PROGRAM OUTCOMES OF MSC AGRONOMY

PO1. Understand the basic concepts, fundamental principles, and various theories in the above mentioned subjects.

PO2. Analyze Agronomic behavior in practice.

PO3. Analyze historical and current events from an economic perspective

PO4. Write and discuss Agricultural issues at national levels

PO5. Find alternative approaches to Agronomic problems through the exposure from the coursework in allied fields.

PO6. Develop an ability to suggest solutions for various Agriculture and agronomic problems

PO7. Prepare for the competitive examinations as ARS, SRF, PSC, Agriculture officers etc.

PO8. Get self-employment in various fields of Agriculture viz., Mushroom cultivation, organic manure preparation, cultivation of crops in poly-house condition, plant tissue, culture laboratories etc.

PO9. Provide a broad foundation in Agriculture scientific methods

PO10. Achieve the skills required to succeed in post graduate s, the Agriculture industry and professional school.

PO11. Develop the ability to communicate scientific information and research results in written and oral formats.

PO12. Learn professionalism, including the ability to work in teams and apply basic ethical principles.

PO13. Acquired the knowledge with facts and figures concerned with the subjects such as Meteorology, water management, soil fertility and nutrient management, etc

PO14. Understand the structure, composition of different spheres of the earth and its Atmosphere. Understand importance of oceans, rivers and water and find the ways of their conservation.

PO15. Understand the Function and types of Biogeography. Understand the science of Remote Sensing Make use of GIS & GPS software

PO16. Understand the various Applications of Agronomy

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PO17. Imparting detailed knowledge of Agriculture and its allied branches

PO18. Providing detailed knowledge of agriculture in India and income generating enterprises of Indian farmers

PO19. Knowledge dissemination regarding various technique of farming and farming system in India

PO20. Study of market and marketing of agricultural produce.

PROGRAM SPECIFIC OUTCOMES OF MSC AGRONOMY

PSO1. Specific knowledge of various branches specialized to their studies.

PSO2. Study the types of land and processes.

PSO3. Detailed knowledge on the subject to improve the farmer's condition by their contributions.

PSO4. Detailed knowledge of cultivation practices, Soil, fertilizers, livestock's insect pest, and economic conditions associated with farming enterprises.

PSO5. To establish potential application of techniques developed within the chosen area of specialization.

PSO6. To ensuring and assuring employability and develop entrepreneurs for emerging knowledge intensive agriculture,

PSO7. To be receptive to new ideas and innovation

PSO8. To develop special expertise in the chosen special areas.

PSO9. To apply research methods, techniques, and problem solving approaches from the field of research in which they are specializing

COURSE OUTCOMES OF MSC AGRONOMY

Course Code	Course Name	Course Outcomes
AGRON 511	Agro meteorology and crop weather forecasting	It imparts knowledge about aim and scope of agro-meteorology and crop weather forecasting. Meet the challenges of aberrant weather conditions. To gain the knowledge about the effects of temperature on plants, evapotranspiration, weather forecasting and remote sensing. Studies on impact of weather factors on crop production, Modification

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		of plant environment in open and control conditions.
AGRON 512	Principles and practices of watermanagemen t	Helps students to get knowledge in enhancing water productivity, properties of water and its role in plants. This course also makes students convergent with water potential, water use efficiency, quality of irrigation water, drainage requirement of crop, methods of drainage, their layout and spacing
AGRON 513	Principles and practices of soil fertility and nutrient management	This course imparts knowledge of soil fertility and plant nutrition among students. It also helps them to apprise about the integrated approach of plant nutrition and sustainability of soil resources. Importance of soil fertility, components of soil fertility, soil pH relates to soil fertility soil sampling and analysis and how soil amendments are used with crop and plants.
STAT 511	Statistical methods	Helps student to summarize data visually and numerically.Build and assess data based models, learn and apply the tools of formal inference.Explains the fundamental principles behind the output of an ANOVA including blocking and interactions
SOILS 513	Analytical techniques and instrumental methods in soil and plant analysis	The idea that one could test or analyze a soil and obtain some information about properties especially its acidity or alkalinity and its nutrient status is long established and can be traced back to the beginning of scientific inquiry about the nature of soil. Analysis of plant to reflect the fertility status of the soil in which they grew is more recent although visual crop observations as old as ancients.
AGRON 521	Modern concepts in crop production	To impart knowledge on basic concepts of crop growth, response to growth factors, crop production of recent time, ideal plant type. Understand the concepts and significance of farming/cropping systems
AGRON 522	Principles and practices of weed management	To understand the weeds and losses caused by weeds, life cycle and growth of weeds, analyze ways weeds are spread, apply methods of weed control,
AGRON 523	Dry land farming and watershed management	Student learns concept and characteristics of dry land farming rainfed farming significance and dimensions of dry land farming in Indian agriculture.
AGRON 524	Cropping systems and sustainable agriculture	The student will be able to explain the major aspects of agriculture practices general relationship among culture, agriculture development cross culture interaction and exchange that linked the world people and facilitates agriculture development is also expected.
STAT 521	Experimental designs	This course is meant for exposing the students in the usage of various statistical analyses of data. It would provide the students an hands on experience in the analysis of their research data. This course is useful to all disciplines
AGRON 531	Agronomy of major cereals and pulses	To impart knowledge and skills on improved production and sustainability of cereals and pulses crops. Role of cereals and pulses in Indian agriculture.

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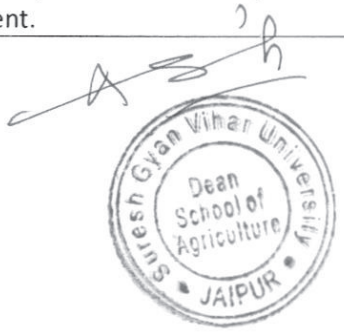
AGRON 532	Agronomy of oilseeds, commercial and fibre crops	To acquaint students about the scientific production of oilseed and fiber crops.
PPHYS 531	Hormonal regulation of plant growth and development	Apply knowledge about anatomy of primary and secondary growth and to distinguish molecular process controlling cell division cell elongation and polarity establishment during plant growth and development
SOILS 532	Management of problem soils and waters	To impart knowledge of resolving and reclamation of soil and water.
AGRON 541	Seminar	To improve students' communication and presentation skills on selected topics, preparation of materials for presentation, and presentation by the student in the class on a particular topic.
AGRON 542	Comprehensive	Students become aware of the learning processes, courses discuss what students are learning why and how it is being learned. Student get better understanding of the ways that learning can transform the individual and motive change within society
AGRON 543	Masters' Research	Methodology of planning, layout, data recording, analysis, interpretation and report writing of agronomic experiments. Preparation of research proposals for Agronomy. Field/Laboratory Experiment. Collection, Compilation and presentation. Interpretation of results and report writing by the student.



PROGRAM OUTCOMES OF MSC HORTICULTURE

PO1. Demonstrate, solve and an understanding of major concepts in all disciplines of horticulture

PO2. Imparting detailed knowledge of horticulture and its allied branches (pomology, olericulture, floriculture and their post-harvest management)

PO3. Employ critical thinking and the scientific knowledge to layout and orchard establishment, commercial cultivation of horticultural crops

PO4. Create an awareness of the impact of horticulture on the environment, society, and development outside the scientific community

PO5. Facilitating detailed study of various agriculture forestry, Livestock and other allied branches required to raise the income of farmers

PO6. Providing detailed knowledge of horticulture in India and disseminate the knowledge among farmers to establish income generating enterprises

PROGRAM SPECIFIC OUTCOMES OF MSC HORTICULTURE

PSO1. Gain the specific knowledge of horticulture through theory and practical's.

PSO2. Specific knowledge of various specializedbranches of horticulture (pomology, olericulture, floriculture, landscaping, spices, aromatic, medicinal, plantation crops and their post-harvest management).

PSO3. Detailed knowledge on the subject to improve the socio-economic status of farmer's to improve their livelihood.

PSO4. Understand good laboratory practices and safety measures.

PSO5. Develop research oriented skills.

PSO6. To create awareness and handle the sophisticated instruments/equipment, agro-chemicals.

PSO7. Identify important biotic and abiotic stress and correct them at farmer's field.

COURSE OUTCOMES OF MSC HORTICULTURE

Course Code	Course Name	Course Outcomes
HORTI511	Tropical and Dry land Horticulture	• To impart basic knowledge about the importance and management of tropical and dry land fruits grown India • Understanding of difference between tropical and dry land horticulture • Solve the numerical problems based on plant population
HORTI 512	Sub-Tropical and Temperate Fruit Production	• To impart basic knowledge about the importance and management of subtropical and temperate fruits grown in India. • To learn the nomenclature and taxonomic rules • Understand the package of practices of crops • Identify and control of important physiological disorders
HORTI 513	Production Technology of warm season Vegetable Crops	• To impart basic knowledge about the importance and management of warm season vegetables grown in India. • Understand the package of practices of crops • Calculate the agro-chemical doses to control biotic stresses • Impart knowledge of varietal importance to improve the production and quality of vegetables
STAT 511	Statistical methods	• Exposed to concepts of statistical methods and statistical inference • Understanding the importance of statistics. • Understanding the concepts involved in data presentation, analysis and interpretation. • Get exposure to presentation of data, probability distributions, parameter estimation, tests of significance, regression and multivariate analytical techniques.
PBG 512	Principles of Plant Breeding	• Familiarization with general knowledge of botany and crop plants • To impart theoretical knowledge and practical skills about plant breeding objectives. • To learn modes of reproduction and genetic consequences, breeding methods for crop improvement. • Conceptualize about different aspects of plant breeding, hybrid vigour and release of variety
HORTI 521	Seed Production Technology of Vegetable Crops	• To educate principles and methods of quality seed and planting material production in vegetable crops • Familiarization with general characteristics of quality seed • To know about seed dormancy causes and breaking methods • Learn about seed storage methods and seed treatment methods
HORTI 522	Propagation and	• Familiarization with principles and practices of

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	Nursery management of Fruit Crops	propagation and nursery management for fruit crops • Learn about requirement of nursery establishment • Get exposure for self-employment in nursery entrepreneurship
HORTI 523	Landscaping and Ornamental Gardening	• Familiarization with principles and practices of landscaping and ornamental gardening. • Understanding the importance of urban landscape and their impact on society • Develop entrepreneurship skills in landscape business • Create awareness of landscaping importance to improve environment and aesthetic value
STAT 521	Experimental Designs	• Designing an experiment is an integrated component of research in almost all sciences. • Exposed to concepts of design of experiments • Students enable to understand the concepts involved in planning, designing their experiments and analysis of experimental data.
PPATH-523	Diseases of Vegetables and Spices Crops	• To impart knowledge about symptoms, epidemiology of different diseases of vegetables and spices caused by fungal, bacterial and viral diseases and theirmanagement • Calculate recommended doses of agro-chemical to control various diseases • Understand the safety measures followed during spray of agro-chemicals
HORTI 531	Production Technology of loose flowers	• To impart basic knowledge about the importance and management of loose flowers grown in India. • Understand the package of practices of loose flower crops • Create awareness the social and industrial importance of loose flowers • Familiarization with use loose flowers in landscaping and ornamental gardening
HORTI .532	Post Harvest Technology for Fruit Crops	• To facilitate deeper understanding on principles and practices of post- harvest management of fruit crops • Educate the students to learn importance to postharvest technology protect perishable commodities • Develop the skills in agri-enterpreneurship in fruit processing industry • Provide facilities for farmers to protect their produce for good earning
HORTI 533	Production Technology of cool season vegetable crops	• To impart basic knowledge about the importance and management of cool season vegetables grown in India. • Understand the package of practices of cool season vegetable crops • Calculate the agro-chemical doses to control biotic stresses • Impart knowledge of varietal importance to improve the

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		production and quality of vegetables
PPHYS 531	Hormonal Regulation Of Plant Growth And Development	• To apprise the students about structure function of plant growth regulator on growth and development of plant. • Demonstrate the use of plant growth regulator • Understand the importance of growth regulators to improve the quality of horticultural produce • Create awareness of use of growth regulators in plant propagation
HORTI 541	Seminar	• Develop the confidence to deliver scientific information • Understand the studies of scientific community and their presentation
HORTI 542	Comprehensive	• Prepare comprehensively to answer questions from all the courses of three semesters. • Attain Oral Presentation skills by answering questions in precise and concise manner. • Gain confidence and inter-personal skills
HORTI 543	Masters' Research	• Considerably more in-depth knowledge of the major subject/field of study, including deeper insight into current research and development work. • A capability to contribute to research and development work. • The capability to use a holistic view to critically, independently and creatively identify, formulate and deal with complex issues. • The capability to plan and use adequate methods to conduct qualified tasks in given frameworks and to evaluate this work. • The capability to create, analyze and critically evaluate different technical solutions of research work. • The capability to critically and systematically integrate knowledge. • The capability to clearly present and discuss the conclusions as well as the knowledge and arguments that form the basis for these findings in written and spoken English. • A consciousness of the ethical aspects of research and development work. • Develop the skills to write scientific report.

