

PROGRAMME: B.Sc. (HONS.) AGRICULTURE

SEMESTER WISE DISTRIBUTION OF COURSES

First Semester

S. N.	Course Code	Course Title	Credit Hrs.
1.	HORT-111	Fundamentals of Horticulture	2(1+1)
2.	BIOCHEM-111	Fundamentals of Plant Biochemistry and Biotechnology	3(2+1)
3.	SSAC-111	Fundamentals of Soil Science	3(2+1)
4.	HORT-112	Introduction to Forestry	2(1+1)
5.	ENG-111	Comprehension & Communication Skills in English	2(1+1)
6.	AGRON-111	Fundamentals of Agronomy	4(3+1)
7.	GPB-111/ MATHS-111	Introductory Biology* / Elementary Mathematics*	2(1+1)*/ 2(2+0)*
8.	AGHR-111	Agricultural Heritage*	1(1+0)*
9.	EXCOM-111	Rural Sociology & Educational Psychology	2(2+0)
10.	EXCOM-112	Human Values & Ethics**	1(1+0)**
11.	NSS/NCC	NSS/NCC**	2(0+2)**
	Total		18+03*+03**

*R: Remedial course; **NC: Non-gradual courses

Note: Students passed out 10 + 2 with Biology/Agriculture have to opt MATH-111 and who have MATHS in 10 + 2 will have to offer Biology. However, if student have studied both (Biology and Math in 10 + 2), may opt anyone.

Second Semester

S. N.	Course Code	Course Title	Credit Hrs.
1.	GPB-121	Fundamentals of Genetics	3(2+1)
2.	SSAC-121	Agricultural Microbiology	2(1+1)
3.	AGENGG-121	Soil and Water Conservation Engineering	2(1+1)
4.	CPHYS-121	Fundamentals of Crop Physiology	2(1+1)
5.	AGECON-121	Fundamentals of Agricultural Economics	2(2+0)
6.	PPATH-121	Fundamentals of Plant Pathology	4(3+1)
7.	ENTO-121	Fundamentals of Entomology	4(3+1)
8.	EXCOM-121	Fundamentals of Agricultural Extension Education	3(2+1)
9.	EXCOM-122	Communication Skills and Personality Development	2(1+1)
10.	NSS/NCC	NSS/NCC** (Continue)	2(0+2)**
		Total	24(16+8)+2**

Third Semester

S. N.	Course Code	Course Title	Credit Hrs.
1.	AGECON-211	Agricultural Finance and Cooperation	3(2+1)
2.	AGENGG-211	Farm Machinery and Power	2(1+1)
3.	AGRINFO 211	Agri- Informatics	2(1+1)
4.	AGRON-211	Crop Production Technology – I (<i>Kharif</i> Crops)	2(1+1)
5.	ANISC-211	Livestock and Poultry Management	4(3+1)
6.	ESDM-211	Environmental Studies and Disaster Management	3(2+1)
7.	GPB-211	Fundamentals of Plant Breeding	3(2+1)
8.	HORT-211	Production Technology for Vegetables and Spices	2(1+1)
9.	STAT-211	Statistical Methods	2(1+1)
10.	NSS/NCC	NSS/NCC ** (Continue)	2(0+2)**
			23(14+9) +2**

Fourth Semester

S. N.	Course Code	Course Title	CreditHrs.
1.	AGRON-221	Crop Production Technology -II (<i>Rabi</i> Crops)	2(1+1)
2.	HORT-221	Production Technology for Ornamental Crops, MAP and Landscaping	2(1+1)
3.	AGENGG-221	Renewable Energy and Green Technology	2(1+1)
4.	SSAC-221	Problematic Soils and their Management	2(2+0)
5.	HORT-222	Production Technology for Fruit and Plantation Crops	2(1+1)
6.	GPB-221	Principles of Seed Technology	3(1+2)
7.	AGRON-222	Farming System & Sustainable Agriculture	1(1+0)
8.	AGECON-221	Agricultural Marketing Trade and Prices	3(2+1)
9.	AGRON-223	Introductory Agro-Meteorology & Climate Change	2(1+1)
10.	AGECON-222	Agribusiness Management (Elective Course)	3(2+1)
11.	NSS/NCC	NSS (Complete)/ NCC **	2(0+2)**
			22 (13+9)+2**

FifthSemester

S. N.	Course Code	Course Title	Cr. Hrs.
1.	PPATH-311	Principles of Integrated Pest and Disease Management	3(2+1)
2.	SSAC-311	Manures, Fertilizers and Soil Fertility Management	3(2+1)
3.	ENTO-311	Pests of Crops and Stored Grains and their management	3(2+1)
4.	PPATH-312	Diseases of Field and Horticultural Crops and their Management - I	3(2+1)
5.	GPB-311	Crop Improvement-I (<i>Kharif</i> Crops)	2(1+1)
6.	EXCOM-311	Entrepreneurship Development and Business Communication	2(1+1)
7.	AGRON-311	Geoinformatics and Nano-technology and Precision Farming	2(1+1)
8.	AGRON-312	PRACTICAL Crop Production-I (<i>Kharif</i> crops)	2(0+2)
9.	GPB-312	Intellectual Property Rights	1(1+0)
10.	EXCOM-312	Agricultural Journalism (Elective Course)	3(2+1)
11.	NCC	NCC **	2(0+2)**
		Total	24(14+10)+2**

SixthSemester

S. N.	Course Code	Course Title	Cr. Hrs.
1	AGRON-321	Rainfed Agriculture & Watershed Management	2(1+1)
2	AGENGG-321	Protected Cultivation and Secondary Agriculture	2(1+1)
3	PPATH-321	Diseases of Field and Horticultural Crops and their Management-II	3(2+1)
4	HORT-321	Post-harvest Management and Value Addition of Fruits and Vegetables	2(1+1)
5	ENTO-321	Management of Beneficial Insects	2(1+1)
6	GPB-321	Crop Improvement-II (<i>Rabi</i> crops)	2(1+1)
7	AGRON-322	Crop Production-II (<i>Rabi</i> crops)	2(0+2)
8	AGRON-323	Principles of Organic Farming	2(1+1)
9	AGECON-321	Farm Management, Production & Resource Economics	2(1+1)
10	HORT-322	Principles of Food Science and Nutrition	2(2+0)
11	HORT 323	Hi-tech Horticulture (Elective Course)	3(2+1)
12	NCC	NCC ** (Complete)	2(0+2)**
			24(13+11)+ 2**

Seventh Semester

S. N.	Course Code	Course Title		
	READY-411	Rural Agricultural Work Experience and Agri- Industrial Attachment (RAW&AIA)		
		Activities	No. of weeks	Cr. Hrs
1.	(i)	General orientation & On campus training by different faculties	1	16
	(ii)	(a) Unit attachment in- University/ College/KVK/ Research Station Attachment	5	
		(b) Village attachment	8	
	(iii)	Plant clinic	2	
2.	(i)	Agro-Industrial Attachment	3	04
	(ii)	Project Report Preparation, Presentation and Evaluation	1	
		Total of RAW&AIA	20	20

- **Agro- Industrial Attachment:** The students would be attached with the agro-industries for a period of 03 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.

Eighth Semester

S. N.	Course Code	Course Title	Cr. Hrs.
1.	READY-421(ELP-I)	Production technology for bioagents & Biofertilizer	0+10
		Commercial Beekeeping	
		Organic Production Technology	
		Seed Production and Technology	
		Food Processing	
		Soil, Plant, water and seed testing	
		Agriculture waste management	
		Mushroom cultivation Technology	
		Poultry Production Technology	
		Commercial Horticulture	
		Floriculture and Land scaping	
Commercial Sericulture			
2.	READY-422(ELP-II)	Soil, Plant, water and seed testing	0+10
		Food Processing	
		Seed Production and Technology	
		Organic Production Technology	
		Commercial Beekeeping	
		Production technology for bioagents & Biofertilizer	
		Agriculture waste management	
		Mushroom cultivation Technology	
		Poultry Production Technology	
		Commercial Horticulture	
		Floriculture and Land scaping	
Commercial Sericulture			
		Total	0+20

Note: ELP I and II will not be same for any student.

Semester wise breakup of credit hours

Semester no.	Regular course	Remedial course	Non-gradial course	Elective course	RAWE	ELP	Total credit hours
I	18	3	3				24
II	24						24
III	23						23
IV	22			3			22
V	21			3			24
VI	21			3			24
VII					20		20
VIII						20	20
Total Credi Load for Degree Programme							181

Basket of Elective courses

Title	Cred Hrs.
Agribusiness Management	3(2+1)
Agrochemicals	3(2+1)
Agricultural Journalism	3(2+1)
Bio pesticides and Bio fertilizers	3(2+1)
Commercial Plant Breeding	3(1+2)
Food Safety and Standards	3(2+1)
Hi-tech Horticulture	3(2+1)
Landscaping	3(2+1)
Micro propagation Technologies	3(1+2)
Protected Cultivation	3(2+1)
System Simulation and Agro advisory	3(2+1)
Weed Management	3(2+1)

HORT-111

Fundamentals of Horticulture

2(1+1)

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

PRACTICAL

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

Suggested Reading:

1. Chadha, K.L. 2002 Handbook of Horticulture, ICAR, NewDelhi
2. Salunkhe D.K. and Kadam S.S. (2013) A handbook of Fruit Science and Technology CRC Press
3. Singh, J. 2011 Basic Horticulture, Kalyani Publications, New Delhi
4. Peter, K.V. 2009 Basics Horticulture, New India Publishing Agency
5. Misra, K.M. and Kumar, R (2014) Fundamentals of Horticulture, Biotech Books
6. Kumar, N. 1990 Introduction to Horticulture, Rajyalakshmi publications, Nagarcoil, Tamilnadu
7. Singh, N.P. 2005 Basic concepts of Fruit Science, IBDC Publishers
8. Prasad, S. and Kumar, U. (2010) A handbook of Fruit Production, Agrobios (India)
9. Singh, H.P. 2005 Advances in Horticulture Biotechnology Vol.-7: Diagnostics for Horticulture crops Westville
10. Swain, S. 2010 Precision Farming in Horticulture: Approaches and Strategies, NPH
11. Sharma, N. 2006 Biometrical methods in Horticultural Sciences, NIPA

BIOCHEM-111

Fundamentals of Plant Biochemistry and Biotechnology

3(2+1)

THEORY

Importance of Biochemistry; Properties of Water, pH and Buffer. Carbohydrate: Importance and Classification, Reducing and Nonreducing sugars, Structures and properties of Monosaccharides, Disaccharides and Polysaccharides. Lipid: Importance and classification, Structures and properties of fatty acids including membrane lipids. Proteins: Importance and classification, Structures, titration and zwitter ion nature of amino acids, Structural organization of proteins. Vitamins- Introduction, Classification and functions Enzymes: General properties, Classification, Mechanism of action, Allosteric enzymes. Nucleic acids: Importance and classification, Structure of Nucleotides, Secondary and Tertiary structures. Metabolism of carbohydrates including Glycolysis, TCA cycle and

Electron Transport Chain. Metabolism of lipids: Beta oxidation and Biosynthesis. Plant Biotechnology: Concepts, Scope and applications. Scope and applications of organ cultures, embryo, cell suspension, callus, anther, pollen and ovule culture. Micro-propagation methods: Organogenesis, Embryogenesis, Synthetic seeds and their significance; Embryo rescue and its significance, Somatic hybridization and cybrids. Soma clonal variation and its use in crop improvement and Cryo-preservation. Introduction to recombinant DNA methods: Physical (Gene gun method), chemical (PEG mediated) and Agrobacterium mediated gene transfer methods. Transgenics: PCR techniques and its applications including Molecular Markers in crop improvement.

PRACTICAL

Preparation of solution, pH & buffers, Qualitative tests of carbohydrates and amino acids. Quantitative estimation of glucose/ proteins. Estimation of amino acids/lipids, Paper chromatography/ TLC demonstration for separation of amino acids/ Monosaccharides. Sterilization techniques. Demonstration of isolation of DNA and gel electrophoresis techniques.

Suggested Readings:

1. Chawla, H. S. 2002. Introduction to Plant Biotechnology. 2nd Edn, Oxford IBH Publishing New Delhi.
2. Goodwin, T. W. and Mercer, E. L. 1998. Introduction to Plant Biochemistry. CBS Publishers and Distributors, New Delhi.
2. Lehninger, A. L. 2004. Principles of Biochemistry. Freeman and Company, USA.
3. Nelson, D. L. and Michael, M. C. 2004. Principles of Biochemistry. Freeman Publishers Narayanan L M. Biochemistry. Saras Publications.
4. Purohit, S. S. 2004. Biotechnology: Fundamentals and Applications. 3rd Edn, Student Edition, Jodhpur.
5. Rameshwar, A. 2006. PRACTICAL Biochemistry (3 rd edit), Kalyani Publishers, New Delhi.
6. Sadashiv, S. and Manickam, A. 1996. Biochemical methods for Agricultural sciences. New age International publishers, New Delhi.
7. Sahney, S. K. and Singh, R. R. 2002. Introductory PRACTICAL Biochemistry. Narosa Publishing House, New Delhi.
8. Singh, B. D. 2007. Biotechnology: Expanding Horiozon, Kalyani Publishers.
9. Yadav, V. K. and Yadav, N. 2007. Biochemistry and Biotechnology-A Laboratory Manual, Pointer Publishers, Jaipur.

SSAC-111

Fundamentals of Soil Science

3(2+1)

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; soil taxonomical classification and soils of India; Soil water retention, movement and availability; Soil air, composition, gaseous exchange, problem and plant growth, Soil temperature; source, amount and flow of heat in soil; effect on plant growth, Soil reaction-pH, soil acidity and alkalinity, buffering, effect of pH on nutrient availability; soil colloids - inorganic and organic; silicate clays: constitution and

properties; sources of charge; ion exchange, cation exchange capacity, base saturation

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. Determination of soil pH and electrical conductivity. Determination of cation exchange capacity of soil. Determination of soil colour. Soil Water Classification. Soil moisture determination by gravimetric method.

Suggested Reading :-

1. Boul S.W., Hole, R.D., McCracken and Southard R.J. (1998). Soil genesis and classification Fourth Ed Panima Publishing corporation, New delhi.
2. Baver, L.D. Gardener, W.H. and gardener W.R. (1976) Soil Physics Wiley Eastern Ltd, New Delhi
3. Biswas, T.D. and Mukherjee, S.K. (2006) Text book of soil science. Tata McGraw Hill publishing Co. Ltd, New Delhi
4. Brady, N.C. and Weil, R.R. (2002) The nature and properties of soils, prentice hall of India Pvt. Ltd, M-97, Connaught Circus, New Delhi
5. Das, D.K. (2002) Introductory Soil Science, Kalyani publisher, New Delhi
6. Mehra R.K. (2004) Text book of Soil Science, ICAR, New Delhi
7. ISSS (2009) Fundamentals of Soil Science, Div. of Soil Science, IARI, New Delhi
8. Chopra S.L. and Kanwar, J.S. (1991) Analytical Agricultural Chemistry, Kalyani publisher, Ludhiana
9. Jackson, M.L. (1973) Soil chemical analysis, Prentice Hall of India, Pvt. Ltd New Delhi
10. Piper, C.S. (1950) Soil and plant analysis, Hans publications, Bombay
11. Richards, L.A. (1960) Diagnosis and improvement of saline and alkali soils., USDA agriculture Hand book 60, Washington D.C., USA
12. Gupta, I.C. & Sharma, S.K. (1988) Crop production in salt affected soils, Oxford and IBH Publication, New Delhi.
13. Agarwal, R.R., Yadav, J.S.P. & Gupta, R.N. (1982) Saline and alkali soils of India. ICAR, New Delhi.

HORT-112

Introduction to Forestry

2(1+1)

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.

Suggested Readings:

1. Champion, H. G. and Seth, S. K. 1968. A Revised Survey of Forest Types of India, Govt. of India Press, New Delhi.
2. Chaturvedi, A. N. and Kanna, L. S. 1982. A Handbook on Forest Mensuration. International Book Distributors.
3. Dwivedi, A. P. 1992. Agroforestry: Principles and Practices. Oxford and IBH Publication Co., New Delhi.
4. Dwivedi, A. P. 1992. Principles and Practice of Indian Silviculture, Surya Publication, 420 p.
5. Dwivedi, A. P. 2004. A Text Book of Silviculture. IBD Publishers.
6. Grebner, D. L., Bettinger, P. and Siry, J. P. 2012. Introduction to Forestry and Natural Resources. Academic Press. 508p (Google eBook).
7. Khanna, L. S. 1989. Principles and Practice of Silviculture. Khanna Bandhu, New Delhi.
8. Mitchell, Beazly. 1981. The International Book of the Forest. Mitchell Beazly Publishers, London.
9. Nair, P. K. R. 1993. An Introduction to Agroforestry. Kluwer Academic Publishers.
10. Persson, R. 1992. World Forest Resources. Periodical Experts, New Delhi.
11. Westoby, J. 1991. Introduction to World Forestry. Wiley, 240 p.

ENG-111 Comprehension & Communication Skills in English (Gradiual course) 2(1+1)

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: test inginitiative, team spirit, leadership, intellectual ability. Group Discussions.

Suggested Readings:

1. Jain, B. S. English Communication Skills, College Book Centre, A-19, Sethi Colony, Jaipur.
2. Lewis, N. 2009. Word Power Made Easy. Goyal Publishers, New Delhi.
3. Mohanraj, J. 2015. Let Us Hear Then Speak. Saje Publishers, New Delhi.
4. Pinker, S. 2014. The Sense of Style: The Thinking Persons' Guide to Writing in the 21st Century. Penguin Publishers, New York.
5. Saxena, Vivek. 2010. English & Communication Skills, Neelkanth Publishers (P) Ltd. B- 1178, Mangal Marg, Bapu Nagar, Jaipur.
6. Shukla, Punit. 2011. English Communication Skills (In English & Hindi) - College Book House (P) Ltd. Chaura Rasta, Jaipur.
7. Thomson and Martinet. 1997. "A PRACTICAL English Grammar, Exercise Books Vol. I & II" OUP Publication.

