Rama University Uttar Pradesh, Kanpur

Ref: RU/FASAI/UB15 **Dated: 13/ 06/2019**

Faculty of Agricultural Sciences & Allied Industries

Minutes of Meeting

Boards of Studies

A meeting of Boards of Studies of **B.Sc. Agriculture** held on **13/ 06/2019** in Director Office. The following members were present:

1. Dr. Shiv Pratap Singh - Chairperson
2. Dr. Krishna Kumar Mishra - Member
3. Dr. Aneeta Yadav - Member

The following members agreed to review the minutes.

1. Dr. V. K. Tripathi - External Member
2. Dr. A. K. Tiwari - External Member

Agenda:

1. Action Taken Report (ATR) on Minutes of Previous Meeting.

The BOS committee confirmed the minutes of the BOS meeting held on **12/ 06/2018**

2. Review of the existing programs and their curricula

S. No.	Item No.	Existing	Recommendation /Action Taken
1.	**RU/FASAI/BOS/2019/06/13/005** Revision in syllabus for the batch 2019-20	Vth Dean Committee as per the recommendation of ICAR	CBCS (Choice based credit system) has been implemented in the ongoing programme.
2.	Added items/ topics	In AGR-111 Sustainable agriculture was not existing	In AGR-111 Sustainable agriculture was added
		In AEX-113 Basic Human Rights was not added	In AEX-113 Basic Human Rights was added
		In GPB-211 SSD method of breeding was not existing	In GPB-211 SSD method of breeding was added
		In HOR-222 production technology of Bel and Aonla was	In HOR-222 production technology of Bel and Aonla

		not existing	was added

3. Recommendation on New courses/Short term training

S. No.	Item No.	Feedback from Faculty/Student	Recommendation /Action Taken
1	**Ref: RU/FASAI/BOS/2019/06/13/002**	MOOCS implementation in Vth Dean Committee	The relevant courses should be opted.

4. Consideration of the curricula of the new programs

S. No.	Item No.	Feedback from Faculty/subject experts/Industries	Recommendation /Action Taken
1	**Ref: RU/FASAI/BOS/2019/06/13/002**	Course is based on entrepreneurship skills, practical based applications & enhance the knowledge of students.	Applicability of the courses have been thoroughly discussed.

5. Review of Teaching Process/Pedagogy

S. No.	Item No.	Existing	Recommendation /Action Taken
1	**RU/FASAI/BOS/2019/06/13/002**	Audio visible aids, Projectors, white board, Peaceful, good aeration, well Lighted.	Proper interaction with students, involve the students in training & learning programme.

6. Result Analysis: --- Summary of Result Analysis of the students' performance in the semester examination was presented and it was suggested that the course instructors should conduct remedial classes for the students whose performance was not found satisfactory.

7. Feedback Analysis; --- Analysis was performed based on summary of already collected feedback from students regarding programmes objective and programmes outcome.

8. Any other issue with the permission of the Chair: ---- No

The meeting concluded with a vote of thanks to the chair.

Date of the Next Meeting: to be decided and conveyed later

Dr. Shiv Pratap Singh
(Chairman)

Encl.: Recommended Curricula attached for consideration and approval.

CC:
1. Dean
2. Registrar Office

RAMA UNIVERSITY UTTAR PRADESH, KANPUR

Faculty of Agricultural Sciences and Allied Industries

Program: Bachelor of Sciences in Agriculture (B. Sc. Ag.)

Report on Feedback on Curriculum by Stakeholders (2019-2020)

- The external experts reviewed the syllabus and suggested that the program and courses designed are important and applicability based. The entrepreneurship aspects can be explored.
- The alumni recommended concentrating more on practical skills development to create job opportunities.
- The faculty suggested that latest concepts of climate change and climate resilient agricultural systems should be discussed in related subjects.

S.P. Singh

BoS Chairman

S.P. Singh

Dean

RAMA UNIVERSITY UTTAR PRADESH, KANPUR

Faculty of Agricultural Sciences and Allied Industries

Program: Bachelor of Sciences in Agriculture (B. Sc. Ag.)

Action Taken Report based on Feedback at BoS held on 13.06.2019

- Syllabus is being discussed based on applicability as well as employability.
- The practical of various courses and job opportunities in specific areas has been focused.
- Climate change and climate smart agriculture is being incorporated as per requirements.

S.P. Singh

BoS Chairman

S.P. Singh

Dean/Principal

RAMA UNIVERSITY UTTAR PRADESH KANPUR

Faculty of Agricultural Sciences and Allied Industries

HOR-111: Fundamentals of Horticulture

L	T	P	CR
1	0	1	2

Course objective:- To make the understanding about the basics of horticulture .

Detail Contents

Unit 1: **50 %**

Unit 2: **50 %**

Unit- I

Horticulture - Its definition and branches, importance and scope; horticultural and botanical classification; climate and soil for horticultural crops; Plant propagation-methods and propagating structures;

Unit-II

Seed dormancy, methods of breaking seed dormancy, Seed germination, principles of orchard establishment; Principles and methods of training and pruning, juvenility and flower bud differentiation; unfruitfulness; pollination, pollinizers and pollinators; fertilization and parthenocarpy; medicinal and aromatic plants; importance of plant bio-regulators in horticulture. Irrigation – methods, Fertilizer application in horticultural crops.

Practical

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

Course Learning Outcomes (CLO)

1. students will be able to identify plant vegetative structure

2. students will understands basic principles, processes and plant propagation methods.

3- students will understands how to propagate plant, manage and harvest a variety of plant.

4.-students will learn how horticulture relates to the economy and environments, both currently and in the future.

Mapping of course outcome with programme outcome and programme specific outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3
CO1	-	3	-	-	-	-	-	-	3	-	3	1
CO2	2	3	1	1	2	2	-	1	3	1	3	1

CO3	1	3	1	1	-	2	-	1	3	1	3	3
CO4	1	2	-	-	1	1	3	3	1	-	1	2
Average	1.3	2.75	1	1	1.5	1.67	3	1.67	2.5	1	2.5	1.75

Text books:-

1. Bose, T. Ornamental Plants and Garden Design in Tropics and subtropics, Vol-2 sets Daya

2. Arora J. S. 2006 Introductory Ornamental Horticulture Kalyani Publishers, Ludhiana

3. Gopalaswamiengar, K.S. The Complete Gardening in India. TheHosali Press, Bangalore

4. Bose, T.K. Malti, R.G. Dhua, R.S. & Das, P. Floriculture and Landscaping (2004) Nayaprakash

5. H.S.Grewal and Parminder Singh Landscape designing and ornamental plants (2014)

6. R.K. Roy Fundamentals of Garden designing (2013) New India publishing agency

7 Rajesh Srivastava Fundamentals of Garden designing (2014) Agrotech press, Jaipur

Reference books:-

1. *Randhawa, G.S. AmitabhaMukhopadhyay Floriculture in India (2004) Allied Publishers Pvt. Ltd., New Delhi*
2. *K.V.Peter. Ornamental plants (2009) New India publishing agency*
3. *Chadha, K.L. and Chaudhary, B. Ornamental Horticulture in India. ICAR*
4. *Bose, T.K. and Mukherjee, D. Gardening in India (2004) Oxford & IBH Publishers*

Signature:-

1. S.P. Singh
2. Krishna Kumar
3. Aneeta Yadav
4. V.K. Trivedi
5. A.K. Tiwari

RAMA UNIVERSITY UTTAR PRADESH KANPUR

Faculty of Agricultural Sciences and Allied Industries

ABC-111: Fundamentals of Plant Biochemistry and Biotechnology

L	T	P	CR
2	0	1	3

Course objective:- To study the Basics of Plant Biochemistry and Biotechnology.

Detail Contents

Unit 1: **25%**

Unit 2: **25 %**

Unit 3: **25 %**

Unit 4: **25 %**

Unit- I

Importance of Biochemistry. Properties of Water, pH and Buffer. Carbohydrate: Importance and classification. Structures of Monosaccharides, Reducing and oxidizing properties of Monosaccharides , Mutarotation; Structure of Disaccharides and Polysaccharides. Lipid: Importance and classification; Structures and properties of fatty acids; storage lipids and membrane lipids. Proteins: Importance of proteins and classification; Structures, titration and zwitterions nature of amino acids; Structural organization of proteins.

Unit- II

Enzymes: General properties; Classification; Mechanism of action; Michaelis & Menten and Line Weaver Burk equation & plots; Introduction to allosteric enzymes. Nucleic acids: Importance and classification; Structure of Nucleotides, A, B & Z DNA; RNA: Types and Secondary & Tertiary structure. Metabolism of carbohydrates: Glycolysis, TCA cycle, Glyoxylate cycle, Electron transport chain.

Unit- III

Metabolism of lipids: Beta oxidation, Biosynthesis of fatty acids. Concepts and applications of plant biotechnology: Scope, organ culture, embryo culture, cell suspension culture, callus culture, anther culture, pollen culture and ovule culture and their applications; Micro-propagation methods; organogenesis and embryogenesis, Synthetic seeds and their significance; Embryo rescue and its significance; somatic hybridization and cybrids; Somaclonal variation and its use in crop improvement; cryo-preservation;

Unit- IV

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

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Practical

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

Course Learning Outcomes (CLO)

At the end of the course, a student will be able to understand –

1. Role of cell organelles and their functions.
2. Functions of biomolecules and their utility in cell.
3. Identify the deficiency symptoms of biomolecules. Synthesis pathways of biomolecules and regulations. Identification of biomolecules in given sample.
4. Application of plant tissue culture in crop improvement. Tackled the problems in convention breeding. Plant tissue culture is an area of entrepreneurship.

Mapping of course outcome with programme outcome and programme specific outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3
CO1	1	2	-	-	-	1	-	-	3	-	1	1
CO2	2	3	1	1	2	2	-	1	3	1	1	2
CO3	1	3	1	1	-	2	-	1	3	1	3	1
CO4	1	2	-	-	1	3	2	3	1	-	3	3
Average	1.25	2.5	1	1	1.5	2	2	1.67	2.5	1	2	1.75

Text books:-

Fundamentals of Biochemistry, Biotechnological tools for Genetic Resources

Reference books:-

Key Notes of Biochemistry and Biotechnology , Biotechnology for Food Agriculture and Environment Vol 1

Signature:-

1. S.P. Singh
2. Kalpana Kumari
3. Aneeta Yadav
4. VK Tripathi
5. A.K. Tiwari

RAMA UNIVERSITY UTTAR PRADESH KANPUR

Faculty of Agricultural Sciences and Allied Industries

ABC-111: Fundamentals of Soil Science

L	T	P	CR
1	1	1	3

Course objective:- To study the basics of Soil Science.

Detail Contents

Unit 1: 35 %

Unit 2: 35 %

Unit 3: 30 %

Unit- I

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; Soil physical properties: soil-texture, structure, density and porosity, soil colour, consistence and plasticity; Elementary knowledge of soil taxonomy classification and soils of India;

Unit- II

Soil water retention, movement and availability; Soil air, composition, gaseous exchange, problem and plant growth, Soil temperature; source, amount and flow of heat in soil; effect on 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;

Unit- III

Soil organic matter: composition, properties and its influence on soil properties; humic substances - nature and properties; soil organisms: macro and micro organisms, their beneficial and harmful effects; Soil pollution - behaviour of pesticides and inorganic contaminants, prevention and mitigation of soil pollution.

Practical

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

Course Learning Outcomes (CLO)

At the end of the course, Students will be able to gain:

1. Knowledge about physical and chemical properties of soil and their effect on plant's health.
2. To aware the students about causes, effects and remedies to prevention and mitigation of soil pollution.

3. Knowledge about soil forming rocks and minerals, their weathering and soil forming processes and climatic factors affect them.

Mapping of course outcome with programme outcome and programme specific outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3
CO1	1	2	2	-	-	1	-	-	3	1	1	1
CO2	2	3	1	1	2	2	1	1	2	-	2	1
CO3	1	3	1	1	3	2	-	1	3	1	2	1
Average	1.33	2.67	1.33	1	2.5	1.67	1	1	2.67	1	1.67	1

Text books:-

Fundamentals of Soil Science, Management of Soil Quality for Sustainable Agriculture

Reference books:-

Organic Farming, Technologies & Strategies, Textbook of Soil Chemistry.

Signature:-

1. S.P. Singh
2. Krishna Kumari
3. Aneeta Yadav
4. VK Tripathi
5. A.K. Tiwari

RAMA UNIVERSITY UTTAR PRADESH KANPUR

Faculty of Agricultural Sciences and Allied Industries

SCW-111: Introduction to Forestry

L	T	P	CR
1	0	1	2

Course objective:-

To improve the knowledge of basics of Forestry

Detail Contents

Unit 1: **35 %**

Unit 2: **35 %**

Unit 3: **30 %**

Unit- I

Introduction – definitions of basic terms related to forestry, objectives of silviculture, forest classification, salient features of Indian Forest Policies. Forest regeneration, Natural regeneration - natural regeneration from seed and vegetative parts, coppicing, pollarding, root suckers; Artificial regeneration – objectives, choice between natural and artificial regeneration, essential preliminary considerations.

Unit- II

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.

Unit- III

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 hypsometer. Volume measurement of logs using various formulae. Nursery lay out, seed sowing, vegetative propagation techniques. Forest plantations and their management. Visits of nearby forest based industries.

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Course Learning Outcomes (CLO)

1. Students will understand to recognize various harvesting, transportation, and processing systems used in the management of forest resources and production of forest products
2. Students will understand develop and evaluate management plans with multiple objectives and constraints.
3. Students will learn how to develop and apply silvicultural prescriptions appropriate to management objectives.
4. Students will understand analyze forest inventory information and project future forest, stand, and tree conditions.

Mapping of course outcome with programme outcome and programme specific outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3
CO1	1	2	-	-	-	1	-	-	3	-	1	1
CO2	2	3	1	1	2	2	2	1	3	1	1	2
CO3	1	3	1	1	-	2	-	1	3	1	3	1
CO4	1	2	-	-	1	3	2	3	1	2	3	3
Average	1.25	2.5	1	1	1.5	2	2	1.67	2.5	1.33	2	1.75

Text books:-

Fundamentals of Forestry, Forest pathology

Reference books:-

Forestry Refresher, Basics of Forestry

Signature:-

1. S.P. Singh
2. Krishna Kumar
3. Ameeta Yadav
4. VK Tripathi
5. A.K. Tiwari

RAMA UNIVERSITY UTTAR PRADESH KANPUR

Faculty of Agricultural Sciences and Allied Industries

AEX-111: Comprehension and Communication Skills in English

L	T	P	CR
1	0	1	2

Course objective:-

To enhance the skills of spoken English as well as English Grammar.

Detail Contents

Unit 1: **35 %**

Unit 2: **35 %**

Unit 3: **30 %**

Unit- I

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.

Unit- II

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.

Course Learning Outcomes (CLO)

At the end of the course students will be able to understand:

1. Students will identify and explain their goals to the semester and also identify the needs of communication helps us meet.
2. They will able to understand the common misconceptions about communication and the reasons, people use language. Students can differentiate the action, interaction and transaction models of communication.

3. They can define the process of both perception and listening .Students can recall the importance of listening effectively and can identify strategies for communicating the cultural awareness.
4. Students will able to introduce themselves to the class and begin getting to know one another and will apply communication strategies by preparing and participating in class discussion.

Mapping of course outcome with programme outcome and programme specific outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3
CO1	1	2	2	-	-	1	-	-	3	-	1	3
CO2	2	3	1	1	2	2	2	1	3	1	1	2
CO3	2	3	1	1	-	2	2	1	3	1	3	1
CO4	1	2	-	-	1	3	2	3	1	2	3	3
Average	1.5	2.5	1.33	1	1.5	2	2	1.67	2.5	1.33	2	2.25

Text books:-

1. Covey Stephen R. 1989. The Seven Habits of Highly Successful People. Free Press.

2. Verma, K.C. 2013. The Art of Communication. Kalpaz.

Reference books:-

1. Mohan Krishna and Meera Banerjee. 1990. Developing Communication Skills. Macmillan India Ltd. New Delhi.

Signature:-

1. S.P. Singh
2. Krishna Kumari
3. Aneeta Yadav
4. VK Tripathi
5. A.K. Tiwari

RAMA UNIVERSITY UTTAR PRADESH KANPUR

Faculty of Agricultural Sciences and Allied Industries

AGR- 111: Fundamentals of Agronomy

L	T	P	CR
2	1	1	4

Course objective:-

To make the understanding of fundamentals of Agronomy with in students.

Detail Contents

Unit 1: **50 %**

Unit 2: **50 %**

Unit- I

Agronomy and its scope, seeds and sowing, tillage and tilth, crop density and geometry, Crop nutrition, manures and fertilizers, nutrient use efficiency, water resources, soil-plant-water relationship, crop water requirement, water use efficiency, irrigation- scheduling criteria and methods, quality of irrigation water, water logging, sustainable agriculture.

Unit- II

Weeds- importance, classification, crop weed competition, concepts of weed management-principles and methods, herbicides- classification, selectivity and resistance, allelopathy. Growth and development of crops, factors affecting growth and development, plant ideotypes, crop rotation and its principles, adaptation and distribution of crops, crop management technologies in problematic areas, harvesting and threshing of crops.

Practical

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

Course Learning Outcomes (CLO)

1. A study 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.
2. 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.
3. Knowledge about Indian Agriculture and importance, present status, scope and future prospect. Cropping seasons of India.

4. Soil formation, classification, physical, chemical properties. Identification of important crops and crop seeds.

Mapping of course outcome with programme outcome and programme specific outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3
CO1	1	2	2	2	-	1	-	-	3	2	1	3
CO2	2	3	1	1	2	2	-	1	3	1	1	2
CO3	1	3	2	1	-	2	-	1	3	1	3	1
CO4	1	2	-	-	1	3	2	3	1	-	3	3
Average	1.25	2.5	1.67	1.33	1.5	2	2	1.67	2.5	1.33	2	2.25

Text books:-

1. Balasubramaniyan, P. and Palaniappan, S.P.2016. Principles and Practices of Agronomy (2nd edition), Agrobios (India), Jodhpur.

2. Reddy, S. R. 2016. Principles of Agronomy, Kalyani Publishers, Ludhiana.

3. Singh, S.S. and Singh, Rajesh. 2015. Principles and Practices of Agronomy (5th Re-set), Kalyani Publishers, New Delhi, Kalyani Publishers, Ludhiana.

Reference books:-

1. Balasubramaniyan, P. and Palaniappan, S.P.2016. Principles and Practices of Agronomy (2nd edition), Agrobios (India), Jodhpur.

2. Yawalkar, K.S., Agarwal, J.P. and Bokde, S. 2008. Manures and Fertilizers (10th edition), Agri-Horticultural Publishing House, Nagpur.

Signature:-

1. S.P. Singh
2. Krishna Kumari
3. Preeta Yadav
4. V.K. Tripathi
5. A.K. Singh

RAMA UNIVERSITY UTTAR PRADESH KANPUR

Faculty of Agricultural Sciences and Allied Industries

UGR-112: Introductory Biology

L	T	P	CR
1	0	1	2

Course objective:-

To make the understanding of Plant Living System.

Detail Contents

Unit 1: **50 %**

Unit 2: **50 %**

Unit- I

Introduction to the living world, diversity and characteristics of life, origin of life, Evolution and Eugenics. Binomial nomenclature and classification Cell and cell division.

Unit-II

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

Practical

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

Course Learning Outcomes (CLO)

1. The student will be able to explain the fundamental biological processes of metabolism, homeostasis, reproduction, development, and genetics, and the relationships between form and function of biological structures at the molecular, cellular, organismal, population, and ecosystem levels of the biological hierarchy.
2. The student will be able to explain the importance of biodiversity at the genetic, organismal, community, and global scales.

Mapping of course outcome with programme outcome and programme specific outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3
CO1	2	2	-	2	-	1	-	-	3	-	1	1
CO2	2	3	1	1	2	2	-	1	3	2	1	2
Average	2	2.5	1	1.5	2	1.5	-	1	3	2	1	1.5

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Faculty of Agricultural Sciences and Allied Industries

Text books:-

1. *Fundamentals of Genetics, B. D. Singh, Kalyani Publishers, latest edition*
2. *Elements of Genetics, Phundan Singh, Kalyani Publishers, latest edition*
3. *Genetics, P. K. Gupta, Rastogi Publications, 5th Revised Edition, , latest edition*
4. *NCERT books , class 11th and 12th*

Reference books:-

1. Plant Breeding- Principles & Methods, B. D. Singh, Kalyani Publishers / Lyall Bk Depot, , latest edition
2. Seed Technolog, DhirendraKharE, M. S. Bhale, Scientific Publishers Journals Dept, 2nd revised & enlarged edition, , latest edition

Signature:-

1. S. P. Singh
2. Krishna Kumari
3. Ameeta Yadav
4. VK Tripathi
5. A. K. Tiwari

RAMA UNIVERSITY UTTAR PRADESH KANPUR

Faculty of Agricultural Sciences and Allied Industries

UGR-113: Elementary Mathematics

L	T	P	CR
1	1	0	2

Course objective:-

To construct appropriate mathematical models to solve a variety of practical problems

Detail Contents

Unit 1 : **25 %**

Unit 2 : **25 %**

Unit 3 : **25 %**

Unit 4 : **25 %**

Unit- I

Straight lines : Distance formula, section formula (internal and external division), Change of axes (only origin changed), Equation of co-ordinate axes, Equation of lines parallel to axes, Slope-intercept form of equation of line, Slope-point form of equation of line, Two point form of equation of line, Intercept form of equation of line, Normal form of equation of line, General form of equation of line, Point of intersection of two st. lines.

Unit- II

Angles between two st. lines, Parallel lines, Perpendicular lines, Angle of bisectors between two lines, Area of triangle and quadrilateral.Circle: Equation of circle whose centre and radius is known, General equation of a circle, Equation of circle passing through three given points, Equation of circle whose diameters is line joining two points (x_1, y_1) & (x_2,y_2), Tangent and Normal to a given circle at given point (Simple problems), Condition of tangency of a line $y = mx + c$ to the given circle $x^2 + y^2 = a^2$.

Unit- III

Differential Calculus : Definition of function, limit and continuity, Simple problems on limit, Simple problems on continuity, Differentiation of x^n , e^x , sin x & cos x from first principle, Derivatives of sum, difference, product and quotient of two functions, Differentiation of functions of functions (Simple problem based on it), Logarithmic differentiation (Simple problem based on it), Differentiation by substitution method and simple problems based on it, Differentiation of Inverse Trigonometric functions. Maxima and Minima of the functions of the form y=f (x) (Simple problems based on it).

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Unit- IV

Integral Calculus : Integration of simple functions, Integration of Product of two functions, Integration by substitution method, Definite Integral (simple problems based on it), Area under simple well-known curves (simple problems based on it).Matrices and Determinants: Definition of Matrices, Addition, Subtraction, Multiplication, Transpose and Inverse up to 3rd order, Properties of determinants up to 3rd order and their evaluation.

Course Learning Outcomes (CLO)

1. Demonstrate competency in the areas that comprise the core of the mathematics major.
2. Demonstrate the ability to understand and write mathematical proofs. Be able to use appropriate technologies to solve mathematical problems.

Mapping of course outcome with programme outcome and programme specific outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3
CO1	1	3	1	1	3	2	2	2	3	1	2	1
CO2	1	2	-	-	1	3	2	3	1	-	2	2
Average	1	2.5	1	1	2	2.5	2	2.5	2	1	2	1.5

Text books:-

1 .Mathematics XI and XII NCERT, New Delhi.

2. Mathematics Class XI , R. D. Sharma, Dhanpat Rai Publications, New Delhi.

3. Coordinate geometry of two diamensions, Hari Kishan, Atlantic Publishers and Distributures

Reference books:-

1.Applied Mathematics, R. D. Sharma, Dhanpat Rai Publications, New Delhi

2.Elementary Engineering Mathematics, B. S. Grewal, Khanna Publication.

Signature:-

1. S.P. Singh
2. Keishna Kumar
3. Aneeta Yadav
4. UK Tripathi
5. A.K. Tiwari

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Faculty of Agricultural Sciences and Allied Industries

UGR-111: Agricultural Heritage

L	T	P	CR
1	0	0	1

Course objective:-

To make the understanding of Ancient Agricultural Practices & Its relevant to modern agriculture practices.

