

# **FACULTY OF AGRICULTURAL SCIENCES**

## **Syllabus**

**Ph.D. Horticulture**

**(2021-22)**



**SHREE GURU GOBIND SINGH TRICENTENARY UNIVERSITY**  
**GURUGRAM (DELHI-NCR)**

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## Eligibility Criteria for Admission to Ph.D. Agriculture

The minimum qualification for admission to Ph.D. programme shall be governed by the eligibility criteria stipulated in SGT University Common Ordinance (SGTU Regulations-2020). The candidates seeking admission in PhD must have obtained Masters Degree in concerned subject/field of specialization. There will be an entrance examination covering the syllabus prescribed by ICAR for the subject and or by the SGT University. The procedure of admission, duration of course, fee refund etc. will be governed by as per SGT University regulations. The syllabus of each subject is provided in the ordinance.

The candidates, who are awarded Fellowship by ICAR/CSIR/UGC, will be admitted to the Ph.D. programme of the University against additional seats in the concerned discipline without Entrance Test conducted by SGTU. The candidates who have not been awarded Fellowship but cleared the examination conducted by ICAR / CSIR/UGC are required to appear in the Entrance Test conducted by SGTU for admission to Ph.D. programme.

No admission in Ph.D. programme shall be made after the last date of admission.

### CREDIT REQUIREMENTS:

Subject	Doctoral Program
Major	15
Minor	08
Supporting	05
Seminar	02
Research	45
Total Credits	75
Compulsory Non Credit Courses	See relevant section

### Explanation:

**Major subject:** The subject (department) in which the student takes admission.

**Minor subject:** The subject closely related to student's major subject (eg. If major subject is Entomology, the appropriate minor subjects should be Plant Pathology and Nematology or as decided by the Faculty Research Committee on the recommendation of Research Advisory Committee of the student).

**Supporting subject:** The subject not related to the major subject. It could be any subject considered relevant for students research work.

**Non-credit Compulsory Courses:** Please see relevant section for details. PhD students may be exempted from these courses if already studied during Master's degree.

**Service Course:** A course offered for other disciplines, and not to be counted towards major credits by the department teaching that course.

### NON CREDIT COMPULSORY COURSES:

Course Code	Old Code	Course Title	Credits	Semester
11060111	PGS 501	LIBRARY AND INFORMATION SERVICES	0+1	I
11060204	PGS 502	TECHNICAL WRITING AND COMMUNICATION SKILLS	0+1	II
11060205	PGS 503	INTELLECTUAL PROPERTY AND ITS	1+0	II

	(e-Course)	MANAGEMENT IN AGRICULTURE		
11060306	PGS 504 (e-Course)	AGRICULTURAL RESEARCH, RESEARCH ETHICS AND RURAL DEVELOPMENT PROGRAMMES	1+0	III
11060106	PGS 505 (e-Course)	DISASTER MANAGEMENT	1+0	I
	HINDI-1*	Prarambhik Hindi	3+0	I, II

\*Compulsory for M.Sc. or Ph.D. programmes in respect of foreign students only.

**Note:** One course of Statistics (3 credit) is compulsory at Ph.D. (if not studied statistics course in Master's programme).

<b>11060111</b>	<b>Library &amp; information services</b>	<b>0+1</b>	<b>Sem- I, II</b>
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### Objective

To equip the library users with skills to trace information from libraries efficiently, to apprise them of information and knowledge resources, to carry out literature survey, to formulate information search strategies, and to use modern tools (Internet, OPAC, search engines etc.) of information search.

### Practical

Introduction to library and its services; Role of libraries in education, research and technology transfer; Classification systems and organization of library; Sources of information- Primary Sources, Secondary Sources and Tertiary Sources; Intricacies of abstracting and indexing services (Science Citation Index, Biological Abstracts, Chemical Abstracts, CABI Abstracts, etc.); Tracing information from reference sources; Literature survey; Citation techniques/Preparation of bibliography; Use of CD-ROM Databases, Online Public Access Catalogue and other computerized library services; Use of Internet including search engines and its resources; e-resources access methods.