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SCHOOL OF AGRICULTURE

SYLLABUS

M.Sc. AGRONOMY

M.Sc. AGRONOMY

List of courses offered in M.Sc. Ag. Degree programme:

I Semester		
Core Courses		
AGRON 511	Agro meteorology and crop weather forecasting	2+1
AGRON 512	Principles and practices of water management	2+1
AGRON 513	Principles and practices of soil fertility and nutrient management	2+1
Supporting course		
STAT 511	Statistical methods	2+1
Minor courses		
SOILS 513	Analytical techniques and instrumental methods in soil and plant analysis	2+1
	Credit hours	15
II Semester		
Core Courses		
AGRON 521	Modern concepts in crop production	3+0
AGRON 522	Principles and practices of weed management	2+1
AGRON 523	Dryland farming and watershed management	3+0
AGRON 524	Cropping systems and sustainable agriculture	3+0
Supporting course		
STAT 521	Experimental designs	2+1
	Credit hours	15
III Semester		
Core Courses		
AGRON 531	Agronomy of major cereals and pulses	2+1
AGRON 532	Agronomy of oilseeds, commercial and fibre crops	2+1
Minor Courses		
PPHYS 531	Hormonal regulation of plant growth and development	2+1
SOILS 532	Management of problem soils and waters	2+1
	Credit hours	12
IV Semester		
AGRON 541	Seminar	0+1
AGRON 542	Comprehensive	0+2
AGRON 543	Masters' Research	15
	Credit hours	18
	Total credit hours	**60**

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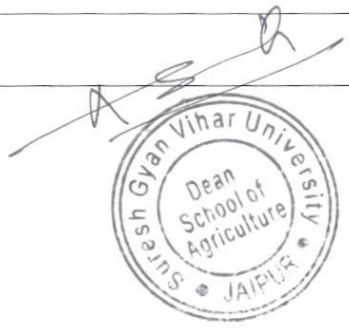
AGRON 511 Agro meteorology and Crop Weather Forecasting 3(2+1)

AGRON- 511	**Agro meteorology and Crop Weather Forecasting**	**Theory**
Learning objective	To impart knowledge about agro-meteorology and crop weather forecasting to meet the challenges of aberrant weather conditions.	
UNIT-I	**Aim and scope of agro meteorology**	**6 Hrs.**
Agro meteorology: aim, scope and development in relation to crop environment, composition of atmosphere, distribution of atmospheric pressure, Solar radiation: characteristics, energy balance of atmosphere system, radiation distribution in plant canopies, radiation utilization by field crops, photosynthesis and efficiency of radiation utilization by crops, energy budget of plant canopies, Environmental temperature: soil, air, canopy temperature.		
UNIT-II	**Effects of temperature on plant**	**5 Hrs**
Temperature profile in air, soil and crop canopies, soil and air temperature effects on plant processes, regulation of air, soil temperature for protection against frost and hot winds, Environmental moisture and evaporation, measures of atmospheric moisture, temperature, relative humidity, vapour pressure and their relationship.		
UNIT-III	**Evapotranspiration**	**5 Hrs**
Evapotranspiration and meteorological factors determining evapotranspiration, Modification of plant environment: artificial rain making, controlling heat load, heat trapping and shedding, protection from cold, reduction in sensible and latent heat flux.		
UNIT-IV	**Weather forecasting**	**4 Hrs**
Monsoon: monsoon and their origin, characteristics of monsoon, onset and progress of monsoon, withdrawal of monsoon, Weather forecasting in India: short, medium and long range forecasting, benefits of weather service to agriculture		
UNIT-V	**Remote sensing**	**4 Hrs**
Forecasting of destructive frost, soil moisture forecast, phenological forecast, crop yield forecast, Aero-space science and remote sensing: application in agriculture, present status of remote sensing in India, Atmospheric pollution and its effect on climate and crop production.		
		Total 24 Hrs.
Reference books	S. Mavi (1994). Introduction to Agrometeorology. Oxford & IBH Publishing Co. New Delhi. P.A. Menon (1989). Our weather. National Book Trust, New Delhi. A.A. Rama Sastu (1984). Weather and Weather forecasting Publication Division, GOI. P.K. Das (1992). The Monsoon. National Book Trust, New Delhi. S. Venkateraman and A. Krishnan. Crops and Weather. Indian Council of Agricultural Research, New Delhi. Critchfield, H.J. 1995. General Climatology, Prentice Hall of India Pvt. Ltd., New Delhi	
Mode of Examination	Written examination/Assignment/Quiz/Viva-Voce/student presentations	
Recommended by BOS on:		



	Agrometeorology and Crop Weather Forecasting Lab	
Sr. N.	**EXPERIMENTS**	**No. of Lectures**
	Any ten experiments	
1.	Agro meteorological observatory – classes, site selection, layout and installation procedures for meteorological instruments	1
2.	Handling of meteorological instruments	1
3.	Measurement of weather parameters	1
4.	Working out agro climatic indices	1
5.	Maintenance of records	1
6.	Calculation of daily, weekly and monthly means	2
7.	Visit to state Remote Sensing Centre, Jodhpur/Jaipur	1
8.	Measurement of soil temperature in different soil conditions/depths	1
9.	Interpretation and use of weather data	1
10.	Rainfall analysis for variability	1
11.	Moisture availability indices for an arid district	
	Total Lecture Hrs.	10 x 2= 20 Hrs.

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AGRON 512 Principles and Practices of Water Management 3(2+1)

AGRON 512	**Principles and Practices of Water Management**	**Theory**
Learning objective	To teach the principles of water management and practices to enhance the water productivity.	
UNIT-I	**Water resources**	**5 Hrs.**
Water, its properties and role in plants; Water resources of India, Major irrigation projects and extent of area and crops irrigated in India.		
UNIT-II	**Water potential**	**6 Hrs**
Water potential – concept, components and relationship between different components; Water movement in plant and soils; Absorption and transpiration of water in plants; Scheduling and methods of irrigation including micro irrigation system.		
UNIT-III	**WUE**	**5 Hrs**
Fertigation, Water use efficiency: Water management of crops and cropping systems; Soil, plant and meteorological factors deter mining water needs of crops; Water deficit stress in plants and its effect on growth.		
UNIT-IV	**Quality of water**	**4 Hrs**
Quality of irrigation water – effect of saline water and soil salinity on plants and its management, Excess soil water and plant growth;		
UNIT-V	**Water management**	**4 Hrs**
Water management in problem soils; Drainage requirement of crops and methods of drainage, their layout and spacing.		
		Total 24 Hrs.
Reference books	A.M. Michael, 1987. Irrigation – Theory and Practice, Vikas Publishing House Pvt. Ltd., New Delhi S.S. Parihar and B.S. Sandhu, 1978. Irrigation of field crops – Principles and Practices, ICAR, New Delhi D. Lenka, 1999. Irrigation and Drainage. Kalyani Publishers, New Delhi. R.D. Mishra and M. Ahmed. 1987. Manual on Irrigation Agronomy, Oxford & IBH Pub. Co. Pvt. Ltd., New Delhi G.H. Sankara Reddy and T. Yellamanda Reddy. 1995. Efficient use of irrigation water. Kalyani Publishers, New Delhi	
Mode of Examination	Written examination/Assignment/Quiz/Viva-Voce/student presentations	
Recommended by BOS on:		

	Principles and Practices of Water Management Lab	
Sr. N.	**EXPERIMENTS**	**No. of Lectures**
	Any ten experiments	
1.	Determination of soluble salts and Ca + Mg in irrigation water	1
2.	Determination of CO3= and HCO3 and Na in irrigation water	2
3.	Determination of FC and PWP	2
4.	Determination of soil moisture by tensiometer and pressure plate apparatus	2
5.	Water flow measurement using different devices	1
6.	Determining soil profile moisture deficit	1
7.	Determination of irrigation requirement of crops	2
8.	Calculations on irrigation efficiencies	2
9.	Computation of water requirement of crops using modified Penman formula	1
10.	Determination of infiltration rate of soil	1
11.	Determination of hydraulic conductivity of soil	
	Total Lecture Hrs.	10 x 2= 20 Hrs.

AGRON 513 Principles and Practices of Soil Fertility and Nutrient Management 3(2+1)

	Theory	
Learning objective	To impart knowledge of soil fertility and plant nutrients and apprise about the integrated approach of plant nutrition and sustainability of soil resources.	
UNIT-I	**Soil fertility**	**6 Hrs.**
Problems and management relating to mechanical impedence and soil submergence; Salt affected soils - problems and remedial measures; Soil acidity and remedial measures; Soil fertility and productivity concept and differences: Criteria of essentiality and forms in which nutrients are absorbed by plants; Physiological methods of increasing FUE.		
UNIT-II	**Functions of different nutrient**	**4 Hrs**
Nitrogen: Functions, deficiency and toxicity symptoms, forms of nitrogen, nitrogen transformation in soil, organic and mineral N balance in soil, mineralization of N compounds, losses of N from soil, nitrogenous fertilizer materials.		
UNIT-III	**Management of phosphorous**	**6 Hrs**
Methods to increase N use efficiency and slow release fertilizers; Biological N fixation, symbiotic and free living N fixers; **Phosphorus:** Functions and deficiency symptoms, forms of P in soil, their availability and P fixation, various phosphatic fertilizers; Practices of increasing the effectiveness of applied and native phosphorus (PSB).		
UNIT-IV	**Management of potassium**	**4 Hrs**
Potassium: Functions and deficiency symptoms, forms of K in soil, fixation and release of potassium in soil; Potassic fertilizers and their application. Sulphur and micronutrients (Fe, Zn) functions, deficiency symptoms and application;		
UNIT-V	**INM**	**4 Hrs**
Inter relationship of nutrient availability and soil pH; Important nutrient interactions and their effect on nutrient availability, cation exchange capacity and availability of plant nutrients; Integrated nutrient management.		
		Total 24 Hrs.
Reference books	S.L. Tisdale, W.L. Nelson, J.D. Beaton and J.L. Havlin. 1997. Soil Fertility and Fertilizers. Prentice Hall of India, Pvt. Ltd., New Delhi T.R. Reddy an G.H.S. Reddi 1992. Principles of Agronomy, Kalyani Publishers, New Delhi L.A. Richards, 1968. Diagnosis and Improvement of Saline and Alkali Soils, Oxford and IBH Publishing Company, New Delhi Tamhaney, Motiramani, Bali and Donahu, 1970. Soils Their Chemistry and Fertility in Tropical Asia, Prentice Hall of India, New Delhi R.R. Agarwal, J.S. P. Yadav and S.N. Gupta, 1982. Saline and Alkalai soils of India. ICAR Publication, New Delhi	
Mode of Examination	Written examination/Assignment/Quiz/Viva-Voce/student presentations	
Recommended by BOS on:		

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	Principles and Practices of Soil Fertility and Nutrient Management Lab	
Sr. N.	**EXPERIMENTS**	**No. of Lectures**
	Any ten experiments	
1.	Procedure of plant and soil sampling	1
2.	Determination of soil pH, ECe and organic carbon	3
3.	Determination of total N and available N, P and K in soil	4
4.	Determination of total N, P, K and S in plant samples	4
5.	Determination of Ca, Mg and Na in soil	2
6.	Determination of gypsum requirement of alkali soils	2
	Total Lecture Hrs.	10 x 2= 20 Hrs.