Detail Contents

Unit 1 : **50 %**

Unit 2 : **50 %**

Unit- I

Introduction of Indian agricultural heritage; Ancient agricultural practices, Relevance of heritage to present day agriculture; Past and present status of agriculture and farmers in society; Journey of Indian agriculture and its development from past to modern era .

Unit- II

Plant production and protection through indigenous traditional knowledge; Crop voyage in India and world; Agriculture scope; Importance of agriculture and agricultural resources available in India; Crop significance and classifications; National agriculture setup in India; Current scenario of Indian agriculture; Indian agricultural concerns and future prospects.

Course Learning Outcomes (CLO)

1. Traditional Technical Knowledge.
2. Our Journey (Developments) in Agriculture and
3. Vision for the Future.

Mapping of course outcome with programme outcome and programme specific outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3
CO1	1	2	2	-	-	1	1	-	3	1	2	1
CO2	2	3	1	1	2	2	3	2	3	1	1	3
CO3	1	3	1	1	1	2	2	1	3	1	3	2
Average	1.33	2.67	1.33	1	1.5	1.67	2	1.5	3	1	2	2

Text Books:

1. M.S. Randhawa, A history of agriculture in india, Vol. IV, ICAR, New Delhi, latest edition

2. D. Kumari, Textbook on Agricultural heritage of India, Agrotech pulishing academy, latest edition

3. S.R.Reddy, Principal of Agronomy, Kalyani Publication, latest edition

Reference Books:

1. Y.L. Nene and R.C. Saxena, A textbook on ancient history of Indian agriculture, Munshiram Mnhorilal publishers pvt. Ltd. latest edition
2. Handbook of Agriculture, ICAR, New Delhi latest edition

Signature:-

1. S.P. Singh
2. Krishna Kumari
3. Sneeta Yadav
4. VK Tripathi
5. A.K. Tiwari

RAMA UNIVERSITY UTTAR PRADESH KANPUR

Faculty of Agricultural Sciences and Allied Industries

UGR-111: Rural Sociology & Educational Psychology

L	T	P	CR
1	1	0	2

Course objective:-

To Understand the concept of rural sociology, its importance in agricultural extension.

Detail Contents

Unit 1 : **50 %**

Unit 2 : **50 %**

Unit- I

Sociology and Rural sociology: Definition and scope, its significance in agriculture extension, Social Ecology, Rural society, Social Groups, Social Stratification, Culture concept, Social Institution, Social Change & Development.

Unit- II

Educational psychology: Meaning & its importance in agriculture extension. Behavior: Cognitive, affective, psychomotor domain, Personality, Learning, Motivation, Theories of Motivation, Intelligence.

Course Learning Outcomes (CLO)

1. Understand social groups, social stratification, culture, social values, social control and attitudes, leadership and training.
2. Understand concept of educational psychology, intelligence, personality, perceptions, emotions, frustration, motivation, teaching and learning.
3. Acquaint with characteristics of rural society, village institutions and social organizations. Select lay leaders and train them.

Mapping of course outcome with programme outcome and programme specific outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3
CO1	2	2	-	-	-	1	1	-	3	-	2	2
CO2	2	3	1	1	2	2	-	1	2	1	1	2
CO3	1	3	1	2	1	2	-	1	3	1	3	1
Average	1.67	2.67	1	1.5	1.5	1.67	1	1	2.67	1	2	1.67

Text Books:

1. Chitambar, J.B. 1973. Introductory rural sociology.New York, John Wilex and Sons.
2. Desai, A.R. 1978. Rural sociology in India. Bombay, Popular Prakashan, 5th Rev. ed.
3. Doshi, S.L. 2007. Rural sociology.Rawat Publishers, Delhi.
4. Sharma, K.L. 1997. Rural society in India.Rawat Publishers, Delhi.

5. Bhushan, V. and Sachdeva, D.R. 2010. An introduction to Sociology, KitabMahal , New Delhi.
6. Mondal, S. 2014. Text Book of Rural Sociology and Educational Psychology.Kalyani Publishers, New Delhi.

Reference Books:

1. Sharma O. P. and Somani L. L. 2012. Fundamentals of Rural Sociology and Educational Psychology.Agrotech Pub. Co., Udaipur
2. Maslow, A.H. 1970. Motivation and personality. Harper and Row publishers , New York.
3. Pujari, D. 2002. Educational Psychology in Agriculture, Agrotech Publishing Academy, Udaipur (Raj.)
4. Jayapalan, N. 2002. Rural sociology. Altanic Publishers, New Delhi.
5. Bhatia, H.R. 1965. A Text Book of Educational Psychology, Asia Publishing House, New Delhi.

Signatures:

1. S.P. Singh
2. Krishna Kumari
3. Ameeta Yadav
4. VK Tripathi
5. A.K. Tiwari

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Faculty of Agricultural Sciences and Allied Industries

AEX-113 : Human Value and Ethics

L	T	P	CR
1	0	0	1

Course objective:-

To Understand the significance of value inputs in a classroom and start applying them in their life and profession.

Detail Contents

Unit 1 : **50 %**

Unit 2 : **50 %**

Unit- I

Values and Ethics-An Introduction. Goal and Mission of Life. Vision of Life. Principles and Philosophy. Self Exploration. Self Awareness. Self Satisfaction.

Unit- II

Decision Making. Motivation. Sensitivity. Success. Selfless Service. Case Study of Ethical Lives. Positive Spirit. Body, Mind and Soul. Attachment and Detachment. Spirituality Quotient. Examination, basic human rights.

Course Learning Outcomes (CLO)

1. Understand the value of harmonious relationship based on trust and respect in their life and profession.
2. Understand the role of a human being in ensuring harmony in society and nature.
3. Distinguish between ethical and unethical practices, and start working out the strategy to actualize a harmonious environment wherever they work.

Mapping of course outcome with programme outcome and programme specific outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3
CO1	1	2	-	1	3	2	-	-	-	3	1	1
CO2	-	1	-	1	2	1	-	1	1	2	1	2
CO3	1	1	1	1	2	-	1	1	1	1	3	1
Average	1	1.33	1	1	2.33	1.5	1	1	1	2	1.67	1.33

Text Books:

1. *Human Value and Professional ethics- R.R. Gaur, R. Sangal and G.P. Bagaria*

2. *Foundation of ethics and management-excel book .*

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Reference Books:

A. *Human values- A.N. Tripathy- New age international publication*

B. *Science and humanism- P.L. Dhar, R.R. Garg- Commonwealth pub;lisher*

Signature:-

1. S.P. Singh
2. Krishna Dumar
3. Pradeep Yadav
4. V.K. Tripathi
5. A.K. Tiwari

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Faculty of Agricultural Sciences and Allied Industries

National Service Scheme I **NSS-111**

Introduction and basic components of NSS:

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

NSS programmes and activities

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

Understanding youth

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

Community mobilisation

Mapping of community stakeholders, designing the message as per problems and their culture; identifying methods of mobilisation involving youth-adult partnership

Social harmony and national integration

Indian history and culture, role of youth in nation building, conflict resolution and peace-building

Volunteerism and shramdan

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

Citizenship, constitution and human rights

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

Family and society

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

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Faculty of Agricultural Sciences and Allied Industries

GPB- 121: Fundamentals of Genetics

L	T	P	CR
1	1	1	3

Course objective:-

To make the detailed understanding of heredity specially in crop plants to improve and develop the new varieties of plants.

Detail Contents

Unit 1 : **35 %**

Unit 2 : **35 %**

Unit 3 : **30 %**

Unit- I

Pre and Post Mendelian concepts of heredity, Mendelian principles of heredity. Architecture of chromosome; chromonemata, chromosome matrix, chromomeres, centromere, secondary constriction and telomere; special types of chromosomes.Chromosomal theory of inheritance- cell cycle and cell division- mitosis and meiosis. Probability and Chi-square.Dominance relationships, Epistatic interactions with example.

Unit- II

Multiple alleles, pleiotropism and pseudoalleles, Sex determination and sex linkage, sex limited and sex influenced traits, Blood group genetics, Genetic code, Linkage and its estimation, crossing over mechanisms, chromosome mapping. Structural and numerical variations in chromosome and their implications, Use of haploids, dihaploids and doubled haploids in Genetics.

Unit- III

Mutation, classification, Methods of inducing mutations & CIB technique, mutagenic agents and induction of mutation.Qualitative & Quantitative traits, Polygenes and continuous variations, multiple factor hypothesis, Cytoplasmic inheritance.Genetic disorders. Nature, structure & replication of genetic material. Protein synthesis, Transcription and translational mechanism of genetic material, Gene concept: Gene structure, function and regulation, Lac and Trp operons.

Practical

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

Course Learning Outcomes (CLO)

1. Understanding of how genetic concepts affect broad societal issues including health and disease, food and natural resources, environmental sustainability, etc.
2. Insight into the mathematical, statistical, and computational basis of genetic analyses that use genome-scale data sets in systems biology settings.
3. Understanding the role of genetic technologies in industries related to biotechnology, pharmaceuticals, energy, and other fields.

Mapping of course outcome with programme outcome and programme specific outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3
CO1	3	2	-	1	3	1	-	-	3	1	2	3
CO2	2	3	1	-	2	2	1	1	3	-	1	2
CO3	1	3	1	1	2	2	-	1	3	1	3	3
Average	2	2.67	1	1	2.33	1.67	1	1	3	1	2	2.67

Text books:-

B. D. Singh. Principles of Genetics. Kalyani Publishers,

P. Singh. Elements of Genetics. Kalyani Publishers.

Reference books:-

Gardner EJ & Snustad DP. 1991. Principles of Genetics.

John Wiley & Sons. Gupta PK. 2000. Cytogenetics. Rastogi Publ.

Signature:-

1. S.P. Singh
2. Krishna Kumar
3. Ameeta Yadav
4. Vk. Tripathi
5. A.K. Tiwari

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Faculty of Agricultural Sciences and Allied Industries

SAC-121: Agricultural Microbiology

L	T	P	CR
1	0	1	2

Course objective:-

To make the understanding of the basic microbial structure, function and study the comparative characteristics of prokaryotes and eukaryotes.

Detail Contents

Unit 1 : **50 %**

Unit 2 : **50 %**

Unit- I

Introduction.Microbial world: Prokaryotic and eukaryotic microbes. Bacteria: cell structure, chemoautotrophy, photo autotrophy, growth. Bacterial genetics: Genetic recombination- transformation, conjugation and transduction, plasmids, transposon.

Unit- II

Role of microbes in soil fertility and crop production: Carbon, Nitrogen, Phosphorus and Sulphur cycles. Biological nitrogen fixation- symbiotic, associative and asymbiotic. Azolla, blue green algae and mycorrhiza. Rhizosphere and phyllosphere. Microbes in human welfare: silage production, biofertilizers, biopesticides, biofuel production and biodegradation of agro-waste.

Practical

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

Course Learning Outcomes (CLO)

1. To know the various Physical and Chemical growth requirements of bacteria.
2. Impart knowledge about production of beneficial bacteria.

Mapping of course outcome with programme outcome and programme specific outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3
CO1	1	2	-	-	-	1	-	-	3	-	1	1
CO2	2	3	1	1	2	2	1	1	3	1	1	2
Average	1.5	2.5	1	1	2	1.5	1	1	3	1	1	1.5

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Text Books:

1. 1. Biswas, T.D. and Mukherjee, S.K. 1990. Text Book of Soil Sciences, Tata McGrawHill Publishing Company Limited, New Delhi.

2. Mukherjee, N. and Ghosh T. 1998. Agricultural Microbiology, Kalyani Publishers, New Delhi.

3. Rangaswami, G. and Bagyaraj, D.J. 2010. IInd ed. Agricultural Microbiology. Prentice Hall of India Pvt. Limited, New Delhi.

4. R.P. Singh , 2013. Plant Pathology.Kalyani Publishers

Reference Books:

1. Mehrotra, R.S. and Agarawal, A. 2012. I2th ed. Plant Pathology. Tata McGraw Hill Publishing Co. Ltd., New Delhi

2. Rao, N.S. 2000. Soil Microbiology, Oxford & IBH Publishing Co.Pvt.Ltd., New Delhi.

3. Vishunavat, K. and Kolte, S.J. 2005. Essentials of Phytopathological Techniques. Kalyani Publishers, New Delhi

Signature:-

1. S.P. Singh
2. Keshav Kumar
3. Aneeta Yadav
4. VK Tripathi
5. A.K. Tiwari

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Faculty of Agricultural Sciences and Allied Industries

SCW-121: Introductory Soil and Water Conservation Engineering

L	T	P	CR
1	0	1	2

Course objective:-

To Study about the various causes of soil erosion and forms of water erosion, classification of gully control measures or structures.

Detail Contents

Unit 1 : **50 %**

Unit 2 : **50 %**

Unit- I

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 Loss Soil Equation. Soil loss measurement techniques.

Unit- II

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.

Practical

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

Course Learning Outcomes (CLO)

1. Course will provide the knowledge of soil loss equation and it can estimate long - term annual soil loss and guide conservationists on proper cropping, management, and conservation practices.
2. This course will help the students to learn about Contour strip cropping designed to minimize soil erosion and Contour bunds which can save soils from erosion.
3. By this course student get the knowledge about Grassed waterways designed to move surface water across farmland without causing soil erosion and various water harvesting techniques.
4. Students will be able to understand the wind erosion, centrifugal pumps and various pressurized irrigation methods. So overall the importance of this technology in farm is given to students by teaching this course.

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Mapping of course outcome with programme outcome and programme specific outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3
CO1	1	2	-	-	-	1	1	-	3	-	1	2
CO2	2	3	1	1	2	2	-	1	3	1	1	2
CO3	1	3	1	1	-	2	-	1	3	1	3	1
CO4	1	2	-	-	1	3	2	3	1	-	3	3
Average	1.25	2.5	1	1	1.5	2	1.5	1.67	2.5	1	2	2

Text books:-

Sanjay Kumar. Fundamentals of Agricultural Engineering. Kalyani Publishers.

Murty V.V .N Jha Madan K. . Land and Water Management Engineering. Kalyani Publishers

Reference books:-

Muzamil M., Jillani Asima, Farm Power & Machinery Agricultural Engineering, Kalyani Publishers,

Signature:-

1. S.P. Singh
2. Krishna Kumar
3. Ankita Yadav
4. V.K. Tripathi
5. A.K. Tiwari

RAMA UNIVERSITY UTTAR PRADESH KANPUR

Faculty of Agricultural Sciences and Allied Industries

PPY-121 : Fundamentals of Crop Physiology

L	T	P	CR
1	0	1	2

Course objective:-

To study the role of crop physiology in crop health.

Detail Contents

Unit 1 : **50 %**

Unit 2 : **50 %**

Unit- I

Introduction to crop physiology and its importance in Agriculture; Plant cell: an Overview; Diffusion and osmosis; Absorption of water, transpiration and Stomatal Physiology; Mineral nutrition of Plants: Functions and deficiency symptoms of nutrients, nutrient uptake mechanisms.

Unit- II

Photosynthesis: Light and Dark reactions, C3, C4 and CAM plants; Respiration: Glycolysis, TCA cycle and electron transport chain; Fat Metabolism: Fatty acid synthesis and Breakdown; Plant growth regulators: Physiological roles and agricultural uses, Physiological aspects of growth and development of major crops: Growth analysis, Role of Physiological growth parameters in crop productivity, role of crop physiology as stress indicator.

Practical

Study of plant cells, structure and distribution of stomata, imbibitions, osmosis, plasmolysis, measurement of root pressure, rate of transpiration, Separation of photosynthetic pigments through paper chromatography, Rate of transpiration, photosynthesis, respiration, tissue test for mineral nutrients, estimation of relative water content, Measurement of photosynthetic CO_2 assimilation by Infra Red Gas Analyser (IRGA).

Course Learning Outcomes (CLO)

1. To understand the metabolic and synthetic pathway of biomolecules.
2. To know the difference between C3, C4 and CAM plant.
3. Importance of growth hormones in Agriculture.

Mapping of course outcome with programme outcome and programme specific outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3
CO1	1	2	-	-	-	1	-	-	3	-	1	1
CO2	2	3	1	1	2	2	-	1	3	1	1	2
CO3	1	3	1	1	-	2	-	1	2	1	3	3
Average	1.33	2.33	1	1	2	1.67	-	1	2.67	1	1.67	2

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Text books:-

Gupta N.K ., Gupta Sunita. Fundamentals of Crop Physiology. Kalyani Publisher

Reference books:-

Arthur Young. Crop Physiology at a Glance. Oxford Publication

Signature:-

1. S. P. Singh
2. Krishna Kumar
3. Aneeta Yadav
4. M. Tripathi
5. A. K. Tiwari

RAMA UNIVERSITY UTTAR PRADESH KANPUR

Faculty of Agricultural Sciences and Allied Industries

AES-121 : Fundamentals of Agricultural Economics

L	T	P	CR
1	1	0	2

Course objective:-

To identify the elements of business success in agriculture and food-processing as well as elements that determine economic role of agriculture in national economy.

Detail Contents

Unit 1 : **25 %**

Unit 2 : **25 %**

Unit 3 : **25 %**

Unit 4 : **25 %**

Unit- I

Economics: Meaning, scope and subject matter, definitions, activities, approaches to economic analysis; micro and macro economics, positive and normative analysis. Nature of economic theory; rationality assumption, concept of equilibrium, economic laws as generalization of human behavior. Basic concepts: Goods and services, desire, want, demand, utility, cost and price, wealth, capital, income and welfare. Agricultural economics: meaning, definition, characteristics of agriculture, importance and its role in economic development. Agricultural planning and development in the country.

Unit- II

Demand: meaning, law of demand, demand schedule and demand curve, determinants, utility theory; law of diminishing marginal utility, equi-marginal utility principle. Consumer's equilibrium and derivation of demand curve, concept of consumer surplus. Elasticity of demand: concept and measurement of price elasticity, income elasticity and cross elasticity. Production: process, creation of utility, factors of production, input output relationship. *Laws of returns*: Law of variable proportions and law of returns to scale.

Unit- III

Cost: Cost concepts, short run and long run cost curves. Supply: Stock v/s supply, law of supply, supply schedule, supply curve, determinants of supply, elasticity of supply. Market structure: meaning and types of market, basic features of perfectly competitive and imperfect markets. Price determination under perfect competition; short run and long run equilibrium of firm and industry, shut down and break even points. Distribution theory: meaning, factor market and pricing of factors of production. Concepts of rent, wage, interest and profit. *National income:* Meaning and importance, circular flow, concepts of national income accounting and approaches to measurement, difficulties in measurement. Population: Importance, Malthusian and Optimum population theories, natural and socio-economic determinants, current policies and programmes on population control.

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Unit- IV

Money: Barter system of exchange and its problems, evolution, meaning and functions of money, classification of money, money supply, general price index, inflation and deflation. Banking: Role in modern economy, types of banks, functions of commercial and central bank, credit creation policy. Agricultural and public finance: meaning, micro v/s macro finance, need for agricultural finance, public revenue and public expenditure. *Tax:* meaning, direct and indirect taxes, agricultural taxation, VAT. *Economic systems:* Concepts of economy and its functions, important features of capitalistic, socialistic and mixed economies, elements of economic planning.

Course Learning Outcomes (CLO)

1. Propose methods of micro- and macroeconomic decision making in agriculture in different agro-ecological and agro-economic circumstances and supply and demand of agricultural and food products on national and international markets.
2. To understand the concepts of consumer choice and how it affect the farm / ranch level agriculture firm.
3. To understand the macroeconomics aspects of the economy as they affect the agricultural sector. It also applies economics principles to understand the conduct and performance of the agricultural industry.

Mapping of course outcome with programme outcome and programme specific outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3
CO1	1	2	-	2	2	1	3	3	3	2	1	3
CO2	2	3	2	2	2	2	3	1	3	1	2	2
CO3	1	3	3	1	3	2	3	2	3	2	3	3
Average	1.33	2.67	2.5	1.67	2.33	1.66	3	2	3	1.67	2	2.67

Text books:-

Chinna S.S. Agricultural Economics and Indian Agriculture. Kalyani Publishers.

Ojha p.k . Dimensions of Agricultural Science. Kalyani Publishers.

Reference books:-

Rout R.K . Basic Ahricultural Economics, Kalyani Publishers.

Subramaniam S. Veerabadran. Globalisation And Sustainable Agriculture. Kalyani Publishers

Signature:-

1. S.P. Singh
2. Kailash Kumar
3. Aneeta Yadav
4. VK Tripathi
5. A.K. Tiwari

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PPA-121: Fundamentals of Plant Pathology

L	T	P	CR
2	1	1	4

Course objective:-

To study the concepts of plant pathogens, major disease causing organisms and their etiology.

Detail Contents

Unit 1 : **25 %**

Unit 2 : **25 %**

Unit 3 : **25 %**

Unit 4 : **25 %**

Unit- I

Introduction: Importance of plant diseases, scope and objectives of Plant Pathology. History of Plant Pathology with special reference to Indian work. Terms and concepts in Plant Pathology.Pathogenesis. Causes / factors affecting disease development: disease triangle and tetrahedron and classification of plant diseases. Important plant pathogenic organisms, different groups: fungi, bacteria, fastidious vesicular bacteria, phytoplasmas, spiroplasmas, viruses, viroids, algae, protozoa, phanerogamic parasites and nematodes with examples of diseases caused by them. Diseases and symptoms due to abiotic causes.

Unit- II

Fungi: general characters, definition of fungus, somatic structures, types of fungal thalli, fungal tissues, modifications of thallus, reproduction (asexual and sexual). Nomenclature, Binomial system of nomenclature, rules of nomenclature, classification of fungi. Key to divisions, sub-divisions, orders and classes.

Unit- III

Bacteria and mollicutes: general morphological characters. Basic methods of classification and reproduction.

Viruses: nature, structure, replication and transmission. Study of phanerogamic plant parasites.

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

Unit- IV

Growth and reproduction of plant pathogens. Liberation / dispersal and survival of plant pathogens.Types of parasitism and variability in plant pathogens. Pathogenesis.Role of enzymes, toxins and growth regulators in disease development.Defense mechanism in plants. Epidemiology: Factors affecting disease development. 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 and microscopy.Collection and preservation of disease specimen.Preparation of media, isolation and Koch's postulates.General study of different structures of fungi.Study of symptoms of various plant diseases.Study of representative fungal genera.Staining and identification of plant pathogenic bacteria.Transmission of plant viruses.Study of phanerogamic plant parasites.

Study of morphological features and identification of plant parasitic nematodes.Sampling and extraction of nematodes from soil and plant material, preparation of nematode mounting.

Course Learning Outcomes (CLO)

1. To provide specific knowledge about host pathogen interactions.
2. Recognition of plant disease is the first step in doing something about them.
3. To give specific knowledge about environment and disease development.

Mapping of course outcome with programme outcome and programme specific outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3
CO1	1	2	2	-	-	1	-	2	3	-	1	1
CO2	2	3	1	1	2	2	-	1	2	1	1	2
CO3	1	3	1	1	-	2	1	1	3	1	3	1
Average	1.33	2.67	1.33	1	2	1.67	1	1.33	2.67	1	1.67	1.33

Text Books:

1. *Introduction to Principles of Plant Pathology, R. S. Singh, Oxford, latest edition*
2. *Plant Pathology, R. S. Mehrotra, Tata McGraw-Hill Education, latest edition*

Reference Books:

1. Plant Pathology, R.P. Singh, Kalyani Publishers, latest edition.
2. Plant Pathology, B.P. Pandey, S. Chand & Company Ltd, latest edition.
3. Plant Pathogens : The Fungi - R. S. Singh, Oxford & IBH Publishing Co., latest edition
4. An Introduction to Fungi-H. C. Dube, Scientific Publishers, latest edition

Signature:-

1. S.P. Singh
2. Kalpana kumari
3. Preeta Yadav
4. VK Tripathi
5. A.K. Tiwari

RAMA UNIVERSITY UTTAR PRADESH KANPUR

Faculty of Agricultural Sciences and Allied Industries

ENT- 121: Fundamentals of Entomology

L	T	P	CR
2	1	1	4

Course objective:-

To study the morphological characteristics, feeding habit and habitat of agriculturally important insect-pest.

