COURSE STRUCTURE AND SYLLABI

B.Sc.(Hons)Agriculture

2021-22 Batch

Centurion UNIVERSITY

M.S.SWAMINATHAN SCHOOL OF AGRICULTURE
CENTURION UNIVERSITY OF TECHNOLOGY & MANAGEMENT
Odisha-761211, INDIA,

Web Site: - www.cutm.ac.in

Bachelor's Programme : B.Sc. (Hons) Agriculture

Semester- wise distribution of courses

	I Semester	**L-P**	**Course No**
1.	Fundamentals of Agronomy	3 (2+1)	ASAG1101
2.	Fundamentals of Genetics	3(2+1)	ASPG1101
3.	Fundamentals of Soil Science	3(2+1)	ASAC1101
4.	Agricultural Economics& Trade/Statistical Method	3(3+0)/2(1+1)	ASEC1101/ ASAS1101
5.	Agricultural Heritage*/Comprehension & Communication Skills in English	1(1+0)/2 (1+1)	ASAH1101/ ASEL1101
6.	Fundamentals of Horticulture	2(1+1)	ASHO1101
7.	Fundamentals of Plant Pathology	3(2+1)	ASPP1101
8.	Rural Sociology & Educational Psychology	2 (1+1)	ASEE1102
9.	Soil and Water Conservation Engineering	2(1+1)	ASAE1101
10	Introductory Biology*/Elementary Mathematics*	2(1+1)/ 2(2+0)*	ASIB1101/ ASEM1101
	NSS/NCC/Physical Education & Yoga Practices**	2 (0+2)**	ASPE1101
TOTAL	***R: Remedial course; **NC: Non-gradial courses**	**22(14+8/13+9)**	
	II Semester	**L-P**	**Course No**
1.	Fundamentals of Crop Physiology	3(2+1)	ASPH1201
2.	Introduction to Forestry	2(1+1)	ASIF1201
3.	Introductory Agro meteorology and climate change	2(1+1)	ASAG1202
4.	Agricultural Microbiology	2(1+1)	ASAM1201
5.	Statistical Method/ Agricultural Economics & Trade	2(1+1)/3(3+0)	ASAS1101/ ASEC1101
6.	Comprehension & Communication Skills in English/Agricultural Heritage*	2 (1+1)/1(1+0)	ASEL1101/ ASAH1101
7.	Irrigation water management	2(1+1)	ASAG1206
8.	Production Technology for Vegetables and Spices	2 (1+1)	ASHO1203
9.	Fundamentals of Entomology –I (Insect Morphology and Taxanomy)	3(2+1)	ASEN1201
10	Fundamentals of Agricultural Extension Education	3(2+1)	ASEE1201
11	Farm Machinery and Power	2 (1+1)	ASAE1202
	NSS/NCC/Physical Education & Yoga Practices**	2 (0+2)**	ASPE1101

Total		**25(15+10/16+9)**	
III Semester		**L-P**	**Course No**
1.	Crop Production Technology – I *(Cereals, millets and pulses) Kharif crops*	3 (2+1)	ASAG2103
2.	Fundamentals of Plant Breeding	3 (2+1)	ASPG2103
3.	Agricultural Finance and Cooperation/Agricultural Marketing &Prices	2 (1+1)	ASEC2102/ ASEC2103
4.	Fundamentals of Entomology- II (Insect ecology and concepts of IPM)	2(1+1)	ASEN2102
5.	Weed management	2 (1+1)	ASAG2105
6.	Fundamentals of Plant Biochemistry	3(2+1)	ASBC2101
7.	Production technology of fruits and plantation crops	2(1+1)	ASHO2102
8.	Agricultural Informatics	2(1+1)	ASAI2101
9.	Live stock and poultry management	3(2+1)	ASAP2101
10	Communication skills and personality development	2(1+1)	ASEE2104
	Human Values & Ethics (Non-gradial)	1(1+0)**	ASHV2101
Total		**24(15+9)**	
IV Semester		**L-P**	**Course No**
1.	Crop Production Technology –II *(Oil seeds, fiber, sugar, tobacco, and fodder Crops) Rabi crops*	3(2+1)	ASAG2204
2.	Production Technology for Ornamental Crops, MAP and Landscaping	2(1+1)	ASHO2204
3.	Renewable Energy and Green Technology	2(1+1)	ASAE2203
4.	Manures, Fertilizers and Soil Fertility Management	3(2+1)	ASAC2202
5.	Agricultural Marketing & Prices/ Agricultural Finance and Cooperation	2 (1+1)	ASEC2103/ ASEC2102
6.	Fundamentals of Plant Biotechnology	2(1+1)	ASPB2201
7.	Rain-fed Agriculture & Watershed Management	2 (1+1)	ASAG2211
8.	Principles of seed technology	3(2+1)	ASPG2202
9.	Diseases of Field and Horticultural Crops and their Management –I	3 (2+1)	ASPP2202
10	Elective Course	3 credit	
Total		**22(14+8) + 3**	

V Semester		L-P	Course No
1.	Entrepreneurship Development and Business Communication	2 (1+1)	ASEE3103
2.	Problematic Soils and their Management	2 (1+1)	ASAC3103
3.	Pests of field Crops and Stored Grain and their Management	3 (2+1)	ASEN3103
4.	Diseases of Field and Horticultural Crops and their Management-II	3 (2+1)	ASPP3103
5.	Crop Improvement-I *(Cereals,millets,pulses and oil seeds etc)(Kharif crops)*	2 (1+1)	ASPG3104
6.	Principles of food science and nutrition	2 (2+0)	ASFS3101
7.	Geoinformatics and Nano-technology for Precision Farming	2 (1+1)	ASAG3110
8.	Practical Crop Production – I (*Kharif*crops)	2 (0+2)	ASAG3108
9.	Environmental studies and disaster management	3(2+1)	ASES3101
10	Elective Course	3 credit	
Total		**21(12+09)+3**	
VI Semester		**L-P**	**Course No**
1.	Farming System &Organic farming for Sustainable Agriculture	3(2+1)	ASAG3207
2.	Practical crop production II (Rabi crops)	2 (0+2)	ASAG3209
3.	Post-harvest Management and Value Addition of Fruits and Vegetables	2 (1+1)	ASHO3205
4.	Pests of horticultural crops and their management and Beneficial Insects	3 (2+1)	ASEN3204
5.	Crop Improvement-II *(fibre, sugar, starches, narcotics, Vegetables, fruits, and flowers)*	2 (1+1)	ASPG3205
6.	Principles of Integrated Pest and Disease Management (50% Entomology and 50% Pathology)	2(1+1)	ASPP3204
7.	Protected cultivation and post harvest technologies	2(1+1)	ASAE3204
8.	Intellectual Property Rights	1(1+0)	ASIP3201
9.	Farm Management	2 (1+1)	ASEC3204
10	Elective Course	3 credits	
Total		**19 (10 +9)+3**	

VII Semester

Rural Agricultural Work Experience and Agro-industrial Attachment (RAWE &AIA)

Sl no.	Activities	No. of weeks	Credit hours
1	General orientation & On campus training by different faculties	1	14
2	Village attachment	8	
	Unit attachment in Univ./ College. KVK/ Research Station Attachment	5	
3	Plant clinic	2	02
	Agro-Industrial Attachment(respective domain related industry)	3	04
4	Project Report Preparation, Presentation and Evaluation	1	
	Total weeks for RAWE & AIA	20	20

*Agro- Industrial Attachment: The students would be attached with the agro-industries(respective domain related industry) for a period of 3 weeks to get an experience of the industrial environment and working.

*Educational tour will be conducted in break between IV & V Semester or VI & VII Semester

RAWE Component-I

Village Attachment Training Programme

Sl. No.	Activity	Duration
1	Orientation and Survey of Village	1 week
2	Agronomical Interventions	1 week
3	Plant Protection Interventions	1 week
4	Soil Improvement Interventions (Soil sampling and testing)	1 week
5	Fruit and Vegetable production interventions	1 week
	Food Processing and Storage interventions	
	Animal Production Interventions	1 week
	Extension and Transfer of Technology activities	1 week

RAWE Component –II

Agro Industrial Attachment

*Students shall be placed in Agro-and Cottage industries and Commodities Boards(respective domain related industry) for 03 weeks.

*Industries include Seed/Sapling production, Pesticides-insecticides, Post harvest-processing value addition, Agri-finance institutions, etc.(respective domain related industry)

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

Modules for Skill Development and Entrepreneurship

A student has to select a track (domain) of 29 credits including 9 credits of electives which are offered from 4th semester on wards. The student has to continue it with the track (domain) in VIII semester. Further, A student has to register 20 credits opting for Tracks consisting of three track course practicals (0+09) credits and 0+11 credits in production by using the technology in the VIII semester.

Track/ Domain courses for B.Sc.(Hons) agriculture.
For VIII semester

Course Code	Name of the Domain	Credits	T-P-P
	Organic Farming	**29**	3+15+11
CUOF2230	Organic Farming	3	1+2+0
CUOF2231	Certification and Inspection Systems in Organic Farming in India	3	1+2+0
CUOF2232	Biopesticides and Biofertilizers	3	1+2+0
CUOF2233	Organic Production- Field Crops	3	0+3+0
CUOF2234	Organic Production- Horticultural Crops	3	0+3+0
CUOF2235	Biofertilizer and Biopesticide Production Technology	3	0+3+0
CUOF2236	AELP Project	11	0+0+11
	Dairy Processing and Development	**28**	3+15+10
CUDP2240	Milk Processing in Dairy Industry	3	1+2+0
CUDP2241	Dairy Starters in Fermented Milk Products	3	1+2+0
CUDP2242	Quality Assurance in Dairy Industry	3	1+2+0
CUDP2243	Dairy Products Development	3	0+3+0
CUDP2244	Synbiotic Dairy Foods	3	0+3+0
CUDP2245	Quality Analysis of Milk and Milk Products	3	0+3+0

CUDP2246	Project/Industrial internship	10	0+0+10
	Intensive Aquaculture	**29**	3+15+11
CUAQ2250	Intensive Fish Rearing	3	1+2+0
CUAQ2251	Ornamental Fish Farming	3	1+2+0
CUAQ2252	Biofloc Aquaculture	3	1+2+0
CUAQ2253	Framing of SOPs for Intensive fish culture and ornamental fish culture	3	0+3+0
CUAQ2254	Health Management in Aquaculture	3	0+3+0
CUAQ2255	Feed Management in Aquaculture	3	0+3+0
CUAQ2256	Aquaculture rearing	11	0+0+11
	Seed Production using Manual and Molecular Methods	**29**	3+15+11
CUSP2260	Breeding methods: conventional and molecular approach	3	1+2+0
CUSP2261	Seed production of vegetable and cereals crops	3	1+2+0
CUSP2262	Seed certification	3	1+2+0
CUSP2263	Hybridization techniques	3	0+3+0
CUSP2264	Vegetable Seed production	3	0+3+0
CUSP2265	Cultivar purity and seed quality testing	3	0+3+0
CUSP2266	AELP Project	11	0+0+11
	Genetic Engineering & Genomics	**29**	3+15+11
CUGE2270	Computational Biology	3	1+2+0
CUGE2271	Genetic Engineering and its applications	3	1+2+0
CUGE2272	Plant Molecular Biology	3	1+2+0
CUGE2273	Molecular Genomics	3	0+3+0
CUGE2274	Plant Tissue Culture Technologies	3	0+3+0
CUGE2275	Techniques in Molecular Biology	3	0+3+0
CUGE2276	AELP Project	11	0+0+11
	Nutraceuticals	**29**	3+9+17
CUNU2280	Introduction to Nutraceutical	3	1+2+0
CUNU2281	Functional Food	3	1+2+0
CUNU2282	Nutrigenetics	3	1+2+0
CUNU2283	Development of Personalized Food and Medicine	3	0+1+2
CUNU2284	Development of Biopesticides and Biofertilizers	3	0+1+2
CUNU2285	Development of Immune Boosters	3	0+1+2
CUNU2286	AELP Project	11	0+0+11
	SMART Agriculture	**29**	3+15+11

CUAG2290	Applied hi-tech horticulture	3	1+2+0
CUAG2291	Protected cultivation of vegetable crops	3	1+2+0
CUAG2292	High-tech fruit culture	3	1+2+0
CUAG2293	Management of high-value cut-flowers	3	0+3+0
CUAG2294	Management of crops in hydroponics	3	0+3+0
CUAG2295	Use of smart tools for precision crop management	3	0+3+0
CUAG2296	AELP Project/Industrial internship	11	0+0+11
	Protected Horticulture	**29**	3+15+11
CUPH2300	Applied hi-tech horticulture	3	1+2+0
CUPH2301	Protected cultivation of vegetable crops	3	1+2+0
CUPH2302	High tech fruit culture	3	1+2+0
CUPH2303	Production technology of cut flowers & loose flowers	3	0+3+0
CUPH2304	Protected floriculture	3	0+3+0
CUPH2305	Production management of medicinal and aromatic crops	3	0+3+0
CUPH2306	AELP Project	11	0+0+11
	Food Processing	**29**	3+15+11
CUFP2310	Processing Technology of Cereals and Millets	3	1+2+0
CUFP2311	Processing Technology of Legumes and Oilseeds	3	1+2+0
CUFP2312	Processing Technology of Fruits, Vegetables, Spices and Condiments	3	1+2+0
CUFP2313	Product Development and Packaging Technologies	3	0+3+0
CUFP2314	Food Standards and Regulations and HACCP Systems	3	0+3+0
CUFP2315	Sensory Evaluation and Nutritional Labelling of Foods	3	0+3+0
CUFP2316	AELP Project/Industrial internship	11	0+0+11
	Agri Business Management	**23**	2+0+21
CUAB2320	Agri Food Markets and Value Chain Analysis	3	1+0+2
CUAB2321	Agri Input Marketing	3	1+0+2
CUAB2322	Rural Haat and Market Analysis	2	0+0+2
CUAB2323	Community Owned and Managed Agri Businesses	2	0+0+2
CUAB2324	Agri Warehouse Management	2	0+0+2

CUAB2325	Sales and Distribution of Agrifood Products (Internship at LMDC)	11	0+0+11
	Commodity and Food Storage	**29**	3+15+11
CUFS2330	Storage Entomology	3	1+2+0
CUFS2331	Seed pathology	3	1+2+0
CUFS2332	Post-harvest biochemistry and physiology of crops	3	1+2+0
CUFS2333	Recent trends in post-harvest technology	3	0+3+0
CUFS2334	Pest management techniques in storage	3	0+3+0
CUFS2335	Post-harvest storage of fruits and vegetables	3	0+3+0
CUFS2336	AELP Project	11	0+0+11
	Fish Processing Technology	25	3+11+11
	Post harvest handling and processing of fish and shellfish	2	1+1+0
	Design, maintenance of fish processing plant and instrumentation	2	1+1+0
	Quality assurance, management and certification	1	1+0+0
	Fish and shellfish waste management	3	0+3+0
	Microbiological analysis of fish and fisheries products	3	0+3+0
	Biochemical analysis of fish and fisheries product	3	0+3+0
	Preparation of different fisheries products and quality assessment	11	0+0+11

As per V Dean's committee suggestion, the AELP modules were developed in the track mode where a student will learn in one subject and develop expertise.

Evaluation for track I as that of practical courses mode.

Evaluation of Experiential Learning Programme/ HOT Track II

Sl no.	Parameter	Max marks
1	Project Planning and Writing	10
2	Presentation	10
3	Regularity	10
4	Monthly Assessment	10
5	Output delivery	10
6	Technical Skill Development	10
7	Entrepreneurship Skills	10
8	Business networking skills	10
9	Report Writing Skills	10
10	Final Presentation	10
	Total	100

Job Readiness (0-3-0)

Course I: IELTS - Reading, Listening, Speaking and Writing

Course II: IELTS Verbal

Course III: Quantitative Aptitude

Course IV: Logical Reasoning

Course I: IELTS - Reading, Listening, Speaking and Writing

Module I: IELTS Reading

- Skimming and Scanning
- Sentence Completion
- Choose the Correct options (A, B, C, D)
- Locating the Specific Information
- Assessment on Reading Skill

Module II: IELTS Listening

- Notes/ Form/Table completion
- Label the Map/Passage, Multiple Choice Questions
- Complete the Sentences, Listening to Find Information
- Assessment on Listening Skills

Module III: IELTS Speaking

- Speaking about yourself, your family, your work and your interests
- Introduction & Interview
- Topic Discussion (e.g., Environment, Covid 19, Job)
- Assessment on Speaking Skills

Module IV: IELTS Writing

- Summarising the chart, table or graph
- Comparing and contrasting graphs and tables
- Describing maps & diagrams
- Agreeing & disagreeing
- Expressing a personal view & opinion
- Assessment on Writing Skill
- CV Writing (2nd year)
- Letter Writing
- Email Writing(2nd year)
- Getting Started –writing an introduction

Course II: IELTS Verbal

Module I: Grammar (4 Hrs.)

- Articles
- Prepositions
- Subject-Verb
- Spotting Errors
- Sentence Correction

Module II: Vocabulary (5 Hrs.)

- Synonyms
- Antonyms
- Contextual Vocabulary

Module III: Reading Comprehension (3 Hrs.)

- Paragraph/ Sentence Completion
- Jumbled Sentences/ Jumbled Paragraph
- Reading Comprehension

Module IV: Verbal Analogies (3 Hrs.)

Course III: Quantitative Aptitude

Module I: Number System & Operation (14 Hrs.)

- Speed Math-1 : Multiplication tricks, Square, cube, square root, Cube root tricks
- Speed Math-2 : Speed Calculations
- Number System-01 : Operation on Numbers, Classification of Numbers, Tests of Divisibility, Unit Digit Calculation
- Number System-02 : Arithmetic Progression, Geometric Progression, Factors & Factorials, Trailing Zeroes, Remainder Theorem
- HCF & LCM : Concepts, short tricks, question discussion
- Average : Concepts, short tricks, question discussion
- Assessments

Module II: Basic Arithmetic (16 Hrs.)

- Percentage-01 : Basics of Percentage, Effective percentage, shortcuts
- Percentage-02 : Advanced questions and discussions
- Profit & Loss-01 : Basics and advanced questions of Profit & Loss and shortcuts
- Profit & Loss-02 : MRP, Discount, Successive discount
- Ratio & Proportion : Types of ratios, Basics & Advanced Question
- Age : Concepts & Shortcuts
- Partnership : Concepts & Shortcuts
- Mixture & Alligation : Rule of Alligation, Basics & Advanced question, Short tricks
- Assessments

Module III: Time & Analysis (17 Hrs.)

- Time, Speed, Distance : Concepts, Problems based on relations, Average speed, Stoppage time

- Trains : Relative Speed & All types of train problems
- Boats & Streams : Basics, Upstream, Downstream & Shortcuts
- Race : All concepts & Shortcuts
- Time & Work : Efficiency, wages, alternative day, chain rule
- Pipes & Cistern : Positive & Negative work
- Simple Interest : Concepts & Shortcuts on Simple Interest & Instalments
- Compound Interest : Concepts & Shortcuts on Simple Interest & Instalments
- Logarithm : All Formulae, concepts & Shortcuts
- Assessments

Module IV: Advanced Arithmetic (16 Hrs.)

- Equation : Linear & Quadratic
- Permutation : All concepts & Shortcuts on factorial, fundamental principles of counting
- Combination : All concepts & Shortcuts on Selection (Groups/teams)
- Probability: Terms related to Probability, Event, Theorems related Probability, Conditional Probability. Shortcuts on coins, dices, balls, cards, etc
- Data Interpretation : (Bar/Pi-Chart /Line) graph
- Mensuration : Area & Volume
- Height & Distance : Lines of Sight, Horizontal line, Angle of Elevation, Angle of Depression
- Assessments

Course IV: Logical Reasoning

Module I: Verbal Reasoning-I (14 Hrs.)