<b>11060204</b>	<b>Technical writing &amp; communication skills</b>	<b>0+1</b>	<b>Sem- I, II</b>
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### Objective

- To equip the students/scholars with skills to write dissertations, research papers, etc.
- To equip the students/scholars with skills to communicate and articulate in English (verbal as well as writing).

### Practical

Various forms of scientific writings- theses, technical papers, reviews, manuals, etc; Various parts of thesis and research communications (title page, authorship, contents page, preface, introduction, review of literature, material and methods, experimental results and discussion); Writing of abstracts, summaries, précis, citations etc.; commonly used abbreviations in the theses and research communications; Illustrations, photographs and drawings with suitable captions; pagination, numbering of tables and illustrations; Writing of (iv) numbers and dates in scientific write-ups; Editing and proof-reading; Writing of a review article.

*Communication Skills* - Grammar (Tenses, parts of speech, clauses, punctuation marks); Error analysis (Common errors); Concord; Collocation; Phonetic symbols and transcription; Accentual pattern: Weak forms in connected speech: Participation in group discussion: Facing an interview; presentation of scientific papers.

### Suggested Readings

Chicago Manual of Style. 14th Ed. 1996. Prentice Hall of India.

Collins' Cobuild English Dictionary. 1995. Harper Collins.  
 Gordon HM & Walter JA. 1970. Technical Writing. 3rd Ed. Holt, Rinehart & Winston.  
 Gupta RH. 2010. Essentials of Communication. 7th Ed. Pragati Prakashan.  
 Hornby AS. 2000. Comp. Oxford Advanced Learner's Dictionary of Current English. 6th Ed. Oxford University Press.  
 James HS. 1994. Handbook for Technical Writing. NTC Business Books.  
 Joseph G. 2000. MLA Handbook for Writers of Research Papers. 5th Ed. Affiliated East-West Press.  
 Mohan K. 2005. Speaking English Effectively. MacMillan India.  
 Richard WS. 1969. Technical Writing. Barnes & Noble.  
 Robert C. (Ed.). 2005. Spoken English: Flourish Your Language.  
 Abhishek. Sethi J & Dhamija PV. 2004. Course in Phonetics and Spoken English. 2nd Ed. Prentice Hall of India.

<b>11060205</b>	<b>Intellectual property &amp; its management in agriculture (e-Course)</b>	<b>1+0</b>	<b>Sem-I, II</b>
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### **Objective**

The main objective of this course is to equip students and stake holders with knowledge of intellectual property rights (IPR) related protection systems, their significance and use of IPR as a tool for wealth and value creation in a knowledge-based economy.

### **Theory**

Historical perspectives and need for the introduction of Intellectual Property Right regime; TRIPS and various provisions in TRIPS Agreement; Intellectual Property and Intellectual Property Rights (IPR), benefits of securing IPRs; Indian Legislations for the protection of various types of Intellectual Properties; Fundamentals of patents, copyrights, geographical indications, designs and layout, trade secrets and traditional knowledge, trademarks, protection of plant varieties and farmers' rights and bio-diversity protection; Protectable subject matters, protection in biotechnology, protection of other biological materials, ownership and period of protection; National Biodiversity protection initiatives; Convention on Biological Diversity; International Treaty on Plant Genetic Resources for Food and Agriculture; Licensing of technologies, Material transfer agreements, Research collaboration Agreement, License Agreement.

### **Suggested Readings**

Erbisch FH & Maredia K. 1998. Intellectual Property Rights in Agricultural Biotechnology. CABI.  
 Ganguli P. 2001. Intellectual Property Rights: Unleashing Knowledge Economy. McGraw- Hill.  
 Intellectual Property Rights: Key to New Wealth Generation. 2001. NRDC & Aesthetic Technologies.  
 Ministry of Agriculture, Government of India. 2004. State of Indian Farmer. Vol. V. Technology Generation and IPR Issues. Academic Foundation.  
 Rothschild M & Scott N. (Ed.). 2003. Intellectual Property Rights in Animal Breeding and Genetics. CABI.  
 Saha R. (Ed.). 2006. Intellectual Property Rights in NAM and Other Developing Countries: A Compendium on Law and Policies. Daya Publ. House.  
 The Indian Acts - Patents Act, 1970 and amendments; Design Act, 2000; Trademarks Act, 1999; The Copyright Act, 1957 and amendments; Layout Design Act, 2000; PPV and FR Act 2001, and Rules 2003; National Biological Diversity Act, 2003.

