOOC'S:

1. http://ecoursesonline.iasri.res.in/Courses/Agricultural%20Microbiology/AMBE101/Start%20to%20read%20the%20Course.html
2. https://nptel.ac.in/courses/102/105/102105087/ - videos
3. https://www.brainkart.com/article/Microbial-Growth_35241/
4. https://drive.google.com/file/d/1hG40qaP-DfQXvpVI0CaVnSlTW0W__ja6/view
5. https://microbenotes.com/classification-of-bacteria-on-the-basis-of-nutrition/
6. https://nptel.ac.in/courses/102/105/102105087/#
7. https://www.helpforag.app/2018/02/agricultural-microbiology.html?m=1
8. https://www.youtube.com/watch?v=VDFcpUkXalw
9. https://www.youtube.com/watch?v=VDFcpUkXalw
10. https://www.youtube.com/watch?v=fzIKJpcfXfo
11. https://www.youtube.com/watch?v=VDFcpUkXalw

Semester	:	**First**
Course	:	**Comprehension & Communication Skills in English**
Course Code	:	**20ENGL101**
L-T-P structure	:	**1-0-3-0**
Course Credits	:	**2(1+1)**
Course Coordinator	:	**Dr. .K.B. GLORY**
Course Instructors	:	

MAPPING OF COURSE OUTCOMES WITH PO/PSO

COURSE OUTCOMES (CO):

CO NO.	COURSE OUTCOMES (CO)	PO/PSO	BTL
THEORY			
CO1	Understand the various types of passages to know the theme, tone, and main idea of the passage and improve listening skills	PO9	2
CO2	Understand and apply the concepts of writing skill for drafting professional transactions	PO8	2
CO3	Practice telephone etiquette at different official/ informalcontexts	PO9	2
CO4	Recognize and reproduce English sounds	PO9	3

PRACTICAL			
CO5	Practicing Communication skills	PO8	3

COURSE OBJECTIVE:

At the end of the course, the learners will be able to analyze the basic concepts of howto write a letter, report writing, and E-mail ID, active listening, telephone conversation skills and good pronunciation to be fit into the corporate world.

SYLLABUS:

War Minus Shooting- The sporting Spirit. A Dilemma- A layman looks at science Raymond B. Fosdick. You and Your English – Spoken English and broken English G.B. Shaw. Reading Comprehension, Vocabulary- Antonym, Synonym, Homophones, Homonyms, often confused words. Exercises to Help the students in the enrichment of vocabulary based on TOEFL and other competitive examinations. Functional grammar: Articles, Prepositions, Verb, Subject verb Agreement, Transformation, Synthesis, Direct and Indirect Narration. Written Skills: Paragraph writing, Precise writing, Report writing and Proposal writing. The Style: Importance of professional writing. Preparation of Curriculum Vitae and Job applications. Synopsis Writing. Interviews: kinds, Importance and process. Practical Listening Comprehension: Listening to short talks lectures, speeches (scientific, commercial and general in nature). Oral Communication: Phonetics, stress and intonation, Conversation practice. Conversation: rate of speech, clarity of voice, speaking and Listening, politeness &Reading skills: reading dialogues, rapid reading, intensive reading, improving reading skills. Mock Interviews: testing initiative, team spirit, leadership, intellectual ability. Group Discussions.

REFERENCE BOOKS:

1. Balasubramanian, T. 1989. A Textbook of Phonetics for IndianStudent, Orient Longman, New Delhi.
2. Balasubramanyam, M. 1985. Business Communication. Vani Education Books, New Delhi.
3. Jean Naterop, B. and Rod Revell. 1977. Telephoning in English.
Cambridge University Press, Cambridge.
4. Krishna Mohan and Meera Banerjee. 1990. Developing Communication Skills. Mc Millan India Ltd. New Delhi.
5. Krishanswamy, N and Sriraman, T. 1985. Current English for Colleges. Mc Millan India Ltd., Madras.
6. Narayanaswamy V R. 1979. StrengthenYour Writing. Orient Longman, New Delhi.