Detail Contents

Unit 1 : **25 %**

Unit 2 : **25 %**

Unit 3 : **25 %**

Unit 4 : **25 %**

Unit I-

History of Entomology in India. Major points related to dominance of Insecta in Animal kingdom. Classification of phylum Arthropoda upto classes.Relationship of class Insecta with other classes of Arthropoda. Morphology: Structure and functions of insect cuticle and molting.

Body segmentation.Structure of Head, thorax and abdomen. Structure and modifications of insect antennae, mouth parts, legs, Wing venation, modifications and wing coupling apparatus. Structure of male and female genital organ.Metamorphosis and diapause in insects.Types of larvae and pupae.Structure and functions of digestive, circulatory, excretory, respiratory, nervous, secretary (Endocrine) and reproductive system, in insects.Types of reproduction in insects. Major sensory organs like simple and compound eyes, chemoreceptor.

Unit-II

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

Unit-III

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

Unit-IV

Systematics: Taxonomy –importance, history and development and binomial nomenclature. Definitions of Biotype, Sub-species, Species, Genus, Family and Order. Classification of class Insectaupto Orders, basic groups of present day insects with special emphasis to orders and families of Agricultural importance like Orthoptera: Acrididae,

Tettigonidae, Gryllidae, Gryllotalpidae; Dictyoptera: Mantidae, Blattidae; Odonata; Isoptera: Termitidae; Thysanoptera: Thripidae; Hemiptera: Pentatomidae, Coreidae, Cimicidae, Pyrrhocoridae, Lygaeidae, Cicadellidae, Delphacidae, Aphididae, Coccidae, Lophophidae, Aleurodidae, Pseudococcidae; Neuroptera: Chrysopidae; Lepidoptera: Pieridae, Papiloinidae, Noctuidae, Sphingidae, Pyralidae, Gelechiidae, Arctiidae, Saturnidae, Bombycidae; Coleoptera: Coccinellidae, Chrysomelidae, Cerambycidae, Curculionidae, Bruchidae, Scarabaeidae;

Hymenoptera: Tenthridinidae, Apidae. Trichogrammatidae, Ichneumonidae, Braconidae, Chalcididae; Diptera: Cecidomyiidae, Tachinidae, Agromyziidae, Culicidae, Muscidae, Tephritidae.

Practical

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

Course Learning Outcomes (CLO)

1. To be able to apply concepts and analytical approaches in evolutionary biology, genetics and other areas of insect biology of the student's choice.
2. To be able to categorize insects based on basic ecological, behavioural, morphological, physiological, or developmental attributes.
3. To be able to examine insects deeply within a biological level of analysis and make strategies for successful pest management strategy.
4. To be able to understand about different families and orders of class Insecta which cause economic losses for human being.

Mapping of course outcome with programme outcome and programme specific outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3
CO1	1	2	-	-	-	1	-	-	3	-	1	1
CO2	2	3	1	1	2	2	-	1	3	1	1	2
CO3	1	3	1	1	-	2	-	1	3	1	3	1
CO4	1	2	-	-	1	3	2	3	1	-	3	3
Average	1.25	2.5	1	1	1.5	2	2	1.67	2.5	1	2	1.75

Text books:-

Dharmendra Kumar , Raghuraman M. Yadav R.S. Agricultural Entomology. Kalyani Publishers ,

Sehgal P.K . Fundamentals of Agricultural Entomology. Kalyani Publishers

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Faculty of Agricultural Sciences and Allied Industries

Reference books:-

Khare D.P.Stored Grain Pests & Their Management. Kalyani Publishers,

K.Pani Kumar, Viji C.P . Entomology Refresher. Kalyani Publishers

Signature:-

1. S.P. Singh
2. ~~Aneeta Yadav~~ Krishna Kumar
3. Aneeta Yadav
4. V.K. Tiwedi
5. A.K. Tiwari

RAMA UNIVERSITY UTTAR PRADESH KANPUR

Faculty of Agricultural Sciences and Allied Industries

AEX-121: Fundamentals of Agricultural Extension Education

L	T	P	CR
2	0	1	3

Course objective:-

To understand the meaning of Education; Extension Programme planning Meaning, Process, Principles and Steps in Programme Development.

Detail Contents

Unit 1 : **50 %**

Unit 2 : **50 %**

Unit- I

Education: Meaning, definition & Types; Extension Education- meaning, definition, scope and process; objectives and principles of Extension Education; Extension Programme planning- Meaning, Process, Principles and Steps in Programme Development. Extension systems in India: extension efforts in pre-independence era (Sriniketan, Marthandam, Firka Development Scheme, Gurgaon Experiment, etc.) and post-independence era (Etawah Pilot Project, Nilokheri Experiment, etc.); various extension/ agriculture development programmes launched by ICAR/ Govt. of India (IADP, IAAP, HYVP, KVK, IVLP, ORP, ND,NATP, NAIP, etc.). New trends in agriculture extension: privatization extension, cyber extension/ e-extension, market-led extension, farmer-led extension, expert systems, etc.

Unit- II

Rural Development: concept, meaning, definition; various rural development programmes launched by Govt. of India. Community Dev.-meaning, definition, concept & principles, Philosophy of C.D. Rural Leadership: concept and definition, types of leaders in rural context; extension administration: meaning and concept, principles and functions. Monitoring and evaluation: concept and definition, monitoring and evaluation of extension programmes; transfer of technology: concept and models, capacity building of extension personnel; extension teaching methods: meaning, classification, individual, group and mass contact methods, ICT Applications in TOT (New and Social Media), media mix strategies; communication: meaning and definition; Principles and Functions of Communication, models and barriers to communication. Agriculture journalism; diffusion and adoption of innovation: concept and meaning, process and stages of adoption, adopter categories.

Practical

To get acquainted with university extension system. Group discussion- exercise; handling and use of audio visual equipments and digital camera and LCD projector; preparation and use of AV aids, preparation of extension literature – leaflet, booklet, folder, pamphlet news stories and success stories; Presentation skills exercise; micro teaching exercise; A visit to village to understand the problems being encountered by the villagers/ farmers; to study organization and functioning of DRDA and other development departments at district level; visit to NGO and

learning from their experience in rural development; understanding PRA techniques and their application in village development planning; exposure to mass media: visit to community radio and television studio for understanding the process of programme production; script writing, writing for print and electronic media, developing script for radio and television.

Course Learning Outcomes (CLO)

1. Knowledge about Extension systems in India:
2. Extension efforts in Pre-independence era .New trends in agriculture extension: privatization extension.
3. Monitoring and evaluation – concept and definition, monitoring, and evaluation of Extension programmes,
4. Transfer of Technology- Concept and models.

Mapping of course outcome with programme outcome and programme specific outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3
CO1	2	2	2	3	-	1	2	3	3	3	1	1
CO2	2	3	1	1	2	2	-	1	3	1	2	2
CO3	1	3	2	1	1	2	1	1	3	1	3	2
CO4	1	2	-	2	1	3	2	3	1	-	3	3
Average	1.5	2.5	1.67	1.75	1.33	2	1.67	2	2.5	1.67	2.25	2

Text books:-

Azad A.K ., Khajan Singh. A Basic Book on Fundamentals of Agriculture Extension. Kalyani Publishers ,

Birendra Kumar. New Trends in Extension Education. Kalyani Publishers

Reference books:-

Mondal Sagar. Agricultural Extension. Kalyani Publishers

Ranjit Singh. Extension Education. Kalyani Publishers

Signature:-

1. S.P. Singh
2. Krishna Kumari
3. Sneeta Yadav
4. UK Tripathi
5. A.K. Tiwari

RAMA UNIVERSITY UTTAR PRADESH KANPUR

Faculty of Agricultural Sciences and Allied Industries

PPY-211: Environmental Studies and Disaster Management

L	T	P	CR
1	1	1	3

Course objective:-

To appreciate concepts and methods from ecological and physical sciences and their application in environmental problem solving. Interdisciplinary branches of environment and their scopes.

Detail Contents

Unit 1 : **20%**

Unit 2 : **20%**

Unit 3 : **20%**

Unit 4 : **20%**

Unit 5 : **20%**

Unit- I

Multidisciplinary nature of environmental studies Definition, scope and importance.

Natural Resources: Renewable and non-renewable resources, Natural resources and associated problems. a) Forest resources: Use and over-exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forest and tribal people. b) Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems. c) Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies. d) Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies.

Unit- II

e) Energy resources: Growing energy needs, renewable and non-renewable energy sources, use of alternate energy sources. Case studies. f) Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification. • Role of an individual in conservation of natural resources. Equitable use of resources for sustainable lifestyles.

Ecosystems: Concept of an ecosystem, Structure and function of an ecosystem, Producers, consumers and decomposers, Energy flow in the ecosystem. Ecological succession, Food chains, food webs and ecological pyramids. Introduction, types, characteristic features, structure and function of the following ecosystem: a. Forest ecosystem b. Grassland ecosystem c. Desert ecosystem d. Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries).

Unit- III

Biodiversity and its conservation: - Introduction, definition, genetic, species & ecosystem diversity and biogeographical classification of India. Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values. Biodiversity at global, National and local levels, India as a mega-diversity nation.Hot-sports of biodiversity. Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts. Endangered and endemic species of India. Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.

Environmental Pollution: definition, cause, effects and control measures of: a. Air pollution b. Water pollution c. Soil pollution d. Marine pollution e. Noise pollution f. Thermal pollution g. Nuclear hazards. Solid Waste Management: causes, effects and control measures of urban and industrial wastes. Role of an individual in prevention of pollution.

Unit- IV

Social Issues and the Environment: From Unsustainable to Sustainable development, Urban problems related to energy, Water conservation, rain water harvesting, watershed management. Environmental ethics: Issues and possible solutions, climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. dies. Wasteland reclamation.Consumerism and waste products.Environment Protection Act.Air (Prevention and Control of Pollution) Act.Water (Prevention and control of Pollution) Act.

Wildlife Protection Act.Forest Conservation Act. Issues involved in enforcement of environmental legislation. Public awareness.

Human Population and the Environment: population growth, variation among nations, population explosion, Family Welfare Programme. Environment and human health: Human Rights, Value Education, HIV/AIDS. Women and Child Welfare.Role of Information Technology in Environment and human health.

Unit- V

Disaster Management

Natural Disasters- Meaning and nature of natural disasters, their types and effects. Floods, drought, cyclone, earthquakes, landslides, avalanches, volcanic eruptions, Heat and cold waves, Climatic change: global warming, Sea level rise, ozone depletion.

Man Made Disasters- Nuclear disasters, chemical disasters, biological disasters, building fire, coal fire, forest fire, oil fire, air pollution, water pollution, deforestation, industrial waste water pollution, road accidents, rail accidents, air accidents, sea accidents.

Disaster Management- Effect to migrate natural disaster at national and global levels.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 in disaster response; Disaster response; Police and other organizations.

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Faculty of Agricultural Sciences and Allied Industries

Practical

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

Course Learning Outcomes (CLO)

1. To understand the concepts of natural resources, Food resources, mineral resources,
2. To understand the concept of non Conventional energy resources, types and various applications of renewable resources and current potentials of energy resources.
3. Ecosystem Links between environmental components and their role and types of ecosystems.

Mapping of course outcome with programme outcome and programme specific outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3
CO1	3	2	1	3	2	1	-	2	3	-	2	2
CO2	2	3	2	1	2	2	-	1	3	1	1	2
CO3	2	3	1	1	-	2	1	2	3	2	3	1
Average	2.33	2.67	1.33	1.67	2	1.67	1	1.67	3	1.5	2	1.67

Text books:-

Kukal S.S Kingra P.K. Introduction to Environment & Disaster Management. Kalyani Publishers

Reference books:-

Charles Davis .Introduction to Environment. Oxford Publications

Signature:-

1. S.P. Singh
2. Krishna Kumar
3. Neeta Yadav
4. VK Tripathi
5. A.K. Tiwari

RAMA UNIVERSITY UTTAR PRADESH KANPUR

Faculty of Agricultural Sciences and Allied Industries

AGR- 211: Crop Production Technology-I (Kharif Crops)

L	T	P	CR
1	0	1	2

Course objective:-

To study about origin, geographical distribution, and economic importance of Kharif crops.

Detail Contents

Unit 1 : **50 %**

Unit 2 : **50 %**

Unit- I

Origin, geographical distribution, economic importance, soil and climatic requirements, varieties, cultural practices and yield of *Kharif*crops. Cereals – rice, maize, sorghum, pearl millet and finger millet, pulses-pigeonpea, mungbean and urdbean;

Unit- II

Origin, geographical distribution, economic importance, soil and climatic requirements, varieties, cultural practices and yield of *Kharif*crops. oilseeds- groundnut, and soybean; fibre crops- cotton & Jute; forage crops-sorghum, cowpea, cluster bean and napier.

Practical

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

Course Learning Outcomes (CLO)

1. In the course study the students will be able to know about Soil and climatic requirements, varieties, cultural practices and yield of Kharif crops.
2. Analysis of comparative benefits of the different kharif crops .Constraints in production of oilseeds and pulses maybe identified through course content.
3. Production technology of kharif cereals and millets fulfill the need of human consumption and milch cattle.

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Mapping of course outcome with programme outcome and programme specific outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3
CO1	1	2	-	-	-	1	-	-	2	-	1	1
CO2	2	3	1	1	2	2	-	1	3	1	1	2
CO3	1	3	1	1	-	2	-	1	1	1	3	1
Average	1.33	2.67	1	1	2	1.67	-	1	2	1	1.67	1.33

Text Books:

1. Balasubramaniyan, P. and Palaniappan, S.P.2016. Principles and Practices of Agronomy (2nd edition), Agrobios (India), Jodhpur.

2. Reddy, S. R. 2016. Principles of Agronomy, Kalyani Publishers, Ludhiana.

3. Singh, S.S. and Singh, Rajesh. 2015. Principles and Practices of Agronomy (5th Re-set), Kalyani Publishers, New Delhi, Kalyani Publishers, Ludhiana.

Reference Books:

1. Balasubramaniyan, P. and Palaniappan, S.P.2016. Principles and Practices of Agronomy (2nd edition), Agrobios (India), Jodhpur.

2. Yawalkar, K.S., Agarwal, J.P. and Bokde, S. 2008. Manures and Fertilizers (10th edition), Agri-Horticultural Publishing House, Nagpur.

Signature:-

1. S.P. Singh
2. Krishna Kumari
3. Aneeta Yadav
4. VK Tripathi
5. A.K. Tiwari

RAMA UNIVERSITY UTTAR PRADESH KANPUR

Faculty of Agricultural Sciences and Allied Industries

GPB- 211: Fundamentals of Plant Breeding

L	T	P	CR
1	1	1	3

Course objective:-

To study about the the commercial plant breeding to developed new superior crops varieties.

Detail Contents

Unit 1 : **35%**

Unit 2 : **35%**

Unit 2 : **30%**

Unit- I

Historical development, concept, nature and role of plant breeding, major achievements and future prospects; Genetics in relation to plant breeding, modes of reproduction and apomixes, self-incompatibility and male sterility-genetic consequences, cultivar options. Domestication, Acclimatization and Introduction; Centres of origin/diversity, components of Genetic variation; Heritability and genetic advance.

Unit- II

Genetic basis and breeding methods in self- pollinated crops - mass and pure line selection, hybridization techniques and handling of segregating population; Multiline concept, SSD method. Concepts of population genetics and Hardy-Weinberg Law, Genetic basis and methods of breeding cross pollinated crops, modes of selection; Population improvement Schemes- Ear to row method, Modified Ear to Row, recurrent selection schemes.

Unit- III

Heterosis and inbreeding depression, development of inbred lines and hybrids, composite and synthetic varieties; Breeding methods in asexually propagated crops, clonal selection and hybridization; Wide hybridization and pre-breeding; Polyploidy in relation to plant breeding, mutation breeding-methods and uses; Breeding for important biotic and abiotic stresses; Biotechnological tools-DNA markers and marker assisted selection. Participatory plant breeding; Intellectual Property Rights, Patenting, Plant Breeders and & Farmer's Rights.

Practical

Plant Breeder's kit, Study of germplasm of various crops. Study of floral structure of self-pollinated and cross pollinated crops. Emasculation and hybridization techniques in self & cross pollinated crops.Consequences of inbreeding on genetic structure of resulting populations.Study of male sterility system.Handling of segregation populations.Methods of calculating mean, range, variance, standard deviation, heritability. Designs used in plant

breeding experiments, analysis of Randomized Block Design. To work out the mode of pollination in a given crop and extent of natural out-crossing.Prediction of performance of double cross hybrids.

Course Learning Outcomes (CLO)

1. Develop the insect and disease resistant varieties for environment friendly management of disease and insect.
2. Serve the quality food in the market by developing high nutritive varieties.
3. Increase the farm yield to get higher income on farm by developing higher yield crop varieties.
4. To start a consultant company to guide & supply the better varieties to the farmers.

Mapping of course outcome with programme outcome and programme specific outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3
CO1	1	2	1	1	3	1	2	-	3	3	1	3
CO2	2	3	1	1	2	2	-	1	3	1	1	2
CO3	3	3	1	1	-	2	-	1	3	1	3	2
CO4	2	2	-	-	1	3	2	3	1	-	3	3
Average	2	2.5	1	1	3	2	2	1.67	2.5	1.67	2	2.5

Text books:-

B. D. Singh. Principles of Genetics. Kalyani Publishers.
B. D. Singh. Plant Breeding: Principles and Methods. Kalyani Publishers.
P. Singh. Essentials of Plant Breeding. Kalyani Publishers.

Reference books:-

Gupta PK. 1997. Elements of Biotechnology. Rastogi Publ.
Singh BD. 2005. Biotechnology, Expanding Horizons. Kalyani.

Signature:-

1. S.P. Singh
2. Krishna Kumar
3. Aneeta Yadav
4. UK Tripathi
5. A.K. Tiwari

RAMA UNIVERSITY UTTAR PRADESH KANPUR

Faculty of Agricultural Sciences and Allied Industries

AES- 211: Agricultural Finance and Co-Operation

L	T	P	CR
1	1	1	3

Course objective:-

To study about the economics principles to understand the conduct and performance of the agricultural industry.

Detail Contents

Unit 1 : **35%**

Unit 2 : **35%**

Unit 3 : **30%**

Unit- I

Agricultural Finance- meaning, scope and significance, credit needs and its role in Indian agriculture. Agricultural credit: meaning, definition, need, classification. Credit analysis: 4 R's, and 3C's of credits. Sources of agricultural finance: institutional and non-institutional sources, commercial banks, social control and nationalization of commercial banks, Micro financing including KCC. Lead bank scheme, RRBs, Scale of finance and unit cost.

Unit- II

An introduction to higher financing institutions – RBI, NABARD, ADB, IMF, world bank, Insurance and Credit Guarantee Corporation of India. Cost of credit. Recent development in agricultural credit. Preparation and analysis of financial statements – Balance Sheet and Income Statement.Basic guidelines for preparation of project reports- Bank norms – SWOT analysis.

Unit- III

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

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Faculty of Agricultural Sciences and Allied Industries

Practicals

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

Course Learning Outcomes (CLO)

1. Explain the broad feature of Indian financial institutions with instruments to control credit in the country.
2. Effectively narrate the kinds and components of money with its regulatory system .
3. Knowledge of the functions, objectives and limitations of commercial bank.

Mapping of course outcome with programme outcome and programme specific outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3
CO1	1	2	-	-	-	1	2	-	1	-	1	1
CO2	2	3	1	1	2	2	1	1	3	1	1	2
CO3	1	3	1	1	-	2	2	1	3	1	3	1
Average	1.33	2.67	1	1	2	1.67	1.67	1	1.16	1	1.67	1.33

Text books:-

Francis A.T. Knowledge Management in Agriculture & Business. Kalyani Publishers

Ojha P.K . Dimensions of Ahgricultural Science. Kalyani Publishers

Reference books:-

Subramaniaam S. Veerabadran.Globalisation and Sustainable Agriculture . Kalyani Publishers

Signature:-

1. S.P. Singh
2. Krishna Kumari
3. Aneeta Yadav
4. VK Tripathi
5. A.K. Tiwari

RAMA UNIVERSITY UTTAR PRADESH KANPUR

Faculty of Agricultural Sciences and Allied Industries

AES- 212 : Agri-Informatics

L	T	P	CR
1	0	1	2

Course objective:-

To understand the various IT application and different IT tools in Agriculture

Detail Contents

Unit 1 : **50%**

Unit 2 : **50%**

Unit- I

Introduction to Computers, Operating Systems, definition and types, Applications of MS-Office for document creation & Editing, Data presentation, interpretation and graph creation, statistical analysis, mathematical expressions, Database, concepts and types, uses of DBMS in Agriculture, World Wide Web (WWW): Concepts and components. Introduction to computer programming languages, concepts and standard input/output operations.

Unit- II

e-Agriculture, concepts and applications, Use of ICT in Agriculture. Computer Models for understanding plant processes. IT application for computation of water and nutrient requirement of crops, Computer-controlled devices (automated systems) for Agri-input management, Smartphone Apps in Agriculture for farm advises, market price, postharvest management etc; Geospatial technology for generating valuable agri-information. Decision support systems, concepts, components and applications in Agriculture, Agriculture Expert System, Soil Information Systems etc for supporting Farm decisions. Preparation of contingent crop-planning using IT tools.

Practical

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

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Course Learning Outcomes (CLO)

1. Use of Decision support systems, Agriculture Expert System and Soil Information. Systems in Agriculture.
2. Understand analogy of computer. Basic knowledge of MS Office.
3. Some basic knowledge of Internet and WWW.

Mapping of course outcome with programme outcome and programme specific outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3
CO1	1	2	-	-	-	1	-	-	2	-	1	1
CO2	2	3	1	1	2	2	1	1	2	1	1	2
CO3	1	3	1	1	-	2	-	1	2	1	3	1
Average	1.33	2.67	1	1	2	1.67	1	1	2	1	1.67	1.33

Text books:-

Gupta N.K ., Gupta Sunita . Fundamentals of Plant Biochemistry & Biotechnology. Kalyani Publishers

Reference books:-

Gursharan Singh, Chatterjee Mary, Kapoor Sonia. Fundamentals & Industiral Biotechnology. Kalyani Publishers

Signature:-

1. S.P. Singh
2. Krishna Kumari
3. Aneeta Yadav
4. V.K. Tripathi
5. A.K. Tiwari

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AGR- 212: Farm Machinery and Power

L	T	P	CR
1	0	1	2

Course objective:-

To study the various sources of farm power and their uses.

Detail Contents

Unit 1 : **50%**

Unit 2 : **50%**

Unit- I

Status of Farm Power in India, Sources of Farm Power , I.C. engines, working principles of I C engines, comparison of two stroke and four stroke cycle engines , Study of different components of I.C. engine, I.C. engine terminology and solved problems, Familiarization with different systems of I.C. engines: Air cleaning, cooling, lubrication ,fuel supply and hydraulic control system of a tractor.

Unit- II

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 implement, Implement for hill agriculture, implement for intercultural operations, Familiarization with sowing and planting equipment, calibration of a seed drill and solved examples, Familiarization with Plant Protection equipment, Familiarization with harvesting and threshing equipment.

Practicals

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

Course Learning Outcomes (CLO)

1. To know about the working of IC Engines and their uses in modern equipments.
2. Knowledge about various parts of tractors and their mechanism.
3. To study about the financial aspects of using farm power .the various implements used in agriculture farm for various purposes

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3. **Mapping of course outcome with programme outcome and programme specific outcomes:**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3
CO1	1	1	-	3	-	1	1	-	2	-	1	2
CO2	1	3	1	1	2	2	2	1	1	1	2	2
CO3	1	3	1	1	1	2	1	1	3	1	3	1
Average	1	2.33	0.67	1.67	1.5	1.67	1.33	1.5	2	1	2	1.67

Text books:-

Sanjay Kumar. Principles and Appplications of Technologies in Agriculture. Kalyani Publishers

Sanjay Kumar. Farm Power Resources & Technologies. Kalyani Publishers

Reference books:-

Sanjay Kumar . Farm Power & Machinery. Kalyani Publishers

Signature:-

1. S.P. Singh
2. Krishna Kumari
3. Preeta Yadav
4. VK Tripathi
5. A.K. Tiwari

RAMA UNIVERSITY UTTAR PRADESH KANPUR

Faculty of Agricultural Sciences and Allied Industries

HOR-211: Production Technology for Vegetable and Spices

L	T	P	CR
1	0	1	2

Course objective:-

To study about the production techniques of Vegetables and Spices.