<b>11060306</b>	<b>Agricultural research, research ethics &amp; rural development programmes (e-Course)</b>	<b>1+0</b>	<b>Sem- I, II</b>
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**Objective**

To enlighten the students about the organization and functioning of agricultural research systems at national and international levels, research ethics, and rural development programs and policies of Government.

**Theory**

**UNIT I:**

History of agriculture in brief; Global agricultural research system: need, scope, opportunities; Role in promoting food security, reducing poverty and protecting the environment; National Agricultural Research Systems (NARS) and Regional Agricultural Research Institutions; Consultative Group on International Agricultural Research (CGIAR): International Agricultural Research Centres (IARC), partnership with NARS, role as a partner in the global agricultural research system, strengthening capacities at national and regional levels; International fellowships for scientific mobility.

**UNIT II:**

Research ethics: research integrity, research safety in laboratories, welfare of animals used in research, computer ethics, standards and problems in research ethics.

**UNIT III:**

Concept and connotations of rural development, rural development policies and strategies. Rural development programs: Community Development Programme, Intensive Agricultural District Programme, Special group – Area Specific Programme, Integrated Rural Development Programme (IRDP), Panchayati Raj Institutions, Co-operatives, Voluntary Agencies/Non-Governmental Organisations. Critical evaluation of rural development policies and programs. Constraints in implementation of rural policies and programs.

**Suggested Readings**

- Bhalla GS & Singh G. 2001. Indian Agriculture - Four Decades of Development. Sage Publ.  
Punia MS. Manual on International Research and Research Ethics. CCS, Haryana Agricultural University, Hisar.  
Rao BSV. 2007. Rural Development Strategies and Role of Institutions - Issues, Innovations and Initiatives. Mittal Publ.  
Singh K.. 1998. Rural Development - Principles, Policies and Management. Sage Publ.

<b>11060106</b>	<b>Disaster management (e-Course)</b>	<b>1+0</b>	<b>Sem- I, II</b>
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**Objectives**

To introduce learners to the key concepts and practices of natural disaster management; to equip them to conduct thorough assessment of hazards, and risks vulnerability; and capacity building.

**Theory**

**UNIT I**

Natural Disasters- Meaning and nature of natural disasters, their types and effects. Floods, Drought, Cyclone, Earthquakes, Landslides, Avalanches, Volcanic eruptions, Heat and cold Waves, Climatic Change: Global warming, Sea Level rise, Ozone Depletion.

**UNIT II**

Man Made Disasters- Nuclear disasters, chemical disasters, biological disasters, building fire, coal fire, forest fire. Oil fire, air pollution, water pollution, deforestation, Industrial wastewater pollution, road accidents, rail accidents, air accidents, sea accidents.

### UNIT III

Disaster Management- Efforts to mitigate natural disasters at national and global levels. International Strategy for Disaster reduction. Concept of disaster management, national disaster management framework; financial arrangements; role of NGOs, Community-based organizations, and media. Central, State, District and local Administration; Armed forces in Disaster response; Disaster response: Police and other organizations.

#### **Suggested Readings**

Gupta HK. 2003. Disaster Management. Indian National Science Academy.

Orient Blackswan. Hodgkinson PE & Stewart M. 1991. Coping with Catastrophe: A Handbook of Disaster Management.

Sharma VK. 2001. Disaster Management. National Centre.

# HORTICULTURE

## Major:

Course Code	Old Code	Course Title	Credits	Semester
11020118*	FSC 601*	ADVANCES IN BREEDING OF FRUIT CROPS	2+1	II
11020119*	FSC 602*	ADVANCES IN PRODUCTION OF FRUIT CROPS	2+1	I
11020120	FSC 603	ADVANCES IN GROWTH REGULATION OF FRUIT CROPS	2+1	II
11020121	FSC 605	BIOTIC AND ABIOTIC STRESS MANAGEMENT IN HORTICULTURAL CROPS	2+1	I
11020122	FSC 604	INTRODUCTION TO BIOINFORMATICS	2+1	I
11020108	FSC 691	DOCTORAL SEMINAR I	1	I, II
11020109	FSC 692	DOCTORAL SEMINAR II	1	I, II
11020110	FSC 699	DOCTORAL RESEARCH	45	

\*Compulsory courses.