AGRON 521 Modern Concepts in Crop Production 3(3+0)

	Modern Concepts in Crop Production **Theory**
Learning objective	To teach the basic concepts of soil management and crop production.
UNIT-I	**Crop growth and tillage** **8 Hrs.**
Agronomic aspects in food security; Crop growth and production in relation to climate change; Agro ecological and agroclimatic zones of India; Concept of potential yield; Modern concepts in tillage - zero, minimum and conservation tillage.	
UNIT-II	**Biotic and abiotic stress** **8 Hrs**
Optimization of plant population and planting geometry in relation to soil fertility, solar radiation and available moisture regimes; Mitscherlich, Baule and Inverse yield: nitrogen laws; Biotic and abiotic stresses.	
UNIT-III	**Crop modeling** **8 Hrs**
Concept of ideal plant type; Organic farming, Physiology of grain yield in cereals; Crop growth analysis; Crop modelling in agronomic systems.	
UNIT-IV	**Designer crop** **4 Hrs**
Precision agriculture; Growth regulators and their role in agriculture; Designer crops; Vermi-technology	
UNIT-V	**Agro biodiversity** **8 Hrs**
Agro biodiversity; Seed priming; Indigeno us technological knowledge; Herbicide resistance in weeds; Allelopathy in agriculture; Plant nutrition and disease tolerance in field crops.	
	Total 36 Hrs.
Reference books	Gardner, F.P.;Pearce, G.R. and Michell, R.I. Physiology of Crop Plants, Scientific Pub., Jodhpur. S.P. Palaniappan and Shivarama,K. 1996. Cropping Systems in the Tropics - Principles and Management. New Age International Pub. Fageria, N.K. 1992. Maximising crop yields. Marcel Dekker, New York. Reddy,S.R. 2000. Principles of Agronomy. Kalyani Pub. New Delhi. Sankaran, S. and Mudaliar ,T.V.S. 1997. Principles of Agronomy. The Bangalore Printing and Pub. Bangalore.
Mode of Examination	Written examination/Assignment/Quiz/Viva-Voce/student presentations
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AGRON 522 Principles and Practices of Weed Management 3(2+1)

AGRON-522	Principles and Practices of Weed Management	Theory
Learning objective	To familiarize the students about the weeds, herbicides and methods of weed control.	
UNIT-I	**Weed classification**	**5 Hrs.**
Weed–biology, ecology and classification; history, development and classification of herbicides, their properties, mode of action and uses, basis of selectivity of herbicides; herbicide mixtures, adjuvants and safeners.		
UNIT-II	**Weed management**	**5 Hrs**
Weed control principles and management practices in important grain crops, oilseeds, pulses, sugar, fibre crops, tuber crops and forage crops; vegetables and orchards.		
UNIT-III	**Weed control under specific situation**	**5 Hrs**
Weed control under specific situations viz. intercropping systems, non cropped areas and drylands; noxious farm weeds and parasitic weeds and their control;		
UNIT-IV	**Integrated weed management**	**4 Hrs**
Fate of herbicides in soil; herbicide - pesticides and fertilizer interactions; allelopathic effect; integrated weed management;		
UNIT-V	**Aquatic weed types and control**	**5 Hrs**
Problem of aquatic weeds particularly water hyacinth, hydrilla and typha grass in Rajasthan and their possible control measures; weed control through bio herbicides and myco- herbicides; herbicide resistance in weeds and crops		
		Total 24 Hrs.
Reference books	Aldrich RJ & Kramer RJ. 1997. *Principles in Weed Management*. Panima Publ. Ashton FM & Crafts AS. 1981. *Mode of Action of Herbicides*. 2nd Ed. Wiley Inter-Science. Gupta OP. 2007. *Weed Management – Principles and Practices*. Agrobios. Mandal RC. 1990. *Weed, Weedicides and Weed Control - Principles and Practices*. Agro-Botanical Publ. Rao VS. 2000. *Principles of Weed Science*. Oxford & IBH.	
Mode of Examination	Written examination/Assignment/Quiz/Viva-Voce/student presentations	
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	Principles and Practices of Weed Management Lab	
Sr. N.	**EXPERIMENTS**	**No. of Lectures**
	Any ten experiments	
1.	Identification of common Kharif and Rabi weeds	1
2.	Identification of perennial weeds of crop fields, road sides, wastelands and irrigation channels	1
3.	Familiarization with trade names, common names, uses, cost and sources of availability of herbicides	1
4.	Calibration of sprayers and maintenance (before and after use)	1
5.	Study of different herbicidal formulations	1
6.	Calculation on herbicidal requirement for field crops under aquatic situations	1
7.	Application of herbicides in field crops	1
8.	Control of some noxious weeds by cultural and chemical means	1
9.	Study on weed control efficiency and calculation on weed infestation and weed index	1
10.	Preparation of weed herbarium	1
11.	Methodology for weed control research	
	Total Lecture Hrs.	10 x 2= 20 Hrs.

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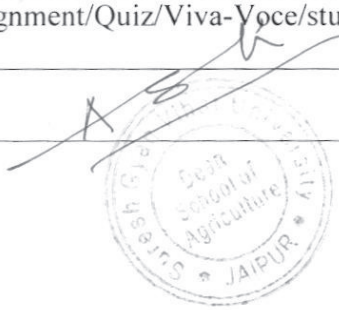
AGRON 523 Dryland Farming and Watershed Management 3(3+0)

AGRON 523	Dryland Farming and Watershed Management	Theory
Learning objective	To teach the basic concepts and practices of dryland farming, soil moisture conservation and watershed management.	
UNIT-I	**Dryland Farming**	**8 Hrs.**
Definition, concept, significance and dimensions of dryland farming in Indian agriculture, characteristics of dryland farming and dryland versus rainfed farming: constraints limiting crop production in dry land areas.		
UNIT-II	**Moisture deficit index and Mulches**	**6 Hrs**
Characterisation of environment for water availability; delineation of dry farming areas on the basis of moisture deficit index and their characteristics, use of mulches, kinds, effectiveness and economics.		
UNIT-III	**Antitranspirants**	**6 Hrs**
Antitranspirants- their types, mechanism and role in dry farming; water harvesting- its concepts, techniques and practices; soil and crop management techniques- tillage, seeding, fertilizer use, crop and varietal choice.		
UNIT-IV	**Weed control and management**	**8 Hrs**
Cropping system, weed control and other management practices; plant ideotypes for drylands, drought management strategies; preparation of appropriate crop plans for dryland areas; mid season corrections for aberrant weather conditions.		
UNIT-V	**Watershed management**	**8 Hrs**
Watershed management- definition, objectives, concepts, problems, approach components, development of cropping systems for watershed areas; alternate land use systems; planning and operation of project for watershed management.		
		Total 36 Hrs.
Reference books	R.P. Singh, Sriniwas Sharma, M.V. Padmanabhan, S.K. Das and P.K. Mishra, 1990. A Field Manual on Watershed Management, ICAR (CRIDA) Publication, Hyderabad. S.C. Verma and M.P. Singh. 1984. Agronomy of New Plant Types. Tara Book Agency, Varanasi. S. Palaniappan. 1985. Cropping Systems in Tropics: Principles and Management, Wiley Eastern Ltd., New Delhi & TNAU, Coimbatore. Mahendra Pal, K.A. Singh and I.P.S. Ahlawat. 1985. Cropping System Research I & II. In processing of the National Symposium on Cropping Systems Published by ISA, New Delhi. Efficient Crop Management in Dry Farming Areas. 1985. ICAR (CRIDA) Publication, Hyderabad.	
Mode of Examination	Written examination/Assignment/Quiz/Viva-Voce/student presentations	
Recommended by BOS on:		



AGRON 524 Cropping Systems and Sustainable Agriculture 3(3+0)

AGRON 524	Cropping Systems and Sustainable Agriculture	Theory
Learning objective	To acquaint the students about prevailing cropping systems and sustainable agriculture in the country and practices to improve productivity.	
UNIT-I	**Types of cropping**	**8 Hrs.**
Cropping systems- intercropping and multiple cropping, concepts, needs, indices and assessment; existing cropping systems under irrigated and rainfed situations.		
UNIT-II	**Farming system**	**8 Hrs**
Cropping system indices viz., relative spread index and relative yield index. Farming system: integrated farming system, alternate farming system - meaning and scope including specific examples.		
UNIT-III	**Natural and organic farming**	**6 Hrs**
Recycling and crop residue management. Natural farming - concept and components. Organic farming.		
UNIT-IV	**Sustainable agriculture**	**6 Hrs**
Crop diversification – principles, types and needs, Sustainable agriculture - definition, scope and objectives, Natural resources, their characterization and management		
UNIT-V	**Environmental degradation**	**8 Hrs**
Sustainable cropping and farming systems in agriculture in relation to environmental degradation; Research needs on sustainable agriculture.		
		Total 36 Hrs.
Reference books	K.N. Singh and R.P. Singh (Eds), 1990. Agronomic Research Towards Sustainable Agriculture, Indian Society of Agronomy, New Delhi R.P. Singh, 1990. Sustainable Agriculture: Issues ,Perspectives and Prospects in Semi Arid Tropics. Vol I & II Indian Society of Agronomy, New Delhi Proceedings of the National Symposium on Cropping Systems 1985. Indian Society of Agronomy, New Delhi R.M. Devlin and E.H. Watham. 1986. Plant Physiology. CBS Publishers and Distributors, New Delhi. L.L.Somani, K.L. Totawat and B.L. Baser. 1992 (Ed.) Proceedings of National Seminar on Natural Farming, NSMP Publication, Rajasthan College of Agriculture, Udaipur	
Mode of Examination	Written examination/Assignment/Quiz/Viva-Voce/student presentations	
Recommended by BOS on:		

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AGRON 531 Agronomy of Major Cereals and Pulses 3(2+1)

AGRON 531	**Agronomy of Major Cereals and Pulses**	**Theory**
Learning objective	To teach the crop husbandry of major cereals and pulses.	
UNIT-I	**Agronomy of Rice and wheat**	**5 Hrs.**
Origin and history, area and production, classification, improved varieties, adaptability, climate, soil, water and cultural requirements, nutrition, quality components, handling and processing of the produce for maximum production of rice, wheat.		
UNIT-II	**Agronomy of maize and barley**	**5 Hrs**
Origin and history, area and production, classification, improved varieties, adaptability, climate, soil, water and cultural requirements, nutrition, quality components, handling and processing of the produce for maximum production of maize, barley.		
UNIT-III	**Agronomy of sorghum and pearl millet**	**5 Hrs**
Origin and history, area and production, classification, improved varieties, adaptability, climate, soil, water and cultural requirements, nutrition, quality components, handling and processing of the produce for maximum production of sorghum, pearl millet.		
UNIT-IV	**Agronomy of chickpea**	**5 Hrs**
Origin and history, area and production, classification, improved varieties, adaptability, climate, soil, water and cultural requirements, nutrition, quality components, handling and processing of the produce for maximum production of chickpea.		
UNIT-V	**Agronomy of pigeon pea**	**4 Hrs**
Origin and history, area and production, classification, improved varieties, adaptability, climate, soil, water and cultural requirements, nutrition, quality components, handling and processing of the produce for maximum production of pigeon pea.		
		Total 24 Hrs.
Reference books	Das NR. 2007. *Introduction to Crops of India*. Scientific Publ. Hunsigi G & Krishna KR. 1998. *Science of Field Crop Production*. Oxford & IBH. Khare D & Bhale MS. 2000. *Seed Technology*. Scientific Publ. Kumar Ranjeet & Singh NP. 2003. *Maize Production in India: Golden Grain in Transition*. IARI, New Delhi. Pal M, Deka J & Rai RK. 1996. *Fundamentals of Cereal Crop Production*.Tata McGrawHill.	
Mode of Examination	Written examination/Assignment/Quiz/Viva-Voce/student presentations	
Recommended by BOS on:		

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	Agronomy of Major Cereals and Pulses Lab	
Sr. N.	**EXPERIMENTS**	**No. of Lectures**
	Any ten experiments	
1.	Phenological studies at different growth stages of crops	1
2.	Methods of raising nursery including dapog in paddy	1
3.	Calculation of fertilizer requirements on the basis of soil test values	1
4.	Computation of cost of cultivation in crops	1
5.	Formulation of cropping schemes for various farm sizes and calculation of cropping and rotation intensities	1
6.	Planning and layout of field experiments	1
7.	Working out of indices of intercropping systems – LER aggressivity, relative crowding coefficient, monetary yield advantage and ATER	1
8.	Determination of physiological maturity in different crops	1
9.	Working out of harvest index in various crops	1
10.	Computation of growth analysis indices	1
11.	Visit of field experiments on cultural, fertilizer, weed control and water management aspects	
	Total Lecture Hrs.	10 x 2= 20 Hrs.