AGRON-111

Fundamentals of Agronomy

4(3+1)

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, soil plant water relationship, crop water requirement, water use efficiency, irrigation- scheduling criteria and methods, quality of irrigation water, water logging.

Weeds- importance, classification, crop weed competition, concepts of weed management-principles and methods, herbicides- classification, selectivity and resistance, allelopathy.

Growth and development of crops, factors affecting growth and development, plant ideotypes, crop rotation and its principles, adaptation and distribution of crops, crop management technologies in problematic areas, harvesting and threshing of crops.

PRACTICAL

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

Suggested Reading :

1. Balasubramanian, P. and Palaniappan, S.P.2016. Principles and Practices of Agronomy (2nd edition), Agrobios (India), Jodhpur
2. Chandra, D.G. (1989) Fundamentals of Agronomy. Oxford & IBH Publishing Co., New-Delhi.

3. Gupta, O.P. (2005) Weed Management: Principles and Practices (2nd Ed) Agribios (India) Jodhpur.
4. ICAR. (2010). Handbook of Agriculture (6th edition), Indian Council of Agricultural Research, New Delhi.
5. पोखवाल, बी. एल., सिंह, पुष्पेन्द्र एवम् शर्मा, डी. डी. 2000. सस्य विज्ञान के मूलतत्त्व, के. पी. प्रकाशन, उदयपुर
6. Michael, A.M. (1987) Irrigation - THEORY and Practice, Vikas Publishing House Pvt. Ltd., New-Delhi.
7. Mishra, R.D. and Ahmed, M. (1987) Manual on Irrigation Agronomy, Oxford & IBH Publishing Co. Pvt.. Ltd., New-Delhi.
8. Panda, S.C. (2012) Modern Concepts and Advance Principles in Crop Production. Agrobios (India), Jodhpur
9. Reddy, S.R. (2012) Principles of Crop Production (4th edition), Kalyani Publishers, Ludhiana.
10. Reddy, T. () Yellamanda and Reddy, G.H. Sankara. 2016. Principles of Agronomy (2nd edition) , Kalyani Publishers, Ludhiana
11. आर्य, आ.एल एवंकुशील, आ.एस. 2016. सस्य विज्ञान के सिद्धान्त, साइंटिफिकपब्लिशर्स, जोधपुर

GPB-111

Introductory Biology (New)

2(1+1)

THEORY

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

PRACTICAL

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

Suggested Readings:

1. Agarwal, P. K. 1999. Seed Technology, ICAR, New Delhi.
2. Allard, R. W. 2000. Principles of Plant Breeding. John Wiley & Sons, New York.
3. Arora, B. B. and Sabharwal, A. K. 2017. Modern's ABC of Biology. Modern Publishers, Lucknow.
4. Arora, D. K. and Trivedi, P. C. A Text Book of Botany. Ramesh Book Depot, Jaipur.
5. Joshi, A. K. and Singh, B. D. 2005. Seed Technology. Kalyani Publishers, New Delhi.
6. Sharma, R. C. 2014. Systematic Biology. Kalyani Publisher.
7. Singh, B. D. 2005. Plant Breeding. Kalyani Publishing House, New Delhi.

MATHS-111

Elementary Mathematics

2(2+0)

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 (x_1, y_1) and (x_2, y_2) , Tangent and Normal to a given circle at given point (Simple problems), Condition of tangency of a line $y = mx + c$ to the given circle $x^2 + y^2 = a^2$.

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

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.

Suggested Readings:

1. Gokhroo, D. C. and Jain, Krishi Ganita, Alka Publication, Ajmer.
2. Gokhroo, D.C. Differential calculus.
3. Gokhroo, D.C. Integral calculus.
4. Pandey R.K. Basic Mathematics.

AGHR-111

Agricultural Heritage (New Course)

1(1+0)*

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.

Suggested Reading:

1. Kumari, D. and Veeral, M (2014) Text Book on Agricultural Heritage of India. Agrotech Publishing Academy.
2. ICAR (1989) Handbook of Agriculture, Indian Council of Agricultural Research, New-Delhi
3. ICAR. Introductory Agriculture. ICAR e-course. Indian Council of Agricultural Research, New Delhi. (<http://www.agrimoon.com/wp-content/uploads/Introductory-Agriculture.pdf>)

4. Nene, Y.L. (2007) Glimpses of the Agricultural Heritage of India. Asian Agri-History Foundation, Secunderabad, Andhra Pradesh.
5. Nene, Y.L., Choudhary, S.L. and Saxena, R.C. (2010) Textbook on Ancient History of Indian Agriculture, Asian Agri-History Foundation.
6. Nene, Y.L., Saxena, R.C. and Choudhary, S.L. (2009) A Textbook on Ancient History of Indian Agriculture, MunshiramManohar Publishers Pvt. Ltd,

EXCOM-111

Rural Sociology & Educational Psychology

2 (2+0)

THEORY:

Sociology and Rural sociology: Definition and scope, its significance in agriculture extension, Social Ecology: Definition, objectives, history, challenges and social ecology in Indian context, Rural society: Important characteristics, differences & Relationship between Rural and Urban societies., Social Groups: Meaning, Definition, Classification, Factors considered in formation and organization of groups. Social Stratification – Meaning, Definition, Functions, Forms of Social stratification. Culture concept - Culture, Customs, Folkways, Mores, Taboos, Rituals and Traditions - Meaning, Definition and their role in Agricultural Extension. Social Institution: Meaning, Definition, Major institutions in Rural society, Functions. Social Change & Development: Meaning, Definition, Nature of Social change and factors of social change. Social process- Meaning, Definition, types. Social Control- - Meaning, Definition, Need and Means of Social control. Rural Leadership: concept and definition, types and roles of leaders in rural context; Methods of selection of leaders.

Educational psychology: Meaning & its importance in agriculture extension. Behavior: Cognitive, affective, psychomotor domain, Cognitive skills, Personality-Meaning, Definition, Types, Factors influencing the Personality and Role of Personality in Agricultural Extension., Motivation; Meaning , Definition, Importance in extension, Theories of Motivation, Intelligence-Meaning, Definition, Types, Factors affecting intelligence..Teaching Learning Process process-Meaning and Definition of Teaching, Learning, Learning experience and Learning situation, Elements of learning situation and its characteristics.Perception, Emotions.

Suggested Reading

1. Chidambaram, J.B. 1(973) Introductory rural sociology. New York, John Wiley and Sons.
2. Desai, A.R. (1978) Rural sociology in India. Bombay, Popular Prakashan, 5th Rev. ed.
3. Doshi, S.L. (2007) Rural sociology. Rawat Publishers, Delhi.
4. Jayapalan, N. (2002) Rural sociology. Altanic Publishers, New Delhi.
5. Sharma, K.L. (1997) Rural society in India. Rawat Publishers, Delhi.
6. Bhatia, H.R. (1965) A Text Book of Educational Psychology, Asia Publishing House, New Delhi.
7. Pujari, D. (2002) Educational Psychology in Agriculture, Agrotech Publishing Academy, Udaipur
8. Bhushan, V. and Sachdeva, D.R. (2010) An introduction to Sociology, Kitab Mahal , New Delhi.
9. Rao, C.N.S. (2015) Sociology, S.Chand& Company, New Delhi.
10. Maslow, A.H (1970) Motivation and personality. Harper and Row publishers , New York.

EXCOM-112

Human Value and Ethics 1(1+0)

1 (1+0)

THEORY

Values and Ethics-An Introduction. Goal and Mission of Life. Vision of Life.Principles and Philosophy. 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. Ethics in Agriculture-Principles, issues.

Suggested Readings:

1. Gaur, R. R., Sangal R. and Bagaria G. P. 2011. A Foundation Course in Human Values and Professional Ethics. Excel Books.
2. My Idea of Education: Dr. Kiran Walia, The General Secretary, Ramakrishna math and Ramakrishna Mission. Belur Math. Howrah District West Bengal 71 1202 India.
3. Sharma, R. P. and Sharma M. 2011. Value Education and Professional Ethics. Kanishka Publishers.
4. Srivastava, S. 2011. Human Values and Professional Ethics. S K Kataria & Sons.
5. Swami Vivekananda, Youth and Modern India, Ramakrishna Mission, Chennai

NSS/NCC/ PEYP

NSS/NCC/Physical Education & Yoga Practices

2(0+2)

National Service Scheme Credit hours: 2(0+2)

PRACTICAL

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:

1. Introduction and basic components of NSS: Orientation
2. NSS programmes and activities
3. Understanding youth
4. Community mobilisation
5. Social harmony and national integration
6. Volunteerism and shramdan
7. Citizenship, constitution and human rights
8. Family and society
9. Importance and role of youth leadership
10. Life competencies
11. Youth development programmes
12. Health, hygiene and sanitation
13. Youth health, lifestyle, HIV AIDS and first aid
14. Youth and yoga

15. Vocational skill development
16. Issues related environment
17. Disaster management
18. Entrepreneurship development
19. Formulation of production oriented project
20. Documentation and data reporting
21. Resource mobilization
22. Additional life skills
23. Activities directed by the Central and State Government

All the activities related to the National Service Scheme course is distributed under four different courses viz., National Service Scheme I, National Service Scheme II, National Service Scheme III and National Service Scheme IV each having one credit load. The entire four courses should be offered continuously for two years. A student enrolled in NSS course should put in at least 60 hours of social work in different activities in a semester other than five regular one-day camp in a year and one special camp for duration of 7 days at any semester break period in the two 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.

Semester I

Course Title: National Service Scheme I

Introduction and basic components of NSS:

- **Orientation:** history, objectives, principles, symbol, badge; regular programmes under NSS, organizational structure of NSS, code of conduct for NSS volunteers, points to be considered by NSS volunteer's awareness about health
- **NSS programmes and activities**
Concept of regular activities, special camping, day camps, basis of adoption of village/slums, conducting survey, analysing guiding financial patterns of scheme, youth programme/ schemes of GOI, coordination with different agencies and maintenance of diary
- **Understanding youth**
Definition, profile, categories, issues and challenges of youth; and opportunities for youth who is agent of the social change
- **Community mobilisation**
Mapping of community stakeholders, designing the message as per problems and their culture; identifying methods of mobilisation involving youth-adult partnership
- **Social harmony and national integration**
Indian history and culture, role of youth in nation building, conflict resolution and peace-building
- **Volunteerism and shramdan**
- Indian tradition of volunteerism, its need, importance, motivation and constraints; shramdan as part of volunteerism
- **Citizenship, constitution and human rights**
Basic features of constitution of India, fundamental rights and duties, human rights, consumer awareness and rights and rights to information
- **Family and society**
Concept of family, community (PRIs and other community based organisations) and society

National Cadet Corps Credit hours: 2(0+2)

Semester I: National Cadet Corps I

- Aims, objectives, organization of NCC and NCC song. DG's cardinals of discipline.
- Drill- aim, general words of command, attention, stands at ease, stand easy and turning.
- Sizing, numbering, forming in three ranks, open and close order march and dressing.
- Saluting at the halt, getting on parade, dismissing and falling out.
- Marching, length of pace, and time of marching in quick/slow time and halt. Side pace, pace forward and to therear.
- Turning on the march and wheeling. Saluting on the march.
- Marking time, forward march and halt.
- Changing step, formation of squad and squad drill.
- Command and control, organization, badges of rank, honours and awards
- Nation Building- cultural heritage, religions, traditions and customs of India.
- National integration.

Physical Education and Yoga Practices Credit hours:2(0+2) Semester I: PHED- I : Physical Education and Yoga Practices

- Teaching of skills of Football – demonstration, practice of the skills, correction, involvement in game situation (For girls teaching of Tennis)
- Teaching of different skills of Football – demonstration, practice of the skills, correction, involvement in game situation (For girls teaching of Tennis)
- Teaching of advance skills of Football – involvement of all the skills in game situation with teaching of rules of the game
- Teaching of skills of Basketball – demonstration, practice of the skills, correction of skills, involvement in game situation
- Teaching of skills of Basketball – demonstration, practice of the skills, involvement in game situation
- Teaching of skills of Basketball – involvement of all the skills in game situation with teaching of rule of the game
- Teaching of skills of Kabaddi – demonstration, practice of the skills, correction of skills, involvement in game situation
- Teaching of skills of Kabaddi – demonstration, practice of the skills, correction of skills, involvement in game situation
- Teaching of advance skills of Kabaddi – involvement of all the skills in game situation with teaching of rule of the game
- Teaching of skills of Ball Badminton – demonstration, practice of the skills, correction of skills, involvement in game situation

B.Sc. (Hons) Agriculture First year Second semester

GPB-121 Fundamentals of Genetics THEORY

3(2+1)

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.

Chromosome structure, function and chemical composition. Structural changes in chromosome, Numerical changes in chromosome, Proof for DNA as genetic material and Genetic code, 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. stains and fixatives, 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.

Suggested Readings:

1. Gardner, J., Simmons, M. J. and Snustad, D. P. 2009. Principles of Genetics (8th Ed.). Wiley India Pvt. Ltd., New Delhi.
2. Gupta, P. K. 2016. Cytology, Genetics and Evolution. Rastogi Publications, Meerut. (Hindi Edition).
3. Klug, W. W. and Cummings, M. R. 2005. Concepts of Genetics. Pearson Education (Singapore) Pvt. Ltd., Indian Branch, Pratapganj, New Delhi.
4. Ramchandra, R. K. 2015. Principles of Genetics. Jaya Publishing House, Delhi.
5. Singh, B. D. 2001. Fundamentals of Genetics. Kalyani Publishers, Ludhiana.
6. Singh, B. D. 2015. Genetics. Kalyani Publishers, New Delhi.
7. Singh, Punshan. 2000. Elements of Genetics. Kalyani Publishers, Ludhiana.
8. Strickberger, M. W. 2004. Genetics. Prentice Hall of India Pvt. Ltd., New Delhi.

SSAC-121 Agricultural Microbiology (Course to be shared with Plant Pathology) 2(1+1)

THEORY

Introduction to microbial world: Prokaryotic and eukaryotic microbes. Sterilization, disinfection, pasteurization and Koch's postulates. Bacteria: cell structure, growth, Gram positive and Gram negative bacteria, chemoautotrophy and photoautotrophy. 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 asymbiotic. Azolla, blue green algae and mycorrhiza. Rhizosphere and phyllosphere. Microbes in human welfare: bio-fertilizers, bio-pesticides, bio-fuel production and biodegradation of agro-wastes. Germ THEORY, Biogas

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. Methods of isolation and purification of microbial cultures. Isolation of *Rhizobium*, *Azotobacter* and BGA. Staining and microscopic examination of microbes. Enumeration of microbial population in soil-bacteria, fungi and actinomycetes.

Suggested Reading :

1. Biswas, T.D. and Mukherjee, S.K. 1990. Text Book of Soil Sciences, Tata McGraw-Hill Publishing Company Limited, New Delhi.
2. Mukherjee, N. and Ghosh T. 1998. Agricultural Microbiology, Kalyani Publishers, New Delhi.
3. Pelczar, Jr. Michel J. Chan, E.C.S. and Krieg, Noel R. 1997. Microbiology. Tata McGraw -Hill Edition, 1993. India.
4. Rangaswami, G. and Bagyaraj, D.J. 1993. Agricultural Microbiology. Prentice Hall of India Pvt. Limited, New Delhi.
5. Rao, N.S. 2000. Soil Microbiology. Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi.
6. Vishunavat, K. and Kolte, S.J. 2005. Essentials of Phytopathological Techniques. Kalyani Publishers, New Delhi
7. Sharma, P.D. 2010. Microbiology. 3rd edition Rastogi Publishers, Meerut
8. Dube H.C. 2007. A Text Book of Fungi, Bacteria & Viruses. 3rd ed. Agrobios India, Jodhpur.
9. Agrios, G.N. 2005. Plant Pathology. 5th ed. Academic Press, New York.

AGENGG-121**Soil and Water Conservation Engineering****2(1+1)****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. Introduction to Universal Soil Loss Equation. Rational formula for runoff measurement. Introduction to contouring, strip cropping. Contour bund. Graded bund and bench terracing. Grassed water ways. Water harvesting and its techniques. Wind erosion - principle of wind erosion control and its control measures. Familiarization with centrifugal pumps, measurement of irrigation water, water conveyance system and familiarization with pressurized irrigation methods.

PRACTICAL

General status of soil conservation in India and Rajasthan. Calculation of erosion index. Estimation of soil loss. Measurement of soil loss. Preparation of contour maps. Design of contour bunds. Design of graded bunds. Problem on wind erosion. Numerical problems on friction head, velocity head, total head and horse power calculation of pumps. Measurement of irrigation water in the field by different methods and related numerical. Study of components of drip and sprinkler system. Study of watershed area.

Suggested Readings:

1. Mahnot, S. C., Singh, P. K. and Chaplot, P. C. 2010. Soil and Water Conservation Water Management. Apex Publication House, Udaipur.
2. Mal, B. C. 2014. Introduction to Soil and Water Conservation Engineering. Kalyani Publishers.
3. Michael A. M. 2012. Irrigation: THEORY and Practices. Vikas Publishing House Pvt. Ltd., New Delhi.
4. Michael, A. M. and Ojha, T. P. 2012. Principles of Agricultural Engineering. Volume II. 4th Edition, Jain Brothers, New Delhi.
5. Murthy, V. V. N. 1982. Land and Water Management Engineering. Kalyani Publishers, New Delhi.
6. Singh, G., Venkataraman, C., Sastry, G. and Joshi, B. P. 1996. Manual of Soil and Water Conservation Practices. Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi.