- Series-1 : Number series (Missing & Wrong)
- Series-2 : Letter, Alpha numeric, Miscellaneous series
- Coding & Decoding : Letter Coding, Number coding, Message coding, Substitution coding, Conditional coding
- Word Problem : Analogy, Odd man out, word formation, letter pair
- Logical Thinking : Brain Riddles
- Assessments

Module II: Verbal Reasoning-II (14 Hrs.)

- Order & Ranking : Ranking & Sequence
- Direction Sense Test : Shortest Distance, Angular movement concept and Dusk & Dawn
- Clock : Concepts of Angle, Reflex angle, Right angle Opposite, Coincide and Incorrect clock
- Calendar : All concepts & Shortcuts
- Blood Relation : Jumbled-up descriptions, coded relations, Relation Puzzles
- Assessments

Module III: Non Verbal Reasoning (14 Hrs.)

- Cubes & Dices
- Cubes & Cuboids

- Embedded Figure& Figure series
- Figure Puzzle & Figure grouping
- Figure Counting
- Mirror & Water Image
- Paper Cutting & Paper folding
- Assessments

Module IV: Advanced Reasoning (16 Hrs.)

- Sitting Arrangement : Circular, Square, Rectangular, Linear, Triangular
- Puzzle : Box, Floor, Month, Day
- Advanced Puzzle : 3 variable
- Logical Venn Diagram
- Syllogism
- Statement & Conclusion
- Data Sufficiency
- Assessments

SEMESTER – I

1.Fundamentals of Agronomy [ASAG1101] 3(2+1)

Objective: Understand the subject of agronomy and its scope in agriculture. Know the basic topics of agronomy to understand the subject in future

Course Outcomes: On successful completion of this course and basing on the diversified outcomes this course offers a wide scope for students in Skill development sector.

Theory

Agronomy and its scope, seeds and sowing, tillage and tilth, crop density and geometry, Crop nutrition, manures and fertilizers, nutrient use efficiency, water resources, crop water requirement, water use efficiency, irrigation- scheduling criteria and methods; logging;

Weeds and its importance, crop-weed competition, concepts of weed management – principles and methods, herbicides- classifications and selectivity;

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 (including map pointing), Identification of major 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 and visit for on-farm and on-station field crops;

References

1. Reddy, S.R. 2016. Principles of Agronomy. Kalyani Publishers, Ludhiana, 5th Edition.
2. Yellamanda Reddy, T. and SankaraReddi, G.H. 2016. Principles of Agronomy, Kalyani Publishers, Ludhiana.
3. Gopal Chandra De. 1989. Fundamentals of Agronomy. Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi.

2.	**Fundamentals of Genetics**	**[ASPG1101]**	**3(2+1)**

Objective: The student knows about the different aspects of cell ultra-structure. The students with general concepts and classification of mutagens.The students have knowledge with general characteristics of chromosomes, genetical disorder and chromosomal aberrations. To acquaint the students with microscopic work on cellular components, mitosis and meiosis. To acquaint the students with different molecular aspect like DNA, RNA & proteins.

Course Outcomes: This course offers a good scope for students to take up employment.

Theory

Pre and Post Mendelian concepts of heredity, Mendelian principles of heredity, Cell division – mitosis, meiosis, Probability and Chi-square.Dominance relationships, gene interaction.

Multiple alleles, pleiotropism and pseudoalleles, Sex determination and sex linkage, sex limited and sex influenced traits, Blood group genetics, Linkage and its estimation, crossing over mechanisms, chromosome mapping. Structural changes in chromosome, Mutation, classification, Methods of inducing mutation & CIB technique, mutagenic agents and induction of mutation. Qualitative & Quantitative traits, Polygenes and continuous variations, multiple factor hypothesis, Epistatic interactions with examples. 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. 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 structure.

References

1. Pundhan Singh, 2006, Genetics, Kalyani Publishers, Ludhiana
2. Singh, B.D. 2015. Fundamentals of Genetics. Kalyani Publishers, Ludhiana
3. Gupta, P.K.2007. Genetics. Rastogi Publications, Meerut
4. Khanna, V.K. 2002. Genetics Numerical Problems. Kalyani publishers. 2nd edition
5. Pundhan Singh.2011. Genetics at a Glance. Kalyani Publishers, Ludhiana
6. Verma, P.S.2013. Cell Biology, Genetics, Molecular Biology, Evolution and Ecology, S.chand & Company Pvt. Ltd.,Kolkata.

7. Snustad , D.P. and Simmons, M.J.2010. Principles of Genetics, 5th Ed. John Wiley & Sons,111, River Street, Hoboken, NJ, U.S.A.
8. Strickberger, M.W.2006, Genetics, Prentice-Hall of India Pvt. Ltd., New Delhi

3.	**Fundamentals of Soil Science**	**[ASAC1101]**	**3(2+1)**

Objective: Understand general concept about soil physical, chemical and biological properties and their characteristics. The students have general concepts and classification of soils of India.The students have knowledge with different types of soils and its importance.

Course Outcomes: This course offers a wide scope for students in skill development sectors.

Theory

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; Soil water retention, movement and availability; soil air, composition, gaseous exchange, problem and plant growth; source, amount and flow of heat in soil; soil temperature and plant growth; Soil reaction-pH, soil acidity and alkalinity, buffering, effect of pH on nutrient availability; soil colloids - inorganic and organic; silicate clays: constitution and properties; sources of charge ion exchange, cation exchange capacity, base saturation; 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.

References

1. Indian Society of Soil Science 2012. Fundamentals of Soil Science. IARI, New Delhi
2. Das,D.K. 2015Intrioductory soil science, 4th edition, Kalyani Publishers, New Delhi.
3. Sehgal, J. L. 2015. A text book of pedology.Kalyani Publishers, New Delhi.

4.i	**Agricultural Economics and trade**	**[ASEC1101]**	**3(3+0)**

Objective: Derive clear understanding of the basic micro and macro-economic principles as they apply to agriculture. Understand and synthesize the magnitude and structure of the agricultural sector. Establish foundation knowledge for the advancement of agricultural economics and agribusiness trade. Broaden the educational knowledge base of the students in the area of agricultural economics and related sciences and their role in the broader Indian

Course Outcomes: This course offers a wide scope for students in employment sectors (Finance, etc).

Theory

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

Demand: meaning, law of demand, demand schedule and demand curve, determinants, utility theory; law of diminishing marginal utility, equi-marginal utility principle. Consumer's equilibrium and derivation of demand curve, concept of consumer surplus. Elasticity of demand: concept and measurement of price elasticity, income elasticity and cross elasticity.

Production: process, creation of utility, factors of production, input output relationship. *Laws of returns*: Law of variable proportions and law of returns to scale.

Cost: Cost concepts, short run and long run cost curves.

Supply: Meaning, 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. 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 and GST.

Economic systems: Concepts of economy and its functions, important features of capitalistic.

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.

References

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

4.ii	**Statistical Methods**	**[ASAS1101]**	**2(1+1)**

Objective: To impart knowledge to the students on basic concepts and statistical techniques applied in agriculture and allied sciences.

Course outcome: To enable the students to analyze data and draw appropriate statistical conclusions. To recognize and examine the relationships between inputs and outputs in their agricultural field to make effective and profitable decisions. Students will demonstrate an ability to engage in critical thinking by analyzing situations and constructing and selecting viable solutions to solve problems.

Theory

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. Introduction to Test of Significance, One sample & two sample test t for Means, Chi-Square Test of Independence of Attributes in $2 \cdot 2$ 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 $2 \cdot 2$ contingency table.Analysis of Variance One Way Classification.Analysis of Variance Two Way Classification.Selection of random sample using Simple Random Sampling.

References

1. Nageswara Rao, G 2007. Statistics for Agricultural Sciences. B.S Publications, Hyderabad
2. Rangaswamy,R 1995. A Text Book of Agricultural Statistics. New Age International (P) Ltd., Publishers, Hyderabad.
3. Chandel SRS, Hand Book of Agricultural Statistics. Achal Prakashan Mandir Publications, New Delhi.
4. Agrawal,B.L. programmed Statistics. 2nd Edition, New Age International Publishers, Hyderabad.

5.i	**Agricultural Heritage**	**[ASAH1101]**	**1(1+0)**

Objective: This Course offers a wide scope for students in employment sector. Know the heritage of Indian agriculture and its relevance to present context.Get an idea of present situation, problem and prospects of Indian agriculture.Acquire information on agricultural set-up of the country as well as world.

Course Outcomes: On completion of this course, the successful students should be able to get employment.

Theory

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; 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.

References

1. Choudary S.L., Sharma, G.S. and Nene, Y.L. (eds). Ancient and Medieval History of Indian Agriculture and its relevance to sustainable agriculture in the 21st century; Proceedings of the summer school held from 28 May to 17 June 1999. Rajasthan College of Agriculture, Udaipur 313001.
2. Nene Y.L. (ed.) 2005. Agricultural Heritage of Asia. Proceedings of the International conference, 6-8 December 2004, Asian-Agri History Foundation, Secunderabad- 500 009, Andhra Predesh, India.
3. Nene, Y.L. 2007. Glimpses of Agricultural Heritage of India. Asian-Agri History Foundation, 47 ICRISAT Colony-1, Brig. Syed Road, Secunderabad- 5000 009, AP, India 901 pp. ISBN-81-903963-0-7.

5.ii	**Comprehension and Communication Skills in English**	**[ASEL1101]**	**2(1+1)**

Objective: To understand the basic concepts of spoken English and communication skills

Course Outcome: After completion of this course, the students will have proficiency in basic speaking and communication skills in English.

Theory

War Minus Shooting- The sporting Spirit. A Dilemma- A layman looks at science Raymond B. Fosdick. You and Your English – Spoken English and broken English G.B. Shaw. Reading Comprehension, Vocabulary- Antonym, Synonym, Homophones, Homonyms, often confused words. Exercises to Help the students in the enrichment of vocabulary based on TOEFL and other competitive examinations. Functional grammar: Articles, Prepositions, Verb, Subject verb Agreement, Transformation, Synthesis, Direct and Indirect Narration. Written Skills: Paragraph writing, Precise writing, Report writing and Proposal writing. The Style: Importance of professional writing. Preparation of Curriculum Vitae and Job applications.Synopsis Writing. Interviews: kinds, Importance and process.

Practical

Listening Comprehension: Listening to short talks lectures, speeches (scientific, commercial and general in nature). Oral Communication: Phonetics, stress and intonation, Conversation practice. Conversation: rate of speech, clarity of voice, speaking and Listening, politeness & Reading skills: reading dialogues, rapid reading, intensive reading, improving reading skills. Mock Interviews: testing initiative, team spirit, leadership, intellectual ability. Group Discussions.

References

1. Balasubramanian, T. 1989. A Text Book of Phonetics for Indian Student, Orient Longman, New Delhi.
2. Balasubramanyam, M. 1985. Business Communication. Vani Education Books, New Delhi.

3. Jean Naterop,B. and Rod Revell. 1977. Telephoning in English. Cambridge University Press, Cambridge.
4. Krishna Mohan and Meera Banerjee. 1990. Developing Communication Skills. McMillan India Ltd.,New Delhi.
5. Krishanswamy, N and Sriramman,T. 1985. Current English for Colleges. Mc Millan India Ltd.,Madras.
6. Narayanaswamy V R. 1979. Strengthen Your Writing. Orient Longman, New Delhi.
7. Sharma R C and Krishna Mohan. 1978. Business Correspondence. Tata Mc Graw Hill Publishing Company, New Delhi.

6.	**Fundamentals of Horticulture**	**[ASHO1101]**	**2 (1+1)**

Objective: Students get an introductory knowledge about horticulture crops. Knowledge about the use of various fertilizers, plant growth regulators and irrigation management. Get acquainted with the tools and implements used for various cultural practices of horticulture.

Course Outcomes: This course offers a wide scope for students in employment sectors.

Theory

Horticulture-Its definition and branches, importance and scope; horticultural and botanical classification; climate and soil for horticultural crops; Plant propagation-methods and propagating structures; principles of orchard establishment; Principles and methods of training and pruning, juvenility and flower bud differentiation; unfruitfulness; pollination, pollinizers and pollinators; fertilization and parthenocarpy; kitchen gardening; garden types and parts; lawn making; medicinal and aromatic plants; species and condiments; use of plant bio-regulators in horticulture. Irrigation & fertilizers application-method and quantity.

Practical

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

References

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

7.	**Fundamentals of Plant Pathology**	**[ASPP1101]**	**3(2+1)**

Objective: The student knows about the early development & role of different micro-organism in development of plant disease. The students gain knowledge on general concepts and classification of plant diseases. The students have knowledge with general characteristics of fungi, bacteria, virus and mycoplasma like organisms causing plant diseases. To acquaint the students with reproduction in fungi and fungal like organisms causing plant diseases.

Course Outcomes: On successful completion of this course and basing on the diversified course outcomes this course offers a good scope for students in employment sector.

Theory

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. Cause 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.

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.

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

Viruses:nature, architecture, multiplication 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* etc.)

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.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. Extraction of nematodes from soil.
Study of fungicides and their formulations. Methods of pesticide application and their safe use. Calculation of fungicide sprays concentrations**.**

References

1. Dube, H.C. 2013, An Introduction to Fungi, 4th (Edition), Scientific Publishers, Jodhpur, India, (major text book)
2. Webster, j.1989. Introduction to fungi, Cambridge Univ.Press(forlife cycles of Fungi)
3. Dasgupta, M.K.1987. Principles of Plant Pathology, Allied Publ.Pvt.Ltd. p985.(for rust life cycles)
4. Students are also advised to refer Introductory Mycology by Alexopoulus, Mims and Blackwell(4th Edition) for Fungi.
5. For Bacteria, Viruses, Viroids, Phanerogamic Plant Parasites, Nematodes.
6. Agrios, G.N. 2006, Plant Pathology, Elsevier Publishers, New Delhi.

8.	**Rural Sociology & Educational Psychology**	**[ASEE1102]**	**2(1+1)**

Objective: Students know the rural society, culture, caste and value system of rural society. Students understand leadership and its role in agricultural extension Students understand the Teaching-Learning process, Students understand various institutions involved in rural society.

Course Outcomes: This course offers a wide scope for students in employment sectors (NGO).

Theory

Sociology and Rural sociology: Definition and scope, its significance in agriculture extension, Rural society, Social Groups, Social Stratification, Culture concept, Social Institution, Social Change & Development. Educational psychology: Meaning & its importance in agriculture extension. Behavior: Cognitive, affective, psychomotor domain, Personality, Learning, Motivation, Theories of Motivation, Intelligence.

Practical

Visit to village to study the charecteristics of rural society and rural stratification; social groups, village institutions- school/ co operative society/ gram panchayat / water users association; visit toa village to list out the Folkways, Mores, Taboos, Ritual, Customs, Tradition, Culture, Etiquette, Social Values, Simulated Exercises for positive and Negative Emotions of farmers in a village. Administering Psychological Tests to assess personality Types of Human Beings. Experiment: 1. Eysenk personality inventory; 2. Edward's Personality inventory. Types of intelligence and frustrations among farmers, Creating a Learning Situation under village Conditions- Organizing a extension Talk for Farmers in the village / conduct of a Method Demonstration in a village situation.

References

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

9.	**Soil and Water Conservation Engineering**	**[ASAE1101]**	**2(1+1)**

Objective: To have an understanding about the degradation of productive soil and the causes of its erosion, measurement techniques for soil loss and wind erosion and suggesting control measures

Course Outcomes: After learning the topic a student will be able to know about the various types of soil, water and wind erosion along with its mitigation measures and agronomic and engineering methods of conservation and the design of bunds and terraces being implemented on the field.

Theory

Introduction to Soil and Water Conservation, causes of soil erosion. Definition and agents of soil erosion, water erosion: Forms of water erosion. Gully classification and control measures. Soil loss estimation by universal Loss Soil Equation. Soil loss measurement techniques. Principles of erosion control: Introduction to contouring, strip cropping. Contour bund. Graded bund and bench terracing. Grassed water ways and their design. Water harvesting and its techniques. Wind erosion: mechanics of wind erosion, types of soil movement. Principles of wind erosion control and its control measures.

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.

References

1. Ghanashyam Das, 2012. Hydrology and soil conservation Engineering, including watershed management. Second edition, PHI Learning Pvt. Ltd., New Delhi
2. Murthy,V.V.N. 2004. Land and Water Management Engineering, Kalyani Publishers, New Delhi
3. Micheal,A.M. 2007. Irrigation Theory and Practice. Second edition. Vikas Publishing House, Pvt. Ltd.
4. Mal,B.C. 1995. Introduction to soil and water conservation engineering. Kalyani Publishers, Ludhiana.
5. Kanetkar,T.P. 1993. Surveying and Levelling. Pune Vidyarthy Griha, prakashan, Pune
6. Suresh,R. 2008. Land and Water Management. Standard Publishers and Distributors, Delhi

10.i	**Introductory Biology**	**[ASIB1101]**	**2(1+1)**

Objective: To understand the basic concepts of biology and evolution of living organism

Course Outcomes: After completion of this course, students will have an updates knowledge on the living organism and their evolution

Theory

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

Report of the ICAR Fifth Deans' Committee

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.

References

1. Biology- Raven P, Mason Johnson G B, Losos J.B, Singer.S.S, 10th edition, 2014, McGraw Hill Publications.
2. M.G.Simpson, 2006. Plant Systematics. Elserier Publications.
3. H.C.Gangulee 1972 College Botany 4th edition.
4. A.C.Dutta 1964 A class book of Botany Botany for Degree Students, Oxford University Press, Calcutta.
5. N.T.Gill, 1966. Agricultural Botany. 2nd edition.

10.ii.	**Elementary Mathematics**	**[ASEM1101]**	**2(2+0)**

Objective: To understand the basic concepts and calculations in mathematics

Course outcome: After successful completion of the course, students will be able to perform the basic calculations and equations in mathematics

Theory

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, 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 (x1, y1) & (x2,y2), 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 x2 + y2 = a2. Differential Calculus : Definition of function, limit and continuity, Simple problems on limit, Simple problems on continuity, Differentiation of xn , ex , 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).

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**.**

References

1. MVSL DN Raju and Dr. K.V. Ramana- Engineering Mathematics-1
2. MVSL DN Raju and Dr. K.V. Ramana- Engineering Mathematics-2
3. Text Book for A.P Intermediate Mathematics-Paper (IA & IIB)
4. MVSL DN Raju and K.V. Ramana-Agricultural Mathematics .

SEMESTER – II

1.	**Fundamentals of Crop Physiology**	**[ASPH1201]**	**3(2+1)**

Objective: The students will be familiar with the recent developments in the area of crop physiology.Distinguish key physiological processes underlying the formation of seedlings from seed embryos, Relate crop physiological processes with agronomic practices used in crop production systems. Integrate and apply their knowledge of crop physiology for analytical thinking and solving practical problems experienced in agricultural systems. Identify the physiological factors that regulate growth and developmental processes of crops

Course Outcomes: On successful completion of this course and basing on the diversified outcomes this course offers a good scope for students in employment sector.

Theory

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; 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.

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).

References

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

2.	**Introduction to Forestry**	**[ASIF1201]**	**2(1+1)**

Objective: Understand the subject of forestry and its scope in agriculture. Know the basics of forestry to understand the importance in agricultural situations as well as in natural resource management

Course Outcomes: On successful completion of this course and basing on the diversified outcomes this course offers a wide scope for students in employment, skill development and entrepreneurial sectors.