WEB REFERENCES/MOOC'S:

1. www.indiabix.com
2. www.freshersworld.com
3. https://www.CATsy11abus.com/logical-Reasoning/logical-connectives.
4. http://mrunan.org/2013/04
/Reasoning- Logical-Connectives.html

STUDENT READY PROGRAMME

Student Rural Entrepreneurship Awareness Development Yojana (READY)

The student READY (Rural Entrepreneurship Awareness Development Yojana) Programme aims to provide rural entrepreneurship awareness, practical experience in real-life situation in rural agriculture and creating awareness to undergraduate student about practical agriculture.

Rural Awareness Works Experience (RAWE) and Agro-Industrial Attachment (AIA)

The programme will be undertaken by the students during the VII semester for a total duration of 20 weeks with a weightage of 0+20 credit hours in two parts viz., RAWE and AIA. It will consist of general orientation and on campus training by different faculties followed by village attachment/unit attachment in University/College/KVK or a Research station. The students will be attached with the agro-industries to get an experience of the industrial environment and working. Weightage in terms of credit hours will be given depending upon the duration of stay of students in villages/agro-industries. At the end of RAWE/AIA, the students will be given one week for project report preparation, presentation and evaluation. The students would be required to record their observations in field and agro-industries on daily basis and will prepare their project report based on these observations.

Experiential Learning Programme (ELP)

This programme will be undertaken by the students preferably during the VIII semester for a total duration of 24 weeks with a weightage of 0+20 credit hours. The students will register for any of two modules (of 0+10 credit hours each) listed below :

1. Production Technology for Bio-agents and Bio-fertilizers
2. Seed Production and Technology
3. Mushroom Cultivation Technology
4. Soil, Plant, Water and Seed Testing
5. Poultry Production Technology
6. Hybrid Seed Production Technologies
7. Floriculture and Landscaping
8. Food Processing
9. Commercial Horticulture
10. Agriculture Waste Management
11. Organic Production Technology
12. Commercial Sericulture

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FARMING SYSTEM & SUSTAINABLE AGRICULTURE 1(1+0)

Course code-20AGRO203

Semester	:	**Fourth**
Course Name	:	**Farming System & Sustainable Agriculture**
Course Code	:	**20 AGRO203**
L-T-P structure	:	**1-0-0-0**
Course Credits	:	~~3(2+1)~~ 1(1+0)
Course Coordinator	:	
Course Instructors	:	

L-T-P: 1-0-0

Course Outcomes (CO):

CO No:	CO	PO	BTL
1	Apply major aspects of agricultural practices and traditions through time and throughout the world.	4,6	3
2	Illustrate with gaining knowledge about general relationships among culture, economics, politics, science, and agricultural development.	4,6	3
3	Apply various enterprises including farming system. Students studied types of farming, crop rotation and other practices of field.	4,6	3
4	Apply to show how agricultural scientists are attempting to minimize agricultural pollution and sustain food production adequate for the world's population	4,6	3

COURSE OBJECTIVE:

1. To impart knowledge to the students on the fundamentals of farming systems and sustainable agriculture
2. To study the various components of organic agriculture

Course Outlines

Theory

Farming system-scope, importance, and concept; Types and systems of farming system and factors affecting types of farming; Farming system components and their maintenance; Cropping system and pattern, multiple cropping system, efficient cropping system and their evaluation; Allied enterprises and their importance, tools for determining production and efficiencies in cropping and farming system; Sustainable agriculture, problems and its impact on agriculture, indicators of sustainability, adaptation and mitigation, conservation agriculture strategies in agriculture, HEIA, LEIA and LEISA and its techniques for sustainability; Integrated farming system, historical background, objectives and characteristics, components of IFS and its advantages, site specific development of IFS model for different agro-climatic zones; Resource use efficiency and optimization techniques, resource cycling and flow of energy in different farming system, farming

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IRRIGATION WATER MANAGEMENT 2 (1+1)