7. Suresh, R. 2014. Soil and Water Conservation Engineering. Standard Publisher Distributors, New Delhi.

CPHYS-121 Fundamentals of Crop Physiology

2(1+1)

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 and nutrient uptake mechanisms. Photosynthesis; Light reaction and Dark reactions: C₃, C₄ and CAM plants. Respiration; Glycolysis, TCA cycle and electron transport chain. Physiology of flowering. Plant growth regulators; physiological roles and agricultural uses. Ascent of sap, Introduction to stress physiology- Drought, Temperature & Salinity Stress, Growth and development

PRACTICAL:

Preparation of solutions and buffers. Demonstration of the process of osmosis, plasmolysis, root pressure in plants. Measurement of transpiration rate using Ganongs potometer. Estimation of relative water content in plants. Visual symptoms of nutrient deficiency in plants. To study structure and distribution of stomata in leaf. Separation of photosynthetic pigments through paper chromatography. To demonstrate that O₂ is evolved during photosynthesis and light and CO₂ is essential for photosynthesis using Moll's half leaf experiment. Measurement of photosynthetic CO₂ assimilation by Infra-Red Gas Analyzer (IRGA). Demonstration of anaerobic respiration. Measurement of respiration quotient, plant growth by Arc auxanometer and growth analysis parameters.

Suggested Readings:

1. Bagdi, D. L. 2016. Crop Physiology. New India Publishing Agency, New Delhi.
2. Bala, M., Gupta, S. and Gupta, N. K. 2013. PRACTICALS in Plant Physiology. Scientific Publisher, Jodhpur.
3. Devlin, R. M. and Witham F. H. 1983. Plant Physiology. 4th Ed. CBS Publishers and Distributors, New Delhi.
4. Gupta, N. K. and Gupta, S. 2005. Plant Physiology. Oxford & IBH Publication, New Delhi.
5. Kumar, A. and Purohit, S. S. 1998. Plant Physiology: Fundamental and Application. Agrobotanica 4E 176 J.N. Vyas Nagar, Bikaner.
6. Mallick, C. P. and Srivastava, A. K. 2000. Text Book of Plant Physiology. Kalyani Publishers, New Delhi.
7. Noggle, G. R. and Fritz, G. J. 1992. Introductory Plant Physiology. 2nd Ed. Prentice Hill of India (P) Ltd., New Delhi.
8. Pandey, S. N. and Sinha, B. K. 1995. Plant Physiology. Vikas Publishing House Pvt. Ltd., New Delhi.
9. Salisbury, J. B. and Ross, C. W. 1992. Plant Physiology. Wadswar Publishing Company, Belmont, California.

AGECON-121 Fundamentals of Agricultural Economics

2(2+0)

THEORY

Economics: Meaning, scope and subject matter, definitions, activities, approaches to economic analysis; micro and macroeconomics, positive and **normative approach**. Nature of economic THEORY; rationality assumption, concept of equilibrium. Basic concepts: Goods and services, desire, want, demand, utility, cost and price, wealth, capital, income and welfare. Agricultural economics: meaning, definition, characteristics of agriculture, importance and its role in economic development. *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, concept of consumer surplus. Elasticity of demand: concept and measurement of price elasticity, income elasticity and cross elasticity. Production: process, creation of utility, factors of production, input output relationship. *Laws of returns*: Law of variable proportions and law of returns to scale. *Cost*: Cost concepts, short run and long run cost curves. Supply: Stock v/s supply, law of supply, supply schedule, supply curve, determinants of supply, elasticity of supply. Market structure: meaning and types of market, basic features of perfectly competitive markets. Distribution THEORY: meaning, factor market and pricing of factors of production. Concepts of rent, wage, interest and profit. *National income*: Meaning and importance, concepts of national income accounting and approaches to measurement. Population: Importance, Malthusian population THEORY, Money meaning and functions of money, general price index, inflation and deflation. Banking: types of banks, functions of commercial Bank. *Tax*: meaning, direct and indirect taxes, agricultural taxation, GST. *Economic systems*: meaning of capitalistic, socialistic and mixed economies. **district cooperative banks/society**

Suggested Readings:

1. Dewett, K. K. 2005. Modern Economic THEORY. S. Chand & Company, New Delhi.
2. Dewett, K. K. and Verma, J. D. 2004. Elementary Economic THEORY. S. Chand & Company, New Delhi.
3. Gupta, B. L. 1996. Introduction to Economic THEORY. Arya Book Depot, New Delhi.
3. Hill, B. 1980. An Introduction to Economics for Students of Agriculture. Pergaman Press, Oxford.
4. Jathar, G. B. and Beri, S. G. 1996. Elementary Principles of Economics. Oxford University Press (10th Ed.), Delhi.
5. Mishra, S. K. and Puri, V. K. 1996. Indian Economy. Himalaya Publishing House, New Delhi.
6. Reddy, S., Raghuram, P., Neelakantan, T. V. and Bhavani D. I. 2004. Agricultural Economics. Oxford and IBH Publishers, New Delhi.
7. Samuelson, P. A. and Nordhaus, W. D. 1987. Economics. McGraw-Hill, Singapore

PPATH-121

Fundamentals of Plant Pathology

4(3+1)

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. Causes, disease triangle and tetrahedron and classification of plant diseases. Important plant pathogenic organisms, different groups: fungi, bacteria, fastidious vascular 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, somatic structures, types of fungal thalli, fungal tissues, modifications of thallus, reproduction (asexual and sexual). Binomial system of nomenclature, rules of nomenclature, general

outline of classification of fungi. *Bacteria and mollicutes*: general morphological characters. Basic methods of classification of plant pathogenic bacteria and reproduction. *Viruses*: nature, structure, 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.) Growth and reproduction of plant pathogens. Liberation / dispersal and survival of plant pathogens. Pathogenesis. Role of enzymes, toxins and growth regulators in disease development. Defense mechanism in plants. Epidemiology: Factors affecting disease development. Principles and methods of plant disease management. Nature, chemical combination, classification, mode of action and formulations of fungicides and antibiotics.

PRACTICAL

Acquaintance with various laboratory equipment's and microscopy. Collection and preservation of disease specimen. Preparation of media, isolation and Koch's postulates. General study of different structures of fungi. Study of symptoms of various plant diseases. Study of representative fungal genera. Staining and identification of plant pathogenic bacteria. Transmission of plant viruses. Study of phanerogamic plant parasites. Study of morphological features and identification of plant parasitic nematodes. Sampling and extraction of nematodes from soil and plant material, preparation of nematode mounting. Study of fungicides and their formulations. Methods of pesticide application and their safe use. Calculation of fungicide sprays concentrations.

Suggested Reading

1. Agrios, G.N. 2005. Plant Pathology. 5th ed. Academic Press, New York.
2. Alexopolus, C.J., Mims, C.W. and Blackwell, M. 2013. Introductory Mycology. John Wiley Estern Private Limited, New York.
3. Mehrotra, R.S. and Agrawal, A. 2013. Plant Pathology. 2nd ed. Tata McGraw Hill Publishing Co. Ltd., New Delhi.
4. Singh, R.S. 2011. Introduction to Principles of Plant Pathology. 4th ed. Oxford & IBH Publishing Company. New Delhi.
5. Nene Y.L. and Thapliyal, P.N. 2011. Fungicides in Plant Diseases Control. 3rd Ed. Oxford & IBH published Co. Pvt. Ltd. New Delhi.
6. Dube H.C. 2007. A Text Book of Fungi, Bacteria & Viruses. 3rd ed. Agrobios India, Jodhpur.
7. Dube, H.C. 2012, Modern Plant Pathology, 2nd ed. Agrobios (India), Jodhpur
8. Dube, H.C. 2013, An Introduction to Fungi. 4thed. , Scientific Publishers India, Jodhpur.

ENTO-121 Fundamentals of Entomology

4(3+1)

THEORY

Part – I

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

(Endocrine) and reproductive system, in insects. Types of reproduction in insects. Major sensory organs like simple and compound eyes, chemoreceptor.

Part-II

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

Part III

Categories of pests. Concept of IPM, Practices, scope and limitations of IPM. Classification of insecticides, toxicity of insecticides and formulations of insecticides. Chemical control importance, hazards and limitations. Recent methods of pest control, repellents, anti-feed ants,

hormones, attractants, gamma radiation. Insecticides Act 1968- Important provisions. Application techniques of spray fluids. Symptoms of poisoning, first aid and antidotes.

Part – IV

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, Papilionidae, Noctuidae, Sphingidae, Pyralidae, Gelechiidae, Arctiidae, Saturnidae, Bombycidae; Saturnidae; Coleoptera: Coccinellidae, Chrysomelidae, Cerambycidae, Curculionidae, Bruchidae, Scarabaeidae; Hymenoptera: Tenthredinidae, Apidae. Trichogrammatidae, Ichneumonidae, Braconidae, Chalcididae; Diptera: Cecidomyiidae, Tachinidae, Agromyziidae, Culicidae, Muscidae, Tephritidae.

PRACTICAL

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

Suggested Readings

1. Atwal, A. S. and Dhaliwal, G. S. 2002. Agricultural Pests of South Asia and their Management, Kalyani Publishers, New Delhi.
2. Chapman, R. F. 1998. The Insects: Structure and Function. Cambridge Univ. Press, Cambridge.
3. David B.V. and Ananthkrishnan .T.N. 2003. General and Applied Entomology, 2nd Ed. Mc graw Hill publishing Co. Ltd. New Delhi.
4. David, B. V. and Ramamurthy, V. V. 2016. Elements of Economic Entomology, 8th Ed. Popular Book Depot, Chennai.
5. Dhaliwal, G. S. and Ramesh, A. 2001. Integrated Pest Management: Concepts and Approaches. Kalyani Publishers, New Delhi.
6. Dhawan, A. K., Singh, B. and Arora, B. 2012. THEORY and Practice of Integrated Pest Management. Scientific Publishers, Jodhpur.

7. Larry, P. Pedigo, 1991. Entomology and Pest Management. Mc Millan Publishing Company, New York.
8. Mathur and Upadhyay, 2005. A Text Book of Entomology, Aman Publishing House, Meerut.
9. Metcalf, R. L. and Luckman, W. H. 1982. Introduction to Insect Pest Management. Wiley Inter Science publishing, New York.
10. Pant. N.C. and Ghai, S. 1981. Insect Physiology and Anatomy, ICAR, New Delhi.
11. Richards O.W. and Davies R.G. 1977. Imm's General Text Book of Entomology, Vol. I & II. Chapman and Hall, London.
12. Snodgrass R.E .2001. Principles of Insect Morphology, CBS Publishers and Distributors, New Delhi.
13. Yazdani, G. S. and Agarwal, M. L. 1979. Elements of Insect Ecology. Naroji Publishing House, New Delhi.

EXCOM-121 Fundamentals of Agricultural Extension 3(2+1)
Education

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.). 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, NARP, ATIC, RKVY, Pradhan Mantri Fasal Bima Yojana, Soil Health Card, NRLM 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. T & V System,SGSY, ICDS, IRDP, NHM,MNREGA, Rajiv Gandhi Scheme for empowerment of Adolesent girls / Boys, Gramin Bhandaran Yojana, Pradhan Mantri Adarsh Gram yojana, Pradhan Mantri Kaushal Vikas yojana,

Community Development-meaning, definition, concept & principles, Philosophy of C.D, Panchayati Raj System.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; Training: Types , planning a training Programme.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; preparation and use of AV aids, preparation of extension literature – leaflet, booklet, folder, pamphlet news stories and success stories; A visit to village to understand the problems being encountered by the villagers/ farmers; to study organization and functioning of 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.

Suggested readings

1. Adivi Reddy, A., 2001, *Extension Education*, Sree Lakshmi press, Bapatla.

2. Dahama, O. P. and Bhatnagar, O. P., 1998, *Education and Communication for Development*, Oxford and IBH publishing Co. Pvt. Ltd., New Delhi.
3. Jalihal, K. A. and Veerabhadraiah, V., 2007, *Fundamentals of Extension Education and Management in Extension*, Concept publishing company, New Delhi.
4. Muthaiah Manoraharan, P. and Arunachalam, R., *Agricultural Extension*, Himalaya Publishing House (Mumbai).
5. Rathore, O. S. *et al.*, 2012, *Handbook of Extension Education*, Agrotech Publishing Academy, Udaipur.
6. Ray, G. L., 1991 (1st Edition), *Extension Communication and Management*, Kalyani Publishers, Ludhiana {7th revised edition - 2010}.
7. Supe, S. V., 2013 (2nd Edition), *A Text Book of Extension Education*, Agrotech Publishing Academy, Udaipur.
8. Van Den Ban, A. W. and Hawkins, H. S., *Agricultural Extension*, S. K .Jain for CBS Publishers & Distributors, New Delhi.
9. Debabrata Das Gupta. *Extension Education*. Agrobios (India), Agro house behind Nasrani Cinema, Chaupasani Road, Jodhpur- 342402, Phone -0291-2642319, Fax- 0291-2643993, Email- agrobios@sify.com
10. Sharma, O. P. & Somani, L. L. 2012. *Dimension of Agricultural Extension*, Agrotech Publishing Academy. Udaipur.

EXCOM-122

**Communication Skills and Personality
Development**

2(1+1)

THEORY

Communication: meaning and definition; Principles and Functions of Communication, models and barriers to communication. 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. Soft Skills. Extension teaching methods: meaning, classification, individual, group and mass contact methods. ICT Applications in TOT (New and Social Media), media mix strategies;

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. Handling and use of audio visual equipment's and digital camera and LCD projector; Group discussion- exercise; Presentation skills exercise; micro teaching exercise; Script writing, writing for print and electronic media, developing script for radio and television. Visit to community radio.

Suggested readings

1. Sandhu, A. S. (1999). *Textbook on Agricultural Communication; process and methods* oxford RIBH Publishing co. Pvt. Ltd. New Delhi.
2. Berlo, David K. (1960). *The process of Communication*. Nw Yark, Holt, Rinehart and Winston Inc.
3. Dahama, O. P. and Bhatnagar, O.P., 1998, *Education and Communication for Development*, Oxford and IBH publishing Co. Pvt. Ltd., New Delhi.

4. Jalihal, K. A. and Veerabhadraiah, V., 2007, *Fundamentals of Extension Education and Management in Extension*, Concept publishing company, New Delhi.
5. Ray, G. L., 1991 (1st Edition), *Extension Communication and Management*, Kalyani Publishers, Ludhiana {7th revised edition - 2010}.
6. Supe, S. V., 2013 (2nd Edition), *A Text Book of Extension Education*, Agrotech Publishing Academy, Udaipur.
7. M Hilaris 2011. *Indian agriculture and information and communication technology (ICT)*: Soundari, New century Publications, Carnegie,
8. Dale. 2012. *How to Win Friends and Influence People in the Digital Age*. Simon & Schuster.
9. Covey Stephen R. 1989. *The Seven Habits of Highly Successful People*. Free Press.
10. Verma, K.C. 2013. *The Art of Communication*. Kalpaz.
11. Mohan Krishna and Meera Banerjee. 1990. *Developing Communication Skills*. Macmillan India Ltd. New Delhi.
12. Sharma R C and Krishna Mohan. 1978. *Business Correspondence*. Tata Mc Graw Hill
13. Adivi Reddy, A., 2001, *Extension Education*, Sree Lakshmi press, Bapatla.

Semester II

Course Title: National Service Scheme II

- Importance and role of youth leadership
- Meaning, types and traits of leadership, qualities of good leaders; importance and roles of youth leadership
- Life competencies
- Definition and importance of life competencies, problem-solving and decision-making, inter personal communication
- Youth development programmes
- Development of youth programmes and policy at the national level, state level and voluntary sector; youth-focused and youth-led organisations
- Health, hygiene and sanitation
- Definition needs and scope of health education; role of food, nutrition, safe drinking water, water born diseases and sanitation (Swachh Bharat Abhiyan) for health; national health programmes and reproductive health.
- Youth health, lifestyle, HIV AIDS and first aid
- Healthy lifestyles, HIV AIDS, drugs and substance abuse, home nursing and first aid Youth and yoga
- History, philosophy, concept, myths and misconceptions about yoga; yoga traditions and its impacts, yoga as a tool for healthy lifestyle, preventive and curative method

Semester II: National Cadet Corps II

- Values and ethics, perception, communication, motivation, decision making, discipline and duties of good citizen.
- Leadership traits, types of leadership. Character/personality development.
- Civil defense organization, types of emergencies, fire fighting, protection,
- Maintenance of essential services, disaster management, aid during development projects.
- Basics of social service, weaker sections of society and their needs, NGO's and their contribution, contribution of youth towards social welfare and family planning.
- Structure and function of human body, diet and exercise, hygiene and sanitation.
- Preventable diseases including AIDS, safe blood donation, first aid, physical and mental health.
- Adventure activities.

- Basic principles of ecology, environmental conservation, pollution and its control.
- Precaution and general behaviour of girl cadets, prevention of untoward incidents, vulnerable parts of the body, self defense.

Semester II: PHED- II : Physical Education and Yoga Practices

1. Teaching of skills of Ball Badminton – involvement of all the skills in game situation with teaching of rule of the game
2. Teaching of some of Asanas – demonstration, practice, correction and practice
3. Teaching of some more of Asanas – demonstration, practice, correction and practice
4. Teaching of skills of Table Tennis – demonstration, practice of skills, correction and practice and involvement in game situation
5. Teaching of skills of Table Tennis – demonstration, practice of skills, correction and practice and involvement in game situation
6. Teaching of skills of Table Tennis – involvement of all the skills in game situation with teaching of rule of the game
7. Teaching – Meaning, Scope and importance of Physical Education
8. Teaching – Definition, Type of Tournaments
9. Teaching – Physical Fitness and Health Education
10. Construction and laying out of the track and field (The girls will have Tennis and Throw Ball).