Detail Contents

Unit 1 : **50%**

Unit 2 : **50%**

Unit- I

Importance of vegetables & spices in human nutrition and national economy, kitchen gardening, brief about origin, area, climate, soil, improved varieties and cultivation practices such as time of sowing, sowing, transplanting techniques, planting distance, fertilizer requirements, irrigation, weed management, harvesting and yield, physiological disorders, of important vegetable and spices (Tomato, Brinjal, Chilli, Capsicum, Cucumber, Melons, Gourds, Pumpkin, French bean,

Unit- II

Peas; Cole crops such as Cabbage, Cauliflower, Knol-khol; Bulb crops such as Onion, Garlic; Root crops such as Carrot, Raddish, Beetroot; Tuber crops such as Potato; Leafy vegetables such as Amaranth, Palak. Perennial vegetables).

Practical

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

Course Learning Outcomes (CLO)

1. Students will understand practical knowledge on specialized production techniques of vegetables and spices.
2. Students understand will Importance of vegetables & spices in human nutrition improved and national economy.

C. Mapping of course outcome with programme outcome and programme specific outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3
CO1	1	2	2	2	-	1	1	-	3	2	3	3
CO2	2	3	1	1	2	2	2	1	3	3	2	2
Average	1.5	2.5	1.5	1.5	2	1.5	1.5	1	3	2.5	2.5	2.5

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Text books:-

Arya Prem Singh. A text book of Vegetable Culture. Kalyani Publishers

Barche Swati, Kirad Kamal Singh. Vegetable at a Glance . Kalyani Publishers

Reference books:-

Barooah S. Vegetable growing in India. Kalyani Publishers

Choudhary B.R. Vegetables. Kalyani Publishers

Signature:-

1. S.P. Singh
2. Krishna Kumari
3. Aneeta Yadav
4. UK Tripathi
5. A.K. Tiwari

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AEX-122: Communication skills and Personality Development

L	T	P	CR
1	0	1	2

Course objective:-

To study & analyze the basic communication skills.

Detail Contents

Unit 1 : **50 %**

Unit 2 : **50 %**

Unit- I

Communication Skills: Structural and functional grammar; meaning and process of communication, verbal and nonverbal communication; listening and note taking, writing skills, oral presentation skills; field diary and lab record; indexing, footnote and bibliographic procedures.

Unit- II

Reading and comprehension of general and technical articles, precise writing, summarizing, abstracting; individual and group presentations, impromptu presentation, public speaking; Group discussion. Organizing seminars and conferences.

Practical

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

Course Learning Outcomes (CLO)

1. Students Will learn about Communication Skills: Structural and functional grammar; meaning and
2. It will provide the knowledge about process of communication, verbal and nonverbal communication; listening and note taking, writing skills, oral presentation skills

Mapping of course outcome with programme outcome and programme specific outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3
CO1	1	-	-	-	2	1	-	2	2	3	2	2
CO2	1	-	1	1	2	2	-	1	3	2	1	2
Average	1	-	1	1	1	1.5	-	1.5	2.5	2.5	1.5	2

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Text books:-

Variendra Kumar both Raj.*Comprehension & Communication Skills in English.* Kalyani Publisher.

Suradhar D.D Babu S.L .*Human Resource Management in Agriculture.* Kalyani Publishers.

Reference books:-

Mondal Sagar . Communication Skills & Personbality Development ,

Entrepreneurship Development & Business Communication. Kalyani Publishers

Signature:-

1. S.P. Singh
2. Kalpana Kumar
3. Aneeta Yadav
4. V.K. Tripathi
5. A.K. Tiwari

RAMA UNIVERSITY UTTAR PRADESH KANPUR

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AES-213 : Statistical Methods

L	T	P	CR
1	1	1	3

Course objective:-

Acquaintance with some basic concepts in statistics.

Detail Contents

Unit 1 : **50%**

Unit 2 : **50%**

Unit- I

Introduction to Statistics and its Applications in Agriculture, Graphical Representation of Data, Measures of Central Tendency & Dispersion, Definition of Probability, Addition and Multiplication Theorem (without proof). Simple Problems Based on Probability. Binomial & Poisson Distributions, Definition of Correlation, Scatter Diagram.Karl Pearson's Coefficient of Correlation. Linear Regression Equations.

Unit- II

Introduction to Test of Significance, One sample & two sample test t for Means, Chi-Square Test of Independence of Attributes in 2 2 Contingency Table. Introduction to Analysis of Variance, Analysis of One Way Classification. Introduction to Sampling Methods, Sampling versus Complete Enumeration, Simple Random Sampling with and without replacement, Use of Random Number Tables for selection of Simple Random Sample.

Practical

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

Course Learning Outcomes (CLO)

1. Making students familiar with some elementary statistical methods of analysis of data viz. Measures of Central Tendency, Dispersion, Moments, Skewness, and Kurtosis and to interpret them.
2. Analysis of data pertaining to attributes and to interpret the results.

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Mapping of course outcome with programme outcome and programme specific outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3
CO1	1	2	-	-	-	1	3	2	3	2	1	2
CO2	2	3	1	1	2	2	2	1	3	2	1	2
Average	1.5	2.5	1	1	2	1.5	2.5	1.5	3	2	1	2

Text books:-

Majumdar D.N. Statistical Methods. Kalyani Publishers

Sarma Abhijit. Agricultural Statistics for Field & Laboratory Experimentation. Kalyani Publishers

Reference books:-

Sahu P.K. Agriculture And Applied Statistics- I. Kalyani Publishers

Sahu P.K. Agriculture and Applied Statistics- II. Kalyani Publishers

Signature:-

1. S.P. Singh
2. Krishna Kumar
3. Preeta Yadav
4. VK Tripathi
5. A.K. Tiwari

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AHD-211: Livestock & Poultry Management

L	T	P	CR
2	1	1	4

Course objective:-

Develop and evaluate animal production and management systems by integrating knowledge of animal genetics, nutrition, reproduction, and other relevant disciplines and applying scientific and quantitative reasoning to solve real-world challenges.

Detail Contents

Unit 1 : **50%**

Unit 2 : **50%**

Unit- I

Role of livestock in the national economy. Reproduction in farm animals and poultry. Housing principles, space requirements for different species of livestock and poultry. Management of calves, growing heifers and milch animals. Management of sheep, goat and swine. Incubation, hatching and brooding.

Unit- II

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

Practical

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

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Course Learning Outcomes (CLO)

1. It will help to Locate, critically evaluate, and apply information from scholarly animal science literature and other sources to expand personal understanding and knowledge of animal sciences, providing a foundation for lifelong learning.
2. Appreciate the breadth and depth of professional opportunities in animal sciences relating to. The keeping of animals for food and fiber production and other purposes (e.g., companionship, research and teaching, biotechnology, sports, species conservation);
3. It enables the application of scientific principles to animal breeding, reproduction, feeding, growth and development, health management, housing, handling, and end – product safety and quality.

Mapping of course outcome with programme outcome and programme specific outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3
CO1	1	2	-	-	-	1	-	-	3	-	1	1
CO2	2	3	1	1	2	2	1	1	3	1	1	2
CO3	1	3	1	1	-	2	-	1	2	1	3	1
Average	1.33	2.67	1	1	2	1.67	1	1	2.67	1	1.67	1.33

Text Books:

1. Banerjee, G.C. 2013. A Text Book of Animal Husbandary. 8th Ed. Oxford & IBH Pub.CO.PvtLtd.N-Delhi.

2. Sastry N S R and Thomas, Ck 2006. Livestock Production and Management, Kalyani.

3. ICAR,Handbook of Animal Husbandry,2011.3 rd revised Ed.

Reference Books:

1. Sastry N S R and Thomas, Ck 2006. Livestock Production and Management, Kalyani Pub.

2. Singh, R A. 1996. Poultry Production 3rd Ed. Kalyani.

3. Prasad,J.2008. Poultry Production and management. Kalyani Pub.

Signature:-

1. S P Singh
2. Krishna Kumari
3. Sneeta Yadav
4. UK Tripathi
5. A.K. Tiwari

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Faculty of Agricultural Sciences and Allied Industries

AGR- 221: Crop Production Technology-II (Rabi crops)

L	T	P	CR
1	0	1	2

Course objective:-

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

Detail Contents

Unit 1 : **50%**

Unit 2 : **50%**

Unit- I

Origin, geographical distribution, economic importance, soil and climatic requirements, varieties, cultural practices and yield of *Rabi* crops; cereals –wheat and barley, pulses-chickpea, lentil, peas, oilseeds-rapeseed, mustard .

Unit- II

sunflower; sugar crops-sugarcane; medicinal and aromatic crops-mentha, lemon grass and citronella, Forage crops-berseem, lucerne and oat.

Practical

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

Course Learning Outcomes (CLO)

1. It will help the students to identify weeds in rabi season crops, Pulses-chickpea, lentil, peas; oilseeds-rapeseed, mustard and sunflower; sugar crops-sugarcane, Medicinal and aromatic crops-mentha, lemon grass and citronella, Forage crops-berseem, lucerne and oat.
2. proper knowledge of irrigation scheduling in rabi crops, additional area can be increased of low water requiring crops.
3. Students will be able to know about the economic importance of medicinal and Aromatic crops in present sphere.
4. It will be helpful to know about basic morphological characteristics of rabi crops.

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Mapping of course outcome with programme outcome and programme specific outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3
CO1	1	2	3	-	-	1	2	-	3	2	1	3
CO2	2	3	1	1	2	2	-	1	3	1	1	2
CO3	1	3	1	1	-	2	-	1	3	1	3	1
CO4	1	2	-	-	1	3	2	3	1	2	3	3
Average	1.25	2.5	1.67	1	1.5	2	2	1.67	2.5	1.5	2	2.25

Text books:-

1. Balasubramaniyan, P. and Palaniappan, S.P.2016. Principles and Practices of Agronomy (2nd edition), Agrobios (India), Jodhpur.

2. Reddy, S. R. 2016. Principles of Agronomy, Kalyani Publishers, Ludhiana.

3. Singh, S.S. and Singh, Rajesh. 2015. Principles and Practices of Agronomy (5th Re-set), Kalyani Publishers, New Delhi, Kalyani Publishers, Ludhiana.

Reference books:-

5. *Balasubramaniyan, P. and Palaniappan, S.P.2016. Principles and Practices of Agronomy (2nd edition), Agrobios (India), Jodhpur.*
6. *Yawalkar, K.S., Agarwal, J.P. and Bokde, S. 2008. Manures and Fertilizers (10th edition), Agri-Horticultural Publishing House, Nagpur.*

Signature:-

1. S.P. Singh
2. Krishna Kumar
3. Sneeta Yadav
4. V.K. Tripathi
5. A.K. Tiwari

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Faculty of Agricultural Sciences and Allied Industries

AGR- 221: Production Technology for Ornamental Crops, MAPs and Landscaping

L	T	P	CR
1	0	1	2

Course objective:-

To study about the natural herbal products from an economic perspective.

Detail Contents

Unit 1 : **50%**

Unit 2 : **50%**

Unit- I

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.

Unit- II

Package of practices for loose flowers like marigold and jasmine under open conditions. Production technology of important medicinal plants like ashwagandha, asparagus, aloe, costus, Cinnamomum, periwinkle, isabgol and aromatic plants like mint, lemongrass, citronella, palmarosa, ocimum, rose, geranium, vetiver. 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 – care and maintenance.Intercultural operations in flowers and MAP. Harvesting and post harvest handling of cut and loose flowers. Processing of MAP. Visit to commercial flower/MAP unit

Course Learning Outcomes (CLO)

1. To use medicinal and aromatic herbs sustainably.
2. To set up business related to medicinal, aromatic and landscaping.
3. To develop effective ideas related to collecting, processing and marketing herbal natural sources.

Mapping of course outcome with programme outcome and programme specific outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3

CO1	1	1	-	-	-	1	-	-	-	-	1	1
CO2	2	1	1	1	2	2	-	1	2	1	1	2
CO3	1	1	1	1	-	2	1	1	2	1	3	2
Average	1.33	1	1	1	2	1.67	1	1	2	1	1.67	1.67

Text books:-

1. Hartman, HT and Kester, DE (1986). Plant propagation principles and practices. Prentice Hallof India Pvt. Ltd., Bombay

1. Gill, SS. Bal, JS and Sadhu, AS (1985). Raising Fruit Nursery, Kalyani Publishers, NewDelhi.

3. Chadda K.L Advanced in Horticulture (2009) Malhotra Publishing House, New Delhi

5. Chandra,S& Som,V.2000. Cultivating Vegetables in Green House.Indian Horticulture 45:17- 18.

7. Tiwari GN. 2003. Green House Technology for Controlled Environment. Narosa Publ.House.

Reference books:-

1. Chadha, K.L. Handbook of Horticulture (2002) ICAR, NewDelhi

2. Prasad S & Kumar U. 2005. Greenhouse Management for Horticultural Crops. Agrobios

Signature:-

1. S.P. Singh
2. Kulshrestha Kumari
3. Sneeta Yadav
4. VK Tripathi
5. A.K. Tiwari

RAMA UNIVERSITY UTTAR PRADESH KANPUR

Faculty of Agricultural Sciences and Allied Industries

AGR- 222: Renewable Energy and Green Technology

L	T	P	CR
1	0	1	2

Course objective:-

To study the role of renewable sources in agriculture sector.

Detail Contents

Unit 1 : **50%**

Unit 2 : **50%**

Unit- I

Classification of energy sources, contribution of these of sources in agricultural sector, Familiarization with biomass utilization for bio-fuel production and their application, Familiarization with types of biogas plants and gasifiers, biogas, bio-alcohol, biodiesel and bio-oil production and their utilization as bio-energy resource,

Unit- II

Introduction of solar energy, collection and their application, Familiarization with solar energy gadgets: solar cooker, solar water heater, application of solar energy: solar drying, solar pond, solar distillation, solar photovoltaic system and their application, introduction of wind energy and their application.

Practical

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

Course Learning Outcomes (CLO)

1. Student will learn the bio fuel production and their applications in today's world.
2. To understand and utilizing the solar energy in various aspects.

Mapping of course outcome with programme outcome and programme specific outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3
CO1	-	1	-	1	2	3	2	2	3	2	1	3
CO2	-	-	1	1	2	2	1	1	3	2	1	3
Average	-	1	1	1	2	2.5	1.5	1.5	3	2	1	3

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Text books:-

1. Green house: Science and Technology. 2016. Kothari S, S.C.Kaushic and A.N.Mathur. Himanshu Publication, Udaipur.

2. Green House Technology- Application and Practice. Sharma A and V.M.Salokhe. 2006. Agro Tech. publication, Udaipur

3. Agricultural Process Engineering. 1955. Henderson, S.M. and R.L. Perry. John Willy and Sons, New York.

4. Unit operation of Agriculture Processing. 2004. Shay K.M. and Singh, K.K. Vikas Publication House, New Delhi.

Reference books:-

1. Post Harvest Technology of Cereals, Pulses and Oil Seeds.1999. Chakravarty, A. Oxford and IBH Pub. New Delhi.

2. Principles of Agricultural Engineering, Vol. I. 2012. Michael, A.M. and T. P. Ojha . Jain Brothers, New Delhi.

Signature:-

1. S. P. Singh
2. Krishna Kumar
3. Sneeta Yadav
4. VC Tripathi
5. A.K. Tiwari

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Faculty of Agricultural Sciences and Allied Industries

SAC- 221: Problematic Soils and their Management

L	T	P	CR
1	0	1	2

Course objective:-

To study the role of renewable sources in agriculture sector.

Detail Contents

Unit 1 : **50%**

Unit 2 : **50%**

Unit- I

Soil quality and health, Distribution of Waste land and problem soils in India. Their categorization based on properties. Reclamation and management of Saline and sodic soils, Acid soils, Acid Sulphate soils, Eroded and Compacted soils, Flooded soils, Polluted soils.

Unit- II

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

Multipurpose tree species, bio remediation through MPTs of soils, land capability and classification, land suitability classification. Problematic soils under different Agro-ecosystems.

Course Learning Outcomes (CLO)

1. To understand different types of problematic soils.
2. To understand and utilizing the aspects for growing the crops in problematic soils.
3. To understand different ways for reclamation and management of problematic soils.

Mapping of course outcome with programme outcome and programme specific outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3
CO1	1	1	-	-	-	1	-	-	3	-	1	1
CO2	2	-	1	1	2	2	1	1	3	1	1	2
CO3	1	1	1	1	-	2	-	1	3	1	3	1
Average	1.33	1	1	1	2	1.67	1	1	3	1	1.67	1.33

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Text books:-

1.Biswas, T.D. and Mukherjee, S.K. (2006) Text book of soil science.Tata McGraw Hill publishing Co. Ltd, New Delhi

2. Das, D.K. (2002) Introductory Soil Science, Kalyani publisher, New Delhi

3. Rai, M.M. (2002) Principal of Soil Science, Mac Millan India Ltd, New Delhi

4. Jackson, M.L. (1973) Soil chemical analysis, Prentice Hall of India, Pvt. Ltd New Delhi

5. Singh Dhyan, Chhonkar,P.K. and Dwivedi V.S. (2005) Manul on Soil Plant and water analysis. Westville Publishing House, New Delhi

6. Singh Vinay (1996) (Hindi) Soil Science, fertilizer & Manures , V.K. Prakashan Barot Merrut U.P)

7. Yawalkar, K.S. and Agarwal. J.P. (1992). Manure and fertilizers. AgricultureHorticulture Publishing House, Nagpur

Reference books:-

1 . Mehra R.K. (2004) Text book of Soil Science, ICAR New Delhi

2. ISSS (2002) Fundamental of Soil Science Div. of Soil Science, IARI, New Delhi

7. Tisdale,S.L. Nelson, W.L. Beaton, J.D. and Havlin, J.L.(1991) Soil fertility and fertilizers (5th ed.).Prentice Hall of India, Pvt .Ltd, New Delhi.

8. Piper, C.S. (1950) Soil and Plant analysis, .Hans publications, Bombay

Signature:-

1. S.P. Singh
2. Krishna Kumar
3. Neeta Yadav
4. MK Tripathi
5. A.K. Tiwari

RAMA UNIVERSITY UTTAR PRADESH KANPUR

Faculty of Agricultural Sciences and Allied Industries

HOR-222: Production Technology for Fruit and Plantation Crops

L	T	P	CR
1	0	1	2

Course objective:-

Detail Contents

Unit 1 : **50%**

Unit 2 : **50%**

Unit- I

Importance and scope of fruit and plantation crop industry in India; Importance of rootstocks; Production technologies for the cultivation of major fruits-mango, banana, citrus, grape, guava, litchi, papaya, sapota, apple, pear, peach, walnut, almond .

Unit-II

Minor fruits- date, ber, pineapple, pomegranate, jackfruit, strawberry, plantation crops-coconut, arecanut, cashew, tea, coffee & rubber, bel, aonla, jamun and karonda cultivation.

Practical

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

Course Learning Outcomes (CLO)

1. To study about Importance and scope of fruit and plantation crop industry in India
2. To study about Production technologies for the cultivation of major fruits
3. To study about Propagation methods for fruit and plantation crops

Mapping of course outcome with programme outcome and programme specific outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3
CO1	1	1	-	-	-	1	2	2	1	2	3	3
CO2	2	1	1	1	2	2	2	2	2	2	2	3
CO3	1	1	1	1	-	2	2	1	1	3	3	3
Average	1.33	1	1	1	2	1.67	2	1.67	1.33	2.33	2.67	3

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Text books:-

1. Hartman, HT and Kester, DE (1986). Plant propagation principles and practices. Prentice Hallof India Pvt. Ltd., Bombay

1. Gill, SS. Bal, JS and Sadhu, AS (1985). Raising Fruit Nursery, Kalyani Publishers, NewDelhi.

3. Chadda K.L Advanced in Horticulture (2009) Malhotra Publishing House, New Delhi

5. Chandra,S& Som,V.2000. Cultivating Vegetables in Green House.Indian Horticulture 45:17- 18.

7. Tiwari GN. 2003. Green House Technology for Controlled Environment. Narosa Publ.House.

Reference books:-

1. Chadha, K.L. Handbook of Horticulture (2002) ICAR, NewDelhi

2. Prasad S & Kumar U. 2005. Greenhouse Management for Horticultural Crops. Agrobios

Signature:-

1. S.P. Singh
2. Krishna Kumar
3. Aneeta Yadav
4. VK Tripathi
5. A.K. Tiwari

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SST- 221: Principles of Seed Technology

L	T	P	CR
1	0	2	3

Course objective:-

To increase the farm income by producing high yielding disease free quality seed and decrease the cost of cultivation also.

Detail Contents

Unit 1 : **35%**

Unit 2 : **35%**

Unit 3: **30%**

Unit-I

Seed and seed technology: introduction, definition and importance. Deterioration causes of crop varieties and their control; Maintenance of genetic purity during seed production, seed quality; Definition, Characters of good quality seed, different classes of seed. Foundation and certified seed production of important cereals, pulses, oilseeds, fodder and vegetables.

Unit-II

Seed certification, phases of certification, procedure for seed certification, field inspection. Seed Act and Seed Act enforcement. Duty and powers of seed inspector, offences and penalties. Seeds Control Order 1983, Varietal Identification through Grow Out Test and Electrophoresis, Molecular and Biochemical test. Detection of genetically modified crops, Transgene contamination in non-GM crops, GM crops and organic seed production.

Unit- III

Seed drying, processing and their steps, seed testing for quality assessment, seed treatment, its importance, method of application and seed packing. 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 affecting seed marketing, Role of WTO and OECD in seed marketing. Private and public sectors and their production and marketing strategies.

Practical

Seed production in major cereals: Wheat, Rice, Maize, Sorghum, Bajra and Ragi. Seed production in major pulses: Urd, Mung, Pigeonpea, Lentil, Gram, Field bean, pea, cowpea. Seed production in major oilseeds: Soybean, Sunflower, Rapeseed, Groundnut and Mustard. Seed production in important vegetable crops. Seed sampling and testing: Physical purity, germination, viability, etc. Seed and seedling vigour test.

Genetic purity test: Grow out test and electrophoresis. Seed certification: Procedure, Field inspection, Preparation of field inspection report. Visit to seed production farms, seed testing laboratories and seed processing plant.

Course Learning Outcomes (CLO)

1. Increase in Farm Income: An efficient marketing system ensures higher levels of income for the farmers by reducing the number of middlemen or by restricting the commission on marketing services and the malpractices adopted by them in the marketing of farm products.
2. Growth of Agro-based Industries: An improved and efficient system of agricultural marketing helps in the growth of agro-based industries and stimulates the overall development process of the economy. Many industries depend on agriculture for the supply of raw materials.
3. Adoption and Spread of New Technology: The marketing system helps the farmers in the adoption of new scientific and technical knowledge. New technology requires higher investment and farmers would invest only if they are assured of market clearance.
4. Addition to National Income: Marketing activities add value to the product thereby increasing the nation's gross national product and net national product.

Mapping of course outcome with programme outcome and programme specific outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3
CO1	1	2	-	-	-	1	2	3	3	2	1	3
CO2	2	3	1	1	2	2	2	3	3	2	1	3
CO3	1	3	1	1	3	2	2	3	3	2	3	3
CO4	1	2	-	-	1	3	2	3	2	2	3	3
Average	1.25	2.5	1	1	2	2	2	3	2.75	2	2	3

Text books:-

1. Chopra, V.L. 2000. Breeding of Field Crops (Edt.). Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi.
2. Manjit S. Kang 2004. Crop Improvement: Challenges in the Twenty-First Century (Edt) International Book Distributing Co. Lucknow.
3. Ram, H.H. and H.G. Singh. 1994. Crop Breeding and Genetics. Kalyani Publishers, New Delhi.
4. Sharma, A.K. 2005. Breeding Technology of Crop Plants (Edt.). Yash Publishing House, Bikaner.
5. Shekhawat, S. S. (ed) (2016). Advances and Current Issues in Agriculture, Vol.III. ShikshaPrakashan, S. M. S. Highway, Jaipur.