Theory

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. Crown classification. Tending operations – weeding, cleaning, thinning – mechanical, ordinary, crown and advance thinning. Forest mensuration – objectives, diameter measurement, instruments used in diameter measurement; Non instrumental methods of height measurement - shadow and single pole method; Instrumental methods of height measurement - geometric and trigonometric principles, instruments used in height measurement; tree stem form, form factor, form quotient, measurement of volume of felled and standing trees, age determination of trees. Agroforestry – definitions, importance, criteria of selection of trees in agroforestry, different agroforestry systems prevalent in the country, shifting cultivation, taungya, alley cropping, wind breaks and shelter belts, home gardens. Cultivation practices of two important fast growing tree species of the region.

Practical

Identification of tree-species. Diameter measurements using calipers and tape, diameter measurements of forked, buttressed, fluted and leaning trees. Height measurement of standing trees by shadow method, single pole method and 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.

References

1. Dwivedi, A.P.1980. Forestry in India, Jugal Kishore and Company, DehraDun
2. Negi, S.S.1999. Agroforestry hand book, Internaltional book distributor, DehraDun.
3. Ram Prakash and Drake Hocking.1986. some favourite trees for fuel and fodder, International book distributor, Dehradun.
4. Singh, S.P. 2009. Tree farming. Agrotech Publishing academy, Udaipur.
5. Singh, S.P.2010. Favourite Agroforestry trees, Agrotech Publishing academy, Udaipur.
6. Troup, T.S.1986. Silviculture of Indian trees(Vol. II & III)- Internationa book distributor, Dehradun.

3.	**Introductory Agro meteorology and climate change**	**[ASAG1202]**	**2(1+1)**

Objective: Understand different parameters of weather and climate and their relations in crop production. Get knowledge about the issues related to climate change and its impact in agricultural production system. Get knowledge on adaptation and mitigation options to combat adverse effect of climate change

Course Outcomes: On successful completion of this course and basing on the diversified outcomes this course offers a wide scope for students in employment, skill development and entrepreneurial sectors.

Theory

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, 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.

References

1. Radha Krishna Murthy, V. 2016. Principles and Practices of agricultural disaster management, B.S. Publications, Koti, Hyderabad.
2. Reddy, S.R. 2014. Introduction to Agriculture and Agrometeorology. Kalyani Publishers, Ludhiana, Punjab.
3. Radha Krishna Murthy, V. 2002. Basic Principles of Agricultural meteorology, B.S. Publications, Koti, Hyderabad.

4.	**Agricultural Microbiology**	**[ASAM1201]**	**2(1+1)**

Objective: The student knows about the early development & role of diazotrophs in plant growth.The students get acquainted with general concepts and applications of soil microbes in improving soil fertility.

Course Outcomes: On successful completion of this course and basing on the diversified course outcomes this course offers a good scope for students in employment sector.

Theory

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

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

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. Staining and microscopic examination of microbes.

References

1. Microbiology. Pelczar, J.r.,M.J.E.C.S.Chan and Krieg, N.R.(5th Ed.) 2015. McGraw Hill Publishers, New York.
2. Microbiology. Prescott, L.M>, Harley, J.P. and Klein, D.A.(9th Ed.) 2014. McGraw Hill Publishing Ltd.,New York.
3. Brock Biology of Microorganisms. Madigan, M.,Martinko, J.M. and Parker, J. (14 Ed.) 2015. Prentice Hall of India Pvt. Ltd., New Delhi
4. Soil Microbiology: Subba Rao, N.S.(4th Ed.) 2014. Oxford & IBH Publishing Co.Pvt. Ltd.,New Delhi.
5. Microbiology A Laboratory Manual: James, C and Natile, S.(10th Ed.) 2014. Pearson India Education Services Pvt. Ltd., South Asia.
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5.i	**Statistical Methods**	**[ASAS1101]**	**2(1+1)**

Objective: To impart knowledge to the students on basic concepts and statistical techniques applied in agriculture and allied sciences.

Course outcome: To enable the students to analyze data and draw appropriate statistical conclusions. To recognize and examine the relationships between inputs and outputs in their agricultural field to make effective and profitable decisions. Students will demonstrate an ability to engage in critical thinking by analyzing situations and constructing and selecting viable solutions to solve problems.

Theory

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. Introduction to Test of Significance, One sample & two sample test t for Means, Chi-Square Test of Independence of Attributes in $2 \cdot 2$ 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 $2 \cdot 2$ contingency table. Analysis of Variance One Way Classification. Analysis of Variance Two Way Classification. Selection of random sample using Simple Random Sampling.

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5.ii	**Agricultural Economics and trade**	**[ASEC1101]**	**3(3+0)**

Objective: Help students to contribute to better decision making by farmers, or by agencies servicing agriculture. Help students to understand why farmers respond to policies and economic opportunities in the ways they do. To acquaint the learner with introductory Agricultural Economics, development of agriculture in India, use of yield increasing inputs, marketing, trade and prices.

Course outcome: Improved decision making about things like agricultural production methods, agricultural input levels and resource conservation etc. Students should be able to communicate effectively, economic concepts, decision- making, and agricultural and trade concepts. Students should have the skills to fit into a business, agency, or academic environment and use economic concepts to quantify and analyse issues related to their employer's issues.

Theory

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

Demand: meaning, law of demand, demand schedule and demand curve, determinants, utility theory; law of diminishing marginal utility, equi-marginal utility principle. Consumer's equilibrium and derivation of demand curve, concept of consumer surplus. Elasticity of demand: concept and measurement of price elasticity, income elasticity and cross elasticity.

Production: process, creation of utility, factors of production, input output relationship. *Laws of returns*: Law of variable proportions and law of returns to scale.

Cost: Cost concepts, short run and long run cost curves.

Supply: Meaning, 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. 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 and GST.

Economic systems: Concepts of economy and its functions, important features of capitalistic.

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.

References

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6.i.	Comprehension and Communication Skills in English	[ASEL1101]	2(1+1)

Objective: To understand the basic concepts of spoken English and communication skills

Course Outcome: After completion of this course, the students will have proficiency in basic speaking and communication skills in English

Theory

War Minus Shooting- The sporting Spirit. A Dilemma- A layman looks at science Raymond B. Fosdick. You and Your English – Spoken English and broken English G.B. Shaw. Reading Comprehension, Vocabulary- Antonym, Synonym, Homophones, Homonyms, often confused words. Exercises to Help the students in the enrichment of vocabulary based on TOEFL and other competitive examinations. Functional grammar: Articles, Prepositions, Verb, Subject verb Agreement, Transformation, Synthesis, Direct and Indirect Narration. Written Skills: Paragraph writing, Precise writing, Report writing and Proposal writing. The Style: Importance of professional writing. Preparation of Curriculum Vitae and Job applications.Synopsis Writing. Interviews: kinds, Importance and process.

Practical

Listening Comprehension: Listening to short talks lectures, speeches (scientific, commercial and general in nature). Oral Communication: Phonetics, stress and intonation, Conversation practice. Conversation: rate of speech, clarity of voice, speaking and Listening, politeness & Reading skills: reading dialogues, rapid reading, intensive reading, improving reading skills. Mock Interviews: testing initiative, team spirit, leadership, intellectual ability. Group Discussions.

References

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6.ii	Agricultural Heritage	[ASAH1101]	1(1+0)

Objective: This Course offers a wide scope for students in employment sector. Know the heritage of Indian agriculture and its relevance to present context.Get an idea of present situation, problem and prospects of Indian agriculture.Acquire information on agricultural set-up of the country as well as world.

Course Outcomes: On completion of this course, the successful students should be able to get employment.

Theory

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; 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.

References

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3. Nene, Y.L. 2007. Glimpses of Agricultural Heritage of India. Asian-Agri History Foundation, 47 ICRISAT Colony-1, Brig. Syed Road, Secunderabad- 5000 009, AP, India 901 pp. ISBN-81-903963-0-7.

7.	**Irrigation water management**	**[ASAG1206]**	**2(1+1)**

Objective: Get knowledge issues related to water management in crops. Get expertise in efficient water management to ensure maximum water productivity

Course Outcomes: This course offers a wide scope for students in employment, skill development and entrepreneurial sectors.

Theory

Irrigation: Definition and objectives; water resources, irrigation projects (major, medium and minor) in India and A.P. and Odisha; Soil Plant Water relationships; Methods of soil moisture estimation; Evapotranspiration and Crop water requirement; Duty of water; Conjunctive use of water; Scheduling of irrigation; Methods of irrigation-surface, subsurface, sprinkler and drip irrigation; Irrigation efficiency and Water use efficiency; Irrigation water quality criteria and its management; Water logging; Agricultural drainage.

Practical

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

References

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8.	**Production Technology for Vegetable and Spices**	**[ASHO1203]**	**2 (1+1)**

Objective: Classification of vegetables and spices crop. Various cultural practices related to production of vegetables and spices. Seed production techniques of important crops. Economics and Marketing of vegetables and spices crop.

Course Outcomes: This course offers a wide scope for students in entrepreneurship sectors.

Theory

Importance of vegetables & spices in human nutrition and national economy, brief about origin, area, production, improved varieties and cultivation practices such as time of sowing, sowing, transplanting techniques, planting distance, fertilizer requirements, irrigation, weed management, harvesting, storage, physiological disorders, disease and pest control and seed production of important vegetable and spices.

Practical

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

References

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2. Neeraj Pratap Singh, 2007. Basic Concepts of Vegetable Science. International Book Distributing Co. New Delhi, Academic Press, New Delhi.
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9.	**Fundamentals of Entomology-I** **(Insect morphology and Taxonomy)**	**[ASEN1201]**	**3(2+1)**

Objective: The student knows about Morphology of the insects. The student understands the Physiology of insects. Students have knowledge with the classification of insects and distinguished characters of different families

Course Outcomes: Basing on the diversified course outcomes this course offers a good scope for students in employment sector.

Theory

History of Entomology in India. Factors for insect's abundance. 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.

Systematics: Taxonomy –importance, history and development and binomial nomenclature. Definitions of Biotype, Sub-species, Species, Genus, Family and Order. Classification of class Insecta upto 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, lchneumonidae, Braconidae, Chalcididae; Diptera: Cecidomyiidae, Tachinidae, Agromyziidae, Culicidae,Muscidae, Tephritidae.

Practical

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

References

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7. Vasantha Raj David, B. 2003. Elements of Economic Entomology. Popular Book Depot, Coimbatore.

10	**Fundamentals of Agricultural Extension Education**	**[ASEE1201]**	**3 (2+1)**

Objective: Students have the knowledge of concept of extension education and its importance in agricultural development. Students are exposed towards various rural development programmes aimed at poverty alleviation and to increase employment opportunities and their analysis. Students have knowledge about extension system worldwide and new dimensions of Agricultural Extension in India.

Course Outcomes: This course offers a wide scope for students in employment sectors (NGO's, agribusiness companies).

Theory

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.

Rural Development: concept, meaning, definition; various rural development programmes launched by Govt. of India. Community Dev.-meaning, definition, concept & principles, Physiology 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, media mix strategies; communication: meaning and definition; 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.

References

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14. AnandarajaN, Chandrakandan K and Ramasubramaniam. 2008. Extension of Technologies from Labs to Lands. New India Publishing Agency, New Delhi.

11	**Farm Machinery and Power**	**[ASAE1202]**	**2(1+1)**

Objectives : To enable the students to understand the basic principles and parts internal combustion engine and different tillage, sowing, intercultural, plant protection equipment ,working principles of threshers, harvesting of field and horticultural crops .

Course Outcomes: The students will be able to understand the working principle of different systems and parts of internal combustion engines and intercultural and plant protection machinery needed for agricultural farms.

Theory

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

Practical

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

References

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2. Surendra Singh- Farm machinery –Principles and applications, ICAR, New Delhi
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SEMESTER – III

1.	**Crop Production Technology-I , cereals, millets and pulses (Kharif Crops)**	**[ASAG2103]**	**2(1+1)**

Objective: classify the crops with relation to growing environment develop competency in field crop production by knowing scientific technology

Course Outcomes: This course offers a wide scope for students in employment, skill development and entrepreneurial sectors.

Theory

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; 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.

References:

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2.	**Fundamentals of Plant Breeding**	**[ASPG2103]**	**3(2+1)**

Objective: In theoretical point of view students came to know about different breeding methods in both self- pollinated and cross pollinated crop and their application in the crop improvement. Students also acquired the concepts related to different stress (biotic and abiotic) faced by crops and their breeding methods, pre-breeding aspects through wider hybridization and also basic concepts on markers and their importance and application in crop improvement.In practical point of view students come to know the different procedure and techniques of emasculation and hybridization in some of the self & cross pollinated crops. In practical point of view students came to know about the statistical calculations viz., mean, range, variance, standard deviation, heritability and also about different designs used in plant breeding experiment mainly analysis of Randomized Block Design.

Course Outcomes: This course offers a good scope for students in employment.

Theory

Historical development, concept, nature and role of plant breeding, major achievements and future prospects; Genetics in relation to plant breeding, modes of reproduction and apomixes, self – incompatibility and male sterility- genetic consequences, cultivar options. Domestication, Acclimatization, introduction; Centre of origin/diversity, component of Genetic variation; Heritability and genetic advance; Genetic basis and breeding methods in self- pollinated crops-mass and pure line selection, hybridization techniques and handling of segregating population; Multiline concept. Concepts of population genetics and Hardy-Weinberg Law, Genetic basis and methods of breeding cross pollinated crops, modes of selection; 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.Handing of segregation populations.Methods of calculating mean, range, variance, standard deviation, heritability. Designs used in plant breeding experiment, 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.

References

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

3.i	**Agricultural Finance and Co-Operation**	**[ASEC2102]**	**2(1+1)**

Objective: Prepare detailed project report (DPR) on investment analysis and projections of it in future. Understand the level and type of risk analysis. Monitor different kinds of feasibility and evaluation of different projects. Understand about role of different financial institutions and their working procedures, feasibility test of credit, cooperatives and their working procedures, existing and ongoing schemes related to agricultural insurance.

Course Outcomes: This course offers a wide scope for students in employment sectors (Finance, Panchayati Raj Development, Data analytics, etc).

Theory

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

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

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

Practical

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.

References

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3. Mamoria,C.B. and R.D. Saksena. 1973. Co-Operatives in India.Kitab Mahal, Allahabad.
4. Mukhi, H.R. 1983. Cooperation in India and Abroad. New Heights Publishers, New Delhi.
5. Muniraj,R. 1987. Farm Finance for Development. Oxford &IBH Publishing Company Ltd., New Delhi.
6. Subba Reddy,S. and P.Raghuram,P., Sastry,T.V.N. and Bhavani Devi,I. 2016. Agriculral Economics.Oxford &IBH Publishing Company Private Ltd.,New Dehi
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8. Wiiliam,G.Murray and Nelson Aarson,G.Agricultural Finance.The Iowa State University Press,Ames,Iowa State University Press Ames,IOWA.
9. www.rbi.org
10. www.nabard.Org
11. www.wb.org

3.ii	**Agricultural Marketing and prices**	**[ASEC2103]**	**2(1+1)**

Objective: Apply economic theory to problems of agricultural marketing, gain skill to analyze marketing function, market information and intelligence.Design strategies for effective market performance. Use marketing concepts for analyzing market structure and performance in agriculture and formulate effective agricultural marketing policy. Apply theoretical models of imperfect market structures to inform public policy. Appreciate organizational forms unique to agricultural industries; and understand price discovery mechanisms under different market structures.

Course Outcomes: This course offers a wide scope for students in employment sectors(Finance, Panchayatiraj etc).

Theory

Agricultural Marketing: Concepts and definitions of market, marketing, agricultural marketing, market structure, marketing mix and market segmentation, classification and characteristics of agricultural markets**;** demand, supply and producer's surplus of agri-commodities: nature and determinants of demand and supply of farm products, producer's surplus – meaning and its types, marketable and marketed surplus, factors affecting marketable surplus of agri-commodities; 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; 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: 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;

Practical

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

References

1. Subba Reddy,S. and P.Raghuram,P., Sastry,T.V.N. and Bhavani Devi,I. 2016. Agriculral Economics.Oxford &IBH Publishing Company Private Ltd.,New Dehi
2. S.S.Acharya and N.L.Agarwal. 2012. Agricultural Marketing in India. Oxford &IBH Publications Co.Pvt Ltd., New Delhi
3. S.S.Acharya and N.L.Agarwal. Agricultural Price: analysis and Policy. Oxford &IBH Publications Co.Pvt Ltd., New Delhi
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5. Mamoria,C.B. and Joshi,R.L. 1995.Principles and Practices of Marketing in India. Kitab Mahal, Allahabad
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7. www.wto.org
8. www.agricoop.nic.in

4.	**Fundamentals of Entomology II: (Insect Ecology and concepts of IPM**	**[ASEN2102]**	**2(1+1)**

Objective: The student Knows the influence of ecological factors on insect development and distributionStudents Understand the components of integrated pest management. Students Know the classification of insecticides and their use in pest management. Students understand the mass multiplication techniques of major bio-agents

Course Outcomes: Basing on the diversified course outcomes this course offers a good scope for students in employment sector.

Theory

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

Pest surveillance and pest forecasting.Categories of pests. Host plant resistance, Components/ tools of IPM, Cultural, Mechanical, Physical, Legislative, Biological (parasites, predators & transgenic plant pathogens such as bacteria, fungi and viruses).Methods of control:Chemical control-importance, hazards and limitations. Classification of insecticides, toxicity of insecticides and formulations of insecticides. Recent methods of pest control, repellents, antifeedants, hormones, attractants, gamma radiation and genetic control. Practices, scope and limitations of IPM. Insecticides Act 1968-Important provisions. Insecticide act 1969-important provisions. Application techniques of spray fluids.Phytotoxicity of insecticides.Symptoms of poisoning, first aid and antidotes. Beneficial insects: parasites and predators used in pest control and their mass multiplication techniques. Beneficial insects: Important species of pollinators, weed killers and scavengers, their importance.

Practical:

Study and distribution patterns of insects in crop eco systems – Sampling techniques for the estimation of insect population and damage- Pest surveillance through light traps, pheromone traps and fore casting of pest incidence- Calculation of doses/ concentrations of different insecticidal formulations – Aquintance of insecticide formulations. Compatibility of pesticides with other agrochemicals and phytotoxicity of insecticides –aquintance of mass multiplication techniques of important predators; Cheilomenes, Chrsoperlaand cryptolaemus.Important parasitoids; Egg, larval, and pupal parasitoids Viz., Trichogramma, Apanteles and Tetrastichus.Important Entomomorphogenic Fungi Beauveria bassiana and Nucleo Polyhedro Virus (NPV) on Helicoverpa and Spodoptera. Study of insect pollinators, weed killers and scavengers – Identification of major non –insect pests Viz., birds, crabs, snails , slugs and mammalians. House hold and veterinary insect pests.

References

1. Dhaliwal GS and Ramesh Arora 2001. Integrated pest management: Concepts and approaches, Kalyani Publishers New Dlehi.
2. Larry P Pedigo 1991. Entomology and pest management, Mc Millan publishing Co. New York.
3. Metcalf RL and Luckman WH 1982. Introduction to insect pest management. Wiley inter science publishing, New York.
4. Nair KK, Anantha Krishnan TN and BV David 1976. General and applied entomology,Tata Mc Graw Hill publishing co. Ltd, New Delhi.
5. Richards O W and Davies R G. 1977. Imm's General text Book of entomology (vol II). Chapman and London.9

6. Yezdhani GS and Agarwal ML 1979. Elements of insect ecology Naroji publishing house, New Delhi

5.	**Weed Management**	**[ASAG2105]**	**2(1+1)**

Objective: Understand the menace caused by weeds, identify weeds, quantify damage and manage in integrated manner.

Course Outcomes: This course offers a wide scope for students in employment, skill development sectors.