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AGRON 532 Agronomy of Oilseeds, Fibre and Commercial Crops 3(2+1)

AGRON 532	**Agronomy of Oilseeds, Fibre and Commercial Crops**	**Theory**
Learning objective	To teach the crop husbandry of oilseed, fibre and commercial crops.	
UNIT-I	**Agronomy of groundnut, rapeseed and mustard**	**6 Hrs.**
Origin and history, area and production, classification, improved varieties, adaptability, climate, soil, water and cultural requirements, nutrition quality component, handling and processing of the produce for maximum production of oilseeds - groundnut, rapeseed and mustard.		
UNIT-II	**Agronomy of soyabean**	**4 Hrs**
Origin and history, area and production, classification, improved varieties, adaptability, climate, soil, water and cultural requirements, nutrition quality component, handling and processing of the produce for maximum production of oilseeds - soybean.		
UNIT-III	**Agronomy of cotton and jute**	**6 Hrs**
Origin and history, area and production, classification, improved varieties, adaptability, climate, soil, water and cultural requirements, nutrition quality component, handling and processing of the produce for maximum production of fibre crops - cotton and jute.		
UNIT-IV	**Agronomy of sugarcane**	**4 Hrs**
Origin and history, area and production, classification, improved varieties, adaptability, climate, soil, water and cultural requirements, nutrition quality component, handling and processing of the produce for maximum production of commercial crops-sugarcane .		
UNIT-V	**Agronomy of potato**	**4 Hrs**
Origin and history, area and production, classification, improved varieties, adaptability, climate, soil, water and cultural requirements, nutrition quality component, handling and processing of the produce for maximum production of commercial crop potato.		
		Total 24 Hrs.
Reference books	Das, N.R. 2007. Introduction to crops of India. Scientific Publisher, Jodhpur. H.C. Srivastava, S. Bhaskaran, B. Vatsyas and K.K.G. MENon, 1985. Oilseed Production: Constraints and Opportunities, Oxford & IBH Company, New Delhi. Research and Development Strategies for Oilseed Production in India, 1979. Proceedings of National Symposium, 7-9 Nov. 1979, ICAR Publication, New Delhi. P.S. Reddy, 1988. Groundnut, ICAR, New Delhi. Chhidda Singh, Prem Singh and Rajbir Singh, 2003. Modern Techniques of Raising Field Crops. Oxford & IBH Publishing Co., New Delhi.	
Mode of Examination	Written examination/Assignment/Quiz/Viva-Voce/student presentations	
Recommended by BOS on:		

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	Agronomy of Oilseeds, Fibre and Commercial Crops Lab	
Sr. N.	**EXPERIMENTS**	**No. of Lectures**
	Any ten experiments	
1.	Study of yield attributing characters of oilseeds, cotton and jute, computation of yield on the basis of yield attributing characters.	1
2.	Determination of oil content in oilseeds and computation of oil yield	1
3.	Seed treatment of cotton seed with sulphuric acid and cow dung	1
4.	Estimation of protein in oilseed crops	1
5.	Determination of quality of cotton including ginning % and lint index	1
6.	Calculation of fertilizer requirements and their application at different growth stages in various crops on the basis of soil test values	1
7.	Phenological studies in sugarcane	1
8.	Cutting of cane setts, its treatment and method of sowing	1
9.	Tying and propping of sugarcane	1
10.	Determination of cane maturity and calculation on purity, recovery and sucrose content in juice	1
11.	Calculation of seed rate and fertilizer requirement of sugarcane	
	Total Lecture Hrs.	10 x 2= 20 Hrs.

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SOILS 513 Analytical techniques and instrumental methods in soil and plant analysis

SOILS-513	**Analytical techniques and instrumental methods in soil and plant analysis Theory**
Learning objective	To familiarize the students with commonly used instruments – their working, preparations of common analytical reagents for qualitative and quantitative analysis of both soil as well as plant samples.
UNIT-I	**Spectrophotometery**
Principles of visible, ultraviolet and infrared spectrophotometery	4 Hrs.
UNIT-II	**Flame-photometry**
Atomic absorption, flame-photometry	5 Hrs
UNIT-III	**Chromatography**
Inductively coupled plasma spectrometry; chromatographic techniques	5 Hrs
UNIT-IV	**Mass spectrometry**
Mass spectrometry and X-ray defractometery	5 Hrs
UNIT-V	**X- ray**
Identification of minerals by X-ray by different methods	5 Hrs
	Total 24 Hrs.
Reference books	Hesse P. 971. *Textbook of Soil Chemical Analysis*. William Clowes & Sons. Jackson ML. 1967. *Soil Chemical Analysis*. Prentice Hall of India. Keith A Smith 1991. *Soil Analysis; Modern Instrumental Techniques*. Marcel Dekker. Kenneth Helrich 1990. *Official Methods of Analysis* Association of Official Analytical Chemists. Page AL, Miller RH & Keeney DR. 1982. *Methods of Soil Analysis*. Part II. SSSA, Madison.
Mode of Examination	Written examination/Assignment/Quiz/Viva-Voce/student presentations
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SOILS-513	**Analytical techniques and instrumental methods in soil and plant analysis Lab**	
Sr. N.	**EXPERIMENTS**	**No. of Lectures**
	Any ten experiments	
1.	Analytical chemistry – Basic concepts, techniques and calculations	1
2.	Principle of analytical instruments and their calibration for soil and plant analysis	1
3.	Determination of available nitrogen in soil	1
4.	Determination of available phosphorus in soil	1
5.	Determination of available potassium in soil	1
6.	Determination of available sulphur in soil	1
7.	Determination of available Boron in soil	1
8.	Determination of available molybdenum in soil	1
9.	Determination of iron, cupper, manganese and zinc in soil	1
10.	Determination of potential buffering capacity of phosphorus	1
11.	Determination of potential buffering capacity of potassium	
	Total Lecture Hrs.	10 x 2= 20 Hrs.

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SOILS- 532 Management of problem soils and waters

SOILS 532	Management of problem soils and waters	Theory
Learning objective	To educate students about basic concepts of problem soils and brackish water, and their management. Attention will be on management of problem soils and safe use of brackish water in relation to crop production.	
UNIT-I	**Classification of soils**	**5 Hrs.**
Area and distribution of problem soils – acidic, saline, sodic and physically degraded soils; origin and basic concept of problematic soils, and factors responsible, morphological features of saline, sodic and saline-sodic soils		
UNIT-II	**Characteristics of soils**	**5 Hrs**
Characterization of salt-affected soils - soluble salts, ESP, pH; physical, chemical and microbiological properties, management of salt-affected soils; salt tolerance of crops - mechanism and ratings; monitoring of soil salinity in the field		
UNIT-III	**Management principles of soils**	**5 Hrs**
Management principles for sandy, clayey, red lateritic and dry land soils, acid soils - nature of soil acidity, sources of soil acidity; effect on plant growth, lime requirement of acid soils; management of acid soils; biological sickness of soils and its management		
UNIT-IV	**Quality of irrigation**	**5 Hrs**
Quality of irrigation water; management of brackish water for irrigation; salt balance under irrigation; characterization of brackish waters, area and extent		
UNIT-V	**Water use and quality**	**4 Hrs**
Relationship in water use and quality, agronomic practices in relation to problematic soils; cropping pattern for utilizing poor quality ground waters		
		Total 24 Hrs.
Reference books	Bear FE. 1964. *Chemistry of the Soil*. Oxford & IBH. Jurinak JJ. 1978. *Salt-affected Soils*. Department of Soil Science & Biometeorology. Utah State Univ. USDA Handbook No. 60. 1954. *Diagnosis and improvement of Saline andAlkali Soils*. Oxford & IBH.	
Mode of Examination	Written examination/Assignment/Quiz/Viva-Voce/Student presentations	
Recommended by BOS on:		

SOILS 532	**Management of problem soils and waters Lab**	
Sr. N.	**EXPERIMENTS**	**No. of Lectures**
	Any ten experiments	
1.	Characterization of acid and acid sulfate soils salt-affected and calcareous soils	1
2.	Characterization of salt-affected soils	1
3.	Characterization of calcareous soils	1
4.	Determination of Ca++ and Mg++ in soil	1
5.	Determination of Ca++ and Mg++ in ground water	1
6.	Determination of Potassium in ground water	1
7.	Determination of Potassium in soil	1
8.	Determination of sodium in ground water	1
9.	Determination of sodium in soil	1
10.	Determination of CO3-- and HCO3- in ground waters	1
11.	Determination of CO3-- and HCO3- in soil	
	Total Lecture Hrs.	10 x 2= 20 Hrs.

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PPHYS-531 Hormonal regulation of plant growth and development

PPHYS-531	**Hormonal regulation of plant growth and development**	**Theory**
Learning objective	To apprise the students about structure function of plant growth regulator on growth and development of plant.	
UNIT-I	**Classification of PGRs**	**5 Hrs.**
Definition and classifiacation of palnt growth regulators- Hormones, endogenous growth substances and synthetic chemicals, Endogenous growth regulating substances other than hormones. tricontanol, Phenols – polyamines, jasmonates, concept of death hormone		
UNIT-II	**Biosynthesis and metabolism of PGRs**	**5 Hrs.**
Site of synthesis, biosynthetic pathways and metabolism and the influence on plant growth development of individual group of hormones- Auxins, Gibberlins, cytokinins, Abscisic acid and Ethylene Brassinosteroids.		
UNIT-III	**Role of PGRS**	**5 Hrs.**
Signal perception.transduction, and effect at functional gene level of different hormones - Auxins- cell elongation, Gibberellins - germination of dormant seeds, cytokinins- cell division. Retardation of senescence of plant parts.		
UNIT-IV	**Drought hormones**	**5 Hrs.**
Abscisic acid-Stomatal closure and induction of drought resistance, Ethylene- fruit ripening. Interaction of hormones in regulation of plant growth and development processes. Rooting of cuttings - Flowering. Apical dominance.		
UNIT-V	**Molecular control of PGRs.**	**4 Hrs.**
Molecular aspects of control of reproductive growth and development. Synthetic growth regulators- Classification, their effect on plant growth and development. Practical utility in agriculture and horticulture.		
		Total 24 Hrs.
Reference books	Hopkins WG & Huner NPA. 2004. *Introduction to Plant Physiology*. John Wiley & Sons. Salisbury FB & Ross C. 1992.*Plant Physiology*. 4th Ed. Wadsworth Publ.	
Mode of Examination	Written examination/Assignment/Quiz/Viva-Voce/student presentations	
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PPHYS-531	**Hormonal regulation of plant growth and development Lab**	
Sr. N.	**EXPERIMENTS**	**No. of Lectures**
	Any ten experiments	
1.	Extraction of hormones from plant tissue.	5
2.	Auxins- bioassays- auxins effect on rooting of cuttings, abscission, apical dominance	2
3.	Gibberellins- bioassays-GA effect on germination of dormant seeds,	2
4.	Cytokines- bioassays- cytokinin effect on apical dominance and senescence,	2
5.	ABA bioassays estimation. ABA effect on stomatal movement,	2
6.	Ethylene bioassays, effect of hormones on breaking dormancy	2
7.	Estimation of PGRs using physico chemical techniques (with the condition that GLC/ HPLC is provided)	3
	Total Lecture Hrs.	10 x 2= 20 Hrs.