Course code-20AGRO204

Semester	**: Fourth**
Course Name	**: Irrigation Water Management**
Course Code	**: 20 AGRO202**
L-T-P structure	**: 1-0-3-0**
Course Credits	**: 2(1+1)**
Course Coordinator	**:**
Course Instructors	**:**

Course Outcomes (CO):

CO No:	CO	PO	BTL
1	Illustrate the knowledge of irrigation water management to maximising crop yield and quality by developing irrigation and water management techniques can help growers demonstrate best practice to retailers and consumers.	6,8	3
2	Apply the ways for growers to improve crop performance by evaluating the different types of irrigation and water managements systems available.	6,8	3
3	Apply the knowledge of various irrigation methods which are more efficient to minimize the water loss and improve the water use efficiency of crop and water requirements of the crops,	6,8	3
4	Apply the knowledge on Water requirements of crops, soil-plant- relationship, Irrigation requirements, duty and delta, Irrigation efficiencies, methods of irrigation, Quality of irrigation water.	6,8	3
5	Demonstrate on increasing need for efficient and effective irrigation and water management to maximize crop yield and quality whilst making best use of the water available.	6,8	3

COURSE OBJECTIVE:

1. The knowledge of irrigation water management to maximising crop yield and quality by developing irrigation and water management techniques can help growers demonstrate best practice to retailers and consumers.
2. This course will recommend ways for growers to improve crop performance by evaluating the different types of irrigation and water managements systems available.
3. To impart the knowledge of various irrigation methods which are more efficient to minimize the water loss and improve the water use efficiency of crop and water requirements of the crops,
4. There is an increasing need for efficient and effective irrigation and water management to maximise crop yield and quality whilst making best use of the water available

Course outlines

Theory

Irrigation : Definition and objectives; Water resources, Irrigation projects (major, medium & minor) in India and Andhra Pradesh; Soil - plant - water relationships; Methods of soil moisture estimation; Evapotranspiration and Crop water requirement; Duty of water; Conjunctive use of

20SSAC221: Manures Fertilizers and Soil Fertility Management

L-T-P-S: 2-0-3-0 **Credits:3** **Prerequisite: Nil**

Mapping of Course outcomes (CO) with program outcomes (PO):

CO No	Course Outcomes	PO	BTL
CO 1	Introduction - Scientists responsible for the essentiality of nutrients - Essential nutrients – Deficiency symptoms of nutrients -Nitrogen - Leaching losses of nitrate nitrogen – Phosphorus - Potassium	PO1, 2	3
CO 2	Calcium - Sulphur - Micronutrient - Zn and Mn - Fe and Cu - Boron and Molybdenum - Chlorine - Soil fertility Evaluation	PO2,4	3
CO 3	Plant analysis – Soil test based fertilizers recommendation - Nutrient use efficiency - Methods of application of nutrients under rainfed and irrigated conditions - Introduction and importance of organic manures - Bulky organic manures – Compost and composting – Methods of preparation of rural and urban compost.	PO2, 4	3
CO 4	Green manures –Definitions of penning, sewage, sewerage, sullage, pouderette, Activated compost process - Chemical fertilizers – Phosphatic fertilizers – Secondary and micronutrient fertilizers – Amendments - Mixed fertilizers – Fertilizer Control Order (FCO)	PO2, 4	3
CO 5	Acquaint with the analytical instruments and recording the observations from the soil samples and plant samples and also about the estimation and identification of different nutrients.	PO8,1,2,4	4

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Semester	**:Fourth**
Course Name	**:Statistical methods.**
Course Code	**: 20SMCA201**
L-T-P structure	**: 1-0-3-0**
Course Credits	**: 2(1+1)**

MAPPING OF COURSE OUTCOMES WITH PO/PSO

COURSE OUTCOMES (CO):