<b>11020118</b>	<b>Advances in breeding of fruit crops</b>	<b>2+1</b>	<b>Sem- II</b>
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## Objective

To update knowledge on the recent research trends in the field of breeding of fruit crops with special emphasis on tropical, subtropical and temperate crops grown in India.

## Theory

Evolutionary mechanisms, adaptation and domestication, Genetic resources, cytogenetics, cytomorphology, chemotaxonomy, genetics of important traits and their inheritance pattern, variations and natural selection, spontaneous mutations, incompatibility systems in fruits, recent advances in crop improvement efforts- introduction and selection, chimeras, apomixis, clonal selections, intergeneric, interspecific and intervarietal hybridization, mutation and polyploid breeding, resistance breeding to biotic and abiotic stresses, breeding for improving quality, molecular and transgenic approaches in improvement of selected fruit crops.

## Crops

- UNIT-I: Mango and banana
- UNIT-II: Papaya, grapes and citrus
- UNIT-III: Guava and sapota
- UNIT-IV: Pineapple and avocado
- UNIT-V: Apple, pear, plums, peaches, apricot, cherries and strawberry

## Practical

Description and cataloguing of germplasm, pollen viability tests, pollen germination isozyme techniques-survey and clonal selection, observations on pest, disease and stress reactions in inbreds and hybrids, use of mutagenes and colchicine for inducing mutation and ploidy changes, practices in different methods of breeding fruit crops.

## Suggested Readings

- Bose TK, Mitra SK & Sanyal D. (Ed.). 2002. Fruits of India – Tropical and Sub-tropical. 3rd Ed. Vols. I, II. Naya Udyog.
- Chadha KL & Pareek OP. (Eds.). 1996. Advances in Horticulture. Vol. I. Malhotra Publ. House.

- Chadha KL & Shikhamany SD. 1999. The Grape: Improvement, Production and Post-Harvest Management. Malhotra Publ. House.
- Gowen S. 1996. Banana and Plantains. Chapman & Hall.
- Janick J & Moore JN. 1996. Fruit Breeding. Vols.I-III. John Wiley & Sons.
- Nijjar GS. (Ed.). 1977. Fruit Breeding in India. Oxford & IBH.
- Radha T & Mathew L. 2007. Fruit Crops. New India Publ. Agency.
- Singh S, Shivankar VJ, Srivastava AK & Singh IP. (Eds.). 2004. Advances in Citriculture. Jagmander Book Agency.
- Stover RH & Simmonds NW. 1991. Bananas. Longman.

<b>11020119</b>	<b>Advances in production of fruit crops</b>	<b>2+1</b>	<b>Sem - I</b>
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### **Objective**

To keep abreast with latest developments and trends in production technology of fruit crops.

### **Theory**

National and International scenario in fruit production, Recent advances in propagation -root stock influence, planting systems, High density planting, crop modeling, Precision farming, decision support systems - aspects of crop regulation- physical and chemical regulation effects on physiology and development, influence of stress factors, strategies to overcome stress effects, integrated and modern approaches in water and nutrient management, Total quality management(TQM) - Current topics.

### **Crops**

- UNIT-I: Mango and banana
- UNIT-II: Papaya, grapes and citrus
- UNIT-III: Guava, sapota and aonla
- UNIT-IV: Pineapple, avocado and jack
- UNIT-V: Apple, pear, plums, strawberry, peach, apricot, cherries and nut crops

### **Practical**

Survey of existing fruit cropping systems and development of a model cropping system, Estimating nutrient deficiency- estimation of water use efficiency, soil test-crop response correlations, practices in plant growth regulation, studying physiological and biochemical responses, quality analysis.