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STATS- 511	Statistical methods 3(2+1)
Learning objective	This course is meant for students who do not have sufficient background of Statistical Methods. The students would be exposed to concepts of statistical methods and statistical inference that would help them in understanding the importance of statistics. It would also help them in understanding the concepts involved in data presentation, analysis and interpretation. The students would get an exposure to presentation of data, probability distributions, parameter estimation, tests of significance, regression and multivariate analytical techniques.
Unit-I	**Data Collection and distribution**
Classification, tabulation and graphical representation of data. Box-plot, Descriptive statistics. Exploratory data analysis; Theory of probability. Random variable and mathematical expectation, Discrete and continuous probability distributions: Binomial, Poisson, Negative Binomial, Normal distribution, Beta and Gamma distributions and their applications.	
Unit- II	**Statistical tests**
Concept of sampling distribution: chi-square, *t* and *F* distributions. Tests of significance based on Normal, chi-square, *t* and *F* distributions. Large sample theory, Introduction to theory of estimation and confidence - intervals. Correlation and regression. Simple and multiple linear regression model,	
Unit-III	**Correlation and regression**
Estimation of parameters, predicted values and residuals, correlation, partial correlation coefficient, multiple correlation coefficient, rank correlation, test of significance of correlation coefficient and regression coefficients. Coefficient of determination.	
Unit-IV	**Non-parametric test**
Non-parametric tests - sign, Wilcoxon, Mann-Whitney U-test, Wald Wolfowitz run test, Run test for the randomness of a sequence.	
Unit-V	**Experimental design**
Median test, Kruskal- Wallis test, Friedman two-way ANOVA by ranks. Kendall's coefficient of concordance.	
Reference books	1. Anderson TW. 1958. *An Introduction to Multivariate Statistical Analysis*. John Wiley. 2. Dillon WR & Goldstein M. 1984. *Multivariate Analysis - Methods and Applications*. John Wiley. 3. Goon AM, Gupta MK & Dasgupta B. 1977. *An Outline of Statistical Theory*. Vol. I. The World Press. 4. Goon AM, Gupta MK & Dasgupta B. 1983. *Fundamentals of Statistics*. Vol. I. The World Press.

Practical

S. No.	Topic	No. of lectures
1.	Box-Cox plots	1.
2.	Fitting of Binomial distribution	1
3.	Fitting of Poisson distribution	1
4.	Fitting of Negative binomial distribution	1
5.	Fitting of Normal distribution	1
6.	Large Sample tests	1
7.	Chi Square test	1
8.	One sample, two sample and paired t test	1
9.	F- test	1
10.	Computation of Simple correlation	1
11.	Computation of partial and multiple correlation	1
12.	Computation of Simple and partial regression	1
13.	Computation of Run test	1
14.	Sign and sign wilcoxon test	1
15.	Mann-whitney U test	1
16.	Kruskal- Wallis test	1

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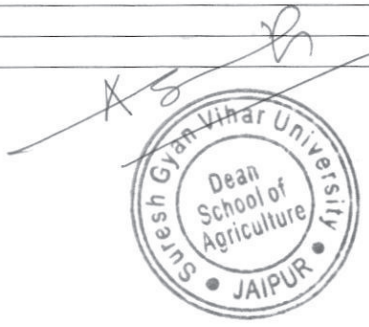
STAT-521	Experimental Designs 3(2+1)
Learning objective	This course is meant for students of agricultural and animal sciences other than Statistics. Designing an experiment is an integrated component of research in almost all sciences. The students would be exposed to concepts of Design of Experiments so as to enable them to understand the concepts involved in planning, designing their experiments and analysis of experimental data.
Unit-I	Design
Need for designing of experiments, characteristics of a good design. Basic principles of designs- randomization, replication and local control, Uniformity trials, size and shape of plots and blocks;	
Unit- II	RBD & LSD
Analysis of variance; Completely randomized design, randomized block design and Latin square design, Factorial experiments, (symmetrical as well as asymmetrical), orthogonality and partitioning of degrees of freedom,	
Unit-III	Factorial experiments
Confounding in symmetrical factorial experiments, Factorial experiments with control treatment, Split plot and strip plot designs; Analysis of covariance and missing plot techniques in randomized block and Latin square designs;	
Unit-IV	Crossing and block design
Transformations, crossover designs, balanced incomplete block design, resolvable designs and their applications	
Unit-V	Experiment analysis
Concepts, randomisation procedure, analysis and interpretation of results. Response surfaces. Experiments with mixtures.	
Reference books	1. Cochran WG & Cox GM. 1957. *Experimental Designs*. 2nd Ed. John Wiley. 2. Dean AM & Voss D. 1999. *Design and Analysis of Experiments*. Springer. 3. Federer WT. 1985. *Experimental Designs*. MacMillan. 4. Fisher RA. 1953. *Design and Analysis of Experiments*. Oliver & Boyd.

Practical

S. No.	Topic	No. of lectures
1.	Formation of plots	1
2.	Formation of blocks	1
3.	Analysis of CRD	1
4.	Analysis of RBD	1
5.	Analysis of LSD	1
6.	Analysis of factorial experiment	1
7.	Analysis of asymmetric factorial experiments	1
8.	Analysis of confounded factorial experiments	1
9.	Analysis with missing data in RBD	1
10.	Analysis with missing data in LSD	1
11.	Transformation of data	1
12.	Analysis of SPD	1
13.	Analysis of strip plot design	1
14.	Analysis of resolvable designs	1
15.	Fitting of response surfaces	2



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SYLLABUS

M.Sc. HORTICULTURE

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SYLLABUS

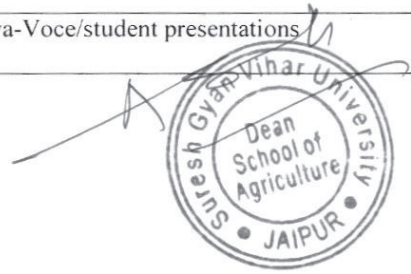
M.Sc. HORTICULTURE

2021-22

HORTI -511	**Tropical and Dry land Horticulture**	**3(2+1)**
Prerequisite		
Learning objective	To impart basic knowledge about the importance and management of tropical and dry land fruits grown India	
Salient features		
Utility		
Unit I	**Commercial varieties of regional , national and international importance**	**5hrs**
	Commercial varieties of regional , national and international importance, ecophysiological requriment, recent trends in propagation, rootstock influence, planting system, cropping system, root zone and canopy management, nutrient management, water management, fertigation, role of bio regulators, abiotic factors limiting fruit pdiduction, physiology of flowering , pollination, fruit set and development, honeybees in cross pollination, physiological disorder-causes and remedies, quality improvement by management practices, maturity indices, harvesting, grading, packing, storage and ripening techniques, industrial and export potential, Agri. Export Zones (AEZ) and industrial supports.-	
UNIT-II	**Production technology**	**5hrs**
	Production technology of Mango ,Banana, papaya, Coconut	
UNIT-III	**Production technology**	**5hrs**
	Production technology of Cashew nut, Sapota, Jackfruit, Pinaapple	
UNIT-IV	**Production technology**	**5hrs**
	Production technology of Annonas , Aonla, Pomegranate, Phalsa, Ber	
UNIT-V	**Production technology**	**4hrs**
	Production technology of Mahua, Lasoda, Mulberry, Tamarind, Chironji	
		Total 24 Hrs.
Reference books	1. Bose, TK,Mitra,SK & Rathore, DS. (Eds.). 1988. Temperate Fruits - Horticulture.Allied Publ. Bose, T.K, Mitra, S.K & Sanyal, D. 2001. (Eds.). Fruits -Tropical and Subtropical. Naya Udyog. 2. Chadha, K.L & Pareek, O.P. 1996. (Eds.). Advances in Horticulture. Vols. II- IV. Malhotra Publ. House. Nakasone, H.Y & Paul, R.E. 1998. Tropical Fruits. CABI. 3. Peter, K.V. 2008. (Ed.). Basics of Horticulture. New India Publ. Agency. 4. Pradeepkumar T, Suma B, Jyothibhaskar & Satheesan, K.N. 2008. Management of Horticultural Crops. Parts I, II. New India Publ. Agency. 5.	
Mode of Examination	Written examination/Assignment/Quiz/Viva-Voce/student presentations	

Practical

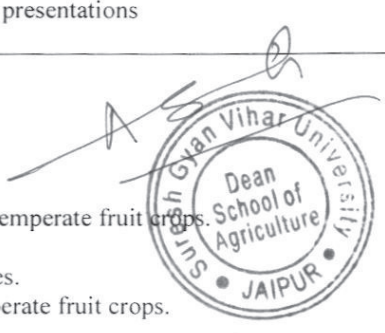
1. Identification of important cultivars
2. Observations on growth and development,
3. Practices in growth regulation,
4. Palady diagnosis,
5. Analyses of quality attributes,
6. Practices of important agro-techniques,
7. Visit to tropical and arid zone orchards,
8. Project preparation for establishing commercial orchards.



HORTI 512	**Subtropical and Temperate Fruit Production**	**3(2+1)**
Prerequisite		
Learning objective	To impart basic knowledge about the importance and management of subtropical and temperate fruits grown in India.	
Salient features		
Utility		
UNIT-I	**Commercial varieties of regional , national and international importance**	**5Hrs**
	Commercial varieties of regional, national and international importance, ecophysiological requirements, recent trends in propagation, rootstock influence, planting systems, cropping systems, root zone and canopy management, nutrient management, water management, fertigation, bio regulation, abiotic factors limiting fruit production, physiology of flowering, fruit set and development, abiotic factors limiting production, physiological disorders-causes and remedies, quality improvement by management practices; maturity indices, harvesting, grading, packing, pre-cooling, storage, transportation and ripening techniques; industrial and export potential, Agri Export Zones(AEZ) and industrial support	
UNIT-II	**Production technology**	**5Hrs**
	Apple, pear, quince, Plums, peach, apricot.	
UNIT-III	**Production technology**	**5Hrs**
	cherries, Litchi, loquat, kiwifruit, strawberry Nuts- walnut, almond	
UNIT-IV	**Production technology**	**5hrs**
	Pistachio, Grapes, Guava, Citrus and Custard apple	
UNIT-V	**Production technology**	**4Hrs**
	Minor fruits- carambola, bael, wood apple, fig, jamun, rambutan, ker, pilu	
	Total 24 Hrs.	
Reference books	1. Bose T.K, Mitra S.K & Sanyal D. (Ed.). 2002. Fruits of India — Tropical and Sub-tropical. 3 2. Naya Udyog. 3. Chadha K.L & Pareek O.P. 1996. (Eds.). Advances in Horticulture. Vol. I. Malhotra Publ. House.Ed. Vols. I, II. 4. Chadha K.L & Shikhamany S.D. 1999. The Grape: Improvement, Production and Post-Harvest 5. Management. Malhotra Publ. House.	
Mode of Examination	Written examination/Assignment/Quiz/Viva-Voce/student presentations	

Practical

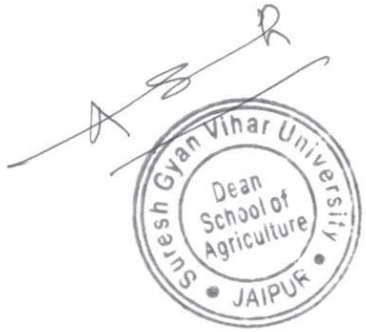
1. Identification of important fruit plants and its available cultivars .
2. Observations on growth and development of Tropical, sub- tropical & temperate fruit crops.
3. Practices in growth regulation and canopy management in fruit crops
4. Diagnosis of different malady / disorders & analyses of quality attributes.
5. Practices of important agro-techniques of tropical, sub- tropical & temperate fruit crops.
6. Visit to tropical, sub- tropical & temperate fruit crops.