B.Sc. (Hons) Agriculture Second year First Semester

AGECON-211 Agricultural Finance and Co-Operation 3(2+1)

THEORY

Agricultural Finance- meaning, scope and significance, credit needs and its role in Indian agriculture. Agricultural credit: meaning, definition, need, classification. Credit analysis: **7Ps**, 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. Preparation and analysis of financial statements – Balance Sheet and Income Statement. Basic guidelines for preparation of project reports

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 NAFED. Status and success story of cooperatives in Rajasthan. [Added in introduction of time value of money, Cash flow statement and Breakeven point.](#)

PRACTICAL

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

Suggested Reading:

1. Reddy, S. and Raghu Ram, P. (2017) “Agricultural Finance and Management” Oxford and IBH, New Delhi
2. Singh, J.P. (1990) “Agricultural Finance- THEORY and Practice” Ashish Publishing House, New Delhi
3. Pandey, U.K. “An Introduction to Agricultural Finance” Kalyani Publishes, New Delhi
4. Pandey, Mukesh and Tewari, Deepali “Rural and Agriculture Marketing”
5. Mamoria, C.B. “Agricultural Problems of India”
6. Krishnaswami, O.R. “Fundamental of Cooperation”
7. Nelson, A.G. and Murray, W.G. 1988 “Agricultural Finance” IOWA State University Press, Ames, IOWA, USA
8. Johl, S.S. : Essentials of Farm Financial Management, Atlas Books and Periodicals (TTPP)

AGENGG-211

Farm Machinery and Power

2(1+1)

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 numerical, 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 farm machinaries**, Estimation of field capacity and power requirements of implements Familiarization with Primary and Secondary Tillage implement, implement for intercultural operations, Familiarization with sowing and planting equipment, Familiarization with Plant Protection equipment, Familiarization with **harvesting (reaper and combine)** and threshing equipment.

PRACTICALS

Study of different components of I.C. engine. To study air cleaning and cooling system of engine, Familiarization with clutch, transmission, differential and final drive of a tractor, Familiarization with lubrication and fuel supply system of engine, Familiarization with brake, steering, hydraulic control system of engine, Learning of tractor driving, Familiarization with operation of power tiller, Familiarization with different types of primary and secondary tillage implements: mould board plough, disc plough and disc harrow. Familiarization with seed metering mechanism and calibration of seed drill, Familiarization with different types of sprayers and dusters Familiarization with different inter-culture implement, Familiarization with harvesting and threshing equipments and machinery. **Numerical on field capacity of implements.**

Suggested Reading:

1. Michael, A.M. and T.P. Ojha (2012) Principles of Agricultural Engineering. Vol. I. Jain Brothers, Jodhpur.
2. Rai and Jain (1989.) Farm Tractors, Maintenance and Repair.Tata Mc Graw Hill Publ. New Delhi.
3. Srivastava, A.C. (1989) Elements of Farm Machinery Oxford IBH Publ. Company, New Delhi.
4. Singhal, O.P. (1989) Elements of Agricultural Engineering, Vol. I & II. Suraj Prakashan, Allahabad.

5. Sahay (1990) Element of Agricultural Engineering Jagdishwar. Agro. Book Agency, New Chitragupta Nagar, Patna.

AGRINFO-211

Agricultural Informatics

2(1+1)

THEORY

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

Computer Programming: General Concepts, Introduction to programming languages, concept and standard input/output operations, Variables and Constants, Operators and Expressions, Flow of control, Inbuilt and User defined functions, programming techniques for agriculture.

e- Agriculture: concepts, design and development, application of innovative ways to use information and communication technologies (IT) in Agriculture. ICT for Data Collection, IT application for computation of water and nutrient requirement of crops etc., Computer-controlled devices (automated systems) for Agri-input management, Smart phone mobile apps in Agriculture for farm advice, market price, post-harvest management etc; Introduction of DSS and its role in agriculture, Introduction and role of expert system in agriculture.

PRACTICAL

Study of Computer Components and accessories. Introduction of different operating systems such as windows, Unix, Linux, Creating, Files & Folders, File Management. Use of MS-WORD and MS Powerpoint for creating, editing and presenting a scientific Document, Handling of Tabular data, animation, video tools, art tool, graphics, template & designs. MS-EXCEL – Creating a spread sheet, 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 to HTML, Use of smart phones and their devices in agri-advisory and dissemination of market information.

Suggested Readings:

1. Capron, H. L. 1996. Computers tool for an information age. Benjamin/ Cummings Publishing Company, Inc. New York
2. Date, C. J. 2000. Introduction to Database System. Addison Wesley
3. Jain, S., Jain, S. and Jain, M. 2003. IT Tools and Applications (BPB Publications)
4. Minhas, D. S. and Choudhary, B. R. 2009. Dynamic Memory Computer Course. Dimond books publisher, New Delhi.
5. Nortons, P. 2001. Introduction to computers, 4th ed, Tata McGraw Hill, New Delhi
6. Parekh, R. 2006. Principles of Multimedia. Tata McGraw-Hill.
7. Rapidex Computer Course (Pustak Mahal).
8. Rob, P. and Coronel, C. 2006. Database Systems: Design, Implementation and Management. 7th ed. Thomson Learning.

AGRON-211

Crop Production Technology – I (Kharif crops)

3(2+1)

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, soybean and **sesame**; 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, cotton and **urdbean**, 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.

Suggested Reading:

1. Panda, S.C. (2012) Modern Concepts and Advance Principles in Crop Production. Agrobios (India), Jodhpur Singh, Chhidda, Singh, Prem and Singh, Rajbir. 2003. Modern Techniques of Raising Field Crops, Oxford & IBH Publishing Co., New Delhi.
2. Singh, S.S. and Singh, R. (2013) Crop Management Under Irrigated and Rainfed Conditions. Kalyani Publishers, New Delhi.
3. Singh, S.S. and Singh, R. (2015) Principles and Practices of Agronomy (5th Re-set), Kalyani Publishers, New Delhi, Kalyani Publishers, Ludhiana.
4. Rathore, P.S. (2000) Techniques and Management of Field Crop Production, Agrobios (India), Jodhpur.
5. Prasad, R. (2002) Text Book of Field Crops Production, ICAR, New Delhi.
6. ICAR. 2010. Handbook of Agriculture (6th edition), Indian Council of Agricultural Research, New Delhi
7. Reddy, S.R. (2012) Agronomy of Field Crops. Kalyani Publishers, Ludhiana.
8. आर्य, आ.एल एवं आर्य, केशव. (2016). खरीफसस्य उत्पादन, कल्याणीपब्लिशर्स, लुधियाना
9. शक्तावत, मोहनसिंह एवं व्यास, अभय कुमार. 2000. वैज्ञानिक फसल प्रबंधन, यश पब्लिशिंग हाउस, बीकानेर

ANISC-211

Livestock and poultry Management

4(3+1)

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 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, 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.

Suggested Reading: -

1. Banerjee, G.C. (2013) A Taxe Book of Animal Husbandry.8th Ed. ICAR.
2. Choudhary J.L. and Gupta L. (2016) a Text Book of Animal Husbandry. Somani Publication
3. Devendra C and Mecleroy GB (1982) Goat and Sheep Production in Tropics.
4. Dimri, U, Sharma, M.C.and Tiwari R. (2013) Swine Production and Health Management.New India Pub Agency.
5. Sastry N.S.R. and Thomas, C.K. (2006). Livestock Production and Management. Kalyani
6. Singh, R.A. (1996) Poultry Production 3rd Ed Kalyani.
7. Thomas CK and Sastry, NSR. (1991) Dairy Bovine Production.Kalyani.

ESDM-211 Environmental Studies and Disaster Management 3(2+1)

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-spots 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 humanhealth.

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, ozonedepletion.

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, seaaccidents.

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 otherorganizations.

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.

Suggested Reading -

1. Bamanayha B.R., Verma, L.N. and Verma A (2005). Fundamentals of Environmental Sciences, Yash Publishing House, Bikaner.
2. Dhaliwal G.S., Sangha G.S. and Ralhan P.K. (2000) Fundamentals of Environmental Sciences, Kalyani Publishers, New Delhi.
3. Odum E.P. and Barrett G.W. (2007) Fundamentals of Ecology, Akash Press, New Delhi.
4. Agrawal, K.C. (1999) Environmental Biology, Agro Botanica, Bikaner
5. Kumar, H.D. (1997) Modern concepts of Ecology, Vikash Publishing House Pvt. Ltd. New Delhi.
6. Dhaliwal G.S., and D.S. Kley (2006) Principles of Agricultural Ecology. Himalyan Publishing house, Bombay
7. Brij Gopal, and N. Bhardwaj (2004) Elements of Ecology. Vikash Publishing House, Pvt. Ltd., New Delhi.
8. Kudesta, V.P. (1990). Pollution Everywhere, PragatgiPrakashan, Meerut
9. Nemeron, R.L.1976. Industrial Water Pollution. Addison Wesley
10. Mishra, P.C. (2001). Soil pollution and Soil Organism, Ashish Publishing House, 8/81, Punjab Bagh, New Delhi- 110026.
11. Pathak, H.and Kumar, S., (2003). Soil and Green House Effect, CBS Publishers and Distributors, 4596/1-A, 11, Dayaganj, New Delhi – 10002.

GPB-211

Fundamentals of Plant Breeding

3(2+1)

THEORY

Historical development, concept, nature and role of plant breeding, objectives of plant breeding, major achievements and future prospects; Genetics in relation to plant breeding, modes of reproduction and pollination, 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; population improvement, 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. **Variability parameters, study of pollen viability and pollen size**

PRACTICAL

Plant Breeder's kit, Study of germplasm of various crops. Study of floral structure of self-pollinated and cross-pollinated crops. Emasculation and hybridization techniques in self- & cross-pollinated crops.

Consequences of inbreeding on genetic structure of resulting populations. Study of male sterility system. Handling of segregating populations. Methods of calculating mean, range, variance, standard deviation, **heritability**.

Designs used in plant breeding experiment, analysis of Randomized Block Design and components of genetic variance. To work out the mode of pollination in a given crop and extent of natural out crossing. Prediction of performance of double cross hybrids.

Suggested Reading:

1. Alard, R.W. (2000) Principles of Plant Breeding. John Willey & Sons, New York.
2. Chahel, G.S. and Ghosal, S.S. (2002) Principles and Procedures of Plant Breeding, Biotechnological and Conventional Approaches. Narosa Publishing House, New Delhi.
3. Singh, B.D. (2005). Plant Breeding. Kalyani Publishing House, New Delhi.
4. Singh, P. (2001) Essentials of Plant Breeding-Principles and Methods. Kalyani Publishing House, New Delhi.
5. Jain, H.K. and Kharsckwal, M.C. (2004) Plant Breeding- Mendelian to Molecular approach. Narosa Publishing House, New Delhi.

HORT-211 Production Technology for Vegetables and Spices 2(1+1)

THEORY

Importance of vegetables & spices in human nutrition and national economy, kitchen gardening, brief about origin, area, climate, soil, improved varieties and cultivation practices such as time and methods of sowing, transplanting techniques, planting distance, fertilizer requirements, irrigation, weed management, harvesting and yield, physiological disorders, of important vegetable and spices (Tomato, Brinjal, Chilli, Capsicum, Cucumber, Melons, Gourds, Pumpkin, French bean, Peas; Cole crops such as Cabbage, Cauliflower, Knol-khol; Bulb crops such as Onion, Garlic, **cumin, coriander, fenugreek and fennel** ; Root crops such as Carrot, Radish, Beetroot; Tuber crops

such as Potato; Leafy vegetables such as Amaranth, Palak. Perennial vegetables (**drumstick and pointed guards**).

PRACTICAL(Production Technology for Vegetable and Spices):

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

Suggested Reading

1. Choudhary, B.R. (2009) A Text book on production technology of vegetables, Kalyani Publishers
2. Yawalkar, K.S. (2008) Vegetable crops in India, Agri-Horticultural Pub. House. Nagpur
3. Kamath K.V (2007) Vegetable Crop Production, oxford Book Company
4. M.K. Rana (2008) Olericulture in India, Kalyani Publishers
5. Dhaliwal, M.S. (2008) Handbook of Vegetable Crops, kalyani Publishers
6. Nath Prem (1994) Vegetables for the Tropical Regions, ICAR New Delhi
7. Hazra, P. (2011) Modern Technology in Vegetable Production, New India Publishing Agency, New Delhi
8. Pruthi, J.S. (1993) Major Spices of India- Crop Management Postharvest Technology ICAR
9. Pruthi, J.S. (1993) Minor Spices of India- Crop Management Postharvest Technology ICAR
10. Singh, D.K. (2007) Modern Vegetable varieties and production, IBN publishers, Technology International Book Distributing Co, Lucknow

STAT-211

Statistical Methods

2(1+1)

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. Normal, 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 × 2 Contingency Table. Introduction to Analysis of Variance, Analysis of One Way Classification. Introduction to Sampling Methods, Sampling versus Complete Enumeration, Simple Random Sampling with and without replacement, Use of Random Number Tables for selection of Simple Random Sample.

PRACTICAL

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

Suggested Reading :

1. Chandel, S.R.S. 1998. Handbook of Agril. Statistics. Achal Prakashan Mandir, Kanpur.
2. Gupta S.P. 2002. Statistical Methods. Sultan Chand & Sons, New Delhi.
3. Agarwal B.L. 1991. Basic Statistics Wiley Eastern, New Delhi.

Semester III

Course Title: National Service Scheme III

Vocational skill development

To enhance the employment potential and to set up small business enterprises skills of volunteers, a list of 12 to 15 vocational skills will be drawn up based on the local conditions and opportunities. Each volunteer will have the option to select two skill-areas out of this list

Issues related environment

Environmental conservation, enrichment and sustainability, climatic change, natural resource management (rain water harvesting, energy conservation, forestation, waste land development and soil conservations) and waste management

Disaster management

Introduction and classification of disaster, rehabilitation and management after disaster; role of NSS volunteers in disaster management.

Entrepreneurship development

Definition, meaning and quality of entrepreneur; steps in opening of an enterprise and role of financial and support service institution.

Formulation of production-oriented project

Planning, implementation, management and impact assessment of project

Documentation and data reporting

Collection and analysis of data, documentation and dissemination of project reports

Semester III: National Cadet Corps III

- Arms Drill- Attention, stand at ease, stand easy. Getting on parade. Dismissing and falling out. Ground/take up arms, examine arms.
- Shoulder from the order and vice-versa, present from the order and vice-versa.
- Saluting at the shoulder at the halt and on the march. Short/long trail from the order and vice-versa.
- Guard mounting, guard of honour, Platoon/Coy Drill.
- Characteristics of rifle (.22/.303/SLR), ammunition, fire power, stripping, assembling, care, cleaning and sight setting.
- Loading, cocking and unloading. The lying position and holding.
- Trigger control and firing a shot. Range Procedure and safety precautions. Aiming and alteration of sight.
- THEORY of groups and snap shooting. Firing at moving targets. Miniature range firing.
- Characteristics of Carbine and LMG.
- Introduction to map, scales and conventional signs. Topographical forms and technical terms.

Semester III: PHED- III: 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 game 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 game 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.

B.Sc. (Hons) Agriculture Second year Second Semester

AGECON-221 Agricultural Marketing, Trade & Prices

3(2+1)

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; **FPO & type of administered price**

Product life cycle (PLC) Meaning and stages in PLC; characteristics of PLC; **strategies in different stages of PLC**. Market promotion **Introduction of Market promotion schemes**

~~— advertising, personal selling, sales promotion and publicity — their meaning and merits & demerits;~~ marketing process and functions: 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; 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; **Introduction of e-NAM** Role of Govt. in agricultural marketing. Introduction to CWC, SWC, FCI, CACP & DMI. Cooperative marketing in India; Risk in marketing: Types of risk in marketing; speculation & hedging; an **overview / Introduction** of futures trading; Agricultural prices and policy: Meaning and functions of price; administered prices; need for agricultural price policy; Trade: Concept of International Trade and its need, theories of absolute and comparative advantage. GATT and WTO; Agreement on Agriculture (AoA) and **its implications on Indian agriculture; IPR.**

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/assignment to market institutions – NAFED, SWC, CWC, cooperative marketing society etc. to study their organization and functioning.

Suggested Reading

1. Acharya S.S. & Aggarwal N.L. (2011) Agricultural Marketing in India, Oxford and IBH
2. Moore, J.R., Johl S.S. and Khusro, A.M. (1973) Indian Food Grain Marketing, Printice Hall.

3. A.S. Kahlon & D.S. Tyagi (1983) Agricultural Price Policy in India, Allied Publishers, New Delhi
4. Bhall, V.K. and Ramu, S.S. (1996) International Business-Environment and Management, Anmol Publications (P) Limited, New Delhi
5. Chandra, P. (1984) Projects: Preparation, Appraisal & Implementation, McGraw Hill Inc.
6. Mukherjee, S. (2002) Modern Economic THEORY. New Age International
7. Gupta R.D. & Lekhi R.K. (1982) Elementary Economic THEORY, Kalyani Publishers
8. Acharya, S.S. & Agarwal, N.L. 2005 Agricultural Prices-Analysis and Policy, Oxford & IBH Publishing Co. PVT. LTD. New Delhi.

AGENGG-221 Renewable Energy and Green Technology 2(1+1)

THEORY

Classification of energy sources, contribution of these of sources in agricultural sector, Familiarization with biomass utilization for bio-fuel production and their application, Familiarization with different types of biogas plants and gasifiers, bio-alcohol, biodiesel. Familiarization with briquetting techniques, Introduction of solar energy, solar collectors and their application, Familiarization with solar energy gadgets: solar cooker, solar water heater, application of solar energy: solar drying, 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 briquetting machine, Familiarization with different solar energy gadgets. To study solar photovoltaic system: solar light, solar pumping, solar fencing. To study solar cooker, To study solar dryers. To study solar distillation system.

Suggested Reading:

1. Rai, G.D. Non-Conventional Energy Sources, Kh Publishers, New Delhi.
2. Rathore, N.S., Kurchania, A.K. and Panwar, N.L. 2007. Non-Conventional Energy Sources, Himanshu Publications.
3. Rathore, N.S., Kurchania, A.K. and Panwar, N.L. 2007. Renewable Energy, THEORY and Practice, Himanshu Publications.
4. Khandelwal, K.C. & Mandi, S.S. 1990. Biogas Technology.

AGRON-221 Crop Production Technology – II (*Rabi* crops) 2(1+1)

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, **Rajmash**,oilseeds-rapeseed, mustard and sunflower; sugar crops-sugarcane; medicinal and aromatic crops-mentha, lemon grass and citronella, Forage crops- berseem, lucerne,oat and **rye grass**.

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.