Theory

Introduction to weeds, characteristics of weeds their harmful and beneficial effects on ecosystem. Classification, reproduction and dissemination of weeds.Herbicide classification,concept of adjuvant, surfactant, herbicide formulation and their use.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.Transformation of herbicide in plant, Fate of herbicides in soil. Residual effect of herbicides in plant and environment.

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 agrochemicals 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.Weed survey and vegetation analysis,Field Visit to Farm to observe the effect of various weed management practices in different crops .

References

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

6.	**Fundamentals of Plant Biochemistry**	**[ASBC2101]**	**3(2+1)**

Objective: The students will be familiar with the recent developments in the area of Plant Biochemistry.Once should get a proficiency in all basic biochemical tests. The students get acquainted with the widely used techniques in plant biochemistry like qualitative and quantitative tests for the important biomolecules. Propagate the knowledge to different areas like agri-food industry, nutraceuticals, phyto-pharmaceutics and medical etc. Know the importance of plant extracts, small molecules and secondary metabolites, pertaining to its isolation, purification and validation aspects.

Course Outcomes: On successful completion of this course and basing on the diversified course outcomes this course offers a good scope for students in employment sector (Industries, R &D etc).

Theory

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. 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. Metabolism of lipids: Beta oxidation, Biosynthesis of fatty acids.

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.

References

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

7.	**Production Technology for Fruit and Plantation Crops**	**[ASHO2102]**	**2 (1+1)**

Objective: Scope, importance and classification of fruit and plantation crops. Knowledge of rootstock along with its utilization for HDP.Knowledge of different aspects related to production of Major fruits, Minor fruits and nut crops.Knowledge about different intercultural practices followed for individual crop.

Course Outcomes: This course offers a wide scope for students in entrepreneurship sectors.

Theory

Importance and scope of fruit and plantation crop industry in India; High density planting; Use of rootstocks; Production technologies for the cultivation of major fruits-mango, banana, citrus, grape, guava, litchi, papaya, apple, pear, peach and; minor fruits- pineapple, pomegranate, jackfruit, strawberry, nut crops; plantation crops-coconut, arecanut, cashew, tea, coffee & rubber.

Practical

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

References

1. Bose,T.K. and Mitra, S.K.1990. fruits-Tropical and Sub-tropical.Naya Prakashan, Calcutta.
2. Chattopadhya,P.K. Year. Text Book on Pomology(Fundamentals of Fruit Growing). Kalyani Publishers, Ludhiana.
3. Bijendra Singh. 2012. Horticulture at a Glance. Kalyani Publishers, Ludhiana.
4. Parthasarathy,V.A., P.K. Chattopadhyay and Bose, T.K. 2006. Plantation Crops.Vol I and II. Parthasankar basu Naya Udyog, Kolkata.

5. Kumar,N., Abdul Khader,J.B.M.,Rangaswamy, P. and Irulappan,I. 2004. Introduction to Spices, Plantation crops, Medicinal and Aromatic Crops. Oxford and IBH Publishing Co.,New Delhi

8.	**Agricultural Informatics**	**[ASAI2101]**	**2(1+1)**

Objectives To acquire a clear understanding of theory and application of Information & Community technology in various fields and promoting the applications of ICT in Agriculture

Course Outcomes : The students will be able to understand the basic concept of computer, MS Office, database, Internet and WWW and their application in agriculture

Theory

Introduction to Computers, Anatomy of Computers, Memory Concepts, Units of Memory, Operating System, definition and types, Applications of MS-Office for creating, Editing and Formatting a document, Data presentation, tabulation and graph creation, statistical analysis, mathematical expressions, Database, concepts and types, creating database, uses of DBMS in Agriculture, Internet and World Wide Web (WWW), Concepts and components.

Computer Programming, General Concepts, Introduction to Visual Basic, Java, Fortran, C/ C++, etc, concepts and standard input/output operations.

e-Agriculture, concepts, design and development. Application of innovative ways to use information and communication technologies (IT) in Agriculture. Computer Models in Agriculture: statistical, weather analysis and crop simulation models, concepts, structure, inputs-outputs files, limitation, advantages and application of models for understanding plant processes, sensitivity, verification, calibration and validation. IT application for computation of water and nutrient requirement of crops, Computer-controlled devices (automated systems) for Agri-input management, Smartphone mobile apps in Agriculture for farm advises, market price, postharvest management etc; Geospatial technology, concepts, techniques, components and uses for generating valuable agri-information. Decision support systems, concepts, components and applications in Agriculture, Agriculture Expert System, Soil Information Systems etc for supporting Farm decisions. Preparation of contingent crop-planning and crop calendars using IT tools.

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, handling macros. MS-ACCESS: Creating Database, preparing queries and reports, demonstration of Agri-information system. Introduction to World Wide Web (WWW) and its components. Introduction of programming languages such as Visual Basic, Java, Fortran, C, C++. Hands on practice on Crop Simulation Models (CSM), DSSAT/Crop-Info/CropSyst/ Wofost. Preparation of Inputs file for CSM and study of model outputs, computation of water and nutrient requirements of crop using CSM and IT tools. Use of smart phones and other devices in agro-advisory and dissemination of market information.Introduction of Geospatial Technology, for generating information important for Agriculture.Hands on practice on preparation of Decision Support System.Preparation of contingent crop planning.

References

1. John Walkenbach, Herb Tyson, Michael R.Groh, Faithe Wempen, Microsoft Office 2010 Bible

2. Bangia,Learning Ms Office 2010
3. Prof. Satish Jain and M.Geetha, MS-Office 2010 Training Guide
4. Johnson, Microsoft Office 2010…….on Demand
5. Kate Shoup, Microsoft Office 2010
6. Melanie Gass, It's All about You! Office 2010
7. Nancy Conner and Matthew MacDonald, Office 2010: The Missing Manual

9.	**Livestock & Poultry Management**	**[ASAP2101]**	**3(2+1)**

Objectives: To meet the basic and overall knowledge requirement of the students on various livestock specifically the farm animals including poultry with respect to physiological and reproductive system.

Course Outcomes: The course knowledge directly reflects on the operation of livestock and poultry farming being taken as a major component of integrated farming system in agriculture.

Theory

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

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

Digestion in livestock and poultry. Classification of feedstuffs. Proximate principles of feed. Nutrients and their functions. Feed ingredients for ration for livestock and poultry. Feed supplements and feed additives. Feeding of livestock and poultry.

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

Practical

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

References

1. A Textbook of Animal Husbandry – G.C. Benerjee
2. Livestock Production and Management – N.S.R. Sastri, C.K. Thomas, R.A. Singh
3. Essentials of Animal Production and Management – R. Singh
4. A Handbook of Animal Husbandry – ICAR
5. A Textbook of Livestock Production Management in Tropics – D.N. Verma

10	**Communication Skills and Personality Development**	**[ASEE2104]**	**2(1+1)**

Objective: Students develop communication skills and creative content writing as well as positive personality traits, Students acquire a language suitable for technical communication and writing. Students inculcate the habit of regular reading and writing

Course Outcomes: This course offers a wide scope for students in employment sectors (social sector, NGO's).

Theory

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. 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.

References

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

SEMESTER – IV

1.	**Crop Production Technology-II (oil seeds, fibre, sugar, tobacco and fodder crops)(Rabi crops)**	**[ASAG2204]**	**3(2+1)**

Objective: classify the crops with relation to growing environment develop competency in field crop production by knowing scientific technology.

Course Outcomes: This course offers a wide scope for students in employment, skill development and entrepreneurial sectors.

Theory

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

References

1. Reddy, S.R. and ReddiRamu. 5th edition. Agronomy of Field Crops, Kalyani Publishers, Ludhiana.
2. Chidda Singh, Singh, P. and Singh, R. 2003. Modern Techniques of Raising Field Crops. Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi.
3. Rajendra Prasad (ed.), 2004. Text Book of Field Crop Production, Commercial Crops, Volume -II. ICAR, New Delhi.
4. Panda, S.C. 2014. Agronomy of Fodder and Forage Crops, Kalyani Publishers, Ludhiana.

2.	**Production Technology for Ornamental Crops, MAPs and Landscaping**	**[ASHO2204]**	**2 (1+1)**

Objective: Importance and scope of Ornamental Crops, MAPs and Landscaping. Knowledge about production technology of cut flower, loose flower, medicinal and aromatic plants. Uses of tree, shrub, climbers, potted plants in landscaping. Processing and value addition in ornamental plants and MAPs produce.

Course Outcomes: This course offers a wide scope for students in entrepreneurship sectors.

Theory

Importance and scope of ornamental crops, medicinal and aromatic plants and landscaping. Principles of landscaping. Landscape uses of trees, shrubs and climbers. Production technology of important cut flowers like rose, gerbera, carnation, lilium and orchids under protected conditions and gladiolus, tuberose, chrysanthemum under open conditions. Package of practices for loose flowers like marigold and jasmine under open conditions. Production technology of important medicinal plants like asparagus, aloe, costus, 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. dentification 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.

References

1. Bose T.K.1999. floriculture and Landscaping. Naya Prakash, Kolkatta.
2. Bose, T.K. and Yadav, L.P. 1992. Commercial Flowers. Naya Prakash, Kolkatta
3. Randhawa, G.S. and Mukhopadhyaya, A.1994. Floriculture in India. Allied Publishers Pvt. Ltd., New Delhi.
4. Chattopadhyay,S.K. 2007. Commercial Floriculture. Gene-Tech Books, New Delhi
5. Srivastava,H.C.2014.Medicinal and Aromatic Plants, ICAR, New Delhi.

6. Kumar,N., Abdul Khader, J.B.M,Rangaswamy, P and Irulappan, I. 2004. Introduction to Spieces, Plantation Crops, Medicinal and Aromatic Crops. Oxford and IBH publishing Co., New Delhi.

3.	**Renewable Energy and Green Technology**	**[ASAE2203]**	**2(1+1)**

Objectives: To understand basic characteristics of renewable sources of energy and technologies for their utilization for the thermal and electrical energy needs and also the environmental aspects of these resources

Course Outcomes: The students will be able to understand the role of renewable energy in product and service sectors, as well as its importance in the energy chain: processing, transportation, distribution and end use.

Theory

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

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.

References

1. Rai, G.D. 2004. Non-Conventional Energy Sources. Khanna Publishers, New Delhi
2. Rajput, R.K. 2012. Non-Conventional Energy Sources. S.Chand Publishers, New Delhi
3. Rathore, N.S., Mathur, A.N. and S.Kothari. Alternate sources of energy. ICAR , New Delhi
4. Chakrava rthy, A. and Amalendu Chakravarthy . 1989. Biotechnology and other Alyernative Technologies for Utilization of Biomass-Agriculture wastes. 1st edition, Oxford and IBH Publishers, New Delhi

4.	**Manures, Fertilizers and Soil Fertility Management**	**[ASAC2202]**	**3(2+1)**

Objective: The students have knowledge with basic principle of soil fertility management.The students with general concepts and classification of manures and fertilizer. The students have knowledge about methods of fertilizer recommendation to crops.

Course Outcomes: This course offers a wide scope for students in employment & entrepreneurship sectors.

Theory

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

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 available N in soils. Estimation of available P in soils. Estimation of available K. Estimation of available S in soils. Estimation of available Ca and Mg in soils. Estimation of available Zn in soils. Estimation of N in plants. Estimation of P in plants. Estimation of K in plants. Estimation of S in plants.

References

1. Indian Society of Soil Science 2012. Fundamentals of Soil Science. IARI, New Delhi
2. Das,D.K. 2015Intrioductory soil science, 4th edition, Kalyani Publishers, New Delhi.
3. Samuel Tisdale, Nelson Werner L, Beaton James D and Havlin John L. 2005.Soil fertility and fertilizers: An introduction to Nutrient Management,Macmillian Publishing Co., New York
4. Yawalkar, K.S., Agarwal,T.P. and Bokde,S. 1995. Manures and fertilizers. Agril.Publishing house, Nagpur.

5.i	**Agricultural Marketing and prices**	**[ASEC2103]**	**2(1+1)**

Course Objectives: To Enable students to gain knowledge on agricultural marketing, challenges and prospects for improving agricultural marketing system.

Course Outcome: At the end of this course, students will understand and appreciate the structure and working of the agricultural marketing system .

Theory

Agricultural Marketing: Concepts and definitions of market, marketing, agricultural marketing, market structure, marketing mix and market segmentation, classification and characteristics of agricultural markets**;** demand, supply and producer's surplus of agri-commodities: nature and determinants of demand and supply of farm products, producer's surplus – meaning and its types, marketable and marketed surplus, factors affecting marketable surplus of agri-commodities; 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; 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: 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;

Practical

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

References

1. Subba Reddy,S. and P.Raghuram,P., Sastry,T.V.N. and Bhavani Devi,I. 2016. Agriculral Economics.Oxford &IBH Publishing Company Private Ltd.,New Dehi
2. S.S.Acharya and N.L.Agarwal. 2012. Agricultural Marketing in India. Oxford &IBH Publications Co.Pvt Ltd., New Delhi
3. S.S.Acharya and N.L.Agarwal. Agricultural Price: analysis and Policy. Oxford &IBH Publications Co.Pvt Ltd., New Delhi
4. Kahlon,A.S. and Tyagi, D.S. 1983. Agricultural price policy in India. Allied Publishers Pvt. Ltd.,New Delhi
5. Mamoria,C.B. and Joshi,R.L. 1995.Principles and Practices of Marketing in India. Kitab Mahal, Allahabad
6. Philipkumar, Kevin Lane Keller, Abraham Koshy and Mithileswar Jha. 2009. Marketing Management. A South asian Perspective. International 13th edition. Pearson Prentice Hall.
7. www.wto.org
8. www.agricoop.nic.in

5.ii	**Agricultural Finance and Co-Operation**	**[ASEC2102]**	**2(1+1)**

Objectives: to impart knowledge and expertise in the field of agricultural finance

Course Outcomes: on the completion of the course, students will be able to Learn sources of Agricultural Micro-Macro financing and credit systems and significance of Farming Cooperatives.

Theory

Agricultural Finance- meaning, scope and significance, credit needs and its role in Indian agriculture. Agricultural credit: meaning, definition, need, classification. Credit analysis: 4 R's, and 3C's of credits. Sources of agricultural finance: institutional and non-institutional sources, commercial banks, social control and nationalization of commercial banks, Micro financing including KCC. Lead bank scheme, RRBs, Scale of finance and unit cost. An introduction to higher financing institutions – RBI, NABARD, ADB, IMF, world bank, Insurance and Credit Guarantee Corporation of India. Cost of

credit. Recent development in agricultural credit.Preparation and analysis of financial statements – Balance Sheet and Income Statement.Basic guidelines for preparation of project reports- Bank norms – SWOT analysis.

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

Practical

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.

References

1. Johil, S.S. and C.V.More. 1970. Essentials of Farm Financial Management. Today and Tomorrow Printers and Publishers, New Delhi
2. John, J. Hamptron.1983. Financial decision making: Concepts, Problems and Cases of India. New Delhi
3. Mamoria,C.B. and R.D. Saksena. 1973. Co-Operatives in India.Kitab Mahal, Allahabad.
4. Mukhi, H.R. 1983. Cooperation in India and Abroad. New Heights Publishers, New Delhi.
5. Muniraj,R. 1987. Farm Finance for Development. Oxford &IBH Publishing Company Ltd., New Delhi.
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7. Pandey,U.K. Agricultural Finance in India.
8. Wiiliam,G.Murray and Nelson Aarson,G.Agricultural Finance.The Iowa State University Press,Ames,Iowa State University Press Ames,IOWA.
9. www.rbi.org
10. www.nabard.Org

www.wb.org

6.	**Fundamentals of Plant Biotechnology**	**[ASPB2201]**	**2(1+1)**

Objective: The students will be familiarized with the key developments in the sphere of Plant Biotechnology. Achieve self-sufficiency in the area of production of agronomically and horticulturally important crop species. The students get acquainted with the widely exploited techniques in plant molecular biology.

Course Outcomes: On successful completion of this course and basing on the diversified out comes this course offers a wide scope for students in employment sector(Industries, R &D etc).

Theory:

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

Practical

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.

References

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

7.	**Rainfed Agriculture and Watershed Management**	**[ASAG2211]**	**2(1+1)**

Objective: Understand contingent crop planning for aberrant weather conditions Assure efficient utilization of water through soil and crop management practices. Choose crops and their agronomic management under rainfed conditions.

Course Outcomes: This course offers a wide scope for students in employment, skill development sectors.

Theory

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

Practical

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

References

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

8.	**Principles of Seed Technology**	**[ASPG2202]**	**3(1+2)**

Objective: Distinguish between various crop seeds and their germination pattern as well as have an distinct idea about seed's morphological features Know about the various seed production procedure of crops and how it varies from commercial crop production. Carry out various seed testing related to determination of viability, vigour, germination, etc.

Course Outcomes: This course offers a good scope for students in skill development and entrepreneurship activities.

Theory

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**. 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.

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.

Practical

Seed production in major cereals: Wheat, Rice, Maize, Sorghum and Bajra. Seed production in major pulses: Urd, Mung, Pigeonpea, Lentil, Gram, Fieldpea. Seed production in major oilseeds: Soybean, Rapeseed and Mustard. Seed production in 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. \

References

1.Agarwal,P.K.1994.Principles of seed technology.ICAR, New Delhi

2. Agarwal,P.K. and Dadlani,M.1986. techniques of Seed Science and Technology. South Asian Publishers, New Delhi

3.Agarwal,R.L.1995. Seed Technology. Oxford and IBH Publication Co., New Delhi

4. Dhrendra Khare and Mohan S. Bhale. 2007. Seed Technology. Scientific Publishers (India), Joghpur

5.Thomson, J.R.1979. An introduction of seed technology. Leonard Hill, London

9.	**Diseases of Field & Horticultural Crops & their Management-I**	**[ASPP2202]**	**3(2+1)**

Objective: The student have knowledge with different diseases of different crop with respect to farmer field. The students with general concepts and classification of plant diseases with relation to environmental condition. The students have knowledge with management of plant disease economically.

Course Outcomes: On successful completion of this course and basing on the diversified course outcomes this course offers a good scope for students in employment sector.

Theory

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

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: Phytophthora blight;Tobacco: black shank, black root rot and mosaic. Horticultural Crops: Guava: wilt and anthracnose;Banana: Panama wilt, bacterial wilt, Sigatoka and bunchy top;Papaya: foot rot, leaf curl and mosaic,Pomegranate: bacterial blight;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.

References

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

SEMESTER – V

1.	**Entrepreneurship Development and Business Communication**	**[ASEE3103]**	**2(1+1)**

Objective: Students understand with key concepts and processes in entrepreneurships and business development. Students know the processes in the form of differences between small and large firms, and the economic environment. Students have knowledge about key debates around entrepreneurship and small businesses. Students get exposed towards various industries and business communication

Course Outcomes: This course offers a wide scope for students in employment sectors (agribusiness companies)

Theory

Concept of Entrepreneur, Entrepreneurship Development, Characteristics of entrepreneurs; Assessment of entrepreneurship skills, SWOT Analysis & achievement motivation, Entrepreneurial behavior, Government policy and programs and institutions for entrepreneurship development, Entrepreneurial Development Process; Business Leadership Skills; Communication skills for entrepreneurship development, Developing organizational skill , Developing Managerial skills, Problem solving skill, Achievement motivation; time management; Supply chain management and Total quality management, Project Planning Formulation and report preparation; Opportunities for entrepreneurship and rural entrepreneurship.

Practical

Assessing entrepreneurial potential, problem solving ability, managerial skills and achievement motivation, exercise in creativity, time audit, preparation of business plan and proposal writing, visit to entrepreneurship development institute and entrepreneurs.