HORTI-513	**Production Technology of Warm Season Vegetable Crops**	**3(2+1)**
Prerequisite		
Learning objective	To impart basic knowledge about the importance and management of subtropical and temperate fruits grown in India.	
Salient features		
Utility		
UNIT-I	**Production Technology of Warm Season Vegetable Crops**	**6hrs**
	Introduction, botany & taxonomy ,climate and soil requirement, commercial varieties/hybrids,sowing/planting times & methods, seed rate and seed treatment, nutritional and irrigation requirement,intercultural operations,weed control, mulching,physiological disorder, harvesting, post-harvesting management,plant protection measures, economics of crop production and sed production of - Tomato	
UNIT-II	**Economics of crop production and seed production**	**5hrs**
	Eggplant, hot and sweet peppers, Okra	
UNIT-III	**Economics of crop production and seed production**	**5hrs**
	Beans, cowpea and clusterbean,	
UNIT-IV	**Economics of crop production and seed production**	**5hrs**
	Cucurbitaceous crops , Colocasia and sweet potato	
UNIT-V	**Production technology**	**3hrs**
	Green leafy warm season vegetables	
Reference books	1. Bose T.K & Som M.G. (Eds.). 1986. *Vegetable Crops in India*. Naya Prokash. 2. Bose T.K, Kabir J, Maity T.K, Parthasarathy V.A & Som M.G. 2003. *Vegetable Crops*. yols. I-III. Naya Udyog. 3. Bose T.K, Som M.G & Kabir J. (Eds.). 2002. *Vegetable Crops*. Naya Prokash. Brown H.D & Hutchison C.S. *Vegetable Science*. JB Lippincott Co. 4. Chadha K.L & Kalloo G. (Eds.). 1993-94. *Advances in Horticulture*. vols. V-X. Malhotra Publ. House. Chadha K.L. (Ed.). 2002. *Hand Book of Horticulture*. ICAR.	
Mode of Examination	Written examination/Assignment/Quiz/Viva-Voce/student presentations	

Practicals

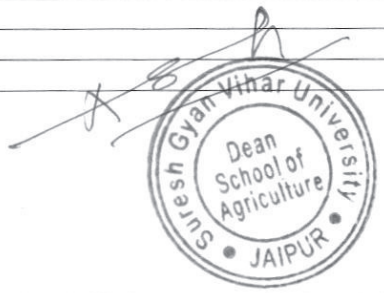
1. Cultural operations (fertilizer application, sowing,mulching)
2. Cultural operations (irrigation and weed control) of summer vegetables crops
3. Economic of summer veg, crops
4. Study of physiological and deficiency of mineral elements
5. Preparation of cropping schemes for commercial farms
6. Experiments to demonstrate the role of mineral element physiological disorder
7. Experiments to demonstrate the physiological disorder
8. Experiments to demonstrate the plant growth substances
9. Experiments to demonstrate the herbicides
10. Experiments to demonstrate the seed extraction techniques
11. Identification of important pests and their control
12. Identification of important diseases and their control
13. Maturity standard of warm season vegetables crops
14. Economics of warm season vegetables crops



STATS- 511	**Statistical methods** 3(2+1)
Learning objective	This course is meant for students who do not have sufficient background of Statistical Methods. The students would be exposed to concepts of statistical methods and statistical inference that would help them in understanding the importance of statistics. It would also help them in understanding the concepts involved in data presentation, analysis and interpretation. The students would get an exposure to presentation of data, probability distributions, parameter estimation, tests of significance, regression and multivariate analytical techniques.
Unit-I	**Data Collection and distribution**
Classification, tabulation and graphical representation of data. Box-plot, Descriptive statistics. Exploratory data analysis; Theory of probability. Random variable and mathematical expectation, Discrete and continuous probability distributions: Binomial, Poisson, Negative Binomial, Normal distribution, Beta and Gamma distributions and their applications.	
Unit- II	**Statistical tests**
Concept of sampling distribution: chi-square, *t* and *F* distributions. Tests of significance based on Normal, chi-square, *t* and *F* distributions. Large sample theory, Introduction to theory of estimation and confidence - intervals. Correlation and regression. Simple and multiple linear regression model,	
Unit-III	**Correlation and regression**
Estimation of parameters, predicted values and residuals, correlation, partial correlation coefficient, multiple correlation coefficient, rank correlation, test of significance of correlation coefficient and regression coefficients. Coefficient of determination.	
Unit-IV	**Non-parametric test**
Non-parametric tests - sign, Wilcoxon, Mann-Whitney U-test, Wald Wolfowitz run test, Run test for the randomness of a sequence.	
Unit-V	**Experimental design**
Median test, Kruskal- Wallis test, Friedman two-way ANOVA by ranks. Kendall's coefficient of concordance.	
Reference books	1. Anderson TW. 1958. *An Introduction to Multivariate Statistical Analysis*. John Wiley. 2. Dillon WR & Goldstein M. 1984. *Multivariate Analysis - Methods and Applications*. John Wiley. 3. Goon AM, Gupta MK & Dasgupta B. 1977. *An Outline of Statistical Theory*. Vol. I. The World Press. 4. Goon AM, Gupta MK & Dasgupta B. 1983. *Fundamentals of Statistics*. Vol. I. The World Press. 5. Hoel PG. 1971. *Introduction to Mathematical Statistics*. John Wiley.

Practical

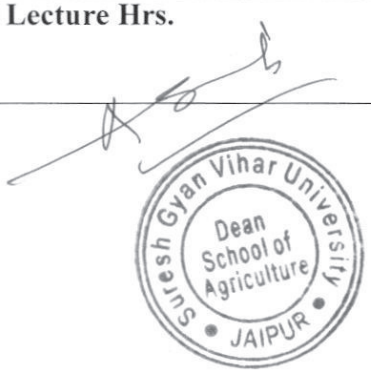
S. No.	Topic	No. of lectures
1.	Box-Cox plots	1.
2.	Fitting of Binomial distribution	1
3.	Fitting of Poisson distribution	1
4.	Fitting of Negative binomial distribution	1
5.	Fitting of Normal distribution	1
6.	Large Sample tests	1
7.	Chi Square test	1
8.	One sample, two sample and paired t test	1
9.	F- test	1
10.	Computation of Simple correlation	1
11.	Computation of partial and multiple correlation	1
12.	Computation of Simple and partial regression	1
13.	Computation of Run test	1
14.	Sign and sign wilcoxon test	1
15.	Mann-whitney U test	1
16.	Kruskal- Wallis test	1



PBG 512 Principles of Plant Breeding

PBG-512	**Principles of Plant Breeding**
Prerequisite	All students are expected to have general knowledge of Botany and crop plants
Learning objective	To impart theoretical knowledge and practical skills about plant breeding objectives, modes of reproduction and genetic consequences, breeding methods for crop improvement.
Salient features	The student will be able to conceptualize about different aspects of plant breeding, hybrid vigour and release of variety
Utility	M. Sc. degree in Genetics and Plant Breeding opens door to have job opportunity in seed companies, Industries, research work with foreign collaborators in India like ICRISAT, CCMB etc. and many more
UNIT-I	**History and Centre of Diversity** **5 Hrs**
History of Plant Breeding (Pre and post-Mendelian era); Objectives of plant breeding, characteristics improved by plant breeding; Patterns of Evolution in Crop Plants- Centres of Origin-biodiversity and its significance, genetic basis of breeding self- and cross -pollinated crops including mating systems and response to selection - nature of variability, components of variation; Heritability and genetic advance, genotype-environment interaction;	
UNIT-II	**Breeding methods** **5 Hrs**
General and specific combining ability; Types of gene actions and implications in plant breeding; Plant introduction and role of plant genetic resources in plant breeding, pure line theory, pure line selection and mass selection methods; Line breeding, pedigree, bulk, backcross, single seed descent and multiline method; Population breeding in self-pollinated crops (diallel selective mating approach), breeding methods in cross pollinated crops;	
UNIT-III	**Population Improvement** **5 Hrs**
Population breeding-mass selection and ear-to-row methods; S1 and S2 progeny testing, progeny selection schemes, recurrent selection schemes for intra and interpopulation improvement and development of synthetics and composites; Hybrid breeding - genetical and physiological basis of heterosis and inbreeding, production of inbreds.	
UNIT-IV	**Self incompatibility and male sterility** **6 Hrs**
Breeding approaches for improvement of inbreds, predicting hybrid performance; seed production of hybrid and their parent varieties/inbreds, breeding methods in asexually/clonally propagated crops, clonal selection apomixes, clonal selection, self- incompatibility and male sterility in crop plants and their commercial exploitation;	
UNIT-V	**Ideotype and Breeding for stress** **3 Hrs**
Concept of plant ideotype and its role in crop improvement; Transgressive breeding, special breeding techniques-Mutation breeding; Breeding for abiotic and biotic stresses.	
Total 24 Hrs.	
Reference books	Allard RW. 1981. Principles of Plant Breeding. John Wiley & Sons. Chopra VL. 2001. Breeding Field Crops. Oxford & IB Pohlman JM & Bothakur DN. 1972. Breeding Asian Field Crops. Oxford & IBH. Singh BD. 2006. Plant Breeding. Kalyani. Singh P. 2002. Objective Genetics and Plant Breeding. Kalyani. Singh P. 2006. Essentials of Plant Breeding. Kalyani.
Mode of Examination	Written examination/Assignment/Quiz/Viva-Voce/student presentations
Recommended by BOS on:	

PBG-512	PRINCIPLES OF PLANT BREEDING LAB	
Sr. N.	**EXPERIMENTS**	**No. of Lectures**
	Any ten experiments	
1.	Floral biology of important crops of the locality.	1
2.	Emasculation, selfing and crossing techniques.	1
3.	Floral biology in self pollinated species I	1
4.	Analysis of variance (ANOVA) through RBD	1
5.	Analysis of variance (ANOVA) through LSD	1
6.	Estimation of components of variance, heritability and genetic advance	1
7.	Observation recording	1
8.	Floral biology in cross pollinated species I	1
9.	Learning techniques in hybrid seed production using male-sterility in field crops (pearlmillet)	1
10.	Selection methods in segregating populations and evaluation of breeding material	1
11.	Learning techniques in hybrid seed production using male-sterility in field crops (Maize)	1
	Total Lecture Hrs.	10 x 2= 20 Hrs.