Suggested Reading

1. Singh, C, Singh, P. and Singh, R. 2003. Modern Techniques of Raising Field Crops, Oxford & IBH Publishing Co., New Delhi.
2. Singh, S.S.1998. Crop Management Under Irrigated and Rainfed Conditions. Kalyani Publishers, New Delhi.
3. Panda, S.C. 2012. Modern Concepts and Advance Principles in Crop Production. Agrobios (India), Jodhpur
4. Singh, S.S. and Singh, R. 2013. Crop Management Under Irrigated and Rainfed Conditions. Kalyani Publishers, New Delhi.
5. Rathore, P.S. 2000. Techniques and Management of Field Crop Production, Agrobios (India), Jodhpur.
6. Prasad, R. 2002. Text Book of Field Crops Production, ICAR, New Delhi.
7. ICAR. 2010. Handbook of Agriculture (6th edition), Indian Council of Agricultural Research, New Delhi.
8. Reddy, S.R. 2012. Agronomy of Field Crops. Kalyani Books, New Delhi.
9. आर्य, आरएल एवंआर्य, केशव. 2016. रबीसस्य उत्पादन, कल्याणीपब्लिशर्स, लुधियाना
10. शक्तावत, मोहन सिंह एवंव्यास, अभय कुमार. 2000.वैज्ञानिकफसलप्रबन्धन, यश पब्लिशिंगहाउस, बीकानेर

AGRON-222

Farming System & Sustainable Agriculture

1(1+0)

THEORY

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

Suggested Reading

1. Panda, S.C. 2004. Cropping Systems and Farming Systems, Agrobios (India), Jodhpur.
2. Panda, S.C. 2012. Modern Concepts and Advance Principles in Crop Production. Agrobios (India), Jodhpur
3. Sharma, A.K. 2002. A Handbook of Organic Farming, Agrobios (India) Ltd., Jodhpur
4. Bala subramaniyan, P. and Palaniappan, S.P. 2016. Principles and Practices of Agronomy (2nd edition), Agrobios (India), Jodhpur.
5. Shukla, R.K. 2004. Sustainable Agriculture, Surbhee Publications, Jaipur

5. Murithy, K, and Radha, V. 1995. PRACTICAL Manual on Agricultural Meteorology, Kalyani Publishers, New-Delhi
6. Panda, S.C.2012. Modern Concepts and Advance Principles in Crop Production. Agrobios (India), Jodhpur
7. Balasubramanian, P. and Palaniappan, S.P.2016. Principles and Practices of Agronomy, Agrobios (India), Jodhpur
8. पोरवाल, बी. एल., सिंह, पुष्पेन्द्र एवम् शर्मा, डी. डी. 2000. सस्य विज्ञान के मूलतत्व, के. पी. प्रकाशन, उदयपुर

GPB-221

Principles of Seed Technology

3(1+2)

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 (Wheat, Rice, Maize, Sorghum and Bajra), pulses (Urd, Mung, Cowpea, Pigeon pea, Lentil, Gram, Field pea), oilseeds (Soybean, Rapeseed and Mustard, Groundnut, sesame), fodder (Berseem) and vegetables (Potato, cauliflower, tomato and chilli), Seed spices (Cumin, Coriander, Fennel and Fenugreek).

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. **Organic certification procedure and standards, field inspection**

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, Cowpea, Pigeonpea, Lentil, Gram, Fieldpea. Seed production in major oilseeds: Soybean, Rapeseed and Mustard, Groundnut. Seed production in vegetable crops & Seed spices.

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.

Suggested Reading

1. Agarwal, R.L.1991. Seed Technology, Oxford & IBH Publishing Co. Delhi
2. Agarwal, P.K. 1999. Seed Technology, ICAR, New Delhi.
3. Sen, S. and Ghosh, N. 1999. Seed Science and Technology, Kalyani Publishers. New Delhi.

THEORY

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

PRACTICAL(Production Technology for Fruit and Plantation Crops):

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

Suggested Reading:

1. Bal, J.S. 2010 Fruit Growing, Kalyani Publishers
2. Banday F.A. and Sharma M.K. 2010 Advances in Temperate Fruit Production Kalyani Publishers
3. Bose, T.K., Mitra, S.K. and Sanyal, D. Nayaprakash, 2002 Tropical and Sub-Tropical-Vol-I Kolkata
4. Chadha, T.R (2001) Text Book of Temperate Fruits, ICAR Publication
5. Chattopadhyay T.K. 2009 A text book on Pomology-IV Devoted to Temperate fruits, Kalyani Publishers
6. Chadda, K.L. 2009 Advanced in Horticulture, Malhotra Publishing House, New Delhi
7. Kumar, N.J.B., Khaddar, A., Swamy, P. and Irrulappan, I. 1997 Introduction to spices, Plantation crops and Aromatic plants, Oxford & IBH, New Delhi
8. Radha, T. and Mathew, L. 2007 Fruit crops, New India Publishing Agency
9. S.P. Singh 2004 Commercial fruits, Kalyani Publishers
10. W.S. Dhillon. 2013 Fruit Production in India. Narendra Publishing House

SSAC-221

Problematic Soils and Their Management

2(2+0)

THEORY

Soil quality and health, Distribution of Waste land and Salt affected 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 Agro-ecosystems.

Suggested Reading

1. Bear F.E. 1964. *Chemistry of the Soil*. Oxford & IBH.
2. Jurinak J.J. 1978. *Salt-affected Soils*. Department of Soil Science & Biometeorology. Utah State University
3. USDA Handbook No. 60. 1954. *Diagnosis and improvement of Saline and Alkali Soils*. Oxford & IBH.
4. Abrol, I.P. and Dhurva, V.V. (1998) Technologies for wasteland development, ICAR, New Delhi-110012
5. Cirsan P.J. (1985) Principles of remote sensing. Longman, New York.
6. Richards, L.A. (1954). Diagnosis and improvement of saline and alkali soils. USDA Hand book No. 60, Washington, DC USA.

7. Somani, L.L. and Totawat, K.L. (1993). Management of salt affected soils and waters.
8. Agrotech publishing Academy, Udaipur.
9. Agarwal, R.R., Yadav, J.S.P. and Gupta, R.N. (1982). Saline Alkali soils of India, ICAR, New Delhi.
10. ISSS (2015) Fundamentals of Soil Science, Div. of Soil Science, IARI, New Delhi

AGECON-222 Agri-business Management (ELECTIVE COURSES) 3 (2+1)

THEORY

Transformation of agriculture into agribusiness, various stakeholders and components of agribusiness systems. Importance of agribusiness in the Indian economy and New Agricultural Policy. Distinctive features of Agribusiness Management: Importance and needs of agro-based industries, Classification of industries and types of agro based industries. Institutional arrangement, procedures to set up agro based industries. Constraints in establishing agro-based industries. Agri-value chain: Understanding primary and support activities and their linkages. Business environment: PEST & SWOT analysis. Management functions: Roles & activities, Organization culture. Planning, meaning, definition, types of plans. Purpose or mission, goals or objectives, Strategies, policies procedures, rules, programs and budget. Components of a business plan, Steps in planning and implementation. Organization staffing, directing and motivation. Ordering, leading, supervision, communications, control. Capital Management and Financial management of Agribusiness. Financial statements and their importance. Marketing Management: Segmentation, targeting & positioning. Marketing mix and marketing strategies. Consumer behaviour analysis, Product Life Cycle (PLC). Sales & Distribution Management. Pricing policy, various pricing methods. Project Management definition, project cycle, identification, formulation, appraisal, implementation, monitoring and evaluation. Project Appraisal and evaluation techniques.

PRACTICAL

Study of agri-input markets: Seed, fertilizers, pesticides. Study of output markets: grains, fruits, vegetables, flowers. Study of product markets, retails trade commodity trading, and value-added products. Study of financing institutions- Cooperative, Commercial banks, RRBs, Agribusiness Finance Limited, NABARD. Preparations of projects and Feasibility reports for agribusiness entrepreneur. Appraisal/evaluation techniques of identifying viable project- non-discounting techniques. Case study of agro-based industries. Trend and growth rate of prices of agricultural commodities. Net present worth technique for selection of viable project. Internal rate of return.

Suggested Readings:

1. Gittinger, J. P. 1984, Economic Analysis of Agricultural Projects. John Hopkins University Press.
2. Kotler, Philip. 1999. Marketing Management. Prentice Hall of India, New Delhi,
3. Mamoria, C. B., Joshi, R. L. and Mulla, N. I. 2005. Principles and Practices of Marketing in India. Kitab Mahal, Allahabad.
4. Meena, G. L., Burark, S. S., Pant, D. C. and Sharma, R. 2017. Fundamentals of Agribusiness Management. Agrotech Publishing Academy, Udaipur.

5. Somani, L. L. and Meena, G. L. 2017. Agribusiness & Farm Management at a Glance. Vol- 1 & 2, Agrotech Publishing Academy, Udaipur.
6. Sudha, G. S. 2000. Business Management. RBSA Publishers, Jaipur.
7. Tripathi, P. C. and Reddy, P. N. 2008. Principles of Management. Tata McGraw Hill Education Private Limited, New Delhi.

Semester IV

Course Title: National Service Scheme IV

- Youth and crime
- Sociological and psychological factors influencing youth crime, cybercrime, peer mentoring in preventing crime and awareness for juvenile justice
- Civil/self defence
- Civil defence services, aims and objectives of civil defence; needs and training of self-defence Resource mobilisation
- Writing a project proposal of self-funded units (SFUs) and its establishment Additional life skills
- Positive thinking, self-confidence and esteem, setting life goals and working to achieve them, management of stress including time management

Semester IV: National Cadet Corps IV

- The grid system. Relief, contours and gradients. Cardinal points and finding north. Types of bearings and use of service protractor.
- Prismatic compass and its use. Setting a map, finding north and own position. Map to ground and ground to map.
- Knots and lashings, Camouflage and concealment, Explosives and IEDs.
- Field defenses obstacles, mines and mine laying. Bridging, watermanship
- Field water supplies, tracks and their construction.
- Nuclear, Chemical and Biological Warfare (NCBW)
- Judging distance. Description of ground and indication of landmarks.
- Recognition and description of target. Observation and concealment. Field signals. Section formations.
- Fire control orders. Fire and movement. Movement with/without arms. Section battle drill.
- Types of communication, media, latest trends and developments.

Semester IV: PHED- IV : Physical Education and Yoga Practices

- Teaching of different field events – demonstration practice of the skills and correction.
- Teaching of different field events – demonstration practice of the skills and correction.
- Teaching of different field events – demonstration practice of the skills and correction with competition among them.
- Teaching of different asanas – demonstration practice and correction.
- Teaching of different asanas – demonstration practice and correction.
- Teaching of different asanas – demonstration practice and correction.
- Teaching of different asanas – demonstration practice and correction.
- Teaching of weight training – demonstration practice and correction.
- Teaching of circuit training – demonstration practice and correction.
- 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.

B.Sc. (Hons) Agriculture third year First semester

AGRON-311 Geoinformatics and Nanotechnology and Precision 2(1+1)
Farming

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; Remote sensing concepts and application in agriculture; Image processing and interpretation; Global positioning system (GPS), components and its functions; Introduction to crop Simulation Models and their uses for optimization of Agricultural Inputs; STCR approach for precision agriculture; Nanotechnology, definition, concepts and techniques, brief introduction about nanoscale effects, nano-particles, nano-pesticides, nano-fertilizers, nano-sensors, Use of nanotechnology in seed, water, fertilizer, plant protection for scaling-up farm productivity.

PRACTICAL

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

Suggested Reading

1. Krishna, K.K. 2013. Precision Farming: Soil Fertility and Productivity Aspects. Apple Academic Press
2. Srivastava, G.S. 2014. An Introduction to Geoinformatics. McGraw Hill Education (India) Pvt. Ltd. , New Delhi
3. Gupta, R.K. and Chander, S. 2008. Principles of Geoinformatics. Jain Brothers, New Delhi.
4. Choudhary, S. 2011. Applied Nanotechnology in Agriculture. Arise Publishers & Distributors
5. Sekhon, B.S. 2014. Nanotechnology in agri-food production: an overview. *Nanotechnology, Science and Applications*7:31-532.

AGRON-312 PRACTICAL Crop Production – I (Kharif crops) 2(0+2)

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.

Suggested Reading

1. Yawalkar, K.S., Agarwal, J.P. and Bokde, S. 2008. Manures and Fertilizers (10th edition), Agri-Horticultural Publishing House, Nagpur.
2. Balasubramanian, P. and Palaniappan, S.P. 2016. Principles and Practices of Agronomy Agrobios (India), Jodhpur.
3. Reddy, S.R., 2016. Principles of Agronomy (5th edition), Kalyani Publishers, Ludhiana.
4. Singh, S.S. and Singh, R. 2015. Principles and Practices of Agronomy (5th Re-set), Kalyani Publishers, New Delhi, Kalyani Publishers, Ludhiana.

ENTO-311

Pests of Crops and Stored Grains and Their Management 3(2+1)

THEORY

Scientific name, order, family, distribution, identification, host range and nature of damage, biology and bionomics, and management of important arthropod pests.

Polyphagous insect pests: Locust, grasshopper, white grub, termite and red hairy caterpillar.

Pests of field crops: Cereals and millets- Rice: Brown plant hopper, yellow stem borer, Sorghum: Shootfly; Maize: Stem borer and fall army worm; Sugarcane: Pyrilla, whitefly, shoot borer. Pulses: Gram pod borer, cutworm. Tobacco: Tobacco caterpillar. Oilseeds: Mustard aphid, sawfly, painted bug, groundnut aphid, soybean girdle beetle, castor semilooper, castor capsule borer, sesame leaf and capsule borer. Cotton: Jassid, whitefly, spotted and pink bollworm, red cotton bug, mealy bug.

Pests of vegetables Brinjal- brinjal shoot and fruit borer; Tomato- Fruit borer (Covered in gram); Okra- Shoot and fruit borer (Covered in cotton). Potato: Tuber moth. Chilli: Thrips; Onion and garlic: Thrips. Cruciferous vegetables: Cabbage caterpillar, diamondback moth, semilooper, tobacco caterpillar (Covered in tobacco). Pea: Stem fly. Cucurbitaceous vegetables: Melon fruit fly, red pumpkin beetle, red vegetable mite.

Pests of fruit crops Mango: Mango hopper, mealy bug, stem borer, fruit fly; Guava: Fruit fly. Citrus: Citrus psylla, citrus caterpillar, bark eating caterpillar. Citrus: Citrus psylla, citrus caterpillar, bark eating caterpillar. Pomegranate: Anar butterfly; Ber: Fruit fly. Apple: San Jose scale, woolly aphid.

Pests of ornamental crops: Rose aphid, hollyhock tinged bug, jasmine budworm.

Pests of spices and condiments: Aphid,

Pests of stored grains: Khapra beetle, lesser grain borer, rice weevil, red rust flour beetle, pulse beetle, Angoumois grain moth, grain mite, storage fungi. Storage structures and methods of grain storage. Principles of stored grain pest management. Management of stored grain pest.

Rodents and their management in fields and godowns.

Birds of agricultural importance and their management.

PRACTICAL

Study of identification, host range and nature of damage, biology and bionomics, and management of important arthropod pests of various field crops, vegetable crops, fruit crops, ornamental crops, spices and condiments including polyphagous insect pests. Identification of insect pests and mites associated with stored grains. Determination of insect infestation by different methods. Fumigation of grain stores and godowns. Identification of rodents and birds and their control operations. Determination of moisture content of grain. Methods of grain sampling under storage condition. Visit to nearest FCI godowns and warehouse.

Suggested Reading

1. Atwal, A.S. and Dhaliwal, G.S. 2002. Agricultural Pests of South Asia and Their Management, Kalyani Publishers, New Delhi.
2. David, B.V. and Ramamurthy, V.V. 2016. Elements of Economic Entomology, 8th Ed. Popular Book Depot, Chennai.
3. Mathur and Upadhyay, 2005. A Text Book of Entomology, Aman Publishing House, Meerut.
4. Nayar, M.R.G.K. 1986. Insects and Mites of Crops in India, ICAR, New Delhi.
5. Srivastava, K.P. 2004. A Text Book of Entomology, Vol.I& II, Kalyani Publishers, New Delhi.
6. Reddy, P. Parvatha 2010. Insect, Mite and Vertebrate Pests and their Management in Horticultural Crops. Scientific Publishers, Jodhpur.

EXCOM-311 Entrepreneurship Development and Business Communication 2 (1+1)

THEORY

Concept of Entrepreneur, Entrepreneurship Development, Characteristics of entrepreneurs; SWOT Analysis & achievement motivation, Government policy and programs and institutions for entrepreneurship development, Impact of economic reforms on Agribusiness/ Agrienterprises, Entrepreneurial Development Process; Business Leadership Skills; Developing organizational skill (controlling, supervising, problem solving, monitoring & evaluation), Developing Managerial skills, Business Leadership Skills (Communication, direction and motivation Skills), Problem solving skill, Supply chain management and Total quality management, Project Planning Formulation and report preparation; Financing of enterprise, Opportunities for agri-entrepreneurship and rural enterprise.

PRACTICAL

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

Suggested Reading

1. Koontz, H & Wehrich, H. 2004. *Essentials of Management: An International Perspective*, 2nd Ed. Tata Mc-Graw Hill Publishing Pvt Ltd.
2. Chole, R.R., Kapse, P.S. and Deshmukh, P.R. 2012. Entrepreneurship Development and Communication Skills scientific Publisher (India), Jodhpur.
3. Bhaskaran, S. 2014. Entrepreneurship Development and Management. Aman Publishing House, Meerut.
4. Mancuso, J. 1974. The Entrepreneurs Handbook (Vol. 192), Artech House, Inc., USA.