References

1. Anil Kumar, S., Poornima, S.C.,Mini, K., Abraham and Jayashree,K. 2003. Entrepreneurship Development. New Age International Publishers, New Delhi.
2. Bhaskaran, S. 2014. Entrepreneurship Development & Management. Aman Publishing House, Meerut.
3. Gupta, C.B. 2001.Management: Theory and Practice. Sultan Chand and Sons, New Delhi.
4. Indu Grover 2008. Handbook on empowerment and Entrepreneurship. Agrotech Publishing Academy, Udaipur.
5. Khanka, S.s. 1999. Entrepreneurship Development.S.Chand and Co., New Delhi.
6. Mary Coulter 2008. Entrepreneurship in Action. Prentice Hall of India Pvt. Ltd., New Delhi
7. Mohanty, S.K. 2009. Fundamentals of Entrepreneurship. Prentice Hall of India Pvt. Ltd., New Delhi
8. Prasad, R. 2003. Entrepreneurship- Concepts and Cases. IC F A I Publications, Hyderabad.
9. SagarMondal and Ray, G.L. 2003. Text Book of Entrepreneurship and Rural Development. Kalyani Publishers, Ludhiana
10. Singh, D. 1995. Effective Managerial Leadership. Deep and Deep Publications, New Delhi.
11. Vasanta Desai. 1997. Small Scale Industries and Entrepreneurship. Himalaya Publishing House, New Delhi.
12. Vasanta Desai. 2000. Dynamics of Entrepreneurial Development and Management. Himalaya Publishing House, New Delhi.

2.	**Problematic Soils and their Management**	**[ASAC3103]**	**2(1+1)**

Objective: The students have knowledge with different types of problematic soils. Management process of problematic soils and reclamation techniques.

Course Outcomes: This course offers a wide scope for students in skill development sectors.

Theory

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.

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 Agroeco systems.

Practical

Field identification of problem soils.Determination of soil pH, EC, gypsum requirement of alkali soils, lime requirement of acid soils, calcium carbonate content in soils, Water quality assessment (pH, Ec, alkalinity, chlorides, SAR, RSC).

References

1. Indian Society of Soil Science 2012. Fundamentals of Soil Science. IARI, New Delhi
2. Das,D.K. 2015Intrioductory soil science, 4th edition, Kalyani Publishers, New Delhi.

3.	**Pests of field Crops and Stored Grains and their Management**	**[ASEN3103]**	**3(2+1)**

Objective: Students have knowledge about pests of various field crops, their symptoms and management. Students have knowledge about various stored grain and non-insect pests along with their management.

Course Outcomes: This course offers a good scope for students in employment sector

Theory

General account on nature and type of damage by different arthropods pests. Scientific name, order, family, host range, distribution, biology and bionomics, nature of damage, and management of major pests and scientific name, order, family, host range, distribution, nature of damage and control practice other important arthropod pests of various field crop, vegetable crop, fruit crop, plantation crops, ornamental crops, narcotics, spices and condiments. Factors affecting losses of stored grain and role of physical, biological, mechanical and chemical factors in deterioration of grain. Insect pests, mites, rodents, birds and microorganisms associated with stored grain and their management. Storage structure and methods of grain storage and fundamental principles of grain store management.

Practical

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

References

1. Atwal, A.S. 1976. *Agricultural Pests of India and South East Asia*. Kalyani Publishers, Ludhiana.
2. Butani, D.K. and Jotwani, M.G. 1984. *Insects in Vegetables*. Periodical Export Book Agency,New Delhi.
3. Butani, D. K. 1984. *Insects and Fruits*. Periodical Export Book Agency, New Delhi.
4. Dennis S Hill 1987 *Agricultural Insect Pests of tropics and their control*, Cambridge Universtiy Press , New York
5. Khare, S.P. 1993. *Stored Grain Pests and Their Management.* Kalyani Publishers, Ludhiana.
6. Nair MRGK. 1986. *Insects and Mites of crops in India*. Indian Council of Agricultural Research New Delhi.

7. Ramakrishna Ayyar, T.V. 1963. *Handbook of Economic Entomology for South India*. Government Press, Madras.
8. Vasantharaj David, B. 2003. *Elements of Economic Entomology*. Popular Book Depot, Coimbatore.
9. Vasantharaj David, B and Aanathakrishnan, T.N. 2006. *General and Applied Entomology*. Tata McGraw-Hill Publishing House, New Delhi.
10. Upadhyaya K.P. and Kusum Dwivedi. 1996. *A Text Book of Plant Nematology*. Aman Publishing House, Meerut.

4.	**Diseases of Field & Horticultural Crops & their Management-II**	**[ASPP3103]**	**3(2+1)**

Objective: The student have knowledge with different diseases of different crop with respect to farmer field. The students with general concepts and classification of plant diseases with relation to environmental condition The students have knowledge with management of plant disease economically

Course Outcomes: On successful completion of this course and basing on the diversified course outcomes this course offers a good scope for students in employment sector**.**

Theory

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

Field Crops:

Wheat: rusts, loose smut, karnal bunt, powdery mildew, alternaria blight, and ear cockle;

Sugarcane: red rot, smut, wilt, grassy shoot, ratoon stunting and Pokkah Boeng;

Sunflower: Sclerotinia stem rot and Alternaria blight; Mustard: Alternaria blight, white rust, downy mildew and Sclerotinia stem rot;Gram: wilt, grey mould and Ascochyta blight; Lentil: rust and wilt;Cotton: anthracnose, vascular wilt, and black arm; Pea: downy mildew, powdery mildew and rustHorticultural Crops: Mango: anthracnose, malformation, bacterial blight and powdery mildew;Citrus: canker and gummosis; Grape vine: downy mildew, Powdery mildew and anthracnose;Apple: scab, powdery mildew, fire blight and crown gall;Peach: leaf curl

Strawberry: leaf spot Potato: early and late blight, black scurf, leaf roll, and mosaic;

Cucurbits: downy mildew, powdery mildew, wilt;Onion and garlic: purple blotch, and Stemphylium blight;Chillies: anthracnose and fruit rot, wilt and leaf curl;Turmeric: leaf spot Coriander: stem gallMarigold: Botrytis blight; Rose: dieback, powdery mildew and black leaf spot.

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-mountedspecimens.

References

1. Rangaswami, G & Mahadevan, K.2001. Diseases of crop plants in India, Prentice Hall of India Pvt. Ltd., New Delhi
2. Singh, R.S.2005. Plant Diseases. Oxford & IBH Publications, New Delhi
3. Pathak, V.n.2001. Diseases of Fruit crops.Oxford & IBH Publications, New Delhi
4. Singh, R.S.1999. Diseases of vegetable crops. Oxford & IBH Publications, New Delhi

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

5.	**Crop Improvement – I** **(Cereals, millets, pulses and oil seeds etc.) (*Kharif crops*)**	**[ASPG3104]**	**2(1+1)**

Objective: The students able to know about the origin, distribution and wild relatives of important kharif crops. The students able to know about the plant genetic resources, and different breeding methods adopted for the development of varieties and hybrids. The students able to know about the floral biology, emasculation and pollination techniques operated in different kharif crops.

Course Outcomes: This course offers a wide scope for students in employment, skill development sectors.

.

Theory

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 Floral biology, study of genetics of qualitative and quantitative characters; Important concepts of breeding self pollinated, cross pollinated and vegetatively propagated crops; Major breeding objectives and procedures including conventional and modern innovative approaches for development of hybrids and varieties for yield, adaptability, stability, abiotic and biotic stress tolerance and quality (physical, chemical, nutritional); Seed production technology in self pollinated, cross pollinated and vegetatively propagated crops. Hybrid seed production technology in Maize, Rice, Sorghum, Pearl millet and Pigeonpea, etc. Ideotype concept and climate resilient crop varieties for future.

Practical

Emasculation and hybridization techniques in different crop species; viz., Rice, Maize, Sorghum, Pearl Millet, Ragi, Pigeonpea, Urdbean, Mungbean, Soybean, Groundnut, Seasame , Caster, Cotton, Cowpea, Pearl millet and Tobacco. 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.

References

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

6.	**Principles of Food Science and Nutrition**	**[ASFS3101]**	**2 (2+0)**

Objectives: To know the principles involving various food preservation methods and gain knowledge of the role of nutrition in sustaining health and preventing diseases

Course Outcome : The student will be able to understand both fundamental and applied aspects of food science and gain insights about role of specific nutrients in maintaining health and identifying nutrient specific foods.

Theory

Concepts of Food Science (definitions, measurements, density, phase change, pH, osmosis, surface tension, colloidal systems etc.); Food composition and chemistry (water, carbohydrates, proteins, fats, vitamins, minerals, flavours, colours, miscellaneous bioactives, important reactions); Food microbiology (bacteria, yeast, moulds, spoilage of fresh & processed foods, Production of fermented foods); Principles and methods of food processing and preservation (use of heat, low temperature, chemicals, radiation, drying etc.); Food and nutrition, Malnutrition (over and under nutrition), nutritional disorders; Energy metabolism (carbohydrate, fat, proteins); Balanced/ modified diets, Menu planning, New trends in food science and nutrition.

References

1. Sumati R. Mudambi, Shalini M.Rao and M.V. Rajagopal. 2006. Food Science, 2nd Ed. New Age International(P) Limited, New Delhi.
2. Martin Eastwood. 2003. Principles of Human Nutrition. Blackwell Science Ltd., Oxford.
3. Norman N.Potter. 1998. Food Science, 5th Ed. Springer Science+ Business Media, New York.
4. Michael J.Pelczar Jr.,E.C.S. Chan and Noel R.Krieg. 1998. Microbiology, 5th Ed. Tata McGraw-Hill Education, New Delhi
5. William C.Frazier and Dennis C. Westfoff. 1987. Food Microbiology, 4th Ed. Tata McGraw-Hill Education, New Delhi.
6. L.E. Casida Jr. 1968. Industrial Microbiology. New Age International Publishers, New Delhi.
7. P. Fellows. 2000. Food Processing Technology: Principles and Practice, 2nd Ed. CRC Press, Boca Raton, FL, USA.
8. Marcus Karel and Darvl B.Lund. 2003. Physical Principles of Food Preservation, 2nd Ed. Marcel Dekker, Inc., NY,USA.
9. Gerald Wiseman. 2002. Nutrition and Health. Taylor & Francis, London.
10. An Introduction to Nutrition, v.1.0

7.	**Geoinformatics and Nano-technology for Precision Farming**	**[ASAG3110]**	**2(1+1)**

Objective: Ensure targeting of inputs and outputs by adoption of precision technologies. Adopt modern hardware and software tools and equipment in crop production. Understand importance and application of nano-technology in agriculture

Course Outcomes: This course offers a good scope for students in skill development sectors.

Theory

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

Practical

Introduction to GIS software, spatial data creation and editing. Introduction to image processing software. Visual and digital interpretation of remote sensing images. Generation of spectral profiles of different objects. Supervised and unsupervised classification and acreage estimation. Multispectral remote sensing for soil mapping. Creation of thematic layers of soil fertility based on GIS. Creation of productivity and management zones. Fertilizers recommendations based 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**.**

References

1. Pradeep, T. 2007. NANO: The Essentials: Understanding Nanosciences and Nanotechnology. Tata McGraw-Hill Publishing Company Ltd, New Delhi.
2. Lillesand, T.M. and Keifer, R.W. 1994. Remote Sensing and image interpretation (3rd edition), John Willey and Sons.
3. Anji Reddy, M. 2006. Text Book of Remote Sensing and Geographical Information Systems, (3rd edition), B.S.Publications, Hyderabad.

8	**Practical Crop Production-I (Kharif Crops)**	**[ASAG3108]**	**2(0+2)**

Objective: Know cultivation technology of different crops in respect to different situations. Understand crop cycle and environmental requirements, agronomic management and economics of crop production.

Course Outcomes: This course offers a wide scope for students in skill development sectors.

Practical

Crop planning, raising field crops in multiple cropping systems: Field preparation, seed, treatment, nursery raising, sowing, nutrient, water and weed management and management of insect-pests diseases of crops, harvesting, threshing, drying winnowing, storage and marketing of produce. The emphasis will be given to seed production, mechanization, resource conservation and integrated nutrient, insect-pest and disease management technologies. Preparation of balance sheet including cost of cultivation, net returns per student as well as per team of 8-10 students.

9.	**Environmental Studies and Disaster Management**	**[ASES3101]**	**3(2+1)**

Objectives : To e nable students to develop a comprehensive understanding of various facets of life forms, ecological processes and how humans have impacted them

Course Outcomes: Upon completion of this course, students will acquire knowledge about the natural environment and its relationships with human activities and have capacity to obtain, analyse, and communicate information on risks, relief needs and lessons learned from earlier disasters in order to formulate strategies for mitigation in future scenarios.

Theory

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. 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)

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.

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.

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.

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.

References

1. Bharucha, E. 2005. Text book of Environmental Studies for undergraduate courses. University Grants Commission, New Delhi.
2. Anjaneyalu, Y. 2004. Introduction to Environmental Science, BS Publications, Hyderabad, A.P.,India.

SEMESTER – VI

1.	**Farming System and Organic farming for Sustainable Agriculture**	**[ASAG3207]**	**3(2+1)**

Objective: Know the organic production system to achieve agricultural sustainability know the farming system approach, their requirements and the practices to obtain production sustainability

Course Outcomes: This course offers a wide scope for students in employment, skill development and entrepreneurial sectors.

Theory

Farming System-scope, importance, and concept, Types and systems of farming system and factors affecting types of farming, Farming system components and their maintenance, Cropping system and pattern, multiple cropping system, Efficient cropping system and their evaluation, Allied enterprises and their importance, Tools for determining production and efficiencies in cropping and farming system; Sustainable agriculture-problems and its impact on agriculture, indicators of sustainability, adaptation and mitigation, conservation agriculture strategies in agriculture, HEIA, LEIA and LEISA

and its techniques for sustainability, Integrated farming system-historical background, objectives and characteristics, components of IFS and its advantages, Site specific development of IFS model for different agro-climatic zones, resource use efficiency and optimization techniques, Resource cycling and flow of energy in different farming system, farming system and environment.

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

Practical

Visit of organic farms to study the various components and their utilization; Preparation of enrich compost, vermicompost, bio-fertilizers/bio-inoculants and their quality analysis; Indigenous 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.

References

1. Arun Kumar Sharma. 2006. A Handbook of Organic Farming. Agrobios (India), Jodhpur.
2. Jayanthi, C., Devasenapathy, P. and Vinnila, C. 2008. Farming Systems, Principles and Practices, Satish Serial Publishing House, Delhi.
3. Panda, S.C. 2011. Cropping and Farming Systems. Agrobios (India), Jodhpur.
4. Ruthenburg, H. 1980. Farming Systems in the Tropics. Oxford University Press.
5. Palaniappan, SP. and Annadurai, K. 1999. Organic Farming: Theory and Practice, Scientific Publishers, Jodhpur, India.257p.
6. Mukund Joshi and Prabhakarsetty, T.K. 2006. Sustainability through organic farming. Kalyani Publishers, New delhi. 349p.
7. Balasubramanian, R., Balakrishnan, K. and Siva Subramanian, K. 2013. Principles and Practices of organic Farming. Satish Serial Publishing House,453p.
8. Tarafdar, J.C., Tripathy, K.P. and Mahesh Kumar. 2009. Organic Agriculture. Scientific Publishers, India, 369p.
9. Tiwari, V.N., Gupta, D.K., Maloo, S.R. and Somani, L.L. 2010. Natural, organic, biological, ecological and biodynamic farming. Agrotech Publishing Academy, Udaipur, 420p.
10. Dushyent Gehlot. 2005. Organic Farming- standards, accreditation, certification and inspection. Agrobios, India.357p.

2.	**Practical Crop Production-II *(Rabi Crops)***	**[ASAG3209]**	**2(0+2)**

Objectives : To teach the practical growing of crop husbandry of different rabi crops

Course Outcomes: This course offers a wide scope for students in skill development for rabi crop production

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

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

3.	**Post-harvest Management and Value Addition of Fruits and Vegetables**	**[ASHO3205]**	**2 (1+1)**

Objective: Knowledge about the extent and possible causes of post-harvest losses. Knowledge about harvesting, field handling of produce, processing and storage. Value addition of produce and their packaging.

Course Outcomes: This course offers a good scope for students in skill and entrepreneurship sectors.

Theory

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

Practical

Applications of different types of packaging containers for shelf life extension. Effect of temperature on shelf life and quality of produce. Demonstration of chilling and freezing injury in vegetables and fruits. Extraction and preservation of pulps and juices. Preparation of jam, 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.

References

1. Rathore, N.S., Mathur, G.K., Chasta, S.s. 2012. Post-harvest Management and Processing of Fruits and Vegetables. ICAR, New Delhi
2. Srivastava, R.P. and Sanjeev Kumar, 2002. Fruit and vegetable Preservation: Principles and Practices. International Book Distributio Company, Lucknow.
3. Giridharilal, G.S., Siddappa and Tondon, G.L. 2007. Preservation of Fruits and Vegetables. ICAR, New Delhi.
4. Mitra, S.K. 2005, Post Har4vest Physiology and Storage of Tropical and Subtropical Fruits. CABI Publishers, Kolkatta.

4.	**Pests of Horticultural crops and their management and Beneficial Insects**	**[ASEN3204]**	**3(2+1)**

Objectives: To study the causal organism, symptomatology, etiology and epidemiology of the important pests of field and horticulture crops for devising efficient management strategies against them.

Course Outcomes: This course will help the students in accurate identification of the diseases under farmer field conditions and in suggesting efficient and cost effective management strategies against them..

Theory

General account on nature and type of damage by different arthropod pests.Scientific name, order, family, host range, distribution, biology and bionomics, nature of damage and management of major pests and scientific names, order, family,host rage, distribution, nature of damage and cOntrol practices for other important arthropod pests of various vegetable crops, fruit crops, plantation crops, ornamental crops, narcotics, spices and condiments.

Importance of beneficial Insects, Beekeeping, pollinating plant and their cycle, 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.

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.

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.

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

Practical

Identification of different types of damage. Identification and study of life cycle ans seasonal history of various insect pests attacking horticultural crops – Vegetable crops, fruit crops, plantation gardens, narcotics, spices and condiments. Visit to orchards and gardens**.**

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.

References

1.Butani, D. K. 1984. *Insects and Fruits*. Periodical Export Book Agency, New Delhi.

2.Ganga, G. and Sulochana Chetty, J 1997 (2nd edt). An introduction to Sericulture .Oxford and IBH Publishing Co. Pvt Ltd., New Delhi

3. Hisao Aragu 1994.Principles of Sericulture. Oxford and IBH Publishing Co. Pvt Ltd., New Delhi

4. Krishnaswamy, S. 1990. Sericulture manual – Silkworm, FAO

5. Singh S, 1975.Bee keeping in India . ICAR, New Delhi

6. Glover P M 1937. Lac cultivation in India>The Indian Lac Research Institute, Ranchi

7. Mishra R C 1995. Honey bees and their management in India .ICAR, New Delhi

8. Vasantharaj David, B.,and V.V. Ramanamurthy, 2003. *Elements of Economic Entomology*. Popular Book Depot, Coimbatore.

5.	**Crop Improvement – II (Fibre, sugar, starches, narcotics, vegetables, fruits and flowers) (*Rabi crops*)**	**[ASPG3205]**	**2(1+1)**

Objective: The students able to know about the origin, distribution and wild relatives of important rabi crops. The students able to know about the plant genetic resources, and different breeding methods adopted for the development of varieties and hybrids. The students able to know about the floral biology, emasculation and pollination techniques operated in different Rabi crops.

Course Outcomes: This course offers a wide scope for students in employment, skill development sectors.