SEM-II

HORTI 521	**Seed Production Technology of Vegetable Crops**	**3(2+1)**
Prerequisite		
Learning objective	To educate principles and methods of quality seed and planting material production in vegetable crops	
Salient features		
Utility		
UNIT-I	**Seed production; methods**	**6hrs**
	Definition of seed and its quality, new seed policies; DUS test, scope of vegetable seed industry in India , Genetical and agronomical principles of seed production; methods of seed production; use of growth regulators and chemicals in vegetable seed production; floral biology, pollination, breeding behaviour, seed development and maturation; methods of hybrid seed production .	
UNIT-II	**Categories of seed**	**6hrs**
	Categories of seed; maintenance of nucleus, foundation and certified seed; seed certification, seed standards; seed act and law enforcement, plant quarantine and quality control,Physiological maturity, seed harvesting, extraction, curing, drying, grading, seed processing, seed coating and pelleting, packaging (containers/packets), storage and cryopreservation of seeds, synthetic seed technology.	
UNIT-III	**Agro-techniques for seed production in**	**4hrs**
	Tomato, potato ,Brinjal ,Chilli ,Cauliflower,Cabbage	
UNIT-IV	**Production technology**	**4hrs**
	Knol - khol ,Sprouting broccoli ,Brussels sprout, Okra,Cucurbitaceous crops ,Onion,Garlic	
UNIT-V	**Production technology**	**4hrs**
	Pea, Broadbean, Cluster bean, Cow pea, Palak, Amarnthus, Fenugreek	
		Total 24 Hrs.
Reference books	1. Agrawal P.K & Dadlani M. (Eds.). 1992. Techniques in Seed Science and Technology. South Asian Publ. Agrawal R.L. (Ed.). 1997. Seed Technology. Oxford & IBH. 2. Bendell P.E. (Ed.). 1998. Seed Science and Technology: Indian Forestry Species. Allied Publ. 3. Fageria M.S, Arya P.S & Choudhary A.K. 2000. Vegetable Crops: Breeding and Seed Production. vol. I. Kalyani. George RAT. 1999. Vegetable Seed Production. 2nd Ed. CABI. 4. Rajan S & Baby L Markose. 2007. Propagation of Horticultural Crops. New India Publ. Agency.	
Mode of Examination	Written examination/Assignment/Quiz/Viva-Voce/student presentations	

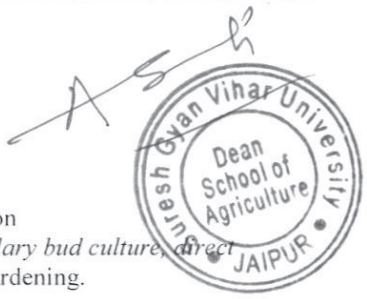
Practical

1. Seed sampling
2. Seed testing (genetic purity, seed viability
3. Seed viability
4. Seedling vigour
5. Physical purity) and seed health testing
6. Releasing and notification procedures of varieties
7. Floral biology

8. Rouging

HORTI 522	**Propagation and Nursery Management for Fruit Crops**
Prerequisite	
Learning objective	Familiarization with principles and practices of propagation and nursery management for fruit crops
Salient features	
Utility	
UNIT-I	**Propagation and Nursery Management for Fruit Crops** **4hrs**
	Introduction, life cycles in plants ,Cellular basis for propagation in fruit crops, Sexual propagation, apomixis, polyembryony, chimeras ,
UNIT-II	**Factor influencing seed germination** **5hrs**
	Principal factors influencing seed germination of horticultural crops, dormancy, hormonal regulation of germination and seedling growth,Seed quality, treatment, packing, storage, certification, testing .
UNIT-III	**Production technology** **5hrs**
	Asexual propagation — rooting of cuttings,Physiological, anatomical and biochemical aspects of root induction in cuttings,Layering — principle and methods ,Buding and grafting-slelection of elite mother plants, methods
UNIT-IV	**Establishment of bank** **5hrs**
	Establishment of bud wood bank, stock, scion and inter stock, relationship — Incompatibility, Rejuvenation through top working — Progeny orchard and scion bank , Micro-propagation— principles and concepts, commercial exploitation in horticultural crops
UNIT-V	**In-Vitro propagation Techniques** **5hrs**
	Techniques - in vitro clonal propagation, direct organogenesis, embryogenesis, micro grafting, meristem culture ,Hardening, packing and transport of micro-propagules, shoot tip grafting/ micro grafting, Nursery — types, structures, components, planning and layout Nursery management practices for healthy propagule production
Reference books	1. Hartmann H.T & Kester D.E. 1989. Plant Propagation — Principles and Practices. Prentice Hall of India. 2. Bose T.K, Mitra S.K & Sadhu M.K. 1991. Propagation of Tropical and Subtropical Horticultural Crops. Naya 3. Prokash. 4. T & Mathew L. 2007. Fruit Crops. New India Publ. Agency.
Mode of Examination	Written examination/Assignment/Quiz/Viva-Voce/student presentations

1. Preparation and planting of cuttings and layering
2. Raising of root stock
3. Practices of different methods of budding and grafting
4. Study of media and PGR
5. Hardening, micro propagation, explant preparation, media preparation
6. *In vitro clonal propagation, meristem culture, shoot tip culture, axillary bud culture, direct* organogenesis, direct and indirect embryogenesis, micro grafting, hardening.
7. Visit to TC labs and nurseries



HORTI 523	**Landscaping and Ornamental Gardening**
Prerequisite	
Learning objective	Familiarization with principles and practices of landscaping and ornamental gardening.
Salient features	
Utility	
UNIT-I	**Landscape designs** **5hrs**
	Landscape designs,Styles of garden, formal, informal and free style gardens ,Mughal garden , English Garden ,Japanese garden ,Persian garden, Spanish garden, Italian & Buddha garden,Urban landscaping .
UNIT-II	**Situational Landscaping** **5hrs**
	Landscaping for specific situations Institutions, Landscaping for specific situations: Industries, Landscaping for specific situations: Residents & hospitals, Roadsides, traffic islands, damsites Landscaping for specific situations: IT parks & corporate.
UNIT-III	**Production technology for selected ornamental plant** **5hrs**
	Garden plant components, arboretum, Shrubbery , Fernery, palmatum, Arches and pergolas, Edges and Hedges, Climbers and creepers, Cacti and succulents ,Herbs, annuals, flower borders and beds , Ground covers, carpet beds, bamboo groves, Production technology for selected ornamental plant.
UNIT-IV	**Special types of gardens** **5hrs**
	Lawns: Establishment and maintenance, Special types of gardens: vertical garden, roof garden, Bog garden, sunken garden, Rock garden, clock garden, colour wheels, temple garden, sacred groves
UNIT-V	**5hrs**
	Bio-aesthetic p l a n n i n g , eco-tourism, theme parks, Indoor gardening , Therapeutic gardening, non-plant components, Water scaping, Xeri scaping & hard scaping.
Reference books	1. Bose T.K, Maiti R.G, Dhua R.S & Das P.1999. Floriculture and Landscaping. Naya Prakash. 2. Lauria A & Yictor H.R. 2001. Floriculture — Fundamentals and Practices Agrobios. 3. Nambisan K.M.P.1992. Design Elements of Landscape Gardening. Oxford & IBH. 4. Randhawa G.S & Mukhopadhyay A. 1986. Floriculture in India. Allied Publ. 5. Sabina G.T & Peter K.Y. 2008. Ornamental Plants for Gardens. New India Publ. Agency.
Mode of Examination	Written examination/Assignment/Quiz/Viva-Voce/student presentations

Practical

1. Identification of ornamental plants
2. Practices in preparing designs for home gardens, industrial gardens, institutional gardens, corporate
3. Avenue planting, practices in planning and planting of special types of gardens, burlapping
4. Lawn making
5. Planting herbaceous and shrubbery borders
6. Project preparation on landscaping for different situations
7. Visit to parks and botanical gardens
8. Case study on commercial landscape gardens

STAT-521	Experimental Designs 3(2+1)
Learning objective	This course is meant for students of agricultural and animal sciences other than Statistics. Designing an experiment is an integrated component of research in almost all sciences. The students would be exposed to concepts of Design of Experiments so as to enable them to understand the concepts involved in planning, designing their experiments and analysis of experimental data.
Unit-I	**Design**
Need for designing of experiments, characteristics of a good design. Basic principles of designs- randomization, replication and local control, Uniformity trials, size and shape of plots and blocks;	
Unit- II	**RBD & LSD**
Analysis of variance; Completely randomized design, randomized block design and Latin square design, Factorial experiments, (symmetrical as well as asymmetrical), orthogonality and partitioning of degrees of freedom,	
Unit-III	**Factorial experiments**
Confounding in symmetrical factorial experiments, Factorial experiments with control treatment, Split plot and strip plot designs; Analysis of covariance and missing plot techniques in randomized block and Latin square designs;	
Unit-IV	**Crossing and block design**
Transformations, crossover designs, balanced incomplete block design, resolvable designs and their applications	
Unit-V	**Experiment analysis**
Concepts, randomisation procedure, analysis and interpretation of results. Response surfaces. Experiments with mixtures.	
Reference books	1. Cochran WG & Cox GM. 1957. *Experimental Designs*. 2nd Ed. John Wiley. 2. Dean AM & Voss D. 1999. *Design and Analysis of Experiments*. Springer. 3. Federer WT. 1985. *Experimental Designs*. MacMillan. 4. Fisher RA. 1953. *Design and Analysis of Experiments*. Oliver & Boyd.

Practical

S. No.	Topic	No. of lectures
1.	Formation of plots	1
2.	Formation of blocks	1
3.	Analysis of CRD	1
4.	Analysis of RBD	1
5.	Analysis of LSD	1
6.	Analysis of factorial experiment	1
7.	Analysis of asymmetric factorial experiments	1
8.	Analysis of confounded factorial experiments	1
9.	Analysis with missing data in RBD	1
10.	Analysis with missing data in LSD	1
11.	Transformation of data	1
12.	Analysis of SPD	1
13.	Analysis of strip plot design	1
14.	Analysis of resolvable designs	1
15.	Fitting of response surfaces	2

Suresh Gyan Vihar University
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School of Agriculture
JAIPUR

PPATH -523	Diseases of Vegetables and Spices Crops
Prerequisite	
Learning objective	To impart knowledge about symptoms, epidemiology of different diseases of vegetables and spices caused by fungal, bacterial and viral diseases and their management
Salient features	
Utility	
UNIT-I	**General introduction** **5hrs**
	General introduction ,Diseases of potato, Disease of onion
UNIT-II	**Diseases** **5hrs**
	Disease of Tomato, Disease of garlic, Disease of crucifers
UNIT-III	**Diseases** **5hrs**
	Disease of cucurbits, disease of chilli, disease of brinjal, disease of leafy vegetables
UNIT-IV	**Diseases** **5hrs**
	Diseases of root crops, Diseases of ginger, Diseases of turmeric, Diseases of saffron, Diseases of black pepper
UNIT-V	**Diseases** **4hrs**
	Diseases of cumin, Diseases of fenugreek, Diseases of fennel, Diseases of coriander
Reference books	1. Chaube HS, Singh US, Mukhopadhyay AN & Kumar J. 1992. Plant Diseases of International Importance.Vol.II. 2. Diseases of Vegetable and Oilseed Crops. Prentice Hall, Englewood Cliffs, New Jersey. Godara,S,l,Kapoor,BBS and Rathore,B.S.2010. Madhu Publications,Bikaner-,India. 3. Gupta VK & Paul YS. 2001. Diseases of Vegetable Crops. Kalyani Publ., New Delhi

Practical

1. Study of symptoms and host parasite relationship of diseases of potato.
2. Study of symptoms and host parasite relationship of diseases of tomato
3. Study of symptoms and host parasite relationship of diseases of crucifers
4. Study of symptoms and host parasite relationship of diseases of cucurbits
5. Study of symptoms and host parasite relationship of diseases of chilli
6. Study of symptoms and host parasite relationship of diseases of brinjal
7. Study of symptoms and host parasite relationship of diseases of onion
8. Study of symptoms and host parasite relationship of diseases of ginger& turmeric
9. Study of symptoms and host parasite relationship of diseases of cumin
10. Study of symptoms and host parasite relationship of diseases of coriander
11. Study of symptoms and host parasite relationship of diseases of fenugreek
12. Study of symptoms and host parasite relationship of diseases of fennel
13. Collection and dry preservation of diseased specimens of important crops

SEM III

HORTI 531	**Production Technology for Loose Flowers**
Prerequisite	
Learning objective	Familiarization with principles and practices of landscaping and ornamental gardening
Salient features	
Utility	
UNIT-I	**Significance in the domestic market export** **5hrs**
	Scope of loose flower trade, Significance in the domestic market export , Varietal wealth and diversity, Propagation: Sexual and asexual propagation methods. Propagation in mist chambers , nursery managwme nt , pro -tray nursery under shade nets, transplanting techniques.
UNIT-II	**Field preparation and planting systems** **5hrs**
	Soil and climate requirements, field preparation, systems of planting, precision farming techniques, Water and nutrient management, weed management, training and pruning, pinching and disbudding, special horticultural practices, use of growth regulators, physiological disorders and remedies, IPM and IDM, Flower forcing and year round
UNIT-III	**5hrs**
	Jasmine ,Scented rose, Chrysanthemum, Marigold, Tuberose, Crossandra
UNIT-IV	**5hrs**
	Nerium , Hibiscus, Barleria, Gaillardia, Nyctanthes, Tabernaemontana
UNIT-V	**5hrs**
	Ixora, Lotus, Lilies, Tecoma, Champaka,Pandanus
Reference books	4. Arora J.S. 2006. Introductory Ornamental Horticulture. Kalyani. 5. Bhattacharjee S.K. 2006. Advances in Ornamental Horticulture. vols. I-VI. Pointer Publ. Bose T.K & Yadav LP. 1989. Commercial Flowers. Naya Prokash. 6. Bose T.K, Maiti R.G, Dhua R.S & Das P. 1999. Floriculture and Landscaping. Naya Prokash. Chadha K.L & Chaudhury B.1992. Ornamental Horticulture in India. ICAR.
Mode of Examination	Written examination/Assignment/Quiz/Viva-Voce/student presentations