CO NO.	COURSE OUTCOMES (CO)	PO/PSO	BTL
THEORY			
CO1	Understand various definitions of Statistics - Singular and plural reference of Statistics - A comprehensive definition of Statistics - Importance of Statistics in agriculture - limitations of statistics	3, 7	2
CO2	Understand the Probability – Addition - Multiplication theorems - Binomial and Poisson distributions	3, 7	2
CO3	Understand the Chi-Square test for 2x 2 and m x n contingency Table - Yate's correction forContinuity, Correlation, regression, ANOVA and block designs.	3, 7	2
CO4	Understand ANOVA with Two way Classification (RBD) - Layout and analysis, Advantagesanddisadvantages, Sampling methods.	3, 7	2

SYLLABUS

THEORY

CO1: Introduction and various definitions of Statistics - Singular and plural reference of Statistics - A comprehensive definition of Statistics - Importance of Statistics in agriculture - limitations of statistics.Frequency Distribution- Exclusive and inclusive methods - Discrete and continuous variables - Graphical representation of data 3. Central tendency-Definition - Measures of Central tendency - List of all the different measures and study of Arithmetic Mean – Median - Mode in detail (including merits and demerits) for ungrouped and grouped data. 4. Measures of Dispersion – Meaning of measures of Dispersion - Standard Deviation for ungrouped and grouped data- Coefficient of Variation (C.V) - Standard Error (S.E.) and difference between S.D. and S.E..

CO2: Definition of Probability – Addition - Multiplication theorems - Binomial andPoisson distributions6. Normal Curve and its properties - Identification of normality through data i.e.., criterion. etc., expression for frequency function of Normal distribution7. Testing of Hypothesis – Concept - Null hypothesis - Type I and Type II Errors -Level of Significance - Critical region - General setup of testing - Large SampleTest with known and unknown8. Small Sample test (t-test for one and two samples and Paired t- test) and F-test.

CO3: Chi-Square test for 2x 2 and m x n contingency Table - Yate's correction forContinuity

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Semester	**:Fourth**
Course Name	**:Agricultural marketing, trade and prices**
Course Code	**:20AECO242**
L-T-P structure	**: 2-0-1-0**
Course Credits	**: 3(2+1)**

MAPPING OF COURSE OUTCOMES WITH PO/PSO

COURSE OUTCOMES (CO):

CO NO.	COURSE OUTCOMES (CO)	PO/PSO	BTL
THEORY			
CO1	Understand the concept of market and its types, demand-supply of farm products, exchange functions, facilitating functions and market functionaries	PO9	3
CO2	Understanding the marketing channels, supply chain, marketing mix, product life cycle, pricing, market promotion, segmentation, and integration	PO10	3
CO3	Explain the marketing costs, margins, and price spread, regulated markets, APMC, cooperative marketing, types of risk in marketing, future trading and commodity exchanges	PO9	3
CO4	Describe the agricultural product price, CACP, MSP, international trade, WTO and its agreements, TRIPS and IPR in Indian agriculture	PO7	3
PRACTICAL			
CO5	Analyse elasticities and plot demand supply curve for agricultural commodities, study market arriva., prices, and comparative advantage, compute marketable and marketed surplus, construct index numbers, estimate costs, margins and price spread	PO11	3

COURSE OBJECTIVE:

1. To gain knowledge about market and its various functions
2. To gain basic knowledge regarding marketing channels, mix, segmentation and integration
3. To gain knowledge on the marketing costs, margin, along with future trading and commodity exchange
4. To impart knowledge on the various prices and WTO, its agreements

SYLLABUS

THEORY

CO1: Agricultural Marketing - Concepts and definitions of market, marketing, agricultural marketing - Components of market, dynamics of market structure. Classification and

ELCT 333 Biopesticides and biofertilizers

L-T-P-S: 2-0-3-0 **Credits: 3** **Prerequisite: Nil**

Mapping of Course outcomes (CO) with program outcomes (PO):

CO No:	Course Outcomes	PO	BTL
1	Study of Biopesticides	3	3
2	Acquainted with the mass production technologies of bio-pesticides	3	3
3	Acquainted with various biofertilizers	3	3
4	Awareness on application technologies of bio fertilizers	3	4