5. Karthikeyan, C. 2008. A Text Book of Agricultural Extension Management. Atlantic Publishers, New Delhi.
6. Natrajan, K. and Ganeshan, K.P. 2012. Principles of Management. Himalaya Publishing House, New Delhi.
7. Balasubramanyam, M. 1985. *Business Communication*. Vani Educational Books, New Delhi.
8. Dipak De & Jirli, B. *Entrepreneurship : THEORY and practice in agriculture*. ISBN 81-85694-57-5, Ganga Kaveri Publishing House, D.35/77, Jangamawadimath, Varanasi-221001 (India), Ph.- 0542-2451936
9. Pandey, M. and Tewari, D. 2010. *The Agribusiness Book*. IBDC Publishers.
10. Nandan H. 2011. *Fundamentals of Entrepreneurship*. PHI Learning Pvt Ltd India.
11. Charantimath, P. 2006. *Entrepreneurship Development: Small Business Enterprise*. Pearson Education.
12. Harsh, S.B., Conner, U.J. and Schwab, G.D. 1981. *Management of the Farm Business*. Prentice Hall Inc., New Jersey.
13. Joseph, L. Massie. 1995. *Essentials of Management*. Prentice Hall of India Pvt. Ltd., New Delhi.
14. Omri R.N. 1980. *Introduction to Agribusiness*. Prentice Hall Inc., New Jersey
15. Thomas W Zimmer and Norman M Scarborough. 1996. *Entrepreneurship*. Prentice-Hall, New Jersey.
16. Dollinger, M.J., 1999. *Entrepreneurship Strategies and Resources*. Prentice-Hall, Upper Saddle River, New Jersey.
17. Khanka S.S., 1999. *Entrepreneurial Development*. S. Chand and Co. New Delhi.
18. Mohanty S.K., 2007. *Fundamentals of Entrepreneurship*. Prentice Hall India Ltd., New Delhi.

GPB-311

Crop Improvement-I (Kharif crops)

2(1+1)

THEORY

Centers of origin, distribution of species, wild relatives in different cereals (Rice, Maize, Sorghum and Bajra); pulses (Urd, Mung, Cowpea and Pigeonpea); oilseeds (Soybean, sesame and Groundnut); fibres (Cotton); fodders (Bajra) and cash crops (Castor); vegetable ~~and horticultural crops~~ (Chilli and tomato); 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. [Variability parameters](#)

PRACTICAL

Emasculation and hybridization techniques in different crop species; viz., Rice, Maize, Sorghum, Pearl Millet, Ragi, Pigeonpea, Urdbean, Mungbean, Soybean, Groundnut, Sesame, Castor, 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.

Suggested Reading

1. Chopra, V.L. 2000 Breeding of Field Crops (Edt.). Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi.
2. Chaddha. K.L. and Gupta, R. 1995. Advances in Horticulture Vol. II Medicinal and Aromatic Plant. Malhotra Publishing House, New Delhi.
3. Mandal, A.K., Ganguli, P.K. and Banerjee, S.P. 1991. Advances in Plant Breeding Vol. I and II. CBS Publishers and Distributors, New Delhi.
4. Manjit S.K. 2004. Crop Improvement: Challenges in the Twenti-First Century (Edt). International Book Distributing Co. Lucknow.
5. Poehlman, J.M. 1987. Breeding of Field Crops. AVI Publishing Co. INC, East Port, Conneacticut, USA.
6. Ram, H.H. and Singh, H.G. 1994. Crop Breeding and Genetics. Kalyani Publishers, New Delhi.
7. Sharma, A.K. 2005. Breeding Technology of Crop Plants (Edt.). Yash Publishing House, Bikaner.
8. Ram. H.H. 2005. Vegetable Breeding — Principles and Practices. Kalyani Publishers, New Delhi.

GPB-312

Intellectual Property Rights

1(1+0)

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.

Suggested Readings:

1. Allard, R. W. 2000. Principles of Plant Breeding. John Willey & Sons, New York.
2. Chahel, G. S. and Ghosal, S. S. 2002. Principles and Procedures of Plant Breeding, Biotechnological and Conventional Approaches. Narosa Publishing House, New Delhi.
3. Chopra, V. L. 2012. Plant breeding: THEORY and Practice. Oxford & IBH Publishing CO. Pvt. Ltd., New Delhi.
4. Jain, H. K. and Kharsckwal, M. C. 2004. Plant Breeding- Mendelian to Molecular Approach. Narosa Publishing House, New Delhi.
5. Ramchandra, R. K. 2015. Principles of Plant Breeding. Jaya Publishing House, Delhi.
6. Sharma, J. R. 1994. Principles and Practices of Plant Breeding. Tata McGraw Publishing Company Ltd., New Delhi.
7. Singh, B. D. 2006. Plant Breeding. Kalyani Publishing House, New Delhi.
8. Singh, Phundan, 2001. Essentials of Plant Breeding-Principles and Methods. Kalyani Publishing House, New Delhi.

PPATH311: Principles of Integrated Pest and Disease Management 3(2+1)

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/IDM module. Implementation and impact of IPM /IDM (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*, *Pseudomonas*, *Trichogramma*, NPV etc. Identification and nature of damage of important insect pests and diseases and their management. Crop (agroecosystem) dynamics of a selected insect pest and diseases. Plan & assess preventive strategies (IPM / IDM module) and decision making. Crop monitoring attacked by insect pest and diseases. Awareness campaign at farmers' fields.

Suggested Readings:

1. Agrios, G. N. 2005. Plant Pathology. (5th Ed). Academic Press, New York.
2. Dhaliwal, G. S. and Arora, R. 2002. Integrated Pest Management: Concept and Approaches. Kalyani Publishers, New Delhi, 297 p.
3. Dube, H. C. 2012, Modern Plant Pathology, (2nd Ed). Agrobios (India), Jodhpur.
4. Gupta, V. K. and Sharma, R. C. 1995. Integrated Disease Management and Plant Health. Scientific Publ., Jodhpur.
5. Mehrotra, R. S. and Agrawal, A. 2013. Plant Pathology. (2nd Ed). Tata McGraw Hill Publishing Co. Ltd., New Delhi.
6. Metcalf, R. L. and Luckmann, W. H. 1982. Introduction of Insect Pest Management. A Wiley – Interscience Publication, 561 p.
7. Nene Y. L. and Thapliyal, P. N. 2011. Fungicides in Plant Diseases Control. (3rd Ed). Oxford & IBH published Co. Pvt. Ltd., New Delhi.
8. Sharma, R. C. and Sharma, J. N. 1995. Integrated Plant Disease Management. Scientific Publ., Jodhpur.
9. Singh, R. S. 2001. Plant disease management. Oxford & IBH publishing Co., Pvt. Ltd, New Delhi.
10. Singh, R. S. 2011. Introduction to Principles of Plant Pathology. (4th Ed). Oxford & IBH Publishing Company, New Delhi.

PPATH-312 Diseases of Field and Horticultural Crops and their Management-I 3(2+1)

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 blight; **Sorghum:** smuts, blight/spot and anthracnose and grain mold, **Bajra:** Downy mildew and ergot; **Groundnut:** Tikka, collar rot, clump virus and bud necrosis; **Soybean:** Charcoal rot & Rhizoctonia blight, pod blight, bacterial pustule and mosaic; **Pigeon pea:** Phytophthora blight, wilt and sterility mosaic; **Black & green gram:** Cercospora leaf spot, anthracnose, powdery mildew and yellow mosaic; **Castor:** Phytophthora blight; **Guar:** Bacterial blight and alternaria blight; **Sesamum:** Stem & root rot and phyllody; **Cotton:** Wilt, root rot, bacterial blight and leaf curl.

Horticultural Crops:

Guava: wilt and anthracnose; **Banana:** Panama wilt, bacterial wilt, sigatoka and bunchy top; **Papaya:** foot rot, mosaic and ring spot, **Pomegranate:** bacterial blight & Leaf spot; **Cruciferous vegetables:** Alternaria leaf spot and black rot and mosaic; **Brinjal:** Phomopsis blight and fruit rot and little leaf and root knot; **Tomato:** damping off, wilt, early and late blight, buck eye rot and leaf curl and mosaic; **Okra:** Yellow vein mosaic and powdery mildew; **Beans:** anthracnose and bacterial blight; **Ginger:** soft rot; **Colocasia:** Phytophthora blight and Alternaria leaf spot; **Coconut:** wilt and bud rot and cadangcadang; **Tea:** Blister blight and red rust ; **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 25 pressed and well mounted specimens.

Suggested Reading

1. Cook, A.A. 1981. Diseases of Tropical and Sub-Tropical Field Fiber and Oil Plants. Mac Millan Publishing Co. New York.
2. Gupta V.K. and Paul Y.S. 2002. Diseases of Field Crops. Indus Publishing Co. New Delhi.
3. Mehrotra R.S. and Agrawal A. 2013. Plant Pathology. 2nd.ed. Tata McGraw-Hill Publishing Co Ltd. New Delhi.
4. Rangaswamy, G and Mahadevan, A. 2001. Diseases of Crop Plants in India. Prentice hall of India Pvt. Ltd. New Delhi.
5. Singh, R.S. 2009. Plant Diseases. 9th ed. Oxford & IBH Publishing Company Pvt. Ltd. New Delhi.
6. Agrios, G.N. 2005. Plant Pathology. 5th ed. Academic Press, New York.
7. Gupta, S.K. and Thind, T.S. 2012. Disease problem in vegetable production. Scientific Publishers, Jodhpur.
8. Singh, R.S. 2012. Diseases of Fruit Crops. Oxford and IBH Publishing Co. Pvt. Ltd. New Delhi.
9. Singh, R.S. 1998. Diseases of Vegetable Crops. 3rd ed. Oxford and IBH Publishing Co. Pvt. Ltd. New Delhi.

SSAC-311

Manures, fertilizers and Soil Fertility Management

3(2+1)

THEORY

Introduction and importance of organic manures, properties and methods of preparation of bulky and concentrated manures. Green/leaf manuring. Soil organic matter, composition, properties and influences of soil fertility, Humic substances – nature and properties.

Chemical fertilizers: classification, specification and properties of major nitrogenous, phosphatic, potassic fertilizers, secondary & micronutrient fertilizers, Complex fertilizers, nano fertilizers Soil amendments, Fertilizer Storage, Fertilizer Control Order. Fertilizer adulteration.

History of soil fertility and plant nutrition. criteria of essentiality. Forms of nutrients in soil, role, deficiency and toxicity symptoms of essential plant nutrients, Mechanisms of nutrient transport to plants, factors affecting nutrient availability to plants. Soil fertility evaluation, Soil testing. Critical levels of different nutrients in soil. Indicator plants. Methods of fertilizer recommendations to crops. Factor influencing nutrient use efficiency (NUE), Integrated nutrient management.

PRACTICAL

Introduction of analytical instruments and their principles, Estimation of soil organic carbon, Estimation of available N in soils. Estimation of soil extractable P in soils. Estimation of exchangeable K; Ca and Mg in soils. Estimation of soil extractable S in soils. Estimation of DTPA extractable Zn, Cu, Fe and Mn in soils. Estimation of N in plants. Estimation of P in plants. Estimation of K in plants. Estimation of S in plants.

Suggested Reading

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

2. Das, D.K. 2002 Introductory Soil Science, Kalyani publisher, New Delhi
3. Rai, M.M. 2002 Principal of Soil Science, Mac Millan India Ltd, New Delhi
4. Mehra R.K. 2004 Text book of Soil Science, ICAR New Delhi
5. ISSS (2002) Fundamental of Soil Science Div. of Soil Science, IARI, New Delhi
6. Jackson, M.L. 1973 Soil chemical analysis, Prentice Hall of India, Pvt. Ltd New Delhi
7. Piper, C.S. 1950 Soil and Plant analysis, Hans publications, Bombay
8. Singh Dhyana, Chhonkar, P.K. and Dwivedi V.S. 2005 Manual on Soil Plant and water analysis. Westville Publishing House, New Delhi
9. Tisdale, S.L. Nelson, W.L. Beaton, J.D. and Havlin, J.L. 1991 Soil fertility and fertilizers (5th ed.). Prentice Hall of India, Pvt. Ltd, New Delhi.
10. Singh V. 1996 (Hindi) Soil Science, fertilizer & Manures, V.K. PrakashanBarot Merrut (U.P)
11. Yawalkar, K.S. and Agarwal. J.P. 1992. Manure and fertilizers. Agriculture-Horticulture Publishing House, Nagpur.
12. Sanchalli, V.K. 1960. Chemistry and Technology of Fertilizers. Reinheblpublishing corporation, New York, USA.
13. Chopra, S.L. and Kanwar, J.S. 1991. Analytical Agriculture, Chemistry, Kalyani Publishers, New Delhi.
14. Tandon, H.L.S. 1989. Soil water and fertilizers analysis, Fertilizer Development and Consultant organization, New Delhi
15. FAI. 1999. Fertilizer (Control) Order, 1985 and the essential commodities Act, 1995. FAI, New Delhi, pp. 203.
16. Kanwar, J.S. 1976. Soil Fertility: THEORY and practice. (ed) ICAR, New Delhi pp. 583.
17. Vicker, M.H. 1952. Using commercial fertilizers, Interstate Danvil, US

EXCOM-312 AGRICULTURAL JOURNALISM (Elective Course)3(2+1)

THEORY

Agricultural Journalism: The nature and scope of agricultural journalism characteristics and training of the agricultural journalist, how agricultural journalism is similar to and different from other types of journalism. Newspapers and magazines as communication media: Characteristics; kinds and functions of newspapers and magazines, characteristics of newspaper and magazine readers. Form and content of newspapers and magazines: Style and language of newspapers and magazines, parts of newspapers and magazines. The agricultural story: Types of agricultural stories, subject matter of the agricultural story, structure of the agricultural story. Gathering agricultural information: Sources of agricultural information, interviews, coverage of events, abstracting from research and scientific materials, wire services, other agricultural news sources. Writing the story: Organizing the material, treatment of the story, writing the news lead and the body, readability measures. Illustrating agricultural stories: Use of photographs, use of artwork (graphs, charts, maps, etc.), writing the captions. Editorial mechanics: Copy reading, headline and title writing, proofreading, lay outing.

PRACTICAL

Practice in interviewing. Covering agricultural events. Abstracting stories from research and scientific materials and from wire services. Writing different types of agricultural stories. Selecting pictures and artwork for the agricultural story.

Practice in editing, copy reading, headline and title writing, proofreading, lay outting. Testing copy with a readability formula. Visit to a publishing office.

Suggested Readings:

1. Bhaskaran, C. 2008. Farm Journalism and Media Management. Agrotech Publishing Company.
2. Bhatnagar, R. 2001. Print Media and Broadcast Journalism. Indian Publisher Distributors, Delhi.
3. Bhatt, S. C. 1993. Broadcast Journalism: Basic Principles, Har Anand Publications, Delhi.
4. Katyal, V. P. 2007. Fundamentals of Media Ethics. Cyber Tech Publishers, New Delhi.
5. Kumar, Arvind. 1999. The Electronic Media. Anmol Publications, New Delhi.
6. Narayanaswamy, V. R. 1979. Strengthen your writing. Orient Longman, New Delhi.
7. Ray, G. L. and Mondal, S. 2005. Journalism including communication, Farm and Rural Journalism, Public Relations, Kalyani Publication, Ludhiana.
8. Singh, A. K. 2014. Agricultural Extension and Farm Journalism. Agrobios, Jodhpur.

Sixth Semester

AGECON-321 Farm Management, Production & Resource Economics 2(1+1)

THEORY

Meaning and concept of farm management, objectives and relationship with other sciences. Meaning and definition of farms, its types and characteristics, factor determining types and size of farms. Principles of farm management: concept of production function and its type, use of production function in decision-making on a farm, factor-product, factor-factor and product-product relationship, law of equi-marginal/or principles of opportunity cost and law of comparative advantage. 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 labour 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. Introduction to linear programming. Concept of risk and uncertainty in agriculture production, nature and sources of risks Crop/livestock/machinery insurance – weather-based crop insurance, features, determinants of compensation. Concepts of resource economics, types of natural resources, differences between NRE and agricultural economics, unique properties of natural resources. **Positive and negative externalities in agriculture**, solutions, Important issues in economics and management of common property resources of land, water, pasture and forest resources etc. **Externalities in agriculture-identification and its measurements**

PRACTICAL

Preparation of farm layout. Determination of cost of fencing of a farm. Computation of depreciation cost of farm assets. Application of equi-marginal

returns/opportunity cost principle in allocation of farm resources. Determination of most profitable level of inputs use in a farm production process. Determination of least cost combination of inputs. Selection of most profitable enterprise combination. Application of cost principles including CACP concepts in the estimation of cost of crop and livestock enterprises. Preparation of farm plan and budget, farm records and accounts and profit & loss accounts. Collection and analysis of data on various resources in Rajasthan.

Suggested Reading:

1. Mittal, S.K. and Sethi, C.P. "Linear Programming."
2. Tandan, R.K. and Dhondiyal, S.P. "Principles and Methods of Farm Management".
3. Heady, E.O. and Candler, W. "Linear Programming Methods."
4. Johl, S.S. and Kapoor, T.R. "Fundamental of Farm Business Management, Kalyani Publishers, Ludhiana and New Delhi
5. Sankhayan, P.L "Introduction to the Economics of Agricultural Production."
6. Singh, I.J. "Elements of Farm Management"
7. Dorfman, R. and Samuelson and Solow, R. "Linear Programming and Economic Analysis."
8. Heady, E.O. and Dillors, J.L."Agricultural Production Function".
9. Karam, A.S. and Karan Singh "Economics of Farm Management in India".
10. M.E. Sharpe and Armonk, N.Y.: Environmental and Natural Resource Economics: THEORY, Policy and the Sustainable Society
11. Hartieick, J.M. and Olewiler, N.D.: The Economics of Natural Resource Use

AGENGG-321

Protected Cultivation and Secondary Agriculture

2(1+1)

THEORY

Green house technology: Introduction, Types of Green Houses; climate control in Green house, Planning and design of greenhouses, Design criteria of green house for cooling and heating purposes. Green house equipment's, materials of construction for traditional and low cost green houses. Irrigation systems used in greenhouses naturally ventilated solar green house, high tech green house, use of green house in drying. Concept and construction of low tunnels. Use of shade net house in protected cultivation.

Important Engineering properties such as physical, thermal and aero & hydrodynamic of cereals, pulses and oilseed. Concepts of cleaning and grading. Drying and dehydration: Moisture measurement, EMC, drying THEORY, various drying methods, commercial grain dryers (bin dryer, tray dryer, fluidized bed dryer, re-circulatory dryer and solar dryer). Material handling equipment: conveyer and elevators, their principle, working and selection.