Theory

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; Floral biology, study of genetics of qualitative and quantitative characters; Important concepts of breeding self pollinated, cross pollinated and vegetatively propagated crops; Major breeding objectives and procedures including conventional and modern innovative approaches for development of hybrids and varieties for yield, adaptability, stability, abiotic and biotic stress tolerance and quality (physical, chemical, nutritional); Seed production technology in self pollinated, cross pollinated and vegetatively propagated crops. Hybrid seed production technology of rabi crops. Ideotype concept and climate resilient crop varieties for future.

Practical

Emasculation and hybridization techniques in different crop species namely Wheat, Oat, Barley, Chickpea, Lentil, Field pea, Rapeseed Mustard, Sunflower, Potato, Berseem. Sugarcane, Cowpea; 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.

References

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

6.	**Principles of Integrated Pest and Disease Management**	**[ASPP3204]**	**3(2+1)**

Objective: The students have knowledge with different method to control and manage the plant disease in field condition. Student have knowledge to establish commercial production unit of bio-pesticide.

Course Outcomes: On successful completion of this course and basing on the diversified course outcomes this course offers a good scope for students to take up employment and entrepreneurship activities.

Theory

Categories of insect pests and diseases, IPM: Introduction, history, importance, concepts, principles and tools of IPM. Economic importance of insect pests, diseases and pest risk analysis. Methods of detection and diagnosis of insect pest and diseases. Calculation and dynamics of economic injury level and importance of Economic threshold level. Methods of control: Host plant resistance, cultural, mechanical, physical, legislative, biological and chemical control. Ecological management of crop environment. Introduction to conventional pesticides for the insect pests and disease management. Survey surveillance and forecasting of Insect pest and diseases. Development and validation of IPM module. Implementation and impact of IPM (IPM module for Insect pest and disease. Safety issues in pesticide uses. Political, social and legal implication of IPM. Case histories of important IPM programmes.

Practical

Methods of diagnosis and detection of various insect pests, and plant diseases, Methods of insect pests and plant disease measurement, Assessment of crop yield losses, calculations based on economics of IPM, Identification of biocontrol agents, different predators and natural enemies. Mass multiplication of *Trichoderma*, *Pseudomona*s, *Trichogramma*, NPV etc. Identification and nature of damage of important insect pests and diseases and their management. Crop (agro-ecosystem) dynamics of a selected insect pest and diseases. Plan & assess preventive strategies (IPM module) and decision making. crop monitoring attacked by insect, pest and diseases . Awareness campaign at farmers fields.

References

1. Dhaliwal, G.S. and Ramesh Arora 2001. Integrated pest management: Concepts and approaches, Kalyani Publishers, Ludhiana
2. Metcalf, R.L. and Luckman, W.H.1982. Introduction to insect pest management Wiley inter science publishing, New York.
3. Larry P Pedigo 1991. Entomology and pest management, Prentice Hall of India Pvt. Ltd., New Delhi
4. Venugopala Rao, N., Umamaheswari, T., Rajendraprasad, P., Naidu,V.G. and Savithri,P.2004.Integrated Insect Pest Management, Agrobios (India) Limited, Jodhpur.
5. Chaube, H.S. and Ramji Singh. 2001. Introductory Plant Pathology. International Book Distribution Co., Lucknow. 136.
6. Mehrotra, R.S. 1980. Plant Pathology. Tata McGraw-Hill Publishing Co. Ltd. New Delhi
7. Singh, R.S. 2002. Introduction to Principles of Plant Pathology. Oxford & IBH Publishing Co.Pvt. Ltd.,New Delhi.
8. Vidyasekharan,P. 1993. Principles of Plant Pathology. CBS Publishers and Distributors, New Delhi
9. Y.L. Nene and P.N. Thaplial, 1993, Fungicides in Plant Disease Control. Oxford & IBH Publishing Co.

7.	**Protected Cultivation and Post harvest Technology**	**[ASAE3204]**	**2(1+1)**

Objectives: To impart knowledge on agro-technique and management of different horticultural crops under protected environmental conditions.

Student will be made aware of the technological changes that are occurring in this field along with pre and post-harvest technology

Course Outcomes : It will aware students and they will gain knowledge about post-harvest technology which enables storage of agricultural products during the whole year in full quality, identification and elimination of negative processes which may be occur during processes and storage.

Theory

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. 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. 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.

References

1. RadhaManohar, K. and Igathinathene.C. greenhouse Technology and Management, 2nd edition, BS publications

2.TiwaryG.N. Greenhouse Technology for Controlled Environment.Narosa Publishing House. Pvt Ltd.

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

4. Sahay, K.M. and Singh,K.K. 1994. Unit Operation of Agricultural Processing. Vikas Publishing House Pvt Ltd., New delhi

5. Chakravarthy,A. Post Harvest Technology of cereals, pulses and Oil seeds. Oxford and IBH Publishing Co. Ltd., New Delhi

6. Ojha, T.P. and A.M.Michael, A.M. Principles of Agricultural Engineering. Vol.I. Jain brothers, 16/893, East Park Road, Karol Bagh, New Delhi -110005

8.	**Intellectual Property Rights**	**[ASIP3201]**	**1(1+0)**

Objective: To understand the necessity of patents, copyright, trademark, GI, etc. Skill development in IPR is one of the most important outcomes of this course.

Course Outcomes: This course offers a scope for student employability, skill development in the field of IPR.

Theory

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, Copyrights,

Trademark, Industrial design, Geographical indications, Integrated circuits, Trade secrets. 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.

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.

References

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

9.	**Farm Management**	**[ASEC3204]**	**2(1+1)**

Objectives: Determine and outline the conditions that give the optimum use of resources in the production of crops, livestock and allied enterprises. Explain the means and methods in getting from the existing use to optimum use of resources.

Course Outcomes: This course offers a wide scope for students in entrepreneurship sectors.

Theory

Meaning and concept of farm management, objectives and relationship with other sciences. Meaning and definition of farms, its types and characteristics, changing structure, of land holdings in India and charecteristics of small and marginal farm holdings, Farm management problems in India.

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.

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. 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

Computation of depreciation cost of farm assets.Determination of most profitable level of inputs use in a farm production process. Application of equi-marginal returns/opportunity cost principle in allocation of farm resources. Determination of least cost combination of inputs. Selection of most profitable enterprise combination.Application of cost principles including CACP concepts in the estimation of cost of crop and livestock enterprises.Farm business analysis, preparation of farm plan and budget, farm records and accounts and profit and loss accounts.Collection and analysis of data on various resources in India.

References

1.Bishop,C.E., W.E. Tousaint.1958. Introduction to Agricultural Economic Analysis. John Wiley and Sons, London

2. Heady,Earl O.,1964. Economics of agricultural production and Resource Use.Printice Hall of India, Pvt., Ltd.New Delhi

3. Johl, S.S., J.R.Kapur.2006. Fundamentals of Farm Business Management.Kalyani Publishers.

4. Kalhon ,A.S. and Karam Singh. 1965. Principles of Farm Business Management. Kalyani Publishers.

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

6. www.core_economics.org

Non-gradial courses

1.	**NSS/NCC**	**[ASPE1101]**	**2(0+2)**

Theory

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

Following activities are to be taken up under the NSS course:

Introduction and basic components of NSS: Orientation NSS programmes and activities
Understanding youth
Community mobilisation
Social harmony and national integration
Volunteerism and shramdan
Citizenship, constitution and human rights

Family and society
Importance and role of youth leadership
Life competencies
Youth development programmes
Health, hygiene and sanitation
Youth health, lifestyle, HIV AIDS and first aid
Youth and yoga
Vocational skill development
Issues related environment
Disaster management
Entrepreneurship development
Formulation of production oriented project
Documentation and data reporting
Resource mobilization
Additional life skills
Activities directed by the Central and State Government

All the activities related to the National Service Scheme course is distributed under fourdifferent courses viz., National Service Scheme I, National Service Scheme II, National ServiceScheme III and National Service Scheme IV each having one credit load. The entire four coursesshould be offered continuously for two years. A student enrolled in NSS course should put in atleast 60 hours of social work in different activities in a semester other than five regular one daycamp in a year and one special camp for duration of 7 days at any semester break period in the two year. Different activities will include orientation lectures and practical works.Activities directed by the Central and State Government have to be performed by all the volunteers of NSS as per direction.

1.	**Physical Education and Yoga Practices**	**[ASPE1201]**	**2(0+2)**

Semester II: Physical Education and Yoga Practices

1. Teaching of skills of Football – demonstration, practice of the skills, correction, involvement in game situation (For girls teaching of Tennikoit)
2. Teaching of different skills of Football – demonstration, practice of the skills, correction, involvement in game situation (For girls teaching of Tennikoit)
3. Teaching of advance skills of Football – involvement of all the skills in game situation with teaching of rules of the game
4. Teaching of skills of Basketball – demonstration, practice of the skills, correction of skills, involvement in game situation
5. Teaching of skills of Basketball – demonstration, practice of the skills, involvement in game situation
6. Teaching of skills of Basketball – involvement of all the skills in game situation with teaching of rule of the game.e ICAR Fifth Deans' Committee
7. Teaching of skills of Kabaddi – demonstration, practice of the skills, correction of skills, involvement in game situation
8. Teaching of skills of Kabaddi – demonstration, practice of the skills, correction of skills, involvement in game situation
9. Teaching of advance skills of Kabaddi – involvement of all the skills in game situation with teaching of rule of the game
10. Teaching of skills of Ball Badminton – demonstration, practice of the skills, correction of skills, involvement in game situation

11. Teaching of skills of Ball Badminton – involvement of all the skills in game situation with teaching of rule of the game
12. Teaching of some of Asanas – demonstration, practice, correction and practice
13. Teaching of some more of Asanas – demonstration, practice, correction and practice
14. Teaching of skills of Table Tennis – demonstration, practice of skills, correction and practice and involvement in game situation
15. Teaching of skills of Table Tennis – demonstration, practice of skills, correction and practice and involvement in game situation
16. Teaching of skills of Table Tennis – involvement of all the skills in game situation with teaching of rule of the game
17. Teaching – Meaning, Scope and importance of Physical Education
18. Teaching – Definition, Type of Tournaments
19. Teaching – Physical Fitness and Health Education
20. Construction and laying out of the track and field (*The girls will have Tennikoit and Throw Ball).

Physical Education and Yoga Practices
1. Teaching of skills of Hockey – demonstration practice of the skills and correction.
2. Teaching of skills of Hockey – demonstration practice of the skills and correction. And involvement of skills in games situation
3. Teaching of advance skills of Hockey – demonstration practice of the skills and correction. Involvement of all the skills in games situation with teaching of rules of the game
4. Teaching of skills of Kho-Kho – demonstration practice of the skills and correction.
5. Teaching of skills of Kho-Kho – demonstration practice of the skills and correction. Involvement of the skills in games situation
6. Teaching of advance skills of Kho-Kho – demonstration practice of the skills and correction. Involvement of all the skills in games situation with teaching of rules of the game
7. Teaching of different track events – demonstration practice of the skills and correction.
8. Teaching of different track events – demonstration practice of the skills and correction.
9. Teaching of different track events – demonstration practice of the skills and correction with competition among them.
10. Teaching of different field events – demonstration practice of the skills and correction.
11. Teaching of different field events – demonstration practice of the skills and correction.
12. Teaching of different field events – demonstration practice of the skills and correction.port of
13. Teaching of different field events – demonstration practice of the skills and correction with competition among them.
14. Teaching of different asanas – demonstration practice and correction.
15. Teaching of different asanas – demonstration practice and correction.
16. Teaching of different asanas – demonstration practice and correction.
17. Teaching of different asanas – demonstration practice and correction.
18. Teaching of weight training – demonstration practice and correction.
19. Teaching of circuit training – demonstration practice and correction.
20. Teaching of calisthenics – demonstration practice and correction.

Note: 1) Compulsory Uniform: Half pants, Tee Shirts, Shoes and socks all white (Girls will have white Tee Shirt and Track pants) 2) The games mentioned in the practical may be inter changed depending on the season and facilities.

1.	**Human Value and Ethics**	**[ASHV2101]**	**1(1+0)**

Theory

Values and Ethics-An Introduction. Goal and Mission of Life. Vision of Life. Principles andPhilosophy. Self Exploration. Self Awareness. Self Satisfaction. Decision Making. Motivation. Sensitivity. Success. Selfless Service. Case Study of Ethical Lives. Positive Spirit. Body, Mind and Soul Attachment and Detachment. Spirituality Quotient. Examination.

Educational Tour 2 (0+2)

Electives (9 Credits)

Electives (9 Credits)

Track/ Domain: 1. High tech horticulture (H)

Objective: To acquaint the students with the idea about protected cultivation: structure, process and control

Course Outcomes: The students will get acquainted with hands on experience on Protected cultivation: method and techniques

ASHE. 2201. Applied hi-tech horticulture 3 (2+1)

Theory

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

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

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

ASHE 3102. Protected cultivation of vegetable crops (2+1)

Theory: Crops - Tomato, capsicum, cucumber, melons and lettuce

UNIT I: Importance and scope of protected cultivation of vegetable crops, principles used in protected cultivation, energy management, low cost structures; training methods; engineering aspects.
UNIT II: Regulatory structures used in protected structures, types of greenhouses/ polyhouses/ nethouses, hot beds, cold frames, effect of environmental factors, *viz.* temperature, light, CO2 and humidity on growth of different vegetables, manipulation of CO2, light and temperature for vegetable production, fertigation.

UNIT III: Nursery raising in protected structures like poly-tunnels, types of benches and containers, different media for growing nursery under cover.

UNIT IV: Regulation of flowering and fruiting in vegetable crops, technology for raising tomato, sweet pepper, cucumber and other vegetables in protected structures, training and staking in protected crops, varieties and hybrids for growing vegetables in protected structures.

UNIT V: Problem of growing vegetables in protected structures and their remedies, insect and disease management in protected structures; soil-less culture, use of protected structures for seed production.

Practical: Study of various types of structures; methods to control temperature; CO2; light; media; training and pruning; maintenance of parental lines and hybrid seed production of vegetables; fertigation and nutrient management; control of insect-pests and disease in greenhouse; economics of protected cultivation; visit to established green/polyhouse/net house/shade house in the region.

ASHE 3203. Protected fruit culture 2+1
Theory:
UNIT I: Greenhouse - world scenario, Indian situation: present and future, different agro-climatic zones in India, environmental factors and their effects on plant growth.

UNIT II: Basics of greenhouse design, different types of structures - glasshouse, shade net, poly tunnels - Design and development of low cost greenhouse structures.
UNIT III: Interaction of light, temperature, humidity, CO2, water on crop regulation, greenhouse heating, cooling, ventilation and shading.

UNIT IV: Types of ventilation- forced cooling techniques - glazing materials – microirrigation and fertigation.

UNIT V: Automated greenhouses, microcontrollers, waste water recycling, management of pest and diseases – IPM.

Practical: Designs of greenhouse; low cost poly tunnels; net house- regulation of light, temperature, humidity in greenhouses, media, greenhouse cooling systems; ventilation systems; fertigation systems, special management practices; project preparation for greenhouses; visit to greenhouses.

Track 2. Organic farming (O)

ASOE 2201.Organic Production Technology (3+0)

Organic Management – An Integrated Approach; Management Principals- Developing organic farm, conversion of soil to organic, Multiple cropping and crop rotation, Crop rotation, Seed/ Planting , material Treatment, Manuring and soil enrichment, Use of Biofertilizers and microbial cultures, .

Some important formulations for soil enrichment, Management of Temperature, Protection to all life forms and . Pest management. Some Other forms of Organic Management and Inputs

Biodynamic Agriculture, Rishi Krishi, Panchgavya Krishi, Natural farming, Eco Farming, Homa Farming and EM – Technology

References:
A.K Yadav. Organic Agriculture (Concept, Scenario, Principals and Practices)

ASOE 3102. Biofertilizers (2+1)

Course Outcomes: This course offers a wide scope for students in skill & entrepreneurship sectors.

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

ASOE 3203.Quality considerations, certification, labeling and accreditation processors, marketing, exports (3+0)

National standards for organic production, Guidelines for Organic Production and Processing , Package of Practices.
Organic Certification - Purpose of certification, The certification process, Certification system in India, National Programme on Organic Production, National Standards for Organic Production (NSOP), . Grower Group Certification System, Certification Procedure in brief, Conditions for Products used in fertilization and soil, conditioning in organic farming , Conditions for Products used in Plant pest and disease control

Accreditation, general and specific accreditation criteria, accreditation procedures, Marketing, exports

Track 3. Food processing (F)

Objectives: To impart an understanding of general process flow of various food products, physical principles of operation for various types of equipment and the impact of the processing on the physical, chemical and sensory properties of the food products

Course Outcomes: Upon completion students will be able to operate and maintain processing equipment and formulate and make processed food products

AS FE 2201. Processing Technology of Cereals

Theory

Present status and future prospects of cereals and millets; Morphology, physico-chemical properties of cereals, major and minor millets; Chemical composition and nutritive value; Paddy processing and rice milling: Conventional milling, modern milling, milling operations, milling machines, milling efficiency; Quality characteristics influencing final milled product; Parboiling;
Rice bran stabilization and its methods; Wheat milling: Break system, purification system and reduction system; extraction rate and its effect on flour composition; quality characteristics of flour and their suitability for baking; Corn milling: Dry and wet milling of corn, starch and gluten separation, milling fractions and modified starches; Barley: Malting and milling; Oat/Rye:
Processing, milling; Sorghum: Milling, malting, pearling; Millets (Pearl millets, finger millets): Processing of millets for food uses; Secondary and tertiary products processing of cereals and millets; By-products processing of cereals and millets; Processing of infant foods from cereals and millets; Breakfast cereal foods: Flaked, puffed, expanded, extruded and shredded.

Practical

Morphological characteristics of cereals; Physical properties of cereals; Chemical properties of cereals; Parboiling of paddy; Cooking quality of rice; Milling of rice; Conditioning and milling of wheat; Production of sorghum flakes; Production of popcorns, flaked rice, puffed rice, noodles; Preparation of sorghum malt; Determination of gelatinization temperature by amylograph; Processing of value added products from millets; Visit to Cereal processing unit.

Suggested Reading

Amalendu Chakraverty and R. Paul Singh. 2014. Post Harvest Technology and Food Process Engineering. CRC Press, Boca Raton, FL, USA.
Khalil Khan and Peter R. Shewry. 2009. Wheat: Chemistry and Technology, 4th Ed., AACC International, Inc., St. Paul, MN, USA.

ASFE 3102.Processing Technology of Legumes and Oilseeds

Theory

Present status and future prospects of legumes and oilseeds; Morphology of legumes and oilseeds; Classification and types of legumes and oilseeds; Chemical composition, nutritional value and anti-nutritional compounds in legumes and oilseeds; Methods of removal of anti nutritional compounds; Pulse milling: Home scale, cottage scale and modern milling methods, machines, milling quality, milling efficiency, factors affecting milling quality and quantity; Problems in dhal milling industry; Nutritional changes during soaking and sprouting of pulses; Cooking quality of dhal, methods, factors affecting cooking of dhal; Quick cooking dhal, instant dhal; Soybean milk processing and value addition; Fermented products of legumes; Oil seed milling: Ghanis, hydraulic presses, expellers, solvent extraction methods, machines, milling quality, milling efficiency, factors affecting milling quality and quantity; Problems in oil milling industry; Desolventization; Refining of oils: Degumming,

neutralization, bleaching, filtration, deodorization, their principles and process controls; Hydrogenation of oils; New technologies in oilseed processing; Utilization of oil seed meals for different food uses: High protein products like protein concentrates and isolates; By-products of pulse and oil milling and their value addition.