Syllabus:

Theory

History and concept of biopesticides. Importance, scope and potential of biopesticide. Definitions, concepts and classification of biopesticides viz. pathogen, botanical pesticides, and biorationales. Botanicals and their uses. Mass production technology of bio-pesticides. Virulence, pathogenicity and symptoms of entomopathogens. Methods of application of biopesticides. Methods of quality control and techniques of biopesticide evaluation. Impediments and limitation in production and use of biopesticide. Biofertilizers - Introduction, status and scope. Structure and characteristic features of bacterial biofertilizers- Azospirillum, Azotobacter, Bacillus, Pseudomonas, Rhizobium and Frankia; Cynobacterial biofertilizers- Anabaena, Nostoc, Hapalosiphon and fungal biofertilizers- AM mycorrhiza and ectomycorrhiza. Nitrogen fixation -Free living and symbiotic nitrogen fixation. Mechanism of phosphate solubilization and phosphate mobilization, K solubilization. Production technology: Strain selection, sterilization, growth and fermentation, mass production of carrier based and liquid biofertiizers. FCO specifications and quality control of biofertilizers. Application technology for seeds, seedlings, tubers and setts. Biofertilizers - storage, shelf life, quality control and marketing. Factors influencing the efficacy of biofertilizers.

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Practical

To study about mass production technology of important biopesticides. Identification of important botanicals. Visit to biopesticide lab. Working in nearby area. Field visit to explore naturally infected cadavers. Identification of entomopathogenic entities in field condition. Quality control of biopesticides. Isolation and purification of Azospirillum , Azotobacter, Rhizobium, P-solubilizers and cyanobacteria. Mass multiplication and inoculums production of biofertilizers. Isolation of AM fungi -Wet sieving method and sucrose gradient method. Mass production of AM inoculants.

References

1. B S Parmar and C. Deva Kumar 1993. Botanical and Bio pesticides. West Will Publishing House, New Delhi pp 199.

2. Srivastava, K. P. and Dhaliwal, G.S 2015. Applied Entomology. Vol I &II , Kalyani Publishers, New Delhi

3. Kannaiyan, S., K. Kumar and K. Govindarajan (eds.) (2004). Biofertilizers Technology (Scientific Pub., Jodhpur).

4. Motsora, M.R., P.Bhattacharya and Beena Srivastava (1995). Biofertilizer Technology, Marketing and Usage- A Source Bookcum-Glossary (FDCO, New Delhi).

5. Subbarao, N.S. 1993. Biofertilizers in Agriculture and Forestry (Oxford and IBH Pub. Co., New Delhi)

ELCT 334 Agrochemicals

L-T-P-S: 2-0-3-0 **Credits: 3** **Prerequisite: Nil**

Mapping of Course outcomes (CO) with program outcomes (PO):

CO No:	Course Outcomes	PO	BTL
1	Study of different Herbicides and fungicides	4	3

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nitrogen in Urea. Estimation of water soluble P_2O_5 and citrate soluble P_2O_5 in single super phosphate. Estimation of potassium in Muriate of Potash/ Sulphate of Potash by flame photometer. Determination of copper content in copper oxychloride. Determination of sulphur content in sulphur fungicide. Determination of thiram. Determination of ziram content.

References

1. Vasantharaj David, B and Ramamurthy V V. 2016. Elements of Economic Entomology. Namuratha Publications, Chennai.

2. Vasantharaj David, B and Aanathakrishnan, T.N.. 2006. General and Applied Entomology. Tata Mc Graw-Hill Publishing House, New Delhi.