PRACTICAL

Study of different types of greenhouses based on shape. Measurement of solar radiation, CO₂ level, humidity and temperature inside and outside green house. Determination of drying rate of agricultural products inside green house. Study of greenhouse equipment's. Visit to various Post Harvest Laboratories. Determination of Moisture content of various grains by oven drying method. Study of spiral, centrifugal and disc separator. Determination of Moisture content of various grains by moisture meter. Field visit to seed processing plant and agro processing plant.

Suggested Reading

1. Kothari S, Kaushic, S.C. and Mathur, A.N. 2016. Green house: Science and Technology. Himanshu Publication, Udaipur.
2. Sharma, A and Salokhe, V.M. 2006. Green House Technology- Application and Practice. Agro Tech. publication, Udaipur
3. Michael, A.M. and Ojha T. P. 2012. Principles of Agricultural Engineering, Vol. I. Jain Brothers, New Delhi.
4. Chakravarty, A. 1999. Post Harvest Technology of Cereals, Pulses and Oil Seeds Oxford and IBH Pub. New Delhi.
5. Henderson, S.M. and Perry, R.L. 1955. Agricultural Process Engineering, John Willy and Sons, New York.
6. Shay K.M. and Singh, K.K., 2004. Unit operation of Agriculture Processing. Publication House, New Delhi.

AGRON-321 Rainfed Agriculture & Watershed Management 2(1+1)

THEORY

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

PRACTICAL

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

Suggested Reading

1. Jayanthi, C. and Kalpana, R. 2016. Dryland Agriculture, Kalyani Publishers, Ludhiana.
2. Reddy, S.R. and Reddy, G.P. 2015. Dryland Agriculture, Kalyani Publishers, Ludhiana.
3. Murthy, J.V.S. 1994. Watershed Management, Wiley Eastern Limited. New Age International Limited, New Delhi.
4. Dhruva N.V.V. Singh, P.P., Bhardwaj, S.P., Sharma, U., Sikha, A.K., Vital, K.P.R. and Das, S.K. 1987. Watershed Management for Drought Mitigation, ICAR, New Delhi.

5. Singh, R.P., Sharma, S., Padmnabhan, N.V., Das, S.K. and Mishra, P.K. 1990. A Field Manual on Watershed Management, ICAR (CRIDA), Hyderabad.
6. Singh, P.K. 2000. Watershed Management (Design & Practices), e-media Publication, Udaipur, India.
7. Singh, R.P.1995, Sustainable Development of Dryland Agriculture in India. Scientific Publishers, Jodhpur.
8. Singh, S.S., 1993, Crop Management Under Irrigated and Rainfed Conditions, Kalyani Publishers, New Delhi.

AGRON-322

PRACTICAL Crop Production – II (Rabi crops)

2(0+2)

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 and 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.

Suggested Reading:

1. Yawalkar, K.S., Agarwal, J.P. and Bokde, S. 2008. Manures and Fertilizers (10th edition), Agri-Horticultural Publishing House, Nagpur.
2. Balasubramanian, P. and Palaniappan, S.P.2016. Principles and Practices of Agronomy (2nd edition), Agrobios (India), Jodhpur.
3. Reddy, S.R. 2016. Principles of Agronomy (5th edition), Kalyani Publishers, Ludhiana.
4. Singh, S.S. and Singh, R. 2015. Principles and Practices of Agronomy (5th Re-set), Kalyani Publishers, New Delhi, Kalyani Publishers, Ludhiana.

AGRON-323

Principles of Organic Farming

2(1+1)

THEORY

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

PRACTICAL

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

Suggested Reading:

1. Dhama, A.K. 2014. Organic Farming for Sustainable Agriculture (2nd edition), Agrobios (India), Jodhpur.
2. Sharma, A.K. 2013. A Handbook of Organic Farming, Agrobios (India), Jodhpur
3. Palaniappan, S.P. and Anandurai, K. 1999. Organic Farming – THEORY and Practice. Scientific Pub. Jodhpur
4. Thapa, U and Tripathy, P. 2006. Organic Farming in India, Problems and prospects, Agritech, Publishing Academy, Udaipur.
5. शर्मा, अरुण के. 2015 जैविक खेती-नई दिशाएँ, एग्रोबायोस (इण्डिया), जोधपुर

ENTO- 321

Management of Beneficial Insects

2(1+1)

THEORY-Part - I

Beekeeping- Importance, bee species and biology, commercial methods of rearing, equipment used, seasonal management, bee enemies and disease. Bee pasturage, bee foraging and communication. Sericulture- Importance, species 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. Pests and diseases of silkworm. Lac culture- Importance, species of lac insect, morphology, biology, host plants, lac production- seed lac, button lac, shellac, lac-products. **Part - II-** Insect orders bearing parasitoids and predators used in pest control and their mass multiplication techniques. Important species of pollinators, weed killers and scavengers with their importance.

PRACTICAL

Honeybee species, castes of bees. Beekeeping appliances and seasonal management, bee enemies and disease. Bee pasturage, bee foraging and communication. Species of silkworm, voltinism of silkworm. Knowledge of mulberry cultivation, mulberry varieties and methods of harvesting and preservation of leaves. Species of lac insect, host plant identification. Identification of other important pollinators, weed killers and scavengers. Visit to research and training institutions devoted to beekeeping, sericulture, lac culture and natural enemies. Identification and techniques for mass multiplication of natural enemies.

Suggested Reading -

1. DeBach, P. 1974. Biological control by Natural enemies. Cambridge University Press.
2. Dhaliwal, G.S. and Arora R. 2001. Integrated Pest Management: Concepts and approaches. Kalyani Publ., New Delhi.
3. Dhaliwal, G.S. & Koul O. 2007. Biopesticides and Pest Management. Kalyani Publ., New Delhi.
4. Gautam, R.D. Biological Pest Suppression, Westvill Publishing Co., New Delhi.
5. Mackaur, M., Laster E. Ehler and Roland., J., 1990. Critical Issues in Biological control- Intercept Ltd. Project Directorate of Biological control. 1994. Technology for mass production of Natural enemies. Technical Bulletin - 4.
6. Srivastava, K.P. 2004. A Text Book of Entomology, Vol. I, Kalyani Publishers, New Delhi.
7. Abrol, D.P. 2013. Beekeeping: A Comprehensive Guide to Bee and Beekeeping, Scientific Publishers, Jodhpur.

THEORY

Centers of origin, distribution of species, wild relatives in different cereals(Wheat, Oat and Barley); pulses(Chickpea, Lentil and Field pea); oilseeds (Rapeseed Mustard and Sunflower); fodder crops (Berseem) and cash crops (Sugarcane); vegetable **and horticultural crops**(Potato); 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.[Seed production of different categories, Variability parameters](#)

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.

Suggested Reading:

1. Chopra, V.L. 2000 Breeding of Field Crops (Edt.). Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi.
2. Chaddha. K.L. and Gupta, R. 1995. Advances in Horticulture Vol. II Medicinal and Aromatic Plant. Malhotra Publishing House, New Delhi.
3. Mandal, A.K., Ganguli, P.K. and Banerjee, S.P. 1991. Advances in Plant Breeding Vol. I and II. CBS Publishers and Distributors, New Delhi.
4. Kang, M.S. 2004. Crop Improvement: Challenges in the Twenti-First Century (Edt). International Book Distributing Co. Lucknow.
5. Poehlman, J.M. 1987. Breeding of Field Crops. AVI Publishing Co..INC, East Port, Conneacticut, USA.
6. Ram, H.H. and Singh, H.G. 1994. Crop Breeding and Genetics. Kalyani Publishers, New Delhi.
7. Sharma, A.K. 2005. Breeding Technology of Crop Plants (Edt.). Yash Publishing House, Bikaner.
8. Ram. H.H. 2005. Vegetable Breeding — Principles and Practices. Kalyani Publishers, New Delhi.

THEORY

Importance of post-harvest **processing and value addition of fruits and vegetables**, extent and possible causes of post-harvest losses; Pre-harvest factors affecting

postharvest quality, maturity, ripening and changes occurring during ripening; Respiration and factors affecting respiration rate; Harvesting and field handling; Storage (ZECC, cold storage, CA, MA, and hypobaric); 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. **food safety standards.**

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.

Suggested Reading:

1. Battacharjee, S.K. and De, L.C. 2005 Post Harvest Technology of Flowers and Ornamentals Plants, Pointer Publisher
2. Jacob J.P. 2008 A Handbook on Post Harvest management of Fruits and vegetables, Daya Publishing House, Delhi
3. Manoranjan, K. and Sangita, S. 1996 Food Preservation & Processing, Kalyani Publishers
4. Mitra, S.K. 1997 Post Harvest Physiology and Storage of Tropical and Sub-Tropical Fruits CAB International
5. Morris, T.N. 2006 Principles of Fruit Preservation, Biotech Books, Delhi
6. Saraswathy, S. 2008 Post harvest Management of Horticultural Crops, Agribios
7. Srivastava, R.P. & Kumar, S 2002 Fruits and vegetable Preservation – Principles and Practice, International Book Distributing Co., Lucknow
8. Verma, L. R. and Joshi, V. K. 2000 Post Harvest Technology of Fruits and Vegetables Vol. I & II, Indus Publishing Co., New Delhi
9. Vijay, K. (2001)Text Book of Food Sciences and TechnologyICAR
10. Mayani, Desai, VagadiaPost Harvest management of Horticultural crops Jaya Publishing House
11. M.K. Jatav, Good management Practices for Horticultural Crops, Ed., NIPA
12. Sharma, S., Post Harvest management & Processing of fruits & vegetables- Instant notes, NIPA
13. Laboratory Manual of Analytical Techniques in Horticulture Saini, R. Agro Bot
14. Chavan, U. Nutritional Value and Health benefits from fruits, vegetable, nuts & spices, Daya
15. Olive: Improvement, Production and Processing Lal, S. Astral
16. Bose, T., Ornamental Plants and Garden Design in Tropics and subtropics, Vol- 2 set Daya
17. Sasikaumar, R., Post Harvest Technology of fruits and Vegetables, Biotech

HORT-322

Principles of Food Science and Nutrition

2(2+0)

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 bioactive, 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.

Suggested Reading

1. Srilakshmi, B. 201). Text Book of Food Science. New age international (P) limited, publisher, NewDelhi
2. Sehgal, S. and Raghuvanshi, R.S. 200). Text Book of Community Nutrition, ICAR Publication
3. Khaddar V., 1999). Text Book of Food. Storage and Preservation. Kalyani Publishers, NewDelhi.
4. Srilakshmi,B.2010. Text Book of Nutrition Science. New age international (P) limited, publisher, NewDelhi
5. Swaminathan.M. 1993. Advanced Textbook on Food and Nutrition. Volume I, Bappco, the Bangalore Press and Publishing Co. Ltd. Bangalore, p.576.

PPATH-321

Diseases of Field and Horticultural Crops and their Management-II

3(2+1)

THEORY:

Symptoms, etiology, disease cycle and management of major diseases of following crops:**Field Crops:Wheat:** rusts, loose smut, karnal bunt, powdery mildew, Alternaria blight, and ear cockle and tundu; **Barley:** Stripe, covered smut and Molya disease; **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, collar rot and Ascochyta blight; **Lentil:** rust and wilt; **Pea:** downy mildew, powdery mildew and rust.**Horticultural Crops:Mango:** anthracnose, malformation, black tip and powdery mildew; **Citrus:** canker, die back 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, stem necrosis virus and black heart; **Cucurbits:** downy mildew, powdery mildew, wilt, choanephora rot and Root knot : **Onion and garlic:** purple blotch, and stemphylium blight; **Chilli:** anthracnose and fruit rot, wilt and leaf curl; **Turmeric:** leaf spot; **Coriander:** stem gall, powdery mildew, **Marigold:** Botrytis blight; **Rose:** dieback, powdery mildew and black leaf spot. **Fenugreek:** Powdery mildew and downy mildew; **Ber:** Powdery mildew; **Opium Poppy:** Powdery mildew and downy mildew

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 25 pressed and well-mounted specimens.

Suggested Reading

1. Cook, A.A., 1981. Diseases of Tropical and Sub-Tropical Field Fiber and Oil Plants. Mac Millan Publishing Co. New York.
2. Gupta V.K. and Paul Y.S. 2002. Diseases of Field Crops. Indus Publishing Co. New Delhi.
3. Mehrotra R.S. and Agrawal A. 2013. Plant Pathology. 2nd.ed. Tata McGraw-Hill Publishing Co Ltd. New Delhi.
4. Rangaswamy, G. and Mahadevan, A. 2001. Diseases of Crop Plants in India. Prentice hall of India Pvt. Ltd. New Delhi.
5. Singh, R.S. 2009. Plant Diseases. 9th ed. Oxford & IBH Publishing Company Pvt. Ltd. New Delhi.
6. Agrios, G.N. 2005. Plant Pathology. 5th ed. Academic Press, New York.
7. Gupta, S.K. and Thind, T.S. 2012. Disease problem in vegetable production. Scientific Publishers, Jodhpur.
8. Singh, R.S. 2012. Diseases of Fruit Crops. Oxford and IBH Publishing Co. Pvt. Ltd. New Delhi.
9. Singh, R.S. 1998. Diseases of Vegetable Crops. 3rd ed. Oxford and IBH Publishing Co. Pvt. Ltd. New Delhi.

HORT 323 Hi-tech. Horticulture (ELECTIVE) 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 Geopositioning System (DGPS), Variable Rate applicator (VRA), application of precision farming in horticultural crops (fruits, vegetables and ornamental crops); mechanized harvesting of produce.

PRACTICAL

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

Suggested Readings:

1. Arora, S. K., Bhatia, A. K., Mangal, J. L. and Kumar, P. 2004. PRACTICAL Manual, Green House Technology for Vegetable Production. Deptt. of Vegetable Science, CCSHAU, Hisar (Haryana).

2. Bose, T. K., Mitra, S. K. and Sandhu, M. K. 1986. Propagation of Tropical & Sub-tropical Horticultural crops, Naya Prakash, Calcutta.
3. Chadha, K. L. 2010. Handbook of Horticulture (New eds). Indian Council of Agricultural Research, New Delhi.
4. Gill, S. S., Bal, J. S. and Sadhu, A. S. 1985. Raising Fruit Nursery, Kalyani Publishers, New Delhi.
5. Hartman, H. T. and Kester, D. E. 2001. Plant propagation principles and practices. Prentice Hall of India Pvt. Ltd., Bombay.
6. Singh, Balraj. 2005. Protected Cultivation of Vegetable Crop. Kalyani Publishers, Ludhiana.

Seventh Semester

SEMESTER – VII				
Rural Agricultural Work Experience and Agri-industrial Attachment (RAWE&AIA)				
S. N.		Activities	No. of weeks	Cr. Hrs
1.	(i)	General orientation & On campus training by different faculties	1	16
	(ii)	(a) Unit attachment in- University/ College/KVK/ Research Station Attachment	5	
		(b) Village attachment	8	
		(c) Plant clinic	2	
2.	(i)	Agro-Industrial Attachment	3	04
	(ii)	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 for a period of 03 weeks to get an experience of the industrial environment and working.

Educational tour will be conducted in break between IV and V Semester or VI and VII semester.

RAWE Component-I: Village Attachment Training Programme

S. N.	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
6	Food Processing and Storage interventions	1 week
7	Animal Production Interventions	1 week
8	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 for 03 weeks.

- Industries include Seed / Sapling production, Pesticides-insecticides, Post harvest-processing-value addition, Agri-finance institutions, etc.

Activities and Tasks during Agro-Industrial Attachment Programme

S.N.	Activities and Tasks during Agro-Industrial Attachment Programme
1.	Acquaintance with industry and staff
2.	Study of structure, functioning, objective and mandates of the industry
3.	Study of various processing units and hands-on trainings under supervision of industry staff
4.	Ethics of industry
5.	Employment generated by the industry
6.	Contribution of the industry promoting environment
7.	Learning business network including outlets of the industry Skill development in all crucial tasks of the industry
8.	Documentation of the activities and task performed by the students
9.	Performance evaluation, appraisal and ranking of students

Eighth Semester

Module READY-421/422 Seed Production Technology 0+10

Germination test purity percent and quality parameters, generation system of seed multiplication, identification of suitable area/location for seed production; Ear to row method and nucleus seed production - major characteristics of released and notified, varieties, hybrid seed production technology of importance crops.

Module READY-421/422 Production Technology for Bioagents and Biofertilizer 0+10

Isolation and pure culture establishment of bio-fertilizers and bio-pesticides; Culture methods and substrates; Scale of methods for bio-fertilizers and bio-agents; Substrate preparation and mixing techniques; Quality analysis of bio-fertilizers and bio-pesticides. Testing the final product in small scale level. Storage, marketing and cost analysis of bio-fertilizers and bio-pesticides.# Course shall be shared with Soil Science

Module READY-421/422 Soil, Plant and Water Testing 0+10

Collection and soil water and plant sample for analyses, soil profile study, bulk density, particle density, porosity, water holding capacity, soil texture, estimation of soil moisture by gravimetric and volumetric methods, lime requirement, soil pH, EC, organic carbon and available major and micronutrient in soil and plant sample, leaf area by leaf area meter, relative water content of leaf, specific leaf weight, chlorophyll content of leaf, irrigation water quality analysis, measurement of soil water potential, water flood measurement.

Module READY-421/422 Commercial Beekeeping 0+10

Beneficial insect, scope of apiculture, honey bee colony, different bee hives and apiculture equipment, summer and winter management of colony, Honey extraction and bottling; Study of pests and disease of honey bees; Specifics of honey bees, Bee pasturage, Honey composition and value, bee crop and tissue.

Module READY-421/422 Food Processing 0+10

Planning and execution of a market survey, preparation of processing schedule, preparation of project module based on market information, calculation of capital costs, source of finance, assessment of working capital requirements and other financial aspects, identification of sources for procurement of raw material, production and quality analysis of fruits and vegetables products at commercial scale, packaging, labeling, pricing and marketing of product.