Practical

Determination of physical properties of legumes and oil seeds; Determination of proximate composition of selected pulses and oilseeds; Determination of nutritional quality of selected pulses and oilseeds; Study of mini dhal mill; Study of mini oil mill; Preconditioning of pulses before milling; Preconditioning of oilseeds before milling; Removal of anti-nutritional compounds from selected pulses and oilseeds; Laboratory milling of selected pulses and its quality evaluation; Laboratory milling of selected oilseeds and its quality evaluation; Laboratory refining of selected oils; Laboratory hydrogenation of selected oils; Study of cooking quality of dhal; Processing of composite legume mix and preparation of value added products; Visit to commercial dhal mills and oil mills.

Suggested Reading

Guriqbal Singh, Harbhajan Singh Sekhon, Jaspinder Singh Kolar and Masood Ali. 2005. Pulses. Agrotech Publishing Academy, Udaipur.

A. Chakraverty. 2008. Post Harvest Technology of Cereals, Pulses and Oilseeds, 3rd Ed. Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi.

K.M. Sahay and K.K. Singh. 2001. Unit Operations of Agricultural Processing, 2nd Ed. Vikas Publishing House Pvt. Ltd., Noida.

ASFE 3203.Processing Technology of Fruits, Vegetables , Spices and condiments

Theory

Production and processing scenario of fruits and vegetables in India and world; Scope of fruit and vegetable processing industry in India; Overview of principles and preservation methods of fruits and vegetables; Supply chain of fresh fruits and vegetables; Primary processing and pack house handling of fruits and vegetables; Peeling, slicing, cubing, cutting and other size reduction operations for fruits and vegetables; Minimal processing of fruits and vegetables; Blanching operations and equipment; Canning: Definition, processing steps, and equipment, cans and containers, quality assurance and defects in canned products; FSSAI specifications and preparation and preservation of juices, squashes, syrups, sherbets, nectars, cordials, etc.; Processing and equipment for above products; FSSAI specifications; Preparation, preservation and machines for manufacture of crystallized fruits and preserves, jam, jelly and marmalades, candies, Preparation, preservation and machines for manufacture of chutney, pickles, sauce, puree, paste, ketchup; toffee, cheese, lather, dehydrated, wafers and papads, soup powders; Production of pectin and vinegar; Commercial processing technology of selected fruits and vegetables for production of various value added processed products.

History, scope and importance, Present status, area and production, uses, export potential and role in national economy. Classification, soil and climate, propagation-seed, vegetative and micropropagation systems and methods of planting. Nutritional management, irrigation practices, weed control, mulching and cover cropping. Training and pruning practices, role of growth regulators, shade crops and shade regulation. Harvesting, post-harvest technology, packaging, storage, value added products, methods of extraction of essential oil and oleoresins. Economics of cultivation, role of Spice Board and Pepper. Export Promotion Council, institutions and research centers in R&D. Crops: Cardamom, pepper, betel vine ginger, turmeric, clove, nutmeg, cinnamon, all

spice, curry leaf, coriander, fenugreek, fennel, cumin, dill, celery, bishops weed, saffron, vanilla, thyme and rosemary.

Practical
Primary processing of selected fruits and vegetables; Canning of Mango/Guava/ Papaya; Preparation of jam from selected fruits; Preparation of jelly from selected fruits; Preparation of fruit marmalade; Preparation of RTS; Preparation of squash; Preparation of syrup; Preparation of raisins, dried fig and dried banana; Preparation of anardana; Preparation of papain; Preparation of pickles; Preparation of dried ginger; Preparation of dried onion and garlic; Preparation of banana and potato wafers; Preparation of dehydrated leafy vegetables; Visit to fruits and vegetables pack house, canning plant, vegetable dehydration plant.

Spices and Condiments: Fixing maturity standards, harvesting, curing, processing, grading and extraction of essential oils and oleoresins. Visit to commercial plantations.

Suggested Reading
U.D. Chavan and J.V. Patil. 2013. Industrial Processing of Fruits and Vegetables. Astral International Pvt. Ltd., New Delhi.
S. Rajarathnam and R.S. Ramteke. 2011. Advances in Preservation and Processing Technologies of Fruits and Vegetables. New India Publishing Agency, New Delhi.
R.P. Srivastava and Sanjeev Kumar. 2002. Fruit & Vegetable Preservation: Principles and Practices, 3rd Ed. International Book Distribution Co., Delhi.
Girdhari Lal, G.S. Siddappa and G.L. Tandon. 1959. Preservation of Fruits and Vegetables. ICAR, New Delhi.
Pruthi, J.S., 1980. *Spices and Condiments*. Academic Press, New York.

Track 4. Seed technology (S)

Objectives: To acquaint students with conventional and modern breeding methods and its viable application in varietal development

Course Outcomes:

At the end of this domain, students will enrich their Experiential Learning, practical knowledge and hands on training on emasculation and pollination technique for hybrid seed production and application of molecular marker in seed production

ASSE 2201. Breeding of Vegetable, Tuber and Spice Crops 3(2+1)

Theory
Breeding objectives and important concepts of breeding self pollinated, cross pollinated and vegetatively propagated crops. Plant genetic resources, their conservation and utilization in crop improvement. Breeding for insect resistance, breeding for disease resistance, breeding for abiotic resistance, male sterility and incompatibility and their utilization in development of hybrids.
Origin, distribution of species, wild relatives and forms of vegetable crops Tomato, Brinjal, Bhendi, Capsicum, Chilli, Cucurbits, Cabbage, Cauliflower, Tuber crops, Potato, Carrot, Radish, Spice crops (Ginger, Turmeric).Breeding procedures for development of hybrids/varieties in various crops. Genetic basis of adoptability and stability.

Practical

Floral biology and pollination mechanism in self and cross pollinated vegetables, tuber crops and spices. Working out phenotypic and genotypic heritability, genetic advance. GCA, SCA, combining ability, heterosis, heterobeltosis, standard heterosis, GxE interactions (stability analysis) Preparation and uses of chemical and physical mutagens. Polyploidy breeding and chromosomal studies. Techniques of F1 hybrid seed production. Maintenance of breeding records.

Suggested Reading:

Hari Hara Ram, 2013.*Vegetable Breeding: Principle and Practices***.** Kalyani Publishers. Ludhiana.
Vishnu Swaroop, 2014. *Vegetable Science &Technology in India*. Kalyani Publishers. Ludhiana.
Kallo.G, 1998. *Vegetable Breeding (Vol.I to IV).* CRC Press. Florida. 1988.
H.P. Singh, 2009.*Vegetable Varieties of India*. Studium Press (India) Pvt Ltd. New Delhi.
M.S. Dhaliwal. 2012**.** *Techniques of Developing Hybrids in Vegetable Crops***.** Agrobios. Jodhpur.
P.K.Singh, 2005. *Hybrid Vegetable Development*. CRC Press. Florida.
M.S.Dhaliwal, 2009. *Vegetable Seed Production & Hybrid Technology*. Kalyani Publishers.Ludhiana.

ASSE3102. Seed Production of Vegetable, Tuber and Spice Crops 3(2+1)

Theroy

Introduction and history of seed industry in India. Definition of seed, classes-types of seed. Differences between grain and seed. Importance and scope of vegetable seed production in India.
Principles of vegetable seed production. Role of temperature, humidity and light in vegetable seed production, land requirements, climate, season, planting time, nursery management, seed rate, rouging, seed extraction and storage of cole crops, root vegetables, solanaceous vegetables, cucurbits, okra, leafy vegetables, bulb crops, leguminous vegetables and exotic vegetables. Seed germination and purity analysis. Field and seed standards. Seed drying and extraction. Seed legislation.

Practical

Study of seed structure, colour size, shape and texture. Field inspection of seed crops. Practices in rouging. Harvesting and seed extraction. Germination and purity analysis. Methods of seed production, Seed certification in cole crops, root vegetables, bulb crops, solanaceous vegetables, cucurbits, okra, leafy vegetables, leguminous vegetables and exotic vegetables. Seed processing machines. Visit to seed production units.

Suggested Reading:

Agarwal, P. K. 2010. Techniques in Seed Science and Technology. South Asian Publishers. New Delhi.
Arya, Prem Singh. 2003. Vegetable seed Production Principles. Kalyani Publishers. Ludhiana.
Fageria, M. S. 2011. Vegetable Crops- Breeding and Seed Production. Kalyani Publishers. Ludhiana.
Geetharani, P. 2007. in Horticultural Crops. NPH Publications. Jodhpur.

Singh, Prabhakar.2015.Seed Production Technology of vegetable. Daya Publishing House. New Delhi

ASSE 3203. Seed quality testing

Theory

UNIT I: Introduction, structure of monocot and dicot seeds, seed quality, objectives, concept and components and their role in seed quality control, instruments, devices and tools used in seed testing. ISTA and its role in seed testing, seed sampling: definition, objectives, seed-lot and its size, types of samples, sampling devices, procedure of seed sampling, sampling intensity, methods of preparing 106 composite and submitted samples, sub-sampling techniques, dispatch, receipt and registration of submitted sample in the laboratory, sampling in the seed testing laboratory.

UNIT II: Physical purity: definition, objective and procedure, weight of working samples for physical purity analysis, components of purity analysis and their definitions and criteria, pure seed definitions applicable to specific genera and families, multiple seed units, general procedure of purity analysis, calculation and reporting of results, prescribed seed purity standards, determination of huskless seeds, determination of weed seed and other seed by number per kilogram, determination of other distinguishable varieties (ODV), determination of test weight and application of heterogeneity test.

UNIT III: Seed moisture content: importance of moisture content, equilibrium moisture content, principles and methods of moisture estimation - types, instruments and devices used, pre-drying and grinding requirements, procedural steps in moisture estimation,

UNIT IV: Germination: importance, definitions, requirements for germination, instrument and substrata required, principle and methods of seed germination testing, working sample and choice of method, general procedure for each type of method, duration of test, seedling evaluation, calculation and reporting
of results, dormancy: definition, importance, causal mechanisms, types and methods for breaking dormancy.

UNIT V: Viability and vigour testing: definition and importance of viability tests, different viability tests,quick viability test (TZ- test) - advantages, principles, procedure, vigour testing: concept, historical development, definitions, principles and procedures of different methods used for testing vigour.

UNIT VI: Genetic purity testing, objective and criteria for genetic purity testing, types of test, seedling and mature plant morphology, principles and procedures of chemical, biochemical and molecular tests.
UNIT VII: Seed health testing, field and seed standards , designated diseases, objectionable weeds - significance of seed borne disease vis-a-vis seed quality - seed health testing and detection methods for seed borne fungi, bacteria, viruses and nematodes, testing of GM seeds and trait purity, load of detection (LOD).

Practical: Structure of monocot and dicot seeds of important plant species; identification and handling of instruments used in seed testing laboratory; identification of seeds of weeds and crops; physical purity analysis of samples of different crops; estimation of seed moisture content (oven method) ; seed dormancy breaking methods requirements for conducting germination test, specifications and proper use of different substrata for germination; seed germination testing in different crops; seedling evaluation; viability testing by tetrazolium test(TZ) in different crops; seed and seedling vigour tests in various crops;
species & cultivar identification; genetic purity testing by chemical, biochemical and molecular methods; seed health testing for designated diseases, blotter methods, agar method and embryo count methods; testing coated/ pelleted seeds.

Track 5. Technology enabled agriculture (T)

Objectives: To impart practical knowledge on production of cutflowers, IoT based automation in polyhouse and mobile Apps and drone in precision farming

Course Outcomes: Students will be able to acquire skill of Production of cutflowers under protected cultivation and management of micro-climate under IoT based automated polyhouse

ASTE 2201. E agriculture (Elective) (2+1)

Course Outcomes: This course offers a wide scope for students in employment sectors (agribusiness companies & NGO's)

Unit I
ICTs projects, case studies in India and developing world. ICT use in the field of extension-Expert systems on selected crops and enterprises; Self learning CDs on package of practices,diseases and pest management, Agricultural web sites and portals related to crop productionand marketing etc.

Unit II
Community Radio, Web, Tele, and Video conferencing. Computer Aided Extension. Knowledge management, Information kiosks, Multimedia.Online and Offline Extension. Tools for Mobile technologies, learning concepts.

Unit III
ICT Extension approaches-pre-requisites, precision farming, Human resource information.Basic e-extension training issues, ICT enabled extension pluralism, emerging issues in ICT.

Unit IV
Cloud based extension approaches, Blog extension practices, voice enabled extension services, SWOT analysis of ICT based agriculture projects.
Recommended Books:

1. Batnakar S & Schware R. Information and Communication Technology in Development- Cases from India.Sage Publ.
2. Meera SN. ICTs in Agricultural Extension: Tactical to Practical.
3. Ganga-Kaveri Publ. House. JangamWadiMath, Varanasi.
4. Willem Zip. Improving the Transfer and Use of Agricultural Information - A Guide to Information Technology. The World Bank, Washington

ASTE 3102. Introduction and role of ICT in Agriculture (Elective) (2+1)

Course Outcomes: This course offers a wide scope for students in employment sectors (agribusiness companies & NGO's)

UNIT-I
Introduction & scope of ICT in Agriculture, Need for ICT in Agricultural Extension. National Policies on ICT in Agricultural Extension.

Role of communications in ICT: Concept, elements & their characteristics. Message: meaning,dimensions of a message characteristics of a good message, message treatment and effectiveness,distortion of message. Methods of communication: meaning and function. Forms of communication.Role of Mass Media in dissemination of farm technology. Modern communication media: electronic video, tele text, tele conference, computer assisted instruction.

UNIT-II

Telephone/Mobile Technology: Farmer Call Centre, SMS Broadcast Service, m-krishi. ICT initiatives of NGOs and Private Companies. ICT initiatives by ICAR and SAUs, Value AddedServices, Fisher Friend Project, SMS Services to farmers by Department of Agriculture.

UNIT-III

Practices of ICT for Agricultural Extension: aAQUA, Digital Green, e-Agrik (e-Agriculture), e-Sagu (e-cultivation), KISSAN (Karshaka Information Systems Service and Networking), Solutions through Information, VASAT-Virtual Academy for the Semi-Arid Tropics, Touch Screen Kiosk, e-Extension (e-Soil Health Card Program) Village

UNIT-IV

Village Knowledge Centre (VRC/VRC/CIC): Introduction, concept, process for setting VRC.Warana Wired Village Project, Web Portals: AGRISNET, DACNET, InDG, DEAL, i-KISAN, e-Krishi, ASHA, IFFCO- Agri-Portal, Agriwatch Portal, i-Shakti. ICTs for market information andAgri-Business: AGMARKNET, e-KRISHI VIPNAN, ICT-e-CHOPAL, EID Garry-Indiagriline.

Recommended Books:

1. G.L. Ray, 2006. Extension communication and management.Kalyani Publ.
2. A.S. Sandhu, 2004. Text book on Agricultural communication process and methods. Oxford & TBH.
3. R Saravanan, C Kathiresan& T Indra Devi, 2011. Information & communication technology for agriculture and rural development. New India Publ. Agency.
4. R Saravanan 2010. ICTs for agricultural extension, New India Publ. Agency.
5. B Jirli, Deepak De &GCKendadamth 2005. Information and communication technology (ICT) and sustainable development, Ganga Kaveri Publ. House, Varanasi.
6. Shaik N Meera, 2008. ICTs in agricultural extension tactical to practical. Ganga Kaveri Publ. House, Varanasi.

ASTE 3203. Remote sensing and GIS Techniques for soil, water and crop studies

Theory

UNIT I: Introduction and history of remote sensing, sources, propagation of radiations in atmosphere, interactions with matter.
UNIT II: Sensor systems - camera, microwave radiometers and scanners, fundamentals of aerial photographs and image processing and interpretations.
UNIT III: Application of remote sensing techniques - land use soil surveys, crop stress and yield forecasting, prioritization in watershed and drought management, wasteland identification and management.
UNIT IV: Significance and sources of the spatial and temporal variability in soils, variability in relation to size of sampling, classical and geo-statistical techniques of evaluation of soil variability.

UNIT V: Introduction to GIS and its application for spatial and non-spatial soil and land attributes.

Practical
Familiarization with different remote sensing equipments and data products; interpretation of aerial photographs and satellite data for mapping of land resources; analysis of variability of different soil properties with classical and geostatistical technique; creation of data files in a database program; use of GIS for soil spatial simulation and analysis; to enable the students to conduct soil survey and interpret soil survey reports in terms of land use planning.

6. Biotechnology (B)

Objectives: To impart basic knowledge of bioinformatics in *in silico* and genomics to the students studying agriculture.

Course Outcome: Students will be introduced to the basic concepts of Bioinformatics and its significance in Biological data analysis

ASBE 2201 Plant Biotechnology (2+1)

Theory

Unit I: Cell & tissue culture in plants; Callus Cultures; in vitro morphogenesis; organogenesis and embryogenesis; Artificial Seed Synthesis, Micropropagation (Clonal Propagation)

Unit II: Haploidy; Anther and Ovule Cultures, Embryo Cultures; Somatic Embryogenesis; Protoplast Isolation, Culture and Protoplast Fusion and Somatic Hybridization, Cybrids.

Unit III: Somaclonal Variation; In vitro Mutation Methods; Virus Elimination, Pathogen indexing; Cryopreservation; Production of Secondary Metabolites; Sources of plant secondary metabolites; Criteria for cell selection, Factors affecting the culture of cells; Biochemical pathways for the production of different secondary metabolites.

Unit IV: Biotransformation; Principles and methods of Genetic Engineering and its applications in agriculture. Methods for genetic transformation and transgenic plants production through *Agrobacterim tumefaciens* and *A. Rhiozogenes*; Gene Transfer methods in plants; PEG mediated, Microinjection, Particle Bombardment, Electroporation, Molecular Markers and their Importance in Plant Breeding. Biotechnology and Intellectual Property Rights (IPR); Plant Genetic Resources; Patent For Higher Plant Genes and DNA Sequence.

Practical:
Micropropagation (Clonal Propagation), Factors affecting micropropagation, Sterilization and laboratory techniques, Anther and Ovule Cultures, Embryo Cultures; Somatic Embryogenesis; Protoplast Isolation, Culture and Protoplast Fusion, Cryopreservation; Production of Secondary Metabolites; Sources of plant secondary metabolites; Criteria for cell selection. Visit to Plant tissue culture industries.

References:

1. Biotechnology in crop improvement – H S Chawla.
2. Practical application of plant molecular biology – R J Henry, Chapman & Hall.
3. Elements of biotechnology – P K Gupta.
4. An introduction to plant tissue culture – M K Razdan.
5. Plant propagation by tissue culture : The technology (Vols. 1 & 2) – Edwin George.
6. Handbook of plant cell culture (Vols. 1 to 4) – Evans et. al., Macmillan.
7. Plant tissue and cell culture – H E Street, Blackwell Scientific.
8. Plant cell culture technology – M M Yeoman.
9. Plant tissue culture and its biotechnological applications – W Bary, et. al., Springer Verlag.
10. Principles of plant biotechnology: An introduction to genetic engineering in plants – S H Mantel, et al.

ASBE 3102. Genetic Engineering And Bioinformatics (2+1)

Theory

Unit I: Genetic Engineering Introduction to the scope of genetic engineering. Overview of the principles and progress in genetic engineering. Basic steps involved in recombinant DNA technology: Isolation of DNA from various sources, fragmentation methods, ligation strategies, introduction of the chimeric DNA into various host cells and selection and screening of recombinant clones.

Unit II: DNA sequencing and sequence assembly. MaxamGilbert's and Sanger's methods, Shot gun sequencing, sequencing strategies for large genomes.

Unit III: DNA mapping and DNA fingerprinting: Physical and molecular mapping, Hybridization and PCR based methods of fingerprinting. Site directed mutagenesis: Methods and applications.

Unit IV: Introduction to Bioinformatics: Overview, Internet and bioinformatics, Applications Databases.