3. Srivastava R P and Saxena R C 1989. A text book of Insect toxicology. Himanshu Publications, Udaipur

22ELCT342: Agri Business Management

L-T-P-S: 2-0-3-0 **Credits:3** **Prerequisite: Nil**

Mapping of Course outcomes (CO) with program outcomes (PO):

CO No	Course Outcomes	PO	BTL
CO1	Learning and understanding the basics of various fundamental concepts in Agribusiness management. These basic concepts are needed for further proper understanding of the course and subject.	PO8	2
CO2	Understanding the concept of how to enter a market or industry. The requirements to build a factory/plant/company for goods production or service production. The marketing techniques that can be used will be understood.	PO9	2
CO3	Understanding the next steps after planning and setting up of a factory/plant/company. To decide on the product mix, the packaging decisions, selling strategy. Capital management, financial awareness for establishing a business with strong foundation will be understood.	PO10	2
CO4	Understanding various techniques of appraisal of the business in terms of finance, product, market share etc. Understanding the product and project cycle to know what kind of decisions to be made at what time.	PO11	2
CO5	Balance sheet analysis, profit & Loss analysis, break even analysis, financial ratio analysis for a business, planning of a hypothetical business to understand	PO11	3

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Textbooks:

1. Bishop, C.E. and W. D. Tousaint. 1958. Introduction to Agricultural Economic Analysis. John Wiley and Sons, London.
2. Heady, Earl O. 1964. Economics of Agricultural Production and Resource Use. Prentice Hall of India, Private Limited, New Delhi
3. S.S. Johl, J.R. Kapur. 2006. Fundamentals of Farm Business Management. Kalyani Publishers, New Delhi.
4. Kahlon, A.S. and Karam Singh. 1965. Principles of Farm Business Management. Kalyani Publishers, New Delhi.

Reference Book:

Raju, V.T. and D.V.S. Rao. 2006. Economics of Farm Production and Management. Oxford & IBH Publishing Co. Pvt. Limited, New Delhi

22AGRO301: Geoinformatics and Nanotechnology for Precision Farming

L-T-P-S: 1-0-3-0 **Credits: 2** **Prerequisite: Nil**

Mapping of Course outcomes (CO) with program outcomes (PO):

CO No:	CO	PO	BTL
1	Understand precision agriculture concepts and techniques, principles and practices, geoinformatics concepts, use and crop discrimination monitoring techniques	1	2
2	derstand geodesy principles, management of spatial data, global positioning system and application of nanotechnology in rainfed agriculture.	2	2
3	Describe about cartography, application of remote sensing techniques in rainfed agriculture, fertilizer recommendation using geospatial technologies in precision farming	2	2
4	Apply geo referencing, Nanotechnology concepts and techniques, nano sensors, Nano-fertilizers and nano pesticides	2	3

20COCA100-NSS/NCC/PHYSICAL EDUCATION & YOGA PRACTICES

COURSE CODE	COCA 100	MODE	Offline	LTPS	0-0-2-0	PRE-REQUISITE	COCA 100

Course Outcomes

CO#	CO Description	BTL	PO Mapping
CO5	To understand the concept and importance of the National Service Scheme. To develop leadership skills and teamwork abilities. To promote community engagement and social responsibility. To foster a sense of national integration and cultural diversity. To encourage participants to actively contribute to social welfare projects.	4	PO4 + POS4

20SSAC321 PROBLEMATIC SOILS AND THEIR MANAGEMENT

COURSE CODE	23SSAC321	MODE	Offline	LTPS	1-0-2-0	PRE-REQUISITE	23 SSAC 221

Course Outcomes

CO#	CO Description	BTL	PO Mapping
CO1	To apply the problematic soils, definition, distribution in India and Andhra pradesh. Saline and sodic soils visual symptoms, characteristic features, Effect of salinity and sodicity on plant growth and development, reclamation measures and management practices	3	PO1,PO4 & PSO1
CO2	To apply the acid, acid sulphate soils area, distribution in India and andra pradesh. Land degradation problems and sources of polluted soils	3	PO7,PO4 & PSO2
CO3	To apply the soil pollution management practices, Bio remediation problems and Land capability and land suitability classification	3	PO1,PO7 3 & PSO2
CO4	To apply the Remote sensing and GIS techniques, Soil healthy and Quality, Irrigation water qualty standards, Guidelines for judging the water quality.	4	PO1,PO4 3 & PSO3
CO5	To analyze the problematic soils identification, determination of infiltration rate, PH, EC, ESP,GR,LR,	4	PO1,PO4 4 & PSO4