Reference books:-

1. Ram. H.H. 2005. Vegetable Breeding — Principles and Practices. Kalyani Publishers, New Delhi.

2. Mandal, AK., P.K. Ganguli and S.P. Banerjee. 1991. Advances in Plant Breeding Vol. I and II. CBS Publishers and Distributors, New Delhi.

RAMA UNIVERSITY UTTAR PRADESH KANPUR

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3. Chaddha. K.L. and Rajendra Gupta. 1995. Advances in Horticulture Vol. II Medicinal and Aromatic Plants. Malhotra Publishing House, New Delhi.

Signature:-

1. S.P. Singh
2. Krishna Kumari
3. Aneeta Yadav
4. VK Tripathi
5. A.K. Tiwari

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Faculty of Agricultural Sciences and Allied Industries

AGR- 223: Farming System and Sustainable Agriculture

L	T	P	CR
1	0	0	1

Course objective:-

To study about the major aspects of agricultural practices and traditions through time and throughout the world.

Detail Contents

Unit 1 : 50%

Unit 2 : 50%

Unit- I

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;

Unit-II

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.

Course Learning Outcomes (CLO)

1. The student will study and analyze the refereed-journal articles, texts, and practices that represent the perspectives of different societies and agricultural traditions.
2. To show how agricultural scientists are attempting to minimize agricultural pollution and sustain food production adequate for the world's population.

Mapping of course outcome with programme outcome and programme specific outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3
CO1	3	2	2	2	-	1	2	3	3	3	1	3
CO2	2	3	1	2	2	2	2	1	3	2	2	2
Average	2.5	2.5	1.5	2	2	1.5	2	2	3	2.5	1.5	2.5

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Text books:-

1. _Balasubramaniyan, P. and Palaniappan, S.P.2016. Principles and Practices of Agronomy (2nd edition), Agrobios (India), Jodhpur.

2. Reddy, S. R. 2016. Principles of Agronomy, Kalyani Publishers, Ludhiana.

3. Singh, S.S. and Singh, Rajesh. 2015. Principles and Practices of Agronomy (5th Re-set), Kalyani Publishers, New Delhi, Kalyani Publishers, Ludhiana.

Reference books:-

1. Balasubramaniyan, P. and Palaniappan, S.P.2016. Principles and Practices of Agronomy (2nd edition), Agrobios (India), Jodhpur.

2. Yawalkar, K.S., Agarwal, J.P. and Bokde, S. 2008. Manures and Fertilizers (10th edition), Agri-Horticultural Publishing House, Nagpur.

Signature:-

1. S.P. Singh
2. Krishna Kumar
3. Aneela Yadav
4. VK Tripathi
5. A.K. Tiwari

RAMA UNIVERSITY UTTAR PRADESH KANPUR

Faculty of Agricultural Sciences and Allied Industries

AES-221: Agricultural Marketing Trade & Prices

L	T	P	CR
1	0	1	2

Course objective:-

To study about the improved and efficient system of agricultural marketing helps in the growth of agro-based industries and stimulates the overall development process of the economy.

Detail Contents

Unit 1 : 35 %

Unit 2 : 35 %

Unit 2 : 30 %

Unit- I

Agricultural Marketing: Concepts and definitions of market, marketing, agricultural marketing, market structure, marketing mix and market segmentation, classification and characteristics of agricultural markets; Demand, supply and producer's surplus of agri-commodities: nature and determinants of demand and supply of farm products, producer's surplus – meaning and its types, marketable and marketed surplus, factors affecting marketable surplus of agri-commodities Product life cycle (PLC) and competitive strategies: Meaning and stages in PLC; characteristics of PLC; strategies in different stages of PLC; pricing and promotion strategies: pricing considerations and approaches – cost based and competition based pricing;

Unit- II

Market promotion – advertising, personal selling, sales promotion and publicity – their meaning and merits & demerits Marketing process and functions: Marketing process-concentration, dispersion and equalization; exchange functions – buying and selling; physical functions – storage, transport and processing; facilitating functions – packaging, branding, grading, quality control and labeling (AGMARK);Market functionaries and marketing channels: Types and importance of agencies involved in agricultural marketing; meaning and definition of marketing channel; number of channel levels; marketing channels for different farm products; Integration, efficiency, costs and price spread:

Unit- III

Meaning, definition and types of market integration; marketing efficiency; marketing costs, margins and price spread; factors affecting cost of marketing; reasons for higher marketing costs of farm commodities; ways of reducing marketing costs; Role of Govt. in agricultural marketing: Public sector institutions- CWC, SWC, FCI, CACP & DMI – their objectives and functions; cooperative marketing in India; Risk in marketing: Types of risk in marketing; speculation & hedging; an overview of futures trading; Agricultural prices and policy: Meaning and functions of price; administered prices; need for agricultural price policy; Trade: Concept of International Trade and

its need, theories of absolute and comparative advantage. Present status and prospects of international trade in agri-commodities; GATT and WTO; Agreement on Agriculture (AoA) and its implications on Indian agriculture; IPR

Practicals

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

Course Learning Outcomes (CLO)

1. Students will increase their knowledge about Atmospheric pressure, its variation with height;
2. Knowledge about wind, types of wind, daily and seasonal variation of wind speed, cyclone, anticyclone, land breeze and sea breeze;
3. Nature and properties of solar radiation, solar constant, depletion of solar radiation.

Mapping of course outcome with programme outcome and programme specific outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3
CO1	1	2	-	-	-	1	2	-	1	-	1	1
CO2	2	3	1	1	2	2	2	1	1	1	1	2
CO3	1	3	1	1	-	2	2	1	1	1	3	1
Average	1.33	2.67	1	1	2	1.67	2	1	1	1	1.67	1.33

Text books:-

1. Dhondyal, S.P., "Farm Management – An Economic Analysis", Aman Publishing House,vMadhu Market, Meerut (U.P.).

2. Kerr, John M., et al., 1997, Natural Resource Economics: Theory and Applications in India, Oxford & IBH, New Delhi.

3. Raju, V. T. and D. V. S. Rao, 2002, "Economics of Farm Production and Management", Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi.

4. Singh, I. J., 1977, Elements of Farm Management Economics, Affiliated East-West Press Pvt. Ltd., New Delhi

Reference books:-

1. Sankhayan, P. L., 1988, Introduction to the Economics and Agricultural Production, Prentice Hall of India Private Limited, New Delhi.

2. Johl, S.S. and T.R. Kapur, 1989, Fundamentals of Farm Business Management, Kalyani Publishers, Ludhiyana

3. BhavaniDevi,P. Raghu Ram,S. SubbaReddy,T.V. Neelakanta Sastry, 2009, Agricultural economics, Oxford and IBH Co. Pvt. Ltd., , New Delhi.

Signature:-

1. S.P. Singh
2. Krishna Kumar
3. Dheeraj Yadav
4. V.K. Tripathi
5. A.K. Tiwari

RAMA UNIVERSITY UTTAR PRADESH KANPUR

Faculty of Agricultural Sciences and Allied Industries

AGR- 224: Introductory Agro-meteorology & Climate Change

L	T	P	CR
1	0	1	2

Course objective:-

To study about the Climate and its impact in the growth and development of Plant.

Detail Contents

Unit 1 : **50 %**

Unit 2 : **50 %**

Unit-I

Meaning and scope of agricultural meteorology; Earth atmosphere- its composition, extent and structure; Atmospheric weather variables; Atmospheric pressure, its variation with height; Wind, types of wind, daily and seasonal variation of wind speed, cyclone, anticyclone, land breeze and sea breeze; Nature and properties of solar radiation, solar constant, depletion of solar radiation, short wave, longwave and thermal radiation, net radiation, albedo; Atmospheric temperature, temperature inversion, lapse rate, daily and seasonal variations of temperature, vertical profile of temperature.

Unit- II

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- mechanism and importance in Indian agriculture, Weather hazards - drought, floods, frost, tropical cyclones and extreme weather conditions such as heat-wave and cold-wave.Agriculture and weather relations; Modifications of crop microclimate, climatic 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 longwave 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.

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Faculty of Agricultural Sciences and Allied Industries

Course Learning Outcomes (CLO)

1. Students will increase their knowledge about Atmospheric pressure, its variation with height;
2. Wind, types of wind, daily and seasonal variation of wind speed, cyclone, anticyclone, land breeze and sea breeze;
3. Nature and properties of solar radiation, solar constant, depletion of solar radiation.

Mapping of course outcome with programme outcome and programme specific outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3
CO1	1	2	-	-	-	1	2	-	1	-	1	1
CO2	2	3	1	1	2	2	2	1	3	1	1	2
CO3	2	3	1	1	-	2	1	1	2	1	3	1
Average	1.67	2.67	1	1	2	1.67	1.67	1	2	1	1.67	1.33

Text books:-

1. Sacheti,A.K. 1985. Agricultural Meteorological Instructional Cum Practical Manual (Ed.) NCERT Publication, New Delhi.

2. Lal, D.S. 2005 Climatology, ShardaPustakBhawan, Allahabad.. 3. Varshneya, M.C. and Balakrishna, Pillai, 2003. Text book of Agricultural Meteorology.ICAR, New-Delhi.

3. Murithy, K, and Radha, V. 1995. Practical Manual on Agricultural Meteorology , Kalyani Publishers, New-Delhi

Reference books:-

1.Balasubramaniyan, P. and Palaniappan, S.P.2016. Principles and Practices of Agronomy, Agrobios (India), Jodhpur

2. Sahu, D.D., 2007. Agrometeorology and Remote sensing: Principles and Practices ,Agrobios (India) , Jodhpur.

Signature:-

1. S.P. Singh
2. Krishna Kumar
3. Aneeta Yadav
4. VK Tripathi
5. A.K. Tiwari

RAMA UNIVERSITY UTTAR PRADESH KANPUR

Faculty of Agricultural Sciences and Allied Industries

UGE- 221: Agri-Business Management

L	T	P	CR
1	1	1	3

Course objective:-

To apply the business principles in agro based industries and its management.

Detail Contents

Unit 1 : **35 %**

Unit 2 : **35 %**

Unit 3 : **30%**

Unit- I

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

Unit- II

Constraints in establishing agro-based industries. Agri-value chain: Understanding primary and support activities and their linkages. Business environment: PEST & SWOT analysis. Management functions: Roles & activities, Organization culture. Planning, meaning, definition, types of plans. Purpose or mission, goals or objectives, Strategies, polices procedures, rules, programs and budget. Components of a business plan, Steps in planning and implementation.

Unit- III

Organization staffing, directing and motivation. Ordering, leading, supervision, communications, control. Capital Management and Financial management of Agribusiness. Financial statements and their importance. Marketing Management: Segmentation, targeting & positioning. Marketing mix and marketing strategies. Consumer behavior analysis, Product Life Cycle (PLC).Sales & Distribution Management. Pricing policy, various pricing methods. Project Management definition, project cycle, identification, formulation, appraisal, implementation, monitoring and evaluation. Project Appraisal and evaluation techniques.

Practical

Study of agri-input markets: Seed, fertilizers, pesticides. Study of output markets: grains, fruits, vegetables, flowers. Study of product markets, retails trade commodity trading, and value added products. Study of financing institutions- Cooperative, Commercial banks, RRBs, Agribusiness Finance Limited, NABARD. Preparations of projects and Feasibility reports for agribusiness entrepreneur. Appraisal/evaluation techniques of identifying viable project- Non-

discounting techniques. Case study of agro-based industries. Trend and growth rate of prices of agricultural commodities. Net present worth technique for selection of viable project. Internal rate of return.

Course Learning Outcomes (CLO)

1. Students will enhance the knowledge about Constraints in establishing agro-based industries.
2. Agri-value chain: Understanding primary and support activities and their linkages. Business environment: PEST & SWOT analysis.
3. Management functions: Roles & activities, Organization culture. Planning, meaning, definition, types of plans.
4. Purpose or mission, goals or objectives, Strategies, polices procedures, rules, programs and budget. Components of a business plan, Steps in planning and implementation.

Mapping of course outcome with programme outcome and programme specific outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3
CO1	1	2	-	-	-	1	2	-	3	1	1	3
CO2	2	3	1	1	2	2	2	1	3	1	1	2
CO3	1	3	1	1	-	2	2	1	3	1	2	1
CO4	1	2	-	-	1	3	2	3	1	-	2	3
Average	1.25	2.5	1	1	1.5	2	2	1.67	2.5	1	1.5	2.25

Text books:-

1. G. L. Meena, S. S. Burark, D. C. Pant and Rajesh Sharma, 2017.FundamentalsAgribusiness Management, Agrotech Publishing Academy, Udaipur, ISBN: 978-81- 8321-418-6. First edition.

2. Mamoria, C. B., Joshi, R. L. and Mulla, N. I. 2005, Principles and Practices of Marketing in India, Kitab Mahal, Allahabad.

3. Tripathi, P. C. and Reddy, P. N, Principles of Management, Tata McGraw Hill Education Private Limited, New Delhi, 2008.

Reference books:-

1. L.L. Somani and G. L. Meena, 2017. Agribusiness & Farm Management at a Glance, Vol-2, Basic & Applied Fundamentals, Agrotech Publishing Academy, Udaipur, ISBN: 978-81-8321-429-2. Second edition.

Signature:-

1. S.P. Singh
2. Krishna Dumar
3. Preeta Yadav
4. MC Tripathi
5. A.K. Tiwari

RAMA UNIVERSITY UTTAR PRADESH KANPUR

Faculty of Agricultural Sciences and Allied Industries

UGE- 221: Agrochemicals

L	T	P	CR
1	1	1	3

Course objective:-

To study about the fertilizers, pesticides, fungicides and other chemicals that are important for plant growth.

Detail Contents

Unit 1 : **35 %**

Unit 2 : **35 %**

Unit 3 : **30%**

Unit-I

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

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

Fungicides - Classification – Inorganic fungicides - characteristics, preparation and use of sulfur and copper, Mode of action-Bordeaux mixture and copper oxychloride.

Organic fungicides- Mode of action- Dithiocarbamates-characteristics, preparation and use of Zineb and maneb.

Unit- II

Systemic fungicides- Benomyl, carboxin, oxycarboxin, Metalaxyl, Carbendazim, characteristics and use. Introduction and classification of insecticides: inorganic and organic insecticides Organochlorine, Organophosphates, Carbamates, Synthetic pyrethroidsNeonicotinoids, Biorationals, Insecticide Act and rules, Insecticides banned, withdrawn and restricted use, Fate of insecticides in soil & plant. IGRs Biopesticides, Reduced risk insecticides, Botanicals, plant and animal systemic insecticides their characteristics and uses.

Fertilizers and their importance. Nitrogenous fertilizers: Feedstocks and Manufacturing of ammonium sulphate, ammonium nitrate, ammonium chloride, urea. Slow release N-fertilizers. Phosphatic fertilizers: feedstock and manufacturing of single superphosphate. Preparation of bone meal and basic slag.Potassic fertilizers: Natural sources of potash, manufacturing of potassiumchloride, potassium sulphate and potassium nitrate.

Unit- III

Mixed and complex fertilizers: Sources and compatibility–preparation of major, secondary and micronutrient mixtures. Complex fertilizers: Manufacturing of ammonium phosphates, nitrophosphates and NPK complexes. Fertilizer control order. Fertilizer logistics and marketing.

Plant bio-pesticides for ecological agriculture, Bio-insect repellent.

Practical

Sampling of fertilizers and pesticides. Pesticides application technology to study about various pesticides appliances. Quick tests for identification of common fertilizers. Identification of anion and cation in fertilizer. Calculation of doses of insecticides to be used. To study and identify various formulations of insecticide available kin market. Estimation of nitrogen in Urea. Estimation of water soluble P_2O_5 and citrate soluble P_2O_5 in single super phosphate. Estimation of potassium in Muraite of Potash/ Sulphate of Potash by flame photometer .Determination of copper content in copper oxychloride.Determination of sulphur content in sulphur fungicide. Determination of thiram. Determination of ziram content.

Course Learning Outcomes (CLO)

1. Students will enhance the knowledge about agrochemicals, their type and role in agriculture
2. Study about effect of agrochemicals on environment, soil, human and animal health, merits and demerits of their uses in agriculture,
3. Knowledge about management of agrochemicals for sustainable agriculture.

Mapping of course outcome with programme outcome and programme specific outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3
CO1	1	2	-	-	-	1	1	-	2	1	1	1
CO2	1	1	1	1	2	2	-	1	2	1	1	2
CO3	1	2	1	1	2	2	1	1	3	1	3	1
Average	1	1.67	1	1	2	1.67	1	1	2.33	1	1.67	1.33

Text books:-

1.Biswas, T.D. and Mukherjee, S.K. (2006) Text book of soil science.Tata McGraw Hill publishing Co. Ltd, New Delhi

2. Das, D.K. (2002) Introductory Soil Science, Kalyani publisher, New Delhi

3. Rai, M.M. (2002) Principal of Soil Science, Mac Millan India Ltd, New Delhi

4. Jackson, M.L. (1973) Soil chemical analysis, Prentice Hall of India, Pvt. Ltd New Delhi

5. Singh Dhyan, Chhonkar,P.K. and Dwivedi V.S. (2005) Manul on Soil Plant and water analysis. Westville Publishing House, New Delhi

6. Singh Vinay (1996) (Hindi) Soil Science, fertilizer & Manures , V.K. Prakashan Barot Merrut U.P)

7. Yawalkar, K.S. and Agarwal. J.P. (1992). Manure and fertilizers. AgricultureHorticulture Publishing House, Nagpur

Reference books:-

1. Mehra R.K. (2004) Text book of Soil Science, ICAR New Delhi

2. ISSS (2002) Fundamental of Soil Science Div. of Soil Science, IARI, New Delhi

3. Tisdale,S.L. Nelson, W.L. Beaton, J.D. and Havlin, J.L.(1991) Soil fertility and

fertilizers (5th ed.).Prentice Hall of India, Pvt .Ltd, New Delhi.
4. Piper, C.S. (1950) Soil and Plant analysis, .Hans publications, Bombay

Signature:-

1. S.P. Singh
2. Krishna Kumari
3. Aneeta Yadav
4. VK Tripathi
5. A.K. Tiwari

RAMA UNIVERSITY UTTAR PRADESH KANPUR

Faculty of Agricultural Sciences and Allied Industries

UGE- 221: Commercial Plant Breeding

L	T	P	CR
1	1	1	3

Course objective:-

To study about the plant breeding techniques for development of lines for commercial purpose.

Detail Contents

Unit 1 : **35 %**

Unit 2 : **35 %**

Unit 3 : **30%**

Unit- I

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. Advances in hybrid seed production of maize, rice, sorghum, pearl millet, castor, sunflower, cotton pigeon pea, Brassica etc.

Unit- II

Quality seed production of vegetable crops under open and protected environment. Alternative strategies for the development of the line and cultivars: haploid inducer, tissue culture techniques and biotechnological tools. IPR issues in commercial plant breeding: DUS testing and registration of varieties under PPV & FR Act. Variety testing, release and notification systems in India. Principles and techniques of seed production, types of seeds, quality testing in self and cross pollinated crops.

Practical

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

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Course Learning Outcomes (CLO)

1. To make the understanding of types of crops and modes of plant reproduction.
2. 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 in students.

Mapping of course outcome with programme outcome and programme specific outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3
CO1	1	3	1	2	2	1	2	2	3	3	3	2
CO2	2	3	1	1	2	2	1	1	3	3	1	2
Average	1.5	3	1	1.5	2	1.5	1.5	1.5	3	3	2	2

Text books:-

1. Chopra, V.L. 2000. Breeding of Field Crops (Edt.). Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi.

2. Manjit S. Kang 2004. Crop Improvement: Challenges in the Twenty-First Century (Edt) International Book Distributing Co. Lucknow.

3. Ram, H.H. and H.G. Singh. 1994. Crop Breeding and Genetics. Kalyani Publishers, New Delhi.

4. Sharma, A.K. 2005. Breeding Technology of Crop Plants (Edt.).Yash Publishing House, Bikaner.

5. Shekhawat, S. S. (ed) (2016). Advances and Current Issues in Agriculture, Vol.III. ShikshaPrakashan, S. M. S. Highway, Jaipur.

Reference books:-

1. Ram. H.H. 2005. Vegetable Breeding — Principles and Practices. Kalyani Publishers, New Delhi.

2. Mandal, AK., P.K. Ganguli and S.P. Banerjee. 1991. Advances in Plant Breeding Vol. I and II. CBS Publishers and Distributors, New Delhi.

3. Chaddha. K.L. and Rajendra Gupta. 1995. Advances in Horticulture Vol. II Medicinal and Aromatic Plants. Malhotra Publishing House, New Delhi.

Signature:-

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2. Krishna Kumari
3. Aneeta Yadav
4. VK Tripathi
5. A.K. Tiwari

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UGE- 224: Landscaping

L	T	P	CR
1	1	1	3

Course objective:-

To study about the principles of Landscaping in development of gardens, lawns and rockery.

Detail Contents

Unit 1 : **35 %**

Unit 2 : **35 %**

Unit 3 : **30%**

Unit- I

Importance and scope of landscaping. Principles of landscaping, garden styles and types, terrace gardening, vertical gardening, garden components, adornments, lawn making, rockery, water garden, walk-paths, bridges, other constructed features etc. gardens for special purposes. Trees: selection, propagation, planting schemes, canopy management, shrubs and herbaceous perennials: selection, propagation, planting schemes, architecture. Climber and creepers: importance, selection, propagation, planting.

Unit- II

Annuals: selection, propagation, planting scheme, Other garden plants: palms, ferns, grasses and cacti succulents. Pot plants: selection, arrangement, management. Bio-aesthetic planning: definition, need, planning; landscaping of urban and rural areas, Peri-urban landscaping, Landscaping of schools, public places like bus station, railway station, townships, river banks, hospitals, play grounds, airports, industries, institutions. Bonsai: principles and management, lawn: establishment and maintenance. CAD application.

Practical

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

Course Learning Outcomes (CLO)

1. Understanding about Principles of landscaping,
2. Knowledge about garden styles and types, terrace gardening, vertical gardening, garden components, adornments, lawn making, rockery,
3. Awareness about new concepts like water garden, walk-paths, bridges, other constructed features etc. gardens for special purposes.

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Mapping of course outcome with programme outcome and programme specific outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3
CO1	2	2	3	2	-	1	2	-	3	3	3	3
CO2	2	3	1	1	2	2	2	1	3	3	1	2
CO3	3	3	1	1	1	2	-	1	3	3	3	3
Average	2.33	2.67	1.67	1.33	1.5	1.67	2	1	3	3	2.33	2.67

Text books:-

1. . Bose, T. Ornamental Plants and Garden Design in Tropics and subtropics, Vol-2 sets Daya

2. Arora J. S. 2006 Introductory Ornamental Horticulture Kalyani Publishers, Ludhiana

3. Gopalaswamiengar, K.S. The Complete Gardening in India.TheHosali Press, Bangalore

4. Bose, T.K. Malti, R.G. Dhua, R.S. & Das, P. Floriculture and Landscaping (2004) Nayaprakash

5. H.S.Grewal and Parminder Singh Landscape designing and ornamental plants (2014)

6. R.K. Roy Fundamentals of Garden designing (2013) New India publishing agency

7 Rajesh Srivastava Fundamentals of Garden designing (2014) Agrotech press, Jaipur

Reference books:-

1. Randhawa, G.S. AmitabhaMukhopadhyay Floriculture in India (2004) Allied Publishers Pvt. Ltd., New Delhi

2. K.V.Peter. Ornamental plants (2009) New India publishing agency

3. Chadha, K.L. and Chaudhary, B. Ornamental Horticulture in India. ICAR

4. Bose, T.K. and Mukherjee, D. Gardening in India (2004) Oxford & IBH Publishers

Signature:-

1. S.P. Singh
2. Krishna Kumar
3. Neeta Yadav
4. VK Tripathi
5. A.K. Tiwari

RAMA UNIVERSITY UTTAR PRADESH KANPUR

Faculty of Agricultural Sciences and Allied Industries

PPA-311: Principles of Integrated Pest and Disease Management

L	T	P	CR
1	1	1	3

Course objective:-

To study about identification of different insect pest of field, horticulture, ornamentals,vegetables and stored grains at the field level.