Practical

1. Botanical description of species and varieties
2. Propagation techniques
3. Mist chamber operation
4. Training and pruning techniques
5. Practices in manuring, drip and fertigation, foliar nutrition
6. Growth regulator application
7. Pinching, disbudding, staking
8. Harvesting techniques
9. Post-harvest handling
10. Storage and cold chain
11. Project preparation for regionally important commercial loose flowers

HORTI 532	**Post Harvest Technology for Fruit Crops**	**3(2+1)**
Prerequisite		
Learning objective	To facilitate deeper understanding on principles and practices of post- harvest management of fruit crops	
Salient features		
UNIT-I	**Harvest Technology**	**5hrs**
	Maturity indices, harvesting practices for specific market requirements, influence of pre-harvest practices, enzymatic and textural changes, respiration, transpiration.	
UNIT-II	**Chemistry Ripening**	**4hrs**
	Physiology and biochemistry of fruit ripening, ethylene evolution and ethylene management, factors leading to post-harvest loss, pre-cooling.	
UNIT-III	**Treatments prior to shipment**	**5hrs**
	Treatments prior to shipment, viz., chlorination, waxing, chemicals, biocontrol agents and natural plant products. Methods of storage- ventilated, refrigerated, MAS, CA storage, physical injuries and disorders	
UNIT-IV	**Packing methods and transport**	**5hrs**
	Packing methods and transport, principles and methods of preservation, food processing, canning, fruit juice beverages, pickles, jam, jellies, sauces and ketchup, candies, preserve. Dried and dehydrated products.	
UNIT-V	**Packing methods and transport**	**5 hrs**
	Nutritionally enriched products, fermented fruit beverages, packaging technology, processing waste management, food safety standards	
Reference books	1. Bhutani R.C. 2003. Fruit and Vegetable Preservation. Biotech Books. 2. Chadha K.L & Pareek O.P. (Eds.). 1996 Advances in Horticulture. Vol. IV. Malhotra Publ. House. 3. Haid N.F & Salunkhe S.K. 1997. Post Harvest Physiology and Handling of Fruits and Vegetables. Grenada Publ. Mitra S.K. 1997. Post Harvest Physiology and Storage of Tropical and Sub-tropical Fruits. CABI. 4. Ranganna S. 1997. Hand Book of Analysis and Quality Control for Fruit and Vegetable Products. Tata McGraw-Hill.	
Mode of Examination	Written examination/Assignment/Quiz/Viva-Voce/student presentations	

Practical

1. Analyzing maturity stages of commercially important horticultural crops
2. Improved packing and storage of important horticultural commodities
3. Physiological loss in weight of fruits and vegetables
4. Estimation of transpiration, respiration rate, ethylene release
5. Study of shelf life extension in cut flower using chemicals
6. Estimation of quality characteristics in stored fruits and vegetables
7. Practices of preservation by salt, sugar, vinegar and chemical preservatives
8. Cold chain management - visit to cold storage and CA storage units
9. Visit to fruit and vegetable processing units
10. Project preparation
11. Evaluation of processed horticultural product

HORTI 532	**Post Harvest Technology for Fruit Crops**	**3(2+1)**
Prerequisite		
Learning objective	To facilitate deeper understanding on principles and practices of post- harvest management of fruit crops	
Salient features		
UNIT-I	**Harvest Technology**	**5hrs**
	Maturity indices, harvesting practices for specific market requirements, influence of pre-harvest practices, enzymatic and textural changes, respiration, transpiration.	
UNIT-II	**Chemistry Ripening**	**4hrs**
	Physiology and biochemistry of fruit ripening, ethylene evolution and ethylene management, factors leading to post-harvest loss, pre-cooling.	
UNIT-III	**Treatments prior to shipment**	**5hrs**
	Treatments prior to shipment, viz., chlorination, waxing, chemicals, biocontrol agents and natural plant products. Methods of storage- ventilated, refrigerated, MAS, CA storage, physical injuries and disorders	
UNIT-IV	**Packing methods and transport**	**5hrs**
	Packing methods and transport, principles and methods of preservation, food processing, canning, fruit juice beverages, pickles, jam, jellies, sauces and ketchup, candies, preserve. Dried and dehydrated products.	
UNIT-V	**Packing methods and transport**	**5 hrs**
	Nutritionally enriched products, fermented fruit beverages, packaging technology, processing waste management, food safety standards	
Reference books	1. Bhutani R.C. 2003. Fruit and Vegetable Preservation. Biotech Books. 2. Chadha K.L & Pareek O.P. (Eds.). 1996 Advances in Horticulture. Vol. IV. Malhotra Publ. House. 3. Haid N.F & Salunkhe S.K. 1997. Post Harvest Physiology and Handling of Fruits and Vegetables. Grenada Publ. Mitra S.K. 1997. Post Harvest Physiology and Storage of Tropical and Sub-tropical Fruits. CABI. 4. Ranganna S. 1997. Hand Book of Analysis and Quality Control for Fruit and Vegetable Products. Tata McGraw-Hill.	
Mode of Examination	Written examination/Assignment/Quiz/Viva-Voce/student presentations	

Practical

1. Analyzing maturity stages of commercially important horticultural crops
2. Improved packing and storage of important horticultural commodities
3. Physiological loss in weight of fruits and vegetables
4. Estimation of transpiration, respiration rate, ethylene release
5. Study of shelf life extension in cut flower using chemicals
6. Estimation of quality characteristics in stored fruits and vegetables
7. Practices of preservation by salt, sugar, vinegar and chemical preservatives
8. Cold chain management - visit to cold storage and CA storage units
9. Visit to fruit and vegetable processing units
10. Project preparation
11. Evaluation of processed horticultural product

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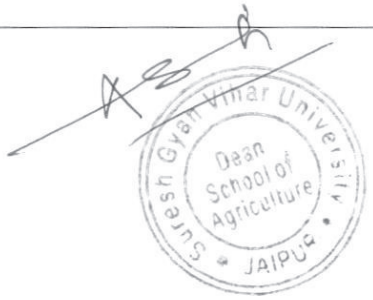
HORTI 533	**Production Technology of Cool Season Vegetable Crops**	**3(2+1)**
Prerequisite		
Learning objective	To educate production technology of cool season vegetables.	
Salient features		
Utility		
UNIT-I	**Introduction, botany and taxonomy**	**4 hrs**
	Introduction, botany and taxonomy, climatic and soil requirements, commercial varieties/hybrids, sowing/planting times and methods, seed rate and seed treatment, nutritional and irrigation requirements, intercultural operations, weed control, mulching, physiological disorders, harvesting, post-harvest management, plant protection measures and seed production .	
UNIT-II	**Plant protection measures and seed production**	**5hrs**
	Plant protection measures and seed production of: Potato ,Cole crops: cabbage, cauliflower, knol-kohl	
UNIT-III	**Plant protection measures and seed production**	**5hrs**
	Prouting broccoli, Brussels sprout	
UNIT-IV	**Plant protection measures and seed production**	**5hrs**
	Root crops: carrot, radish, turnip and beetroot,	
UNIT-V	**Plant protection measures and seed production**	**5hrs**
	Bulb crops: onion and garlic, Peas and broad bean, green leafy cool season vegetables	
Reference books	1. Bose T.K & Som M.G. (Eds.). 1986. Vegetable Crops in India. Naya Prokash. 2. Bose T.K, Som G & Kabir J. (Eds.). 2002. Vegetable Crops. Naya Prokash. 3. Bose T.K, Som M.G & Kabir J. (Eds.). 1993. Vegetable Crops. Naya Prokash. 4. Bose T.K, Kabir J, Maity TK, Parthasarathy VA & Som MG. 2003. Vegetable Crops. vols. I-III. Naya Udyog. 5. Chadha K.L & Kalloo G. (Eds.). 1993-94. Advances in Horticulture vols. V-X. Malhotra Publ. House. Chadha K.L. (Ed.). 2002. Hand Book of Horticulture. ICAR.	
Mode of Examination	Written examination/Assignment/Quiz/Viva-Voce/student presentations	

Practical

1. Identification of vegetable crops and seed.
2. Fertilizer application in vegetable crops
3. Seed treatment in vegetable crops
4. Mulching in vegetable crops
5. Irrigation management in vegetable crops.
6. Weed management in vegetable crops.
7. Role of mineral nutrition in vegetable crops
8. Role of PGR's in vegetable crops
9. Physiological disorders of cole crops
10. Physiological disorders of bulb crops
11. Physiological disorders of root crops
12. Maturity standard of vegetable crops

PPHYS-531	**Hormonal regulation of plant growth and development** **Theory**
Learning objective	To apprise the students about structure function of plant growth regulator on growth and development of plant.
UNIT-I	**Classification of PGRs** **5 Hrs.**
Definition and classifiacation of palnt growth regulators- Hormones, endogenous growth substances and synthetic chemicals, Endogenous growth regulating substances other than hormones. tricontanol, Phenols – polyamines, jasmonates, concept of death hormone	
UNIT-II	**Biosynthesis and metabolism of PGRs** **5 Hrs.**
Site of synthesis, biosynthetic pathways and metabolism and the influence on plant growth development of individual group of hormones- Auxins, Gibberlins, cytokinins, Abscisic acid and Ethylene Brassinosteroids.	
UNIT-III	**Role of PGRS** **5 Hrs.**
Signal perception.transduction, and effect at functional gene level of different hormones - Auxins- cell elongation, Gibberellins - germination of dormant seeds, cytokinins- cell division. Retardation of senescence of plant parts.	
UNIT-IV	**Drought hormones** **5 Hrs.**
Abscisic acid-Stomatal closure and induction of drought resistance, Ethylene- fruit ripening. Interaction of hormones in regulation of plant growth and development processes. Rooting of cuttings - Flowering. Apical dominance.	
UNIT-V	**Molecular control of PGRs.** **4 Hrs.**
Molecular aspects of control of reproductive growth and development. Synthetic growth regulators-Classification, their effect on plant growth and development. Practical utility in agriculture and horticulture.	
	Total 24 Hrs.
Reference books	Hopkins WG & Huner NPA. 2004. *Introduction to Plant Physiology*. John Wiley & Sons. Salisbury FB & Ross C. 1992.*Plant Physiology.* 4th Ed. Wadsworth Publ.
Mode of Examination	Written examination/Assignment/Quiz/Viva-Voce/student presentations



PPHYS-531	**Hormonal regulation of plant growth and development Lab**	
Sr. N.	**EXPERIMENTS**	**No. of Lectures**
	Any ten experiments	
1.	Extraction of hormones from plant tissue.	5
2.	Auxins- bioassays- auxins effect on rooting of cuttings, abscission, apical dominance	2
3.	Gibberellins- bioassays-GA effect on germination of dormant seeds,	2
4.	Cytokines- bioassays- cytokinin effect on apical dominance and senescence,	2
5.	ABA bioassays estimation. ABA effect on stomatal movement,	2
6.	Ethylene bioassays, effect of hormones on breaking dormancy	2
7.	Estimation of PGRs using physico chemical techniques (with the condition that GLC/ HPLC is provided)	3
	Total Lecture Hrs.	10 x 2= 20 Hrs.