Module READY-421/422 Organic Production Technology 0+10

Organic production requirement, Crop management in organic farming, organic seed production, organic manures, composting, vermin composting, Green manuring, biofertilizers, organic liquid fertilizers, organic management protection for controlling insects, disease and weeds, organic certification, processing and marketing, Quality standards; Important herbs, shrubs and trees their identification, uses and characteristics; habitat management in rainfed and integrated farm, integrated farming system

Elective Courses

ENTO-221# Bio-pesticides and Bio-fertilizers (Elective course) 3(2+1)

THEORY

History and concept of biopesticides;. Importance, scope and potential of biopesticide; Definitions, concepts and classification of biopesticides viz. pathogen, botanical pesticides, and biorationales; Botanicals and their uses; Mass production technology of bio-pesticides; Virulence, pathogenicity and symptoms of entomopathogenic pathogens and nematodes; Methods of application of biopesticides; Methods of quality control and Techniques of biopesticides; Impediments and limitation in production and use of biopesticide.

Biofertilizers - Introduction, status and scope; Structure and characteristic features of bacterial biofertilizers Azospirillum, Azotobacter, Bacillus, Pseudomonas, Rhizobium and Frankia; Cyanobacterial biofertilizers Anabaena, Nostoc, Hapalosiphon and fungal biofertilizers- AM : endomycorrhiza and ectomycorrhiza. Nitrogen fixation -Free living and symbiotic nitrogen fixation; Mechanism of phosphate solubilization and phosphate mobilization, K solubilization. Production technology: Strain selection, sterilization, growth and fermentation, mass production of carrier based and liquid biofertilizers; FCO specifications and quality control of biofertilizers; Application technology for seeds, seedlings, tubers, sets

etc. Biofertilizers-Storage, shelf life, quality control and marketing; Factors influencing the efficacy of biofertilizers.

PRACTICAL

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

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

Course to be shared with Soil Science.

Suggested Readings:

1. Biswas, T. D. and Mukherjee, S. K. 1990. Text Book of Soil Science. Tata McGraw-Hill Publishing Company Limited, New Delhi.
2. Campbell, R. 1989. Biological Control of Microbial Plant Pathogens. Cambridge Univ. Press, Cambridge.
3. Cook, R. J. and Baker, K. F. 1983. The Nature and Practice of Biological Control of Plant Pathogens. APS, St Paul, Minnesota.
4. Dhaliwal, G. S. and Koul, O. 2007. Biopesticides and Pest Management. Kalyani Publ., New Delhi.
5. Mukerji, K. G., Tewari, J. P., Arora, D. K. and Saxena, G. 1992. Recent Developments in Biocontrol of Plant Diseases. Aditya Books, New Delhi.
6. Mukherjee, N. and Ghosh, T. 1998. Agricultural Microbiology. Kalyani Publishers, New Delhi.
7. Rangaswami, G. and Bagyaraj, D. J. 1993. Agricultural Microbiology. Prentice Hall of India Pvt. Limited, New Delhi.
8. Srivastava, K. P. 2004. A Text Book of Entomology. Vol. I, Kalyani Publishers, New Delhi.
9. Vishunavat, K. and Kolte, S. J. 2005. Essentials of Phytopathological Techniques. Kalyani Publishers, New Delhi.

GPB-222 Commercial Plant Breeding (Elective course) 3(1+2)

THEORY

Types of crops and modes of plant reproduction; Line development and maintenance breeding in self and cross pollinated crops (A/B/R and two line system) for development of hybrids and seed production; Genetic purity test of commercial hybrids; Advances in hybrid seed production of maize, rice, sorghum, pearl millet, castor, sunflower, cotton, pigeon pea, Brassica etc.; Quality seed production of vegetable crops under open and protected environment; Alternative strategies for the development of the line and cultivars: haploid inducer, tissue culture techniques and biotechnological tools; IPR issues in commercial plant breeding: DUS testing and registration of varieties under PPV & FR Act; Variety testing, release and notification systems in India; Principles and techniques of seed production, types of seeds, quality testing in self and cross pollinated crops.

PRACTICAL

Floral biology in self- and cross-pollinated species, selfing and crossing techniques. Techniques of seed production in self- and cross-pollinated crops using A/B/R and two-line system. Learning techniques in hybrid seed production using male-sterility

in field crops. Understanding the difficulties in hybrid seed production, Tools and techniques for optimizing hybrid seed production. Concept of rouging in seed production plot. Concept of line its multiplication and purification in hybrid seed production. Role of pollinators in hybrid seed production. Hybrid seed production techniques in sorghum, pearl millet, maize, rice, rapeseed-mustard, sunflower, castor, pigeon pea, cotton and vegetable crops. Sampling and analytical procedures for purity testing and detection of spurious seed. Seed drying and storage structure in quality seed management. Screening techniques during seed processing viz., grading and packaging. Visit to public private seed production and processing plants.

Suggested Readings:

1. Agarwal, R. L. 1991. Seed Technology. Oxford & IBH Publishing Co. Delhi.
2. Arya, P. S. 2001. Vegetable Breeding and Seed Production. Kalyani Pub., Ludhiana.
3. Chopra, V. L. 2000. Breeding of Field Crops (Edt). Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi.
4. Joshi, A. K. and Singh, B. D. 2005. Seed Technology. Kalyani Publishers, New Delhi.
5. Khare, D. and Mohan, S. Bhale. 2000. Seed Technology. Scientific Publishers, Jodhpur (India).
6. Maloo, S. R., Intodia, S. K. and Singh, P. 2008. Beej Pradyogiki. Agrotech Publishing Academy.
7. Mandal, A. K., Ganguli, P. K. and Banerjee, S. P. 1991. Advances in Plant Breeding. Vol. I and II. CBS Publishers and Distributors, New Delhi.
8. Manjit S. Kang. 2004. Crop Improvement: Challenges in the Twenty-First Century (Edt). International Book Distributing Co. Lucknow.
9. Poehlman, J. M. 1987. Breeding of Field Crops. AVI Publishing Co. INC, East Port, Connecticut, USA.
10. Ram, H. H. and Singh, H. G. 1994. Crop Breeding and Genetics. Kalyani Publishers, New Delhi.
11. Ram. H. H. 2005. Vegetable Breeding — Principles and Practices. Kalyani Publishers, New Delhi.
12. Sharma, A. K. 2005. Breeding Technology of Crop Plants (Edt.). Yash Publishing House, Bikaner.
13. Singh, B. D. 2005. Plant Breeding. Kalyani Publishing House, New Delhi.
14. Singh, P. 2001. Essentials of Plant Breeding-Principles and Methods. Kalyani Publishing House, New Delhi.

HORT-311 Protected Cultivation (Elective course) 3(2+1)

THEORY

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

PRACTICAL

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

Suggested Readings:

1. Anonymous 2003. Proc. All India Seminar on Potential and Prospects for Protective Cultivation. Organised by Institute of Engineers, Ahmednagar. Dec.12-13, 2003.
2. Arora, S. K., Bhatia, A. K., Mangal, J. L. and Kumar, P. 2004. PRACTICAL Manual Green House Technology for Vegetable Production. Deptt. of Vegetable Science, CCSHAU, Hisar (Haryana).
3. Chandra, S. and Som, V. 2000. Cultivating Vegetables in Green House. Indian Horticulture, 45: 17-18.
4. More, T. A., Jagtap, K. B. and Ranpsie, 1988. Green House Technology. Continental Publishers, Pune.
5. Singh, Balraj. 2005. Protected Cultivation of Vegetable Crop. Kalyani Publishers, Ludhiana.

AGRON-313 Weed Management (Elective course) 3(2+1)

THEORY

Introduction to weeds, characteristics of weeds their harmful and beneficial effects on ecosystem; Classification, reproduction and dissemination of weeds; Weed prevention, control and eradication; Methods of weed control: physical, chemical and biological. Integrated weed management; 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.

PRACTICAL

Techniques of weed preservation. Weed identification and their losses study. Biology of important weeds. Study of herbicide formulations and mixture of herbicide. Herbicide and agro-chemicals study. Shift of weed flora study in long term experiments. Study of methods of herbicide application, spraying equipments. Calculations of herbicide doses and weed control efficiency and weed index.

Suggested Readings:

1. Das, T.K.2019. Weed Science: Basics and Applications, Jain Brothers, New Delhi (India)
2. Gupta, O. P. 2015. Weed Management: Principles and Practices (3rd edition), Agrobios (India), Jodhpur.
3. Gupta, O. P. 2016. Modern Weed Management (3rd edition), Agrobios (India), Jodhpur.
4. Rao, V. S. 2000. Principals of Weed Science (2nd edition), Oxford and IBH Publishing Co., New Delhi.
5. Saraswat, V. N., Bhan, V. M. and Yaduraju, N. T. 2003. Weed Management, ICAR, New Delhi.

6. Shukla, U.N. 2016. A PRACTICAL Manual on Weed Management (Fourth Dean Committee), Department of Agronomy, College of Agriculture, Jodhpur (Publication No.: CoA/MND/02/2016)
7. Shukla, U.N. and Mishra, M.L. 2020. A PRACTICAL Manual on Weed Management (Fifth Dean Committee), Department of Agronomy, College of Agriculture, Jodhpur (Publication No.: CoA/JODH/27/2020)

GPB -313 Micro propagation Technologies (Elective course) 3(1+2)

THEORY

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

PRACTICAL

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

Suggested Readings:

1. Bhojwani, S. S. 1983. Plant Tissue Culture. THEORY and Practice, Elsevier.
2. Christou, P. and Klee, H. 2004. Handbook of Plant Biotechnology. John Wiley & Sons.
3. Dixon, R. A. 2003. Plant Cell Culture. IRL Press.
4. George, E. F., Hall, M. A. and De Klerk, G. J. 2008. Plant Propagation by Tissue Culture. Agritech Publishing.
5. Herman, E. B. 2005-08. Media and Techniques for Growth, Regeneration and Storage. Agritech Publishing.
6. Pierik, R. L. M. 1997. In vitro Culture of Higher Plants. Kluwer.
7. Singh, B. D. 2007. Biotechnology: Expanding Horiozon. Kalyani Publishers.

HORT-322 Landscaping (Elective course) 3(2+1)

THEORY

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

PRACTICAL

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

Suggested Readings:

1. Bose, T. K. and Mukherjee, D. 1972. Gardening in India. Oxford and IBH Publishing Company, Calcutta.
2. Bose, T. K., Maiti, R. G., Dhua, R. S. and Das, P. 1999. Floriculture and Landscaping. Naya Prakash, Calcutta, India.
3. Lauria, A. and Victor, H. R. 2001. Floriculture – Fundamentals and Practices Agrobios. Jodhpur.
4. Nambisan, K. M. P. 1992. Design Elements of Landscape Gardening. Oxford & IBH.
5. Randhawa, G. S. and Mukhopadhyay, A. 1986. Floriculture in India. Allied Publishers Pvt. Ltd., New Delhi.

FSN-322 Food Safety and Standards (Elective course) 3(2+1)

THEORY

Food Safety – Definition, Importance, Scope and Factors affecting Food Safety; Hazards and Risks, Types of hazards - Biological, Chemical, Physical hazards; Management of hazards - Need. Control of parameters; Temperature control; Food storage; Product design; Hygiene and Sanitation in Food Service Establishments Introduction; Sources of contamination and their control; Waste Disposal; Pest and Rodent Control; Personnel Hygiene. Food Safety Measures. Food Safety Management Tools- Basic concepts. PRPs, GHPs, GMPs, SSOPs etc. HACCP. ISO series; TQM - concept and need for quality, components of TQM, Kaizen. Risk Analysis; Accreditation and Auditing, Water Analysis, Surface Sanitation and Personal Hygiene; Food laws and Standards- Indian Food Regulatory Regime, FSSA. Global Scenario CAC. Other laws and standards related to food. Recent concerns- New and Emerging Pathogens; Packaging, Product labeling and Nutritional labelling; Genetically modified foods\ transgenics; Organic foods; Newer approaches to food safety; Recent Outbreaks; Indian and International Standards for food products.

PRACTICAL

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

Suggested Readings:

1. Hester, R. E. and Harrison, R. M. 2001. Food Safety and Food Quality. Royal Society of Chemistry, Cambridge, UK.

2. Inteaz, Alli. 2004. Food Quality Assurance: Principles and Practices. CRC Press, Boca Raton, FL, USA.
3. Ronald, H. S. and Gary, E. R. 2003. Food Safety Handbook. John Wiley & Sons, Inc., Hoboken. New Jersey, USA.

ENTO-322* Agrochemicals (Elective course) 3(2+1)

THEORY

An introduction to agrochemicals, their type and role in agriculture, effect on environment, soil, human and animal health, merits and demerits of their uses in agriculture, management of agrochemicals for sustainable agriculture; Herbicides- Major classes, properties and important herbicides; Fate of herbicides. Fungicides - Classification – Inorganic fungicides - characteristics, preparation and use of sulfur and copper, Mode of action-Bordeaux mixture and copper oxychloride; Organic fungicides- Mode of action Dithiocarbamates-characteristics, preparation and use of Zineb and maneb; Systemic fungicides Benomyl, carboxin, oxycarboxin, Metalaxyl, Carbendazim, characteristics and use; Introduction and classification of insecticides: inorganic and organic insecticides Organochlorine, Organophosphates, Carbamates, Synthetic pyrethroids Neonicotinoids, Biorationals, Insecticide Act and rules, Insecticides banned, withdrawn and restricted use, Fate of insecticides in soil & plant; IGRs Biopesticides, Reduced risk insecticides, Botanicals, plant and animal systemic insecticides their characteristics and uses. Fertilizers and their importance. Nitrogenous fertilizers: Feedstocks and Manufacturing of ammonium sulphate, ammonium nitrate, ammonium chloride, urea. Slow release N-fertilizers; Phosphatic fertilizers: feedstock and manufacturing of single superphosphate; Preparation of bone meal and basic slag; Potassic fertilizers: Natural sources of potash, manufacturing of potassium chloride, potassium sulphate and potassium nitrate; Mixed and complex fertilizers: Sources and compatibility–preparation of major, secondary and micronutrient mixtures; Complex fertilizers: Manufacturing of ammonium phosphates, nitrophosphates and NPK complexes; Fertilizer control order; Fertilizer logistics and marketing; Plant bio-pesticides for ecological agriculture, Bio-insect repellent.

PRACTICAL

Sampling of fertilizers and pesticides. Pesticides application technology to study about various pesticides appliances. Quick tests for identification of common fertilizers. Identification of anion and cation in fertilizer. Calculation of doses of insecticides to be used. To study and identify various formulations of insecticide available in market. Estimation of nitrogen in Urea. Estimation of water soluble P₂O₅ and citrate soluble P₂O₅ in single super phosphate. Estimation of potassium in Muriate of Potash/ Sulphate of Potash by flame photometer. Determination of copper content in copper oxychloride. Determination of sulphur content in sulphur fungicide. Determination of thiram. Determination of ziram content. *Course to be shared with Soil Science.

Suggested Readings:

1. Nene, Y. L. and Thapliyal, P. N. 1991. Fungicides in Plant Disease Control. Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi.

2. Panda, H. 2003. The Complete Technology Book on Pesticides, Insecticides, Fungicides and Herbicides with Formulae & Processes. National Institute of Industrial Research publisher.
3. Rao, V. S. 1992. Principles of Weed Science. Oxford & IBH Publishing Co. Pvt. Ltd., NewDelhi.
4. Seetharaman, S., Biswas, B. C., Maheswari, S. and Yadav, D. S. 1996. Hand Book on Fertilizers Usage. The Fertilizer Association of India, New Delhi.
5. Sreeramalu, U. S. 1991. Chemistry of Insecticides and Fungicides. Oxford & IBH Publishing Co, New Delhi.
6. Yawalkar, K. S., Agarwal, J. P. and Bokde, S. 1992. Manures and Fertilizers. Agri-Horticultural Publishing House, Nagpur. 7. Basak, R. K. 2007. Fertilizers: A Text Book. Kalyani Publishers, Ludhiana.

AGRON-324 System Simulation and Agro-advisory (Elective course) 3(2+1)

THEORY

System Approach for representing soil-plant-atmospheric continuum, system boundaries, Crop models, concepts & techniques, types of crop models, data requirements, relational diagrams; Evaluation of crop responses to weather elements; Elementary crop growth models; calibration, validation, verification and sensitivity analysis; Potential and achievable crop production- concept and modelling techniques for their estimation; Crop production in moisture and nutrients limited conditions; components of soil water and nutrients balance; Weather forecasting, types, methods, tools & techniques, forecast verification; Value added weather forecast, ITK for weather forecast and its validity; Crop-Weather Calendars; Preparation of agro-advisory bulletin based on weather forecast; Use of crop simulation model for preparation of Agro-advisory and its effective dissemination.

PRACTICAL

Preparation of crop weather calendars. Preparation of agro-advisories based on weather forecast using various approaches and synoptic charts. Working with statistical and simulation models for crop growth. Potential and achievable production; yield forecasting, insect and disease forecasting models. Simulation with limitations of water and nutrient management options. Sensitivity analysis of varying weather and crop management practices. Use of statistical approaches in data analysis and preparation of historical, past and present meteorological data for medium range weather forecast. Feedback from farmers about the agroadvisory.

Suggested Readings:

1. Gordan, G. 1992. System Simulation. 2nd Ed. Prentice Hall.
2. Kropff, M. J. and Vann Laar H. H. 1993. Modelling Crop Weed Interactions. (Ed.). ISBN.
3. Murithy, K. and Radha, V. 1995. PRACTICAL Manual on Agricultural Meteorology. Kalyani Publishers, New Delhi.
4. Panda, S. C. 2012. Modern Concepts and Advance Principles in Crop Production. Agrobios (India), Jodhpur.
5. Ritchie, J. T. and Hanks, J. 1991. Modelling Plant and Soil Systems. American Society of Agronomy, Madison.
6. Sahu, D. D. 2007. Agrometeorology and Remote Sensing: Principles and Practices. Agrobios (India), Jodhpur.

7. Varshneya, M. C. and Balakrishna, Pillai, P. 2003. Text book of Agricultural Meteorology. ICAR, New Delhi.
8. Weixing, C., Jeffrey, W. W. and Wang, E. 2009. Crop Modeling and Decision Support (Ed). Springer, Heidelberg, Germany.