Detail Contents

Unit 1 : **50 %**

Unit 2 : **50 %**

Unit- I

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.

Unit- II

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 pestand 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. 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, 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, pestand diseases . Awareness campaign at farmers fields.

Course Learning Outcomes (CLO)

1. Understand how insects affect animal and Plant health and agricultural production, and be able to safely manipulate populations of beneficial and destructive species in habitats
2. Knowledge about production of agro-ecosystems with minimal environmental impact.

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Mapping of course outcome with programme outcome and programme specific outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3
CO1	2	2	2	-	-	1	1	-	3	2	1	2
CO2	2	3	1	1	1	2	1	1	3	1	1	2
Average	2	2.5	1.5	1	1	1.5	1	1	3	1.5	1	2

Text books:-

1. Atwal, A.S. and Dhaliwal, G.S. 2002. Agricultural Pests of South Asia and Their Management, Kalyani Publishers, New Delhi.

2. Mathur and Upadhyay, 2005. A Text Book of Entomology, Aman Publishing House, Meerut.

3. Srivastava, K.P. 2004. A Text Book of Entomology, Vol.I, Kalyani Publishers, New Delhi.

4. Dhawan, A.K. Integrated Pest Management, Scientic Publishers, Jodhpur.

Reference books:-

1. Dhaliwal, G.S. and Ramesh Arora 2001. Integrated Pest Management. Concepts and Approaches. Kalyani publishers, New Delhi.

2. Gautam, R.D. Biological Pest Suppression, WestvillPublising Co., New Delhi

Signature:-

1. S. P. Singh
2. Krishna Kumari
3. Aneeta Yadav
4. VK Tripathi
5. A. K. Tiwari

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SAC- 311: Manures, Fertilizers and Soil Fertility Management

L	T	P	CR
1	1	1	3

Course objective:-

To study of different manure and fertilizers used in different crops according to soil condition.

Detail Contents

Unit 1 : **50 %**

Unit 2 : **50 %**

Unit- I

Introduction and importance of organic manures, properties and methods of preparation of bulky and concentrated manures. Green/leaf manuring. Fertilizer recommendation approaches. Integrated nutrient management.
Chemical fertilizers: classification, composition and properties of major nitrogenous, phosphatic, potassic fertilizers, secondary & micronutrient fertilizers, Complex fertilizers, nano fertilizers Soil amendments, Fertilizer Storage, Fertilizer Control Order.

Unit- II

History of soil fertility and plant nutrition. criteria of essentiality. role, deficiency and toxicity symptoms of essential plant nutrients, Mechanisms of nutrient transport to plants, factors affecting nutrient availability to plants. Chemistry of soil nitrogen, phosphorus, potassium, calcium, magnesium, sulphur and micronutrients. Soil fertility evaluation, Soil testing. Critical levels of different nutrients in soil. Forms of nutrients in soil, plant analysis, rapid plant tissue tests. Indicator plants. Methods of fertilizer recommendations to crops. Factor influencing nutrient use efficiency (NUE), methods of application under rainfed and irrigated conditions.

Practical

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

Course Learning Outcomes (CLO)

1. To understand essentiality of plant nutrients and mechanism of nutrient transport to plant and factors affecting nutrient availability.
2. To understand the procedure of soil testing and
3. To establish soil testing laboratory in future as an entrepreneur.

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Mapping of course outcome with programme outcome and programme specific outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3
CO1	2	2	2	-	1	1	2	2	2	2	1	3
CO2	2	3	1	1	2	2	2	1	3	1	1	1
CO3	1	3	1	1	2	2	2	1	3	1	3	3
Average	1.67	2.67	1.33	1	1.67	1.67	2	1.33	2.67	1.33	1.67	2.33

Text books:-

1.Biswas, T.D. and Mukherjee, S.K. (2006) Text book of soil science.Tata McGraw Hill publishing Co. Ltd, New Delhi

2. Das, D.K. (2002) Introductory Soil Science, Kalyani publisher, New Delhi

3. Rai, M.M. (2002) Principal of Soil Science, Mac Millan India Ltd, New Delhi

4. Jackson, M.L. (1973) Soil chemical analysis, Prentice Hall of India, Pvt. Ltd New Delhi

5. Singh Dhyan, Chhonkar,P.K. and Dwivedi V.S. (2005) Manul on Soil Plant and water analysis. Westville Publishing House, New Delhi

6. Singh Vinay (1996) (Hindi) Soil Science, fertilizer & Manures , V.K. Prakashan Barot Merrut U.P)

7. Yawalkar, K.S. and Agarwal. J.P. (1992). Manure and fertilizers. AgricultureHorticulture Publishing House, Nagpur

Reference books:-

1. Mehra R.K. (2004) Text book of Soil Science, ICAR New Delhi

2. ISSS (2002) Fundamental of Soil Science Div. of Soil Science, IARI, New Delhi

3. Tisdale,S.L. Nelson, W.L. Beaton, J.D. and Havlin, J.L.(1991) Soil fertility and fertilizers (5th ed.).Prentice Hall of India, Pvt .Ltd, New Delhi.

4. Piper, C.S. (1950) Soil and Plant analysis, .Hans publications, Bombay

Signature:-

1. S.P. Singh
2. Krishna Kumar
3. Ameeta Yadav
4. V.K. Tripathi
5. A.K. Tiwari

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Faculty of Agricultural Sciences and Allied Industries

GPB- 311: Crop Improvement – I (*Kharif*)	L	T	P	CR
	1	0	1	2

Course objective:-

To study about importance of wild relative to produce new varieties of kharif crop.

Detail Contents

Unit 1 : **50 %**

Unit 2 : **50 %**

Unit- I

Centers of origin, distribution of species, wild relatives in different cereals; pulses; oilseeds; fibres; fodders and cash crops; vegetable and horticultural crops; Plant genetic resources, its utilization and conservation, study of genetics of qualitative and quantitative characters; Important concepts of breeding self pollinated, cross pollinated and vegetatively propagated crops.

Unit- II

Major breeding objectives and procedures including conventional and modern innovative approaches for development of hybrids and varieties for yield, adaptability, stability, abiotic and biotic stress tolerance and quality (physical, chemical, nutritional); Hybrid seed production technology in Maize, Rice, Sorghum, Pearl millet and Pigeonpea, etc. Ideotype concept and climate resilient crop varieties for future.

Practical

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

Course Learning Outcomes (CLO)

1. Provide skills in Gene preservation method for further use to improve kharif crops.
2. learns to apply breeding method to improve kharif crops.
3. Learner learns identification of resistance gene related to kharif crop with high yield potential against Pest and pathogen and utilization genes.
4. Learner learns new genetic approaches to achieve a definite ideotype of khaif crop.

Mapping of course outcome with programme outcome and programme specific outcomes:

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	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3
CO1	1	2	-	-	-	1	-	-	3	-	1	1
CO2	2	3	1	1	2	2	-	1	3	1	1	2
CO3	1	3	1	1	-	2	-	1	3	1	3	1
CO4	1	2	-	-	1	3	2	3	1	-	3	3
Average	1.25	2.5	1	1	1.5	2	2	1.67	2.5	1	2	1.75

Text books:-

1. Chopra, V.L. 2000. Breeding of Field Crops (Edt.). Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi.

2. Chaddha. K.L. and Rajendra Gupta. 1995. Vol. II Medicinal and Aromatic Plant. Malhotra Publishing House, New Delhi.

3. Manjit S. Kang 2004.Crop Improvement: Challenges in the Twenty-First Century (Edt). International Book Distributing Co. Lucknow.

4. Ram, H.H. and H.G. Singh. 1994. Crop Breeding and Genetics. Kalyani Publishers, New Delhi.

5. Sharma, A.K. 2005. Breeding Technology of Crop Plants (Edt.).Yash Publishing House, Bikaner.

Reference books:-

1. Ram, H.H. and H.G. Singh. 1994. Crop Breeding and Genetics. Kalyani Publishers, New

2. Ram. H.H. 2005. Vegetable Breeding — Principles and Practices. Kalyani Publishers, New Delhi.

3. Poehlman, J.M. 1987. Breeding of Field Crops. AVI Publishing Co. INC, East Port, Conneacticut, USA.

4. Mandal, A. K., P.K. Ganguli and S.P. Banerjee. 1991. Advances in Plant Breeding. Vol. I and II. CBS Publishers and Distributors, New Delhi.

Signature:-

1. S.P. Singh
2. Krishna Kumar
3. Aneeta Yadav
4. V.K. Tripathi
5. A.K. Tiwari

RAMA UNIVERSITY UTTAR PRADESH KANPUR

Faculty of Agricultural Sciences and Allied Industries

AEX-311: Entrepreneurship Development and Business Communication

L	T	P	CR
1	0	1	2

Course objective:-

Analyse the business environment in order to identify business opportunities.

Detail Contents

Unit 1 : **50 %**

Unit 2 : **50 %**

Unit- I

Concept of Entrepreneur, Entrepreneurship Development, Characteristics of entrepreneurs; SWOT Analysis & achievement motivation, Government policy and programs and institutions for entrepreneurship development, Impact of economic reforms on Agribusiness/ Agrienterprises,

Unit- II

Entrepreneurial Development Process; Business Leadership Skills; Developing organizational skill (controlling, supervising, problem solving, monitoring & evaluation), Developing Managerial skills, Business Leadership Skills (Communication, direction and motivation Skills), Problem solving skill, Supply chain management and Total quality management, Project Planning Formulation and report preparation; Financing of enterprise, Opportunities for agri-entrepreneurship and rural enterprise.

Practical

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

Course Learning Outcomes (CLO)

1. Identify the elements of success of entrepreneurial ventures.
2. Consider the legal and financial conditions for starting a business venture. Evaluate the effectiveness of different entrepreneurial strategies.
3. Specify the basic performance indicators of entrepreneurial activity.
4. Explain the importance of marketing and management in small businesses venture, Interpret their own business plan.

Mapping of course outcome with programme outcome and programme specific outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3
CO1	1	2	2	-	2	1	3	2	3	3	3	3
CO2	2	3	1	1	2	2	2	1	2	1	1	2

CO3	1	3	1	1	-	2	1	2	3	1	3	2
CO4	1	2	-	2	1	3	2	3	1	2	3	3
Average	1.25	2.5	1.33	1.33	1.67	2	2	2	2.25	1.75	2.5	2.5

Text books:-

1.Harold Koontz & Heinz Weihrich. 2004. Essentials of Management: An International erspective, 2nd Ed. Tata Mc-Graw Hill Publishing Pvt Ltd.
2. Bhaskaran, S. 2014. Entrepreneurship Development and Management. Aman Publishing House, Meerut.
3. Khanka S S. 1999. Entrepreneurial Development. S. Chand and Co. New Delhi.
4. Mohanty S K. 2007. Fundamentals of Entrepreneurship. Prentice Hall India Ltd., New Delhi.
5. Balasubrmanyam M. 1985. Business Communication. Vani Educational Books, New Delhi.

Reference books:-

1. Chole, R. R. Kapse, P. S. and Deshmukh, P. R. 2012. Entrepreneurship Development and Communication Skills scientific Publisher (India), Jodhpur.
2. Natrajan,K. and Ganeshan, K.P. 2012.Principles of Management. Himalaya Publishing House, New Delhi.
3. Mukesh Pandey & Deepali Tewari. 2010. The Agribusiness Book. IBDC Publishers.

Signature:-

1. S.P. Singh
2. Krishna Kumar
3. Ameeta Yadav
4. VK Tripathi
5. A.K. Tiwari

RAMA UNIVERSITY UTTAR PRADESH KANPUR

Faculty of Agricultural Sciences and Allied Industries

AGR-311 Geoinformatics, Nano-technology and Precision Farming

L	T	P	CR
1	0	1	2

Course objective:-

To study the various aspects of geoinformatics and nano-technology and their utilization for precision farming.

Detail Contents

Unit 1 : **25%**

Unit 2 : **25%**

Unit 3 : **25%**

Unit 4 : **25%**

Theory

Unit 1

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,

Unit 1I

soil mapping; fertilizer recommendation using geospatial technologies; Spatial data and their management in GIS; Remote sensing concepts and application in agriculture; Image processing and interpretation;

Unit 1II

Global positioning system (GPS), components and its functions; Introduction to crop Simulation Models and their uses for optimization of Agricultural Inputs; STCR approach for precision agriculture;

Unit 1V

Nanotechnology, definition, concepts and techniques, brief introduction about nanoscale effects, nano-particles, nano-pesticides, nano-fertilizers, nano-sensors, Use of nanotechnology in 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 of VRT and STCR techniques. Crop stress (biotic/abiotic) monitoring using geospatial technology. Use of GPS for agricultural survey. Formulation, characterization and applications of nanoparticles in agriculture. Projects formulation and execution related to precision farming.

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Course Learning Outcomes:

1. Understanding ***Precision agriculture***
2. complete knowledge about Remote sensing concepts and application in agriculture
3. technical knowledge of ***Crop Simulation Models***
4. understanding the modern concept of ***Nanotechnology*** *and* acquire knowledge about ***Nano-fertilizers.***

Mapping of course outcome with programme outcome and programme specific outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3
CO1	1	2	2	-	2	1	3	2	3	2	3	2
CO2	2	3	2	1	2	2	2	1	2	1	1	2
CO3	1	3	2	1	-	2	1	2	3	1	3	2
CO4	1	2	-	2	1	3	2	3	1	2	3	2
Average	1.25	2.5	2	1.33	1.67	2	2	2	2.25	1.5	2.5	2

Text Books:

1. Krishna, K.K. 2013. Precision Farming: Soil Fertility and Productivity Aspects. Apple Academic Press

2. Srivastava, G.S. 2014. An Introduction to Geoinformatics. McGrew Hill Education (India) Pvt. Ltd. , New Delhi

3. Gupta, R.K. and Subhash Chander. 2008. Principles of Geoinformatics. Jain Brothers, New Delhi.

Reference Books:

9. Choudhary, S. 2011. Applied Nanotechnology in Agriculture. Arise Publishers &Distributors

10. Sekhon, B.S. 2014. Nanotechnology in agri-food production: an overview. Nanotechnology, Science and Applications 7:31-532.

Signature:-

1. S.P. Singh
2. Krishna Kumari
3. Aneeta Yadav
4. VK Tripathi
5. A.K. Tiwari

RAMA UNIVERSITY UTTAR PRADESH KANPUR

Faculty of Agricultural Sciences and Allied Industries

AGR- 312: Practical Crop Production-I *(Kharif Crops)*

L	T	P	CR
0	0	1	1

Course objective:-

In the course study students will be acquainted with the knowledge of profitable crop production technology.

Detail Contents

Unit 1 : **50 %**

Unit 2 : **50 %**

Practical

Unit- I

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.

Unit- II

The emphasis will be given to seed production, mechanization, resource conservation and integrated nutrient, insect-pest and disease management technologies. Preparation of balance sheet including cost of cultivation, net returns per student as well as per team of 8-10 students.

Course Learning Outcomes (CLO)

1. Course content will help to students/farmers about ruminative crop production techniques.
2. It helps to adopt diversified farming system according to available farming situation.
3. It will assist to encourage the sustainable agriculture system.
4. Profitable based farming system can be adopted with the help of course content.

Mapping of course outcome with programme outcome and programme specific outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3
CO1	1	2	1	1	-	1	2	-	3	3	2	3
CO2	2	3	1	1	2	2	-	1	3	1	1	2
CO3	1	3	1	1	-	2	-	1	3	2	3	2
CO4	1	2	-	-	1	3	2	3	1	2	3	3
Average	1.25	2.5	1	1	1.5	2	2	1.67	2.5	2	2.25	2.5

Text books:-

1. Balasubramaniyan, P. and Palaniappan, S.P.2016. Principles and Practices of Agronomy (2nd edition), Agrobios (India), Jodhpur.

2. Reddy, S. R. 2016. Principles of Agronomy, Kalyani Publishers, Ludhiana.

3. Singh, S.S. and Singh, Rajesh. 2015. Principles and Practices of Agronomy (5th Re-set), Kalyani Publishers, New Delhi, Kalyani Publishers, Ludhiana.

Reference books:-

1. Balasubramaniyan, P. and Palaniappan, S.P.2016. Principles and Practices of Agronomy (2nd edition), Agrobios (India), Jodhpur.
2. Yawalkar, K.S., Agarwal, J.P. and Bokde, S. 2008. Manures and Fertilizers (10th edition), Agri-Horticultural Publishing House, Nagpur.

Signature:-

1. S.P. Singh
2. Krishna Kumar
3. Aneeta Yadav
4. VK Tripathi
5. A.K. Tiwari

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Faculty of Agricultural Sciences and Allied Industries

GPB-312: Intellectual Property Rights

L	T	P	CR
1	0	0	1

Course objective:-

To understand the concept of intellectual property rights.

Detail Contents

Unit 1 : **35 %**

Unit 2 : **35 %**

Unit 3 : **30 %**

Unit- I

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, case study on revoked patents, Copyrights,Trademark, Industrial design, Geographical indications, Integrated circuits, Trade secrets.

Unit- II

Patents Act 1970 and 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.

Unit- III

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, Registration of plant varieties under PPV&FR Act 2001, breeders, researcher and farmers rights. Traditional knowledge-meaning and rights of TK holders. Convention on Biological Diversity, International treaty on plant genetic resources for food and agriculture (ITPGRFA). Indian Biological Diversity Act, 2002 and its salient features, access and benefit sharing.

Course Learning Outcomes (CLO)

1. Skill to pursue the professional programs in Company Secretaryship, Law, Business, Agriculture, International Affairs, Public Administration and Other fields.
2. Employability as the Compliance Officer, Public Relation Officer and Liaison Officer.
3. Establishment of Legal Consultancy and service provider.

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Mapping of course outcome with programme outcome and programme specific outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3
CO1	1	2	-	-	-	1	-	-	3	2	3	1
CO2	2	3	1	2	2	2	1	1	3	1	1	2
CO3	1	3	1	1	-	2	1	1	3	1	3	1
Average	1.33	2.67	1	1.5	2	1.67	1	1	3	1.33	2.33	1.33

Text books:-

1. *Indian Forestry- K. Manikandan and S. Prabhu*
2. *Principles and practices of silviculture- A.P. Dwivedi*
3. *A text book of forestry- B.S. Chundawat and S.K. Gouatam*

Reference books:-

1. *A hand book of forestry- S.S. Negi*
2. *Plantation Trees- R.K. Luna*

Signature:-

1. S.P. Singh
2. Krishna Kumari
3. Sneeta Yadav
4. VK Tripathi
5. A.K. Tiwari

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Faculty of Agricultural Sciences and Allied Industries

UGE- 311: Food Safety and Standards

L	T	P	CR
1	1	1	3

Course objective:-

To study about evaluation of information on food science and nutrition issues appearing in the popular press.

Detail Contents

Unit 1 : 50%

Unit 2 : 50 %

Unit-I

Food Safety – Definition, Importance, Scope and Factors affecting Food Safety. Hazards and Risks, Types of hazards - Biological, Chemical, Physical hazards. Management of hazards - Need.Control of parameters.Temperature control.Food storage. Product design. Hygiene and Sanitation in Food Service Establishments- Introduction.Sources of contamination and their control. Waste Disposal. Pest and Rodent Control.Personnel Hygiene.Food Safety Measures.Food Safety Management Tools- Basic concepts.PRPs, GHPs, GMPs, SSOPs etc.HACCP.ISO series. TQM - concept and need for quality, components of TQM, Kaizen.

Unit- II

Risk Analysis. Accreditation and Auditing, Water Analysis, Surface Sanitation and Personal Hygiene.Food laws and Standards- Indian Food Regulatory Regime, FSSA.Global Scenario CAC. Other laws and standards related to food. Recent concerns- New and Emerging Pathogens. Packaging, Product labeling and Nutritional labeling.Genetically modified foods\ transgenics.Organic foods.Newer approaches to food safety.Recent Outbreaks.Indian and International Standards for food products.

Practical

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

Course Learning Outcomes (CLO)

1. Undersand basic principles and practices of cleaning and sanitation in food preparation operation.
2. Identity and explain nutrients in foods and the specific functions in maintaining health.

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Mapping of course outcome with programme outcome and programme specific outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3
CO1	1	2	-	-	-	1	-	-	2	-	1	1
CO2	2	3	1	1	2	2	-	1	3	1	1	2
Average	1.5	2.5	1	1	2	1.5	-	1	2.5	1	1	1.5

Text books:-

1. Srilakshmi, B. (2010). Text Book of Food Science.New age international (P) limited, publisher, New Delhi

2. Sehgal, S. and Raghuvanshi, R.S. (2007). Text Book of Community Nutrition, ICAR ublication

3. Khaddar V., (1999). Text Book of Food.Storage and Preservation.Kalyani Publishers, New Delhi.

Reference books:-

1. Swaminathan. M. (1993). Advanced Textbook on Food and Nutrition. Volume I, Bappco, the Bangalore Press and Publishing Co. Ltd. Bangalore, p. 576

2. Srilakshmi, B. (2010). Text Book of Nutrition Science. New age international (P) limited, ublisher, New Delhi

Signature:-

1. S.P. Singh
2. Krishna Kumari
3. Ameeta Yadav
4. VK Tripathi
5. A.K. Tiwari

RAMA UNIVERSITY UTTAR PRADESH KANPUR

Faculty of Agricultural Sciences and Allied Industries

UGE- 312 : Biopesticides & Biofertilizers

L	T	P	CR
1	1	1	3

Course objective:- To understand the different types of chemicals and their mode of actions which are being used as biopesticides and biofertilizers.

Detail Contents

Unit 1 : **35 %**

Unit 2 : **35 %**

Unit 3 : **30 %**

Unit- I

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 entomopathogenic pathogens and nematodes.Methods of application of biopesticides.Methods of quality control and Techniques of biopesticides.Impediments and limitation in production and use of biopesticide.

Unit-II

Biofertilizers - Introduction, status and scope. Structure and characteristic features of bacterial biofertilizers- *Azospirillum, Azotobacter, Bacillus, Pseudomonas, Rhizobium* and *Frankia*; Cynobacterialbiofertilizers- *Anabaena, Nostoc*, Hapalosiphon and fungal biofertilizers- AM mycorrhiza and ectomycorhiza. 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.

Unit-III

Application technology for seeds, seedlings, tubers, sets etc. Biofertilizers -Storage, shelf life, quality control and marketing. Factors influencing the efficacy of biofertilizers.

Practical

Isolation and purification of important biopesticides: *Trichoderma Pseudomonas, Bacillus, Metarhyzium* etc. and its production. Identification of important botanicals. Visit to biopesticide laboratory in nearby area. Field visit to explore naturally infected cadavers. Identification of entomopathogenic entities in field condition.Quality control of biopesticides.

Isolation and purification of *Azospirillum* ,*Azotobacter*, *Rhizobium*, P-solubilizers and cyanobacteria. Mass multiplication and inoculums production of biofertilizers. Isolation of AM fungi -Wet sieving method and sucrose gradient method. Mass production of AM inoculants.

Course Learning Outcomes (CLO)

1. To study about the concept of biopesticides.Importance, scope and potential of biopesticide.
2. To study about concepts and classification of biopesticides viz. pathogen, botanical pesticides, and biorationales.
3. To study about botanicals and their uses.

Mapping of course outcome with programme outcome and programme specific outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3
CO1	1	2	3	-	-	1	1	-	3	2	1	1
CO2	1	3	1	1	2	2	-	1	3	1	1	2
CO3	2	3	1	1	-	2	2	1	3	1	3	1
Average	1.33	2.67	1.67	1	2	1.67	1.5	1	3	1.33	1.67	1.33

Text books:-

1.Lakshman, H.C. (2014) Bio-fertilizers and Bio-pesticides. Pointer Publishers

2.Rabindra, R.J., Kennedy, J.S., Sathaiah, N., Rajeshkharan, B. and Srinivasan, M.R. 2001. Microbial control of crop pests.TNAU.