Unit V: Protein Computational Biology: Structural classification of proteins, structure alignment and comparison and Protein Structure prediction, Active site prediction, Protein modeling, molecular basis of evolution, Phylogenetic trees & different methods for phylogenetic inference.

Practical:

Databases in Bioinformatics, various biological databases, Protein and Nucleotide sequence Data bases. Protein sequence, structure and Classification databases Sequence analysis: Pair-wise alignment, local and global alignment, Drug design Phylogenetic analysis, Multiple sequence alignment, Gene prediction: Gene prediction methods: Signal sites Predictions

Reference Books:

1. Bioinformatics: A Beginners Guide, Clavarie and Notredame
2. Bioinformatics: David Mount
3. Bioinformatics: Rastogi
4. Cell culture and somatic cell genetics of plants (Vols. 1 to 3) – A K Vasil, A. Press.
5. Introduction to Bioinformatics:Arthur M. Lesk

ASBE 3203. Plant Molecular Biology (2+1)

Theory

Unit I: Plant Development -- Model systems; Developmental differences between plant models and other models; Early plant embryogenesis. Patterning and molecular mechanisms of differentiation.

Unit II: Interaction of Plants with Pathogens -- Organization, functions and dynamics of Pathogenes; Associated promoters; RNA-interference and viral infections; Pathogens and their role in pathogenesis; Pathogen-induced gene silencing; Development of transgenic and biotic resistance in crops.

Unit III: Plant Biotechnology and Production of Transgenics for Resistance to Varied Abiotic Stresses -Conventional plant breeding, molecular breeding and transgenic science; Tools and techniques for production of transgenic plants; Developing transgenic plants for resistance/tolerance to abiotic stresses.

Unit IV: Molecular Breeding and IPR-related Issues -- Molecular markers; Marker-assisted breeding (MAB) and molecular-assisted selection (MAS); IPR-related issues, trade marks, copy rights, patents, geographical indicators.

Unit V: Forefronts of Calcium Signal Transduction in Plants -- Calcium as "Hub and Nodal point" in multiple signaling (biotic and abiotic stress); Development of calcium signaling networks with advanced tools and techniques.

Practical:

DNA isolation from plants, Purification and amplification by PCR techniques, Agarose gel electrophoresis; Different types of PCRs and gel electrophoresis; Ions Signaling and homeostasis analysis; Transgenic methods and applications vs Breeding methods and applications.

Reference Books:

Sambrook J, DW Russell, T Maniatis. 2001. Molecular Cloning: a Laboratory Manual. Cold Spring Harbor, N.Y. : Cold Spring Harbor Laboratory Press, c2001. 3rd Edition. 3 vol.
Ausubel F [et al.]. 2001. Current Protocols in Molecular Biology. New York: John Wiley & Sons. 5 volumes. (loose-leaf).

Track course AELP (A) (9 credits for three courses)

Track 1: Hi-tech horticulture (H)

ASHA 4204.Production technology of cut flowers (0+3)

Practical

Description of varieties, propagation techniques, mist chamber operation, training and pruning techniques, practices in manuring, drip and fertigation, foliar nutrition, growth regulator application, pinching, disbudding, staking, harvesting techniques, post-harvest handling, cold chain, project preparation for regionally important cut flowers, visit to commercial cut flower units and case study.

Suggested Readings

Arora JS. 2006. *Introductory Ornamental Horticulture*. Kalyani.
Bhattacharjee SK. 2006. *Advances in Ornamental Horticulture*. Vols. I-VI. Pointer Publ.
Bose TK & Yadav LP. 1989. *Commercial Flowers.* Naya Prokash.

Chadha KL & Chaudhury B. 1992. *Ornamental Horticulture in India*. ICAR.
Reddy S, Janakiram B, Balaji T, Kulkarni S & Misra RL. 2007. *High tech Floriculture.* Indian Society of Ornamental Horticulture, New Delhi.

ASHA 4205. Protected floriculture (0 + 3)

Practical

Study of various protected structures, practices in design, layout and erection of different types of structures, practices in preparatory operations, soil decontamination techniques, practices in environmental control systems, practices in drip and fertigation techniques, special horticultural practices, determination of harvest indices and harvesting methods, post-harvest handling, packing methods, project preparation, visit to commercial greenhouses.

Suggested Readings

Bhattacharjee SK. 2006. *Advances in Ornamental Horticulture*. Vols. I-VI. Pointer Publ.
Bose TK & Yadav LP. 1989. *Commercial Flowers.* Naya Prokash.
Prasad S & Kumar U. 2003. *Commercial Floriculture.* Agrobios
Randhawa GS & Mukhopadhyay A. 1986. *Floriculture in India*. Allied Publ.
Reddy S, Janakiram B, Balaji T, Kulkarni S & Misra RL. 2007. *High tech Floriculture.* Indian Society of Ornamental Horticulture, New Delhi.

ASHA 4206. Value addition in flowers (0+3)

Practical

Practices in preparation of bouquets, button-holes, flower baskets, corsages, floral wreaths, garlands with fresh flowers; Techniques in flower arrangement; Techniques in floral decoration; Identification of plants for dry flower making; Practices in dry flower making; Preparation of dry flower baskets, bouquets, pot-pourri, wall hangings, button holes, greeting cards, wreaths, etc.; Visit to dry flower units, concrete and essential oil extraction units.

Suggested Readings

Bhattacharjee SK. 2006. *Advances in Ornamental Horticulture*. Vols. I-VI. Pointer Publ.
Chadha KL.1995. *Advances in Horticulture*. Vol.XII. Malhotra Publ. House.
Prasad S & Kumar U. 2003. *Commercial Floriculture.* Agrobios.
Reddy S, Janakiram B, Balaji T, Kulkarni S & Misra RL. 2007. *Hightech Floriculture.* Indian Society of Ornamental Horticulture, New Delhi.

AELP -11 credits

Protected cultivation of flowers /vegetable crops / quality planting materials -Practice

Track 2. Organic farming (O)

ASOA 4204. Production of bio pesticides and bio fertilizers (0+3)

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

BAOA 4205. Organic production - field crops (0+3)

Practical :
Features of organic orchards; working out conversion plan; input analysis; manures, nutrient status assessment of manures, biocomposting, biofertilizers and their application; panchagavya preparation and other organic nutrients application; preparation of neem products and application; BD preparations and their role; EM technology and products; biological/natural control of pests and diseases; soil solarisation; frame work for GAP, case studies, HACCP analysis; residue analysis in organic products; documentation for certification; visit to fields cultivated under organic practices

ASOA 4206. Organic production - horticulture crops (0+3)

Practical: Method of preparation of compost; vermicomposting; biofertilizers; soil solarization; bio pesticides in horticulture; green manuring, mycorrhizae and organic crop production; waster management; organic soil amendment for root disease; weed management in organic horticulture; visit to organic fields and marketing centers.

AELP 11 credits

Organic crop Production -practice

Track 3. Food processing (F)

ASFA 4204.Food Packaging Technology and Equipment (0+3)

Practical

Classification of various packages based on material and rigidity; Measurement of thickness of paper, paper boards; Measurement of basic weight and grammage of paper and paperboards; Measurement of water absorption of paper, paper boards; Measurement of bursting strength of paper, paper boards; Measurement of tear resistance of papers; Measurement of puncture resistance of paper and paperboard; Measurement of tensile strength of paper, paper boards; Measurement of grease resistance of papers; Determination of gas and water transmission rate of package films; Determination of laquer integrity test; Drop test, Box compression test; Identification of plastic films; Determination of seal integrity, ink adhesion; packaging practices followed for packing fruits and vegetables; Shelf life calculations for food products; Head space analysis of packaged food; Study of vacuum packaging machine, bottle filling machine and form-fill-seal machine.

Suggested Reading

Gordon L. Robertson. 2014. Food Packaging: Principles and Practice, 3rd Ed. CRC Press, Boca Raton, FL, USA.
Gordon L. Robertson. 2010. Food Packaging and Shelf Life – A Practical Guide. CRC Press, Boca Raton, FL, USA.
Richard Coles, Berek McDowell and Mark J. Kirwan. 2003. Food Packaging Technology. Blackwell Publishing Ltd., Oxford, UK

ASFA 4205. Processing of Spice and Condiments (0+3)

Practical

Identification and characterization of flavouring compounds of spices; Valuable oil determination; Extraction of oil from clove, pepper, cardamom, chilli; Extraction of oleoresins: Turmeric, ginger, pepper, clove; Peperine estimation in pepper oleoresin; Steam distillation of spices; Determination of curcumin content in turmeric; Chemical analysis of spices: Moisture, valuable oil, specific gravity, refractive index, acid value; Study of standard specification of spices; Packaging study of spices; Preparation of curry powder; Visit to spice industry.

Condiments
Curing, processing, grading and extraction of essential oils and oleoresins. Visit to commercial plantations.

Suggested Reading

K.G. Shanmugavelu. Spices and Plantation Crops. Oxford & IBH Publishing Co., New Delhi
J.S. Pruthi. 2001. Spices and Condiments – Major Spices of India. National Book Trust, New Delhi.
J.S. Pruthi. 2001. Spices and Condiments – Minor Spices of India. National Book Trust, New Delhi.
H. Panda. Handbook on Spices and Condiments (Cultivation, Processing and Extraction). Asia Pacific Business Press Inc., New Delhi.
S. Gupta. Handbook of Spices and Packaging with Formulae. Engineers India Research Institute, New Delhi.

ASFA 4206.Food quality, Safety and Standards (0+3)
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.

AELP- 11 credits

Preparation of processed foods , Food Preservation and Storage - practice

4.Seed technology (S)

ASSA 4204. Seed production technology of vegetable crops (0+3)

Practical:

Seed sampling; seed testing (genetic purity, seed viability, seed vigour, physical purity evaluation, release and notification procedures of varieties in India; floral biology; practices in rouging; methods of hybrid seed production in important vegetable crops; seed extraction techniques; handling of seed processing and seed testing equipments; testing of vegetable seeds for seed purity; germination; vigour and health; visit to seed processing units; seed testing laboratory and seed production farms.

ASSA 4205.Seed processing and storage (0+3)

Practical:

Operation and performance evaluation of various seed processing equipments such as pre cleaner; scalpers; air screen cleaner; indented cylinder, gravity separator; pneumatic separator; colour sorter and other equipments; seed treater; conveyors and elevators, bag closers; different types of dryers; design and layout of seed processing plant and its economics; analysis of cost of operation and processing; determination of seed moisture; seed germination and vigour.

ASSA 4206. Cultivar purity and quality testing (0+3)

Practical: Objectives of cultivar purity test; general principles and methods; use and limitations of laboratory; greenhouse and field plot methods; morphological characters of seed; seedling and adult plants of major crops; physiological, chemical and biochemical tests for varietal purity such as phenol and peroxidase; electrophoresis of protein and isozymes; DNA fingerprinting and their use in varietal registration and purity; use of computer based machine vision for varietal identification; DUS testing; varietal purity testing by grow-out test in different cereals; pulses; oilseeds and vegetable crops of the state; study of diagnostic seed traits in different crops; electrophoresis in hybrid seeds and its comparison with GOT; use of other laboratory tests viz.; KOH-Bleach; FeSO4; fluroescence tests etc.

AELP- 11 credits

Seed processing - practice

Track 5. Technology enabled agriculture (T)

AELP (9 credits)

ASTA 4204.Hydroponics (Soilless Culture) (0+3)

Practical:

1.Study of Significance of Soilless Culture in Agriculture
2. Functions of the Root System
3. Physical Characteristics of Soilless Media
4. Irrigation in Soilless Production
5. Technical Equipment in Soilless Production Systems
6 .Chemical Characteristics of Soilless Media
7 .Analytical Methods Used in Soilless Cultivation
8. Nutrition of Substrate-grown Plants
9. Fertigation Management and Crops Response to Solution Recycling in Semi-closed Greenhouses
10. Pathogen Detection and Management Strategies in Soilless Plant Growing Systems

11. Organic Soilless Media Components
12. Inorganic and Synthetic Organic Components of Soilless Culture and Potting Mixes

13. Growing Plants in Soilless Culture

References

Soilless Culture: Theory and Practice,1st Edition .2017.Editors: Michael Raviv J. Heinrich Lieth

ASTA 4205. Mushroom, Apiary and sericulture production technology (0+3)

Practical:

Preparation of spawn; compost, spawning; casing; harvesting and postharvest handling of edible mushroom; identification of various pathogens; competitors of various mushrooms.

Honey bee colony, different bee hives and apiculture equipment. Summer and Winter management of colony. Honey extraction and bottling. Study of pests and diseases of honeybees.

Establishment of mulberry garden. Preparation of mulberry cuttings, planting methods under irrigated and rainfed conditions. Maintenance of mulberry garden-pruning, fertilization, irrigation and leaf harvest. Mulberry pests and diseases and their management and nutritional disorders. Study of different kinds of silkworms and mulberry silkworm morphology, silk glands. Sericulture equipments for silkworm rearing. Mulberry silkworm rearing room requirements. Rearing of silkworms-chalky rearing. Rearing of silkworms late age silkworm rearing and study of mountages. Study of silkworm pests and their management. Study of silkworm diseases and its management.

ASTA 4206. Protected Cultivation (0+3)

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.

AELP -11credits

Practicing Hydroponics

6. Biotechnology (B)

AELP (9 Credits)

ASBA 4204. Plant Biotechnology and Phytotronics (0+3)

Practical:

Unit I: Cell & tissue culture techniques in plants; Callus Cultures; Techniques of organogenesis; Artificial Seed Synthesis, Micropropagation (Clonal Propagation) and steps involved.

Unit II: Haploid production by Anther and Ovule Cultures, Embryo Cultures; Protoplast Isolation, Culture and Protoplast Fusion.

Unit III: Cryopreservation techniques; Production of Secondary Metabolites; Sources of plant secondary metabolites; Criteria for cell selection, Factors affecting the culture of cells.

Unit IV: Gene Transfer methods in plants; Enzymatic methods and Mechanical methods, PEG mediated, Microinjection, Particle Bombardment, Electroporation, Molecular Markers and their Importance in Plant Breeding.

Unit V: Phytotronics Technologies - Artificial conditions, Growth and Analysis; Different types; Applications.

References:

1 Biotechnology in crop improvement – H S Chawla.
2 Practical application of plant molecular biology – R J Henry, Chapman & Hall.
3 An introduction to plant tissue culture – M K Razdan.
4 Plant propagation by tissue culture : The technology (Vols. 1 & 2) – Edwin George.
5 Handbook of plant cell culture (Vols. 1 to 4) – Evans et. al., Macmillan.
6 Plant tissue and cell culture – H E Street, Blackwell Scientific.
7 Plant cell culture technology – M M Yeoman.
8 Plant tissue culture and its biotechnological applications – W Bary, et. al., Springer Verlag.

ASBA 4205. Industrial Biotechnology (0+3)

Practical:

Unit I: Introduction To Industrial Bioprocess: Fermentation- Bacterial, Fungal and Yeast, Biochemistry of fermentation. Traditional and Modern Biotechnology- A brief survey of organisms, processes, products. Basic concepts of Upstream and Downstream processing in Bioprocess, Process flow sheeting – block diagrams, pictorial representation.

Unit II: Production Of Primary Metabolites: Primary Metabolites- Production of commercially important primary metabolites like organic acids, amino acids and alcohols.

Unit III: Production Of Secondary Metabolites: Secondary Metabolites- Production processes for various classes of secondary metabolites: Antibiotics, Vitamins and Steroids.

Unit IV: Production Of Enzymes And Other Bioproducts: Production of Industrial Enzymes, Biopesticides, Biofertilizers, Biopreservatives, Biopolymers Biodiesel. Cheese, Beer, SCP & Mushroom culture, Bioremediation.

Unit V: Production Modern Biotechnology Products: Production of recombinant proteins having therapeutic and diagnostic applications, vaccines. Bioprocess strategies in Plant Cell and Animal Cell culture.

Reference Books:

1. Satyanarayana, U. “Biotechnology” Books & Allied (P) Ltd., 2005.
2. Kumar, H.D. “A Textbook on Biotechnology” 2 nd Edition. Affiliated East West Press Pvt. Ltd., 1998.
3. Balasubramanian, D. etal., “Concepts in Biotechnology” Universities Press Pvt.Ltd., 2004.

4. Ratledge, Colin and Bjorn Kristiansen “Basic Biotechnology” 2 nd Edition Cambridge University Press, 2001.
5. Dubey, R.C. “A Textbook of Biotechnology” S.Chand & Co. Ltd., 2006.

ASBA 4206. Microbial Biotechnology (0+3)

Practical:

Unit I: General concept of Microbial Biotechnology; Fermentation and its economics

Unit II: Microbial production of various products like Antibiotics: penicillin, streptomycin Enzymes: proteases, amylases Organic acids: Citric acid, acetic acid Vitamins: Vit B12, B2 Amino acids: Glutamic acid, Lysine Ergot Alkaloids Industrial Alcohol, Beer and wine Microbial Exopolysaccharides: Xanthan, Alginate Single cell protein from bacteria, fungi and algae.

Unit III: Nutritional value and safety. Single cell oil Microbial Flavours: Diacetyl, Methyl ketones, Terpenes, Vanillin Fermented food and dairy products: Starter cultures, science and technology of bread, cheese and yogurt manufactrure.

Unit IV: Edible Mushrooms: Cultivation of edible and medicinal mushrooms. Bioplastics. Biotransformations of steroids.

Reference Books:

1. Biotechnology: Rehm and Reid.
2. Comprehensive biotechnology: Murray Moo Young.
3. Microbial Techonology: Pepler
4. Microbiology and technology of fermented foods: R. W. Hutkins. Blackwell pubshing. Topic related review papers

AELP -11 credits -Practice

Molecular genetics and genomics: (0+11)

Unit I: GENOME ANATOMIES: Genomes, Transcriptomes and Proteomes, The Plant Genome, Why is the Genome Projects are Important? How genes work, Gene-protein relations, Genetic fine structure, Mutational sites Complementation

Unit II: GENOME MAPPING AND COMPARISION: Mapping Genomes, Genetic and Physical Maps, Sequencing Genomes, the Methodology for DNA Sequencing, Assembly of a Contiguous DNA Sequence, understanding a Genome Sequence, Locating the Genes in a Genome Sequence, Determining the Functions of Individual Genes, Global Studies of Genome Activity, comparative genomics

Unit III: GENOME EXPRESSION AND REGULATION: How Genomes Function, Accessing the Genome, Inside the Nucleus, Chromatin Modifications and Genome Expression, Assembly of the Transcription Initiation Complex, The Importance of DNA-binding Protein-DNA-Protein Interactions During Transcription. Initiation-Regulation of Transcription, Synthesis and Processing of the Proteome, The Role of tRNA in Protein Synthesis, The Role of the Ribosome in Protein Synthesis, Post-translational Processing of Proteins, Protein Degradation. RNA polymerase II, Cofactors, Core

promoter elements in Transcription, Transcriptional Activators, Repressors, Cytokine regulated transcription, Nuclear receptors, HOX genes, NF-κB. Methods for gene expression analysis; DNA array for global expression profile; Types of DNA arrays, Array databases; Applications of DNA microarray

Unit IV: Genomic DNA Isolation and PCR Amplification; Contig Assembly; DNA Sequencing; Genome Mapping, QTL Mapping – RFLP, RAPD, Detection Of SNPs and Physical Mapping of the Genome.

Reference Books:

1. Primrose S.B. and Twyman R.M, "Principles of Gene Manipulation and Genomics", Blackwell Publishing Company, Oxford, UK, Seventh Edition, 2006.
2. Sahai S. "Genomics and Proteomics", Functional and Computational Aspects, Kluwer Academic Publishers, New York, 2002.