	CaCO3, Ca and Mg, CO3 and HCO3, Na and K, RSC and SAR		

20SMCA301- AGRICULTURE INFORMATICS

COURSE CODE	23 SMCA 301	MODE	Offline	LTPS	1-0-2-0	PRE-REQUISITE	23 SMCA 301

Course Outcomes

CO#	CO Description	BTL	PO & PSO Mapping
CO1	To apply an introduction of computers, their advantages, disadvantages, applications, anatomy, Input / output devices, memory concepts, WINDOWS operating system, MS-Office	3	PO5 & PSO3
CO2	To apply features of MS Word, MS- Excel, MS Access such as word processor, Mail merge, Track changes, Data presentation, analysis, graph creation, mathematical expression etc	3	PO5 & PSO1
CO3	To apply concepts, components of Internet and World Wide Web, HTML-XML coding, information technology, ICT tools, computer simulation models in e-Agriculture	4	PO5 & PSO2
CO4	To apply IT, automated systems, mobile apps, Geospatial technology, decision support system for Agri-input and output management	3	PO5 & PSO1
CO5	To analyze computer, operating system, MS office and internet concepts for agricultural input and output data management, analysis and presentation	4	PO5 & PSO4

20ELCT272- FOOD SAFETY ISSUES

L-T-P-S : 1-0-3-0
Credits : 2
Contact Hours : 4
Pre-requisite : NIL

Mapping of Course outcomes with PO/PSO:

Co No.	Course Outcome	PO/PSO	BTL
CO1	To understand the knowledge on weed biology, their classification, reproduction and characteristics of weeds, crop weed competition, survey of weeds in varied ecosystem and their management	1	2
CO2	To acquire knowledge on herbicide mode of action, their classification, formulations and their selectivity	1	2
CO3	To describe herbicides compatibility with nutrients, integrated weed management and management of weeds in different crops	1	1
CO4	Discuss the weed management in aquatic ecosystems, management of problematic weeds and resistance of herbicides in weeds	1	2
CO5	To illustrate on Techniques of weed preservation, weed identification Study of herbicide formulations and mixture of herbicide, Herbicide and nutrient compatibility, methods of herbicide application, spraying equipments and Calculations of herbicide doses, weed control efficiency and weed index	1	2

20 COCA200 Education Tour (Non-gradial)

L-T-P-S	: 0-0-4-0
Credits	: 2
Contact Hours	: 4
Pre-requisite	: NIL

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20ELCT222: Soil, Plant, Water And Seed Testing

L-T-P-S: 1-0-4-0 **Credits:3** **Prerequisite: Nil**

Mapping of Course outcomes (CO) with program outcomes (PO):

CO No	Course Outcomes	PO	BTL
CO 1	To apply the working methods of testing instruments	1, 2	3
CO 2	To apply the principles of soil analysis	2,4	3
CO 3	To apply the principles of plant testing and analysis	2, 4	3
CO 4	To apply the principles of water testing and analysis	2, 4	3
CO 5	To analyze the techniques of soil, plant, water and seed testing	8,1,2,4	4

Syllabus:

Theory: Principle of pH meter, EC meter, spectrophotometer, flame photometer and AAS. Soil analysis: Objectives, sampling of soil, procedure and precautions. Determination of texture, bulk density. Interpretation of analytical data viz., pH, EC, organic carbon, N, P, K, S and micronutrients (Fe, Mn, Zn, Cu, B) and nutrient index. Plant analysis: Sampling stages and plant part to be sampled. Analysis of nutrients, Quantitative rating of plant analysis data and interpretation of results, critical nutrient concentration, critical nutrient ranges. Water analysis:

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