3 . Dhaliwal, GS &Koul O. 2007. Biopesticides and pest management. Kalyani Publ., New Delhi

Reference books:-

1. Dhaliwal, GS &Koul O. 2007. Biopesticides and pest management. Kalyani Publ., New Delhi

2. Sylvia D.N. 2005; Principles and application of Soil Microbiology.Peason Publisher.

Signature:-

1. S.P. Singh
2. Krishna Kumar
3. Aneeta Yadav
4. MK Tripathi
5. A.K. Tiwari

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Faculty of Agricultural Sciences and Allied Industries

UGE- 313: Protected Cultivation

L	T	P	CR
1	1	1	3

Course objective:-

This course will help the students to learn about Irrigation systems used in greenhouses, shade net house in protected cultivation.

Detail Contents

Unit 1 : **50 %**

Unit 2 : **50%**

Protected Cultivation

Unit-I

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.

Unit- II

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, Inter cultural operations, Soil EC and pH measurement, Regulation of irrigation and fertilizers through drip, fogging ad misting.

Course Learning Outcomes (CLO)

1. To get knowledge about green house technology, types of green houses and construction of green houses.
2. Course will give the knowledge of Green house equipments, materials of construction for traditional and low cost green houses.

Mapping of course outcome with programme outcome and programme specific outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3
CO1	1	2	-	-	-	1	2	-	3	-	1	1

CO2	2	3	1	1	2	2	2	1	2	1	1	2
Average	1.5	2.5	1	1	2	1.5	2	1	2.5	1	1	1.5

Text books:-

1. Green house: Science and Technology. 2016. Kothari S, S.C.Kaushic and A.N.Mathur. Himanshu Publication, Udaipur.

2. Green House Technology- Application and Practice. Sharma A and V.M.Salokhe. 2006. Agro Tech. publication, Udaipur

3. Agricultural Process Engineering. 1955. Henderson, S.M. and R.L. Perry. John Willy and Sons, New York.

4. Unit operation of Agriculture Processing. 2004. Shay K.M. and Singh, K.K. Vikas Publication House, New Delhi.

Reference books:-

1. Post Harvest Technology of Cereals, Pulses and Oil Seeds.1999. Chakravarty, A. Oxford and IBH Pub. New Delhi.

2. Principles of Agricultural Engineering, Vol. I. 2012. Michael, A.M. and T. P. Ojha . Jain Brothers, New Delhi.

Signature:-

1. S.P. Singh
2. Krishna Kumari
3. Ameeta Yadav
4. V.K. Tripathi
5. A.K. Tiwari

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Faculty of Agricultural Sciences and Allied Industries

UGE- 314: Micro propagation Technologies

L	T	P	CR
1	1	1	3

Course objective:-

To study about technologies in micro propagation to develop the plant species.

Detail Contents

Unit 1 : 50 %

Unit 2 : 50 %

Unit-I

Introduction, History, Advantages and limitations; Types of cultures (seed, embryo, organ, callus, cell), Stages of micropropagation, Axillary bud proliferation (Shoot tip and meristem culture, bud culture),

Unit-II

Organogenesis (callus and direct organ formation), Somatic embryogenesis, cell suspension cultures, Production of secondary metabolites , Somaclonal variation, Cryopreservation.

Course Learning Outcomes (CLO)

1. Students will understand the micropropagation tools, advantages and limitations;
2. Students will understand types of cultures (seed, embryo, organ, callus, cell)
3. Students will understand stages of micro propagation,
4. Students will understand about secondary metabolites production in vitro

Mapping of course outcome with programme outcome and programme specific outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3
CO1	1	2	1	-	-	1	2	-	3	3	1	2
CO2	2	3	1	1	2	2	-	1	3	1	1	2
CO3	1	3	1	1	-	2	-	1	3	1	3	1
CO4	1	2	-	1	1	3	2	3	1	3	3	3
Average	1.25	2.5	1	1	1.5	2	2	1.67	2.5	2	2	2

Text books:-

1. *Chawala H S (2000). Introduction to Plant Biotechnology. Oxford & IBH, New Delhi*
2. *Ray V. Herren (2005). Introduction to Biotechnology (An Agricultural revolution)*

3. Shekhawat, M. S. (2011) Plant Biotechnology, In vitro Principles, Techniques and Applications. MJP Publishers, Chennai

4. Singh BD. 2005. Biotechnology, Expanding Horizons. Kalyani Publishers, New Delhi

Reference books:-

1. Mascarenhas, A. F. (2008). Hand Book of Plant Tissue Culture. ICAR,New Delhi

2. Gupta, P. K. (2008). Elements of Biotechnology. Rastogi Publications, Meerut

Signature:-

1. S.P. Singh
2. Krishna Kumar
3. Ameeta Yadav
4. VK Tripathi
5. A.K. Tiwari

RAMA UNIVERSITY UTTAR PRADESH KANPUR

Faculty of Agricultural Sciences and Allied Industries

SCW- 321 Rainfed Agriculture and Watershed Management

L	T	P	CR
1	0	1	2

Course objective:-

To study about watershed management and rainfed agriculture .

Detail Contents

Unit 1 : 50 %

Unit 2 : 50 %

Unit-I

Rainfed agriculture: Introduction, types, History of rainfed agriculture and watershed in India; Problems and prospects of rainfed agriculture in India ; Soil and climatic conditions prevalent in rainfed areas; Soil and water conservation techniques, Drought: types, effect of water deficit on physio- morphological characteristics of the plants, Crop adaptation and mitigation to drought;

Unit-II

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 rainfed areas in the country and demarcation of rainfed area on map of India.Interpretation of meteorological data and scheduling of supplemental irrigation on the basis of evapo-transpiration demand of crops.Critical analysis of rainfall and possible drought period in the country, effective rainfall and its calculation. Studies on cultural practices for mitigating moisture stress. Characterization and delineation of model watershed.Field demonstration on soil & moisture conservation measures.Field demonstration on construction of water harvesting structures. Visit to rainfed research station/watershed.

Course Learning Outcomes (CLO)

1. Students will learn about the Rainfed agriculture. Its Introduction, types,
2. Students will understand Problems and prospects of rainfed agriculture in India ;
3. Students will understand Soil and climatic conditions prevalent in rainfed areas;
4. Students will understand Soil and water conservation techniques

Mapping of course outcome with programme outcome and programme specific outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3
CO1	1	2	-	-	-	1	2	-	3	1	1	1
CO2	2	3	1	1	2	2	-	1	3	1	1	2

CO3	1	3	1	1	-	2	-	1	3	1	3	1
CO4	1	2	-	-	1	3	2	3	1	-	3	3
Average	1.25	2.5	1	1	1.5	2	2	1.67	2.5	1	2	1.75

Text books:-

1. Reddy, S.R. and Reddy, G. Prabhakara. 2015. Dryland Agriculture, Kalyani Publishers,Ludhiana.
2. Murthy, J. V. S. 1994. Watershed Management, Wiley Eastern Limited. New AgeInternational Limited, New Delhi.
3. Singh, R.P., Sharma, S., Padmnabhan, N.V. , Das, S.K. and Mishra, P.K. 1990.A FieldManual on Watershed Management, ICAR (CRIDA), Hyderabad
4. Singh, P.K. 2000. Watershed Management (Design & Practices), e-media Publication,Udaipur, India.

Reference books:-

1. Dhruva Narayan, V.V. Singh, P.P., Bhardwaj, S.P., U. Sharma, Sikha, A.K., Vital,K.P.R. and Das, S.K. 1987. Watershed Management for Drought Mitigation, ICAR,New Delhi.
2. Jayanthi, C. and Kalpana, R. 2016. Dryland Agriculture, Kalyani Publishers, Ludhiana.
3. Singh, R.P. 1995, Sustainable Development of Dryland Agriculture in India. ScientificPublishers, Jodhpur.

Signature:-

1. S.P. Singh
2. Krishna Kumar
3. Aneeta Yadav
4. V.K. Tripathi
5. A.K. Tiwari

RAMA UNIVERSITY UTTAR PRADESH KANPUR

Faculty of Agricultural Sciences and Allied Industries

AGR- 322: Protected Cultivation and Secondary Agriculture

L	T	P	CR
1	0	1	2

Course objective:-

To study about green house equipments, materials of construction for traditional and low cost green houses.

Detail Contents

Unit 1 : **35 %**

Unit 2 : **35 %**

Unit 3 : **30 %**

Unit-I

Green house technology: Introduction, Types of Green Houses; Plant response to Green house 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.

Unit-II

Irrigation systems used in greenhouses, typical applications, passive solar green house, hot air green house heating systems, green house drying. Cost estimation and economic analysis. Important Engineering properties such as physical, thermal and aero & hydrodynamic properties of cereals, pulses and oilseed, their application in PHT equipment design and operation.

Unit-III

Drying and dehydration; moisture measurement, EMC, drying theory, various drying method, commercial grain dryer (deep bed dryer, flat bed dryer, tray dryer, fluidized bed dryer, recirculatory dryer and solar dryer). Material handling equipment; conveyer and elevators, their principle, working and selection.

Practical

Study of different type of green houses based on shape. Determine the rate of air exchange in an active summer winter cooling system. Determination of drying rate of agricultural products inside green house. Study of green house equipments. Visit to various Post Harvest Laboratories. Determination of Moisture content of various grains by oven drying & infrared moisture methods. Determination of engineering properties (shape and size, bulk density and porosity of biomaterials).Determination of Moisture content of various grains by moisture meter.Field visit to seed processing plant.

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Course Learning Outcomes (CLO)

1. Students will learn about Green house technology. its Introduction,
2. Students will understand Types of Green Houses,
3. Students will understand Plant response to Green house environment, Planning and design of greenhouses,
4. Students will understand Design criteria of green house for cooling and heating purposes.

Mapping of course outcome with programme outcome and programme specific outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3
CO1	1	2	1	2	-	1	2	-	3	2	1	3
CO2	2	3	1	1	2	2	-	1	3	2	1	2
CO3	1	3	1	1	2	2	-	1	3	1	3	2
CO4	1	2	-	2	1	3	2	3	1	3	3	3
Average	1.25	2.5	1	1.5	1.67	2	2	1.67	2.5	2	2	2.5

Text books:-

1. Green house: Science and Technology. 2016. Kothari S, S.C.Kaushic and A.N.Mathur. Himanshu Publication, Udaipur.

2. Green House Technology- Application and Practice. Sharma A and V.M.Salokhe. 2006. Agro Tech. publication, Udaipur

3. Agricultural Process Engineering. 1955. Henderson, S.M. and R.L. Perry. John Willy and Sons, New York.

4. Unit operation of Agriculture Processing. 2004. Shay K.M. and Singh, K.K. Vikas Publication House, New Delhi.

Reference books:-

1. *Post Harvest Technology of Cereals, Pulses and Oil Seeds.1999. Chakravarty, A. Oxford and IBH Pub. New Delhi.*
2. *Principles of Agricultural Engineering, Vol. I. 2012. Michael, A.M. and T. P. Ojha . Jain Brothers, New Delhi.*

Signature:-

1. S.P. Singh
2. Kuldeep Kumar
3. Aneeta Yadav
4. VK Tripathi
5. A.K. Tiwari

RAMA UNIVERSITY UTTAR PRADESH KANPUR

Faculty of Agricultural Sciences and Allied Industries

PPA-312: Diseases of Field & Horticultural Crops & their Management-I	L	T	P	CR
	1	1	1	3

Course objective:-

To study about the Symptoms, etiology, disease cycle and management of major diseases of Field Crops.

Detail Contents

Unit 1 : **35 %**

Unit 2 : **35 %**

Unit 3 : **30 %**

Unit-I

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

Field Crops: Rice: blast, brown spot, bacterial blight, sheath blight, false smut, khaira and tungro;Maize: stalk rots, downy mildew, leaf spots; Sorghum: smuts, grain mold and anthracnose, Bajra :downy mildew and ergot; Groundnut: early and late leaf spots, wilt

Unit-II

Soybean: Rhizoctonia blight, bacterial spot, seed and seedling rot and mosaic; Pigeonpea: Phytophthora blight, wilt and sterility mosaic; Finger millet: Blast and leaf spot; black & green gram: Cercospora leaf spot and anthracnose, web blight and yellow mosaic; Castor: Phytophthorablight;Tobacco: black shank, black root rot and mosaic. Horticultural Crops: Guava: wilt and anthracnose;

Unit-II

Banana: Panama wilt, bacterial wilt, Sigatoka and bunchy top;Papaya: foot rot, leaf curl and mosaic, Pomegranate: bacterial blight; Cruciferous vegetables: Alternaria leaf spot and black rot; Brinjal: Phomopsis blight and fruit rot and Sclerotinia blight; Tomato: damping off, wilt, early and late blight, buck eye rot and leaf curl and mosaic; Okra: Yellow Vein Mosaic; Beans: anthracnose and bacterial blight; Ginger: soft rot; Colocasia: Phytophthora blight; Coconut: wilt and bud rot; Tea: blister blight; Coffee: rust

Practical

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

Identification and use of equipments in tissue culture Laboratory, Nutrition media composition, sterilization techniques for media, containers and small instruments, sterilization techniques for explants, Preparation of stocks

and working solution, Preparation of working medium, Culturing of explants :Seeds, shoot tip and single node, Callus induction, Induction of somatic embryos regeneration of whole plants from different explants, Hardening procedures.

Course Learning Outcomes (CLO)

1. Students will learn about the Symptoms, etiology,
2. Students will understand disease cycle and management of major diseases of Horticultural crops

Mapping of course outcome with programme outcome and programme specific outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3
CO1	1	2	3	3	1	2	2	-	3	3	2	3
CO2	2	3	2	1	2	2	1	1	3	1	1	2
Average	1.5	2.5	2.5	2	1.5	2	1.5	1	3	2	1.5	2.5

Text books:-

1. Gupta V K and Paul, Y S 2008. IInd ed. Diseases of field crops. Kalyani Publishing Co.ND.
2. Mehrotra R S and Aggarwal A. 2012. 12th ed. Plant Pathology, Tata McGraw-HillPublishing Co Ltd.
3. Rangaswamy,G and Mahadevan, A . 2012. 4th ed. Diseases of crop plants in India.
Prentice hall of India Pvt Ltd, New Delhi.
4. Singh R S .2007. 8thed. Plant Diseases.Oxford and IBH Publishing Co. Pvt. Ltd. NewDelhi
5. Gupta ,V. K. 2014. Diseases of Fruit Crops. Kalyani Publishers
6. Singh , R.P. 2013. Plant Pathology. Kalyani Publishers
7. Tripati, D.P. 2009. Crop Diseases, Kalyani Publishers
8. Gupta, S.K. and Thind, T.S. 2006. Disease problems in vegetable production.Scientific Publishers, Jodhpur.
9. Singh, R.S. 2006. Diseases of fruit crops.Oxford and IBH Publishing Co. Pvt. Ltd. New Delhi.

Reference books:-

1. Mishra A , Bohra A and Mishra , A. 2005. Plant Pathology. Agrobios. Jodhpur (India).
2. Singh R S .2007. Plant Diseases.(9th Ed.) Oxford and IBH Publishing Co.Pvt .Ltd .ND

3. Pathak, V.N. 1980 Diseases of fruit crops. Oxford and IBH Publishing Co. Pvt. Ltd, . New Delhi.

4. Singh, R.S.1994 Diseases of vegetable crops. Oxford and IBH Publishing Co. Pvt. Ltd

Signature:-

1. S.P. Singh
2. Krishna Kumar
3. Aneeta Yadav
4. Vk Tripathi
5. A.K. Tiwari

RAMA UNIVERSITY UTTAR PRADESH KANPUR

Faculty of Agricultural Sciences and Allied Industries

HOR-321: Post-harvest Management and Value Addition of Fruits and Vegetables.

L	T	P	CR
1	0	1	2

Course objective:-

To study about post-harvest processing of fruits and vegetables, extent and possible causes of post harvest losses & Value addition concept.

Detail Contents

Unit 1 : **50 %**

Unit 2 : **50 %**

Unit-I

Importance of post-harvest processing of fruits and vegetables, extent and possible causes of post harvest losses; Pre-harvest factors affecting postharvest quality, maturity, ripening and changes occurring during ripening; Respiration and factors affecting respiration rate; Harvesting and field handling; Storage (ZECC, cold storage, CA, MA, and hypobaric).

Unit-II

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, jelly, RTS, nectar, squash, osmotically dried products, fruit bar and candy and tomato products, canned products. Quality evaluation of products -- physico-chemical and sensory. Visit to processing unit/ industry.

Course Learning Outcomes (CLO)

1. Students Will learn about the Importance of post-harvest processing of fruits and vegetables,
2. Students will understand extent and possible causes of post harvest losses;
3. Students will understand Pre-harvest factors affecting postharvest quality, maturity, ripening and changes occurring during ripening.

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Mapping of course outcome with programme outcome and programme specific outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3
CO1	1	2	3	-	-	1	2	-	3	2	1	2
CO2	2	3	1	1	2	2	-	1	3	1	1	2
CO3	1	3	1	2	1	2	2	1	3	1	3	1
Average	1.33	2.67	1.67	1.5	1.5	1.67	2	1	3	1.33	1.67	1.67

Text books:-

1. Jacob John, P A Handbook on Post Harvest management of Fruits and vegetables (2008) Daya Publishing House, Delhi

2.Manoranjan, K and Sangita, S. Food Preservation & Processing (1996) Kalyani Publishers

3.Mitra, S. K. Post Harvest Physiology and Storage of Tropical and Sub-tropical Fruits (1997) CAB International

4.Srivastava, R. P. & Sanjeev Kumar Fruits and vegetable Preservation – Principles an Practice (2002) International Book Distributing Co., Lucknow

5. Vijay, K. Text Book of Food Sciences and Technology (2001) ICAR

6.Mayani, Desai, Vagadia Post Harvest management of Horticultural crops Jaya Publishing House.

Reference books:-

1. Saraswathy, S. et. al. Post harvest Management of Horticultural Crops (2008) Agribios

2. Rosa L.A. Fruit and Vegetable Phytochemicals: Chemistry, Nutritional Value and Stability BioGreen

3. Verma, L. R. and Joshi, V. K. Post Harvest Technology of Fruits and Vegetables Vol. I & II. (2000) Indus Publishing Co., New Delhi

4. Morris, T. N. Principles of Fruit Preservation (2006) Biotech Books, Delhi

Signature:-

1. S.P. Singh
2. Krishna Kumari
3. Neeta Yadav
4. VK Tripathi
5. A.K. Tiwari

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Faculty of Agricultural Sciences and Allied Industries

ENT- 321: Management of Beneficial Insects

L	T	P	CR
1	0	1	2

Course objective:-

To study about apiculture, sericulture and lac culture as an entrepreneur .

agro climatic zone.

CO 2: To understand

Detail Contents

Unit 1 : 35 %

Unit 2 : 35 %

Unit 3 : 30 %

Unit-I

Importance of beneficial Insects, Beekeeping and pollinators, bee biology, commercial methods of rearing, equipment used, seasonal management, bee enemies and disease. Bee pasturage, bee foraging and communication.Insect pests and diseases of honey bee. Role of pollinators in cross pollinated plants.

Unit-II

Types of silkworm, voltinism and biology of silkworm.Mulberry cultivation, mulberry varieties and methods of harvesting and preservation of leaves. Rearing, mounting and harvesting of cocoons. Pest and diseases of silkworm, management, rearing appliances of mulberry silkworm and methods of disinfection.

Unit-III

Species of lac insect, morphology, biology, host plant, lac production – seed lac, button lac, shellac, lac- products. Identification of major parasitoids and predators commonly being used in biological control.

Insect orders bearing predators and parasitoids used in pest control and their mass multiplication techniques. Important species of pollinator, weed killers and scavengers with their importance.

Practical

Honey bee species, castes of bees. Beekeeping appliances and seasonal management, bee enemies and disease.Bee pasturage, bee foraging and communication.Types of silkworm, voltinism and biology of silkworm.Mulberry cultivation, mulberry varieties and methods of harvesting and preservation of leaves. Species of lac insect, host plant identification. Identification of other important pollinators, weed killers and scavengers. Visit to research and training

institutions devoted to beekeeping, sericulture, lac culture and natural enemies. Identification and techniques for mass multiplication of natural enemies.

Course Learning Outcomes (CLO)

1. Identification of different bio control agents (Predator, Parasite and Parasitoids) and their use for sustainable pest management.
2. Learn about mass multiplication technique of biological control agents and
3. Knowledge about establishment of a bio control lab in future as an entrepreneur.

Mapping of course outcome with programme outcome and programme specific outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3
CO1	1	2	-	-	1	1	2	2	3	2	1	1
CO2	2	2	1	1	2	2	1	1	2	1	1	2
CO3	2	3	1	1	-	2	1	1	3	1	3	3
Average	1.67	2.33	1	1	1.5	1.67	1.33	1.33	2.67	1.33	1.67	2

Text books:-

1. Atwal, A.S. and Dhaliwal, G.S. 2002. Agricultural Pests of South Asia and Their Management, Kalyani Publishers, New Delhi.
2. Mathur and Upadhyay, 2005. A Text Book of Entomology, Aman Publishing House, Meerut.
3. Srivastava, K.P. 2004. A Text Book of Entomology, Vol.I, Kalyani Publishers, New Delhi.
4. Dhawan, A.K. Integrated Pest Management, Scientic Publishers, Jodhpur.

Reference books:-

1. Dhaliwal, G.S. and Ramesh Arora 2001. Integrated Pest Management. Concepts and Approaches. Kalyani publishers, New Delhi.

2. Gautam, R.D. Biological Pest Suppression, WestvillPublising Co., New Delhi.

Signature:-

1. S.P. Singh
2. Krishna Kumari
3. Aneeta Yadav
4. VK Tripathi
5. A.K. Tiwari

RAMA UNIVERSITY UTTAR PRADESH KANPUR

Faculty of Agricultural Sciences and Allied Industries

GPB- 321: Crop Improvement – II (*Rabi*)

L	T	P	CR
1	0	1	2

Course objective:-

To study about importance of wild relative to produce new varieties of Rabi crop.

Detail Contents

Unit 1 : **50 %**

Unit 2 : **50 %**

Unit-I

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

Unit-II

Major breeding objectives and procedures including conventional and modern innovative approaches for development of hybrids and varieties for yield, adaptability, stability, abiotic and biotic stress tolerance and quality (physical, chemical, nutritional); Hybrid seed production technology of *rabi* crops. Ideotype concept and climate resilient crop varieties for future.

Practical

Floral biology, emasculation and hybridization techniques in different crop species namely Wheat, Oat, Barley, Chickpea, Lentil, Field pea, Rajma, Horse gram, Rapeseed Mustard, Sunflower, Safflower, Potato, Berseem. Sugarcane, Tomato, Chilli, Onion; Handling of germplasm and segregating populations by different methods like pedigree, bulk and single seed decent methods; Study of field techniques for seed production and hybrid seeds production in *Rabi* crops; Estimation of heterosis, inbreeding depression and heritability; Layout of field experiments; Study of quality characters, study of donor parents for different characters; Visit to seed production plots; Visit to AICRP plots of different field crops

Course Learning Outcomes (CLO)

1. Learner learns Gene preservation method for further use to improve Rabi varieties.
2. Learner learns to applies breeding method to improve Rabi crops.
3. Learner learns identification of resistance gene relate to Rabi crop with high yield potential against Pest and pathogen and utilization genes.
4. Learner learns new genetic approaches to achieve a definite ideotype of Rabi crop.

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Mapping of course outcome with programme outcome and programme specific outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3
CO1	1	2	2	1	-	1	2	2	3	3	1	3
CO2	2	3	1	1	2	2	-	1	3	2	1	2
CO3	1	3	2	1	-	2	-	1	3	1	3	2
CO4	1	2	1	-	1	3	2	3	1	2	3	3
Average	1.25	2.5	1.5	1	1.5	2	2	1.75	2.5	2	2	2.5

Text books:-

1. Chopra, V.L. 2000. Breeding of Field Crops (Edt.). Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi.

2. Chaddha. K.L. and Rajendra Gupta. 1995. Vol. II Medicinal and Aromatic Plant. Malhotra Publishing House, New Delhi.

3. Manjit S. Kang 2004.Crop Improvement: Challenges in the Twenty-First Century (Edt). International Book Distributing Co. Lucknow.

4. Ram, H.H. and H.G. Singh. 1994. Crop Breeding and Genetics. Kalyani Publishers, New Delhi.

5. Sharma, A.K. 2005. Breeding Technology of Crop Plants (Edt.).Yash Publishing House, Bikaner.

Reference books:-

1. Ram, H.H. and H.G. Singh. 1994. Crop Breeding and Genetics. Kalyani Publishers, New

2. Ram. H.H. 2005. Vegetable Breeding — Principles and Practices. Kalyani Publishers, New Delhi.

3. Poehlman, J.M. 1987. Breeding of Field Crops. AVI Publishing Co. INC, East Port, Conneacticut, USA.

4. Mandal, A. K., P.K. Ganguli and S.P. Banerjee. 1991. Advances in Plant Breeding. Vol. I and II. CBS Publishers and Distributors, New Delhi.

Signature:-

1. S.P. Singh
2. Krishna Kumar
3. Aneeta Yadav
4. V.K. Tripathi
5. A.K. Tiwari

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AGR- 323: Practical Crop Production-II *(Rabi Crops)*

L	T	P	CR
0	0	2	2

Course objective:-

To study about the field preparation and Practical approaches in raising of crops.

Detail Contents

Unit 1 : **50 %**

Unit 2 : **50 %**

Practical

Unit-I

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.

Unit-II

The emphasis will be given to seed production, mechanization, resource conservation and integrated nutrient, insect-pest and disease management technologies. Preparation of balance sheet including cost of cultivation, net returns per student as well as per team of 8-10 students.

Course Learning Outcomes (CLO)

1. students will be acquainted with the knowledge of profitable crop production technology.
2. Course content will help to students/farmers about ruminative crop production techniques.
3. It helps to adopt diversified farming system according to available farming situation. It will assist to encourage the sustainable agriculture system.
4. Profitable based farming system can we adopted with the help of course content.

Mapping of course outcome with programme outcome and programme specific outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3
CO1	1	2	2	1	2	1	-	-	3	2	1	3
CO2	2	3	1	1	2	2	-	1	3	1	1	2
CO3	1	3	1	1	-	2	-	1	3	1	3	1
CO4	2	2	2	-	1	3	2	3	1	2	3	3
Average	1.5	2.5	1.5	1	1.25	2	2	1.67	2.5	1.5	2	2.25

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Text books:-

1. Balasubramaniyan, P. and Palaniappan, S.P.2016. Principles and Practices of Agronomy (2nd edition), Agrobios (India), Jodhpur.

2. Reddy, S. R. 2016. Principles of Agronomy, Kalyani Publishers, Ludhiana.

3. Singh, S.S. and Singh, Rajesh. 2015. Principles and Practices of Agronomy (5th Re-set), Kalyani Publishers, New Delhi, Kalyani Publishers, Ludhiana.

Reference books:-

1. Balasubramaniyan, P. and Palaniappan, S.P.2016. Principles and Practices of Agronomy (2nd edition), Agrobios (India), Jodhpur.

2. Yawalkar, K.S., Agarwal, J.P. and Bokde, S. 2008. Manures and Fertilizers (10th edition), Agri-Horticultural Publishing House, Nagpur.

Signature:-

1. S.P. Singh
2. Krishna Kumari
3. Aneeta Yadav
4. VK Tripathi
5. A.K. Tiwari

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Faculty of Agricultural Sciences and Allied Industries

AGR- 324: Principles of Organic farming

L	T	P	CR
1	0	1	2

Course objective:-

To study about the Organic farming and its implications.

Detail Contents

Unit 1 : **50 %**

Unit 2 : **50 %**

Unit-I

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.

Unit-II

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 technology knowledge (ITK) for nutrient, insect, pest disease and weed management; Cost of organic production system; Post harvest management; Quality aspect, grading, packaging and handling.

Course Learning Outcomes (CLO)

1. Initiative can be taken for organic produce.
2. Knowledge about role of NGOs in producing organic products.
3. Knowledge about selection of crops and varieties for organic produce
4. Certification of organic produce.

Mapping of course outcome with programme outcome and programme specific outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3
CO1	1	2	-	-	-	1	2	-	3	3	1	2
CO2	2	3	2	1	2	2	-	1	3	2	1	2

CO3	2	3	2	1	-	2	-	1	3	1	3	1
CO4	1	2	-	-	1	3	2	3	1	2	3	3
Average	1.5	2.5	2	1	1.5	2	2	1.67	2.5	2	2	2

Text books:-

1. Dhama, A.K. 2014. Organic Farming for Sustainable Agriculture, Agrobios (India), Jodhpur.
2. Palaniappan, S.P. and Anandurai, K.1999. Organic Farming – Theory and Practice.Scientific Pub. Jodhpur

Reference books:-

1. Thapa, U and Tripathy, P. 2006. Organic Farming in India, Problems and prospects, Agrtech, Publising Academy, Udaipur
2. Sharma, Arun K. 2013. A Handbook of Organic Farming, Agrobios (India), Jodhpur

Signature:-

1. S.P. Singh
2. Krishna Kumar
3. Aneeta Yadav
4. VK Tripathi
5. A.K. Tiwari

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Faculty of Agricultural Sciences and Allied Industries

AES- 321: Farm Management, Production and Resource Economics

L	T	P	CR
1	0	1	2

Course objective:-

The objectives of the course is to study about the principles and practices at farm level for the optimization of Profit.

Detail Contents

Unit 1 : **35 %**

Unit 2 : **35 %**

Unit 3 : **30 %**

Unit-I

Meaning and concept of farm management, objectives and relationship with other sciences. Meaning and definition of farms, its types and characteristics, factor determining types and size of farms. Principles of farm management: concept of production function and its type, use of production function in decision-making on a farm, factor-product, factor-factor and product-product relationship, law of equi-marginal or principles of opportunity cost and law of comparative advantage.

Unit-II

Meaning and concept of cost, types of costs and their interrelationship, importance of cost in managing farm business and estimation of gross farm income, net farm income, family labor income and farm business income. Farm business analysis: meaning and concept of farm income and profitability, technical and economic efficiency measures in crop and livestock enterprises. Importance of farm records and accounts in managing a farm, various types of farm records needed to maintain on farm, farm inventory, balance sheet, profit and loss accounts. Meaning and importance of farm planning and budgeting, partial and complete budgeting, steps in farm planning and budgeting-linear programming, appraisal of farm resources, selection of crops and livestock's enterprises.

Unit-III

Concept of risk and uncertainty occurs in agriculture production, nature and sources of risks and its management strategies, Crop/livestock/machinery insurance – weather based crop insurance, features, determinants of compensation. Concepts of resource economics, differences between NRE and agricultural economics, unique properties of natural resources. 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.

Practical

Preparation of farm layout. Determination of cost of fencing of a farm. Computation of depreciation cost of farm assets. Application of equi-marginal returns/opportunity cost principle in allocation of farm resources. Determination of most profitable level of inputs use in a farm production process. Determination of least cost combination of inputs.

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Selection of most profitable enterprise combination. Application of cost principles including CACP concepts in the estimation of cost of crop and livestock enterprises. Preparation of farm plan and budget, farm records and accounts and profit & loss accounts. Collection and analysis of data on various resources in India.

Course Learning Outcomes (CLO)

1. The course contains a comprehensive treatment of the traditional agricultural production economics topics employing both detailed graphics and differential calculus.
2. Focus on the neoclassical factor-product, factor-factor and product- product models, and is suitable for an advanced undergraduate or a beginning graduate –level course in static production economics.

Mapping of course outcome with programme outcome and programme specific outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3
CO1	1	2	3	2	2	1	3	2	3	2	2	2
CO2	2	3	1	1	2	2	3	2	3	2	1	2
Average	1.5	2.5	2	1.5	2	1.5	3	2	3	2	1.5	2

Text books:-

1. Dhondyal, S.P., "Farm Management – An Economic Analysis", Aman Publishing House,vMadhu Market, Meerut (U.P.).

2. Kerr, John M., et al., 1997, Natural Resource Economics: Theory and Applications in India, Oxford & IBH, New Delhi.

3. Raju, V. T. and D. V. S. Rao, 2002, "Economics of Farm Production and Management", Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi.

Reference books:-

1. Sankhayan, P. L., 1988, Introduction to the Economics and Agricultural Production, Prentice Hall of India Private Limited, New Delhi.

2. Johl, S.S. and T.R. Kapur, 1989, Fundamentals of Farm Business Management, Kalyani Publishers, Ludhiyana.

Signature:-

1. S.P. Singh
2. Krishna Kumar
3. Ameta Yadav
4. V.K. Tripathi
5. A.K. Tiwari

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Faculty of Agricultural Sciences and Allied Industries

UGE- 321: Hi-tech. Horticulture (Elective Course)

L	T	P	CR
1	1	1	3

Course objective:-

To study about the Hi-technologies in Horticulture.

Detail Contents

Unit 1 : **50 %**

Unit 2 : **50 %**

Hi-tech. Horticulture (Elective Course)

Unit-I

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

Unit-II

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-protrays, micro-irrigation, EC, pH based fertilizer scheduling, canopy management, visit to hi-tech orchard/nursery.

Course Learning Outcomes (CLO)

1. Students will learn about Nursery Management, ;
2. Knowledge about micro propagation of horticultural crops,
3. Knowledge about Modern field preparation and planting methods, Micro irrigation systems etc.

Mapping of course outcome with programme outcome and programme specific outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3
CO1	1	2	2	-	3	1	1	-	3	2	3	3
CO2	2	3	1	1	2	2	2	1	2	1	2	2
CO3	1	3	1	1	-	2	-	2	2	1	3	2
Average	1.33	2.67	1.33	1	2.5	1.67	1.5	1.5	2.33	1.33	2.67	2.33

Text books:-

1. Hartman, HT and Kester, DE (1986). Plant propagation principles and practices. Prentice Hallof India Pvt. Ltd., Bombay

1. Gill, SS. Bal, JS and Sadhu, AS (1985). Raising Fruit Nursery, Kalyani Publishers, NewDelhi.

3. Chadda K.L Advanced in Horticulture (2009) Malhotra Publishing House, New Delhi

5. Chandra,S& Som,V.2000. Cultivating Vegetables in Green House.Indian Horticulture 45:17- 18.

7. Tiwari GN. 2003. Green House Technology for Controlled Environment. Narosa Publ.House.

Reference books:-

1. Chadha, K.L. Handbook of Horticulture (2002) ICAR, NewDelhi

2. Prasad S & Kumar U. 2005. Greenhouse Management for Horticultural Crops. Agrobios.

Signature:-

1. S.P. Singh
2. Krishna Kumar
3. Ameeta Yadav
4. VK Tripathi
5. A.K. Tiwari

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UGE- 322: Weed Management

L	T	P	CR
1	1	1	3

Course objective:-

Study about the different natures of weeds, harmful and beneficial nature of weeds effect on ecosystem.

Detail Contents

Unit 1 : **50 %**

Unit 2 : **50 %**

Unit- I

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 formulation and their use.

Unit-II

Introduction to mode of action of herbicides and selectivity.Allelopathy and its application for weed management. Bio-herbicides and their application in agriculture. Concept of herbicide mixture and utility in agriculture.Herbicide compatibility with agro-chemicals 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 their losses study. Biology of important weeds.Study of herbicide formulations and mixture of herbicide. Herbicide and agro-chemicals study. Shift of weed flora study in long term experiments. Study of methods of herbicide application, spraying equipments. Calculations of herbicide doses and weed control efficiency and weed index.

Course Learning Outcomes (CLO)

1. Students will learn about characteristics of weeds their harmful and beneficial effects on ecosystem.
2. Knowledge about classification, reproduction and dissemination of weeds.

Mapping of course outcome with programme outcome and programme specific outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3
CO1	1	2	-	-	-	1	1	-	3	-	2	3
CO2	2	2	1	1	2	2	-	1	3	2	1	2
Average	1.5	2	1	1	2	1.5	1	1	3	2	1.5	2.5

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Text books:-

1. *Gupta, O.P. 2016. Modern Weed Management ,Agribios (India), Jodhpur*

2. *Das, T.K. 2008. Weed Science : Basics and Applications , Jain Brothers, New-Delhi.*

3. *Rao, V.S. 2000. Principals of Weed Science, Oxford and IBH Publishing Co.,New Delhi.*

Reference books:-

1. *Saraswat, V.N., Bhan, V.M. and Yaduraju, N.T. 2003. Weed Management , ICAR, NewDelhi.*

2. *Gupta, O.P. 2015. Weed Management: Principles and Practices, Agribios (India),*

Signature:-

1. S.P. Singh
2. Krishna Kumar
3. Aneeta Yadav
4. VK Tripathi
5. A.K. Tiwari

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UGE- 323: System Simulation and Agro-advisory (Elective Course)

L	T	P	CR
1	1	1	3

Course objective:- To understand the system simulation and agro-advisory and its role in agricultural systems

Detail Contents

Unit 1 : **50 %**

Unit 2 : **50%**

Unit-I

System Approach for representing soil-plant-atmospheric continuum, system boundaries, Crop models, concepts & techniques, types of crop models, data requirements, relational diagrams. Evaluation of crop responses to weather elements; Elementary crop growth models; calibration, validation, verification and sensitivity analysis. Potential and achievable crop production- concept and modeling techniques for their estimation.

Unit-II

Crop production in moisture and nutrients limited conditions; components of soil water and nutrients balance. Weather forecasting, types, methods, tools & techniques, forecast verification; Value added weather forecast, ITK for weather forecast and its validity; Crop-Weather Calendars; Preparation of agro-advisory bulletin based on weather forecast. Use of crop simulation model for preparation of Agro-advisory and its effective dissemination.

Practical

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

Course Learning Outcomes (CLO)

1. Students will learn about the System Approach for representing soil-plant-atmospheric continuum, system boundaries,
2. Knowledge about Crop models, concepts & techniques,
3. Knowledge about types of crop models, data requirements, relational diagrams

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Mapping of course outcome with programme outcome and programme specific outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3
CO1	1	2	-	-	-	1	1	-	1	-	1	1
CO2	1	3	1	1	2	2	-	1	1	1	1	2
CO3	1	3	1	1	-	2	-	1	2	1	3	1
Average	1	2.67	1	1	2	1.67	1	1	1.33	1	1.67	1.33

Text books:-

1. Sacheti,A.K. 1985. Agricultural Meteorological Instructional Cum Practical Manual (Ed.) NCERT Publication, New Delhi.

2. Lal, D.S. 2005 Climatology, ShardaPustakBhawan, Allahabad.. 3. Varshneya, M.C. and Balakrishna, Pillai, 2003. Text book of Agricultural Meteorology.ICAR, New-Delhi.

3. Murithy, K, and Radha, V. 1995. Practical Manual on Agricultural Meteorology , Kalyani Publishers, New-Delhi

Reference books:-

1. Balasubramaniyan, P. and Palaniappan, S.P.2016. Principles and Practices of Agronomy, Agrobios (India), Jodhpur

2. Sahu, D.D., 2007. Agrometeorology and Remote sensing: Principles and Practices ,Agrobios (India) , Jodhpur.

Signature:-

1. S.P. Singh
2. Krishna Kumar
3. Aneeta Yadav
4. VK Tripathi
5. A.K. Tiwari

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UGE- 324: Agricultural Journalism (Elective Course)

L	T	P	CR
1	1	1	3

Course objective:-

To study about nature scope and role of Journalism in Agriculture.

Detail Contents

Unit 1 : **35 %**

Unit 2 : **35 %**

Unit 3 : **30 %**

Unit-I

Agricultural Journalism: The nature and scope of agricultural journalism characteristics and training of the agricultural journalist, how agricultural journalism is similar to and different from other types of journalism. Newspapers and magazines as communication media: Characteristics; kinds and functions of newspapers and magazines, characteristics of newspaper and magazine readers.

Unit-II

Form and content of newspapers and magazines: Style and language of newspapers and magazines, parts of newspapers and magazines. The agricultural story: Types of agricultural stories, subject matter of the agricultural story, structure of the agricultural story. Gathering agricultural information: Sources of agricultural information, interviews, coverage of events, abstracting from research and scientific materials, wire services, other agricultural news sources.

Unit-III

Writing the story: Organizing the material, treatment of the story, writing the news lead and the body, readability measures. Illustrating agricultural stories: Use of photographs, use of artwork (graphs, charts, maps, etc.), writing the captions. Editorial mechanics: Copy reading, headline and title writing, proofreading, lay outing.

Practical

Practice in interviewing. Covering agricultural events.Abstracting stories from research and scientific materials and from wire services.Writing different types of agricultural stories.Selecting pictures and artwork for the agricultural story. Practice in editing, copy reading, headline and title writing, proofreading, layouting. Testing copy with a readability formula. Visit to a publishing office.

Course Learning Outcomes (CLO)

1. Students will learn about the nature and scope of agricultural journalism
2. Knowledge about characteristics and training of the agricultural journalist,

3. Knowledge about how agricultural journalism is similar to and different from other types of journalism.

Mapping of course outcome with programme outcome and programme specific outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3
CO1	1	2	-	1	-	1	-	-	2	-	1	1
CO2	2	1	1	1	2	2	1	1	2	1	1	2
CO3	1	3	1	1	1	2	1	1	3	1	3	1
Average	1.33	2	1	1	1.5	1.67	1	1	2.33	1	1.67	1.33

Text books:-

1. Ray, G. L. and Mondal, S. 2005. Journalism including communication, Farm and Rural Journalism, Public Relations, Kalyani Publication, Ludhiana.

2. Arvind Kumar (1999). The Electronic Media.Anmol Publications, New Delhi.

3. Bhatt, S.C. (1993) Broadcast Journalism. Basic Principles Har Anand Publications,

Delhi

4. Bhatnagar, R. (2001). Print Media and Broadcast Journalism. Indian Publisher

Distributors, Delhi

4. Katyal, V.P (2007). Fundamentals of Media Ethics.Cyber Tech Publishers, New Delhi.

Reference books:-

1. Bhaskaranet. Al. 2008. Farm Journalism and media management Agrotech Publishing

2. Subin Mohan et al (2010) Handbook on farm Journalism. Pulari Publishers, Karnal

A.K. Singh, 2014, Agricultural Extension and Farm Journalism.Agrobios, Jodhpur

Signature:-

1. S.P. Singh
2. Krishna Kumari
3. Aneeta Yadav
4. VK Tripathi
5. A.K. Tiwari

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READY- 411 & 412 Rural Agricultural Work Experience and Agro-industrial Attachment	L	T	P	CR
	0	0	20	20

Course objective:-

To Study about the Rural Agricultural Work Experience and Agro-industrial

Activities

READY- 411 RAWE Component-I

1. General orientation & On campus training by different faculties

2. (a) Village attachment training programme

i. Orientation and Survey of Village
ii. Agronomical Interventions
iii. Plant Protection Interventions
iv. Soil Improvement Interventions (Soil sampling and testing)
v. Fruit and Vegetable production interventions
vi. Food Processing and Storage interventions
vii. Animal Production Interventions
viii. Extension and Transfer of Technology activities

(b) Attachment in University/College/KVK/research Station

READY- 412 RAWE Component –II

Agro Industrial Attachment

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

Plant Clinic

Seed/Sampling production, Pesticide/insecticide, post harvest industries, processing- value addition, Agrifinance institutions etc.

Activities and Tasks during Agro-Industrial Attachment Programme

Acquaintance with industry and staff

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

Course Learning Outcomes (CLO)

1. Students will understand the practical approaches, the situation of village with the help of and different agricultural aspects.
2. It gives an exposure to real life situation of farming communities.

Mapping of course outcome with programme outcome and programme specific outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3
CO1	3	3	2	2	3	3	3	3	3	3	2	3
CO2	3	2	2	3	3	3	3	2	3	3	3	3
Average	3	2.5	2	2.5	3	3	3	2.5	3	3	2.5	3

Text books and Reference books:-

Rawe Manual

Signature:-

1. S.P. Singh
2. Krishna Kumari
3. Aneeta Yadav
4. VK Tripathi
5. A.K. Tiwari

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Faculty of Agricultural Sciences and Allied Industries

ELP- 421 Experiential Learning Program Modules for Skill Development and Entrepreneurship

Course objective:-

The develop the skills & Entrepreneurship habits through various courses

L	T	P	CR
0	0	20	20

Modules for Skill Development and Entrepreneurship

A student has to register 20 credits opting for two modules of (0+10) credits each (total 20 credits) from the package of modules.

Title of the module	Department
Production Technology for Bioagents	Plant pathology
Biofertilizer	Soil Science & Agricultural Chemistry
Seed Production and Technology	Seed Science & Technology
Mushroom Cultivation Technology	Plant Physiology
Soil, Plant, Water	Soil Science & Agricultural Chemistry
Seed Testing	Seed Science & Technology
Commercial Beekeeping	Entomology
Poultry Production Technology	Animal Husbandry
Commercial Horticulture	Horticulture
Floriculture and Landscaping	Horticulture
Food Processing	Agricultural Biochemistry
Agriculture Waste Management	Agronomy
Organic Production Technology	Agronomy
Commercial Sericulture	Soil Conservation & Water Management
Seed Processing	Seed Science & Technology

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Value addition in Milk	Animal Husbandry
Micro Propagation	Horticulture

Course Learning Outcomes (CLO)

1. Students can develop the skills and entrepreneurship strategies though different courses.

Mapping of course outcome with programme outcome and programme specific outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3
CO1	3	3	2	3	3	3	2	2	3	3	3	3
Average	3	3	2	3	3	3	2	2	3	3	3	3

Text books:-

1. Bose, T. Ornamental Plants and Garden Design in Tropics and subtropics, Vol-2 sets Daya

2. Arora J. S. 2006 Introductory Ornamental Horticulture Kalyani Publishers, Ludhiana

3. Gopalaswamiengar, K.S. The Complete Gardening in India.TheHosali Press, Bangalore

4. Bose, T.K. Malti, R.G. Dhua, R.S. & Das, P. Floriculture and Landscaping (2004) Nayaprakash

5. H.S.Grewal and Parminder Singh Landscape designing and ornamental plants (2014)

6. .Srilakshmi, B. (2010). Text Book of Food Science.New age international (P) limited, publisher, New Delhi

7. Sehgal, S. and Raghuvanshi, R.S. (2007). Text Book of Community Nutrition, ICAR ublication

8 Khaddar V., (1999). Text Book of Food.Storage and Preservation.Kalyani Publishers, New Delhi

9. Chopra, V.L. 2000. Breeding of Field Crops (Edt.). Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi.

10. Manjit S. Kang 2004. Crop Improvement: Challenges in the Twenty-First Century (Edt) International Book Distributing Co. Lucknow.

11. Ram, H.H. and H.G. Singh. 1994. Crop Breeding and Genetics. Kalyani Publishers, New Delhi.

12. Sharma, A.K. 2005. Breeding Technology of Crop Plants (Edt.).Yash Publishing House, Bikaner.

13. Shekhawat, S. S. (ed) (2016). Advances and Current Issues in Agriculture, Vol.III. ShikshaPrakashan, S. M. S. Highway, Jaipur.

14. Mandal, AK., P.K. Ganguli and S.P. Banerjee. 1991. Advances in Plant Breeding. Vol.I and II.CBS Publishers and Distributors, New Delhi.

15. . *Manjit S. Kang 2004.Crop Improvement: Challenges in the Twenty-First Century (Edt). International Book Distributing Co. Lucknow.*

16. Ram, H.H. and H.G. Singh. 1994. Crop Breeding and Genetics. Kalyani Publishers, New Delhi.

17. Sharma, A.K. 2005. Breeding Technology of Crop Plants (Edt.).Yash Publishing House, Bikaner.

Reference books:-

1. Ram. H.H. 2005.Vegetable Breeding — Principles and Practices. Kalyani Publishers, New Delhi.

2. DhirenraKhare and Mohan S. Bhale.2000.Seed Technology.Scientific Publishers India), Jodhpur.

3. A.K. Joshi and B.D. Singh.2005.Seed Technology.Kalyani Publishers, New Delhi.

4. Arya, P.S. 2001. Vegetable Breeding and Seed Production.Kalyani Pub., Ludhiana

5. Singh, B.D. 2005. Plant Breeding.Kalyani Publishing House, New Delhi.

6. Singh, P. 2001.Essentials of Plant Breeding-Principles and Methods. Kalyani Publishing House, New Delhi.

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