### **Suggested Readings**

- Bose TK, Mitra SK & Rathore DS. (Eds.). 1988. Temperate Fruits – Horticulture. Allied Publ.
- Bose TK, Mitra SK & Sanyal D. (Eds.). 2001. Fruits -Tropical and Subtropical. Naya Udyog.
- Bose TK, Mitra SK, Farooqi AA & Sadhu MK. 1999. Tropical Horticulture. Vol. I. Naya Prokash.
- Chadha KL & Pareek OP. (Eds.). 1996. Advances in Horticulture. Vols. II-IV. Malhotra Publishing House.
- Chadha KL. 2001. Handbook of Horticulture. ICAR.
- Nakasone HY & Paull RE. 1998. Tropical Fruits. CABI.
- Radha T & Mathew L. 2007. Fruit Crops. New India Publ. Agency.

<b>11020120</b>	<b>Advances in growth regulation of fruit crops</b>	<b>2+1</b>	<b>Sem - II</b>
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### **Objective**

Appraisal on the advances in growth regulation of fruit crops.

### **Theory**

UNIT-I: Ecophysiological influences on growth and development of fruit crops flowering, fruit set- Crop load and assimilate partitioning and distribution.

UNIT-II: Root and canopy regulation, study of plant growth regulators in fruit culture structure, biosynthesis, metabolic and morphogenetic effects of different plant growth promoters and growth retardants.

UNIT-III: Absorption, translocation and degradation of phyto-hormones – internal and external factors influencing hormonal synthesis, biochemical action, growth promotion and inhibition, canopy management for fertigated orchards.

UNIT-IV: Growth regulation aspects of propagation, embryogenesis, seed and bud dormancy, fruit bud initiation, regulation of flowering, off season production.

UNIT-V: Flower drop and thinning, fruit set and development, fruit drop, parthenocarpy, fruit maturity and ripening and storage, molecular approaches in crop growth regulation current topics.

### **Practical**

Root- shoot studies, quantifying the physiological and biochemical effects of physical and chemical growth regulation, bioassay and isolation through chromatographic analysis for auxins, gibberellins, experiments on growth regulation during propagation, dormancy, flowering, fruit set and fruit development stages.

### **Suggested Readings**

Buchanan B, Gruissem W & Jones R. 2002. Biochemistry & Molecular Biology of Plants. John Wiley & Sons.

Epstein E. 1972. Mineral Nutrition of Plants: Principles and Perspectives. Wiley.

Fosket DE. 1994. Plant Growth and Development: A Molecular Approach. Academic Press.

Leopold AC & Kriedemann PE. 1985. Plant Growth and Development. 3rd Ed. McGraw-Hill.

Radha T & Mathew L. 2007. Fruit Crops. New India Publ. Agency.

Roberts J, Downs S & Parker P. 2002. Plant Growth Development. In: Plants (I. Ridge, Ed.), pp. 221-274, Oxford University Press. 241

Salisbury FB & Ross CW. 1992. Plant Physiology. 4th Ed. Wadsworth Publ.

<b>11020121</b>	<b>Introduction to bioinformatics</b>	<b>2+1</b>	<b>Sem- I</b>
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### **Objective**

To impart an introductory knowledge about the subject of Bioinformatics to the students studying any discipline of science.

### **Theory**

UNIT-I: Introduction, biological databases - primary, secondary and structural, Protein and Gene Information Resources - PIR, SWISSPROT, PDB, Gene Bank, DDBJ. Specialized genomic resources.

UNIT-II: DNA sequence analysis, cDNA libraries and EST, EST analysis, pair wise alignment techniques, database searching, multiple sequence alignment.

UNIT-III: Secondary database searching, building search protocol, computer aided drug design - basic principles, docking, QSAR.

UNIT-IV: Analysis packages - commercial databases and packages, GPL software for Bioinformatics, web-based analysis tools.

**Practical**

- Usage of NCBI resources
- Retrieval of sequence/structure from databases
- Visualization of structures
- Docking of ligand receptors
- BLAST exercises.

**Suggested Readings**

Attwood TK & Parry-Smith DJ. 2003. Introduction to Bioinformatics. Pearson Edu.  
 Rastogi SC, Mendiratta N & Rastogi P. 2004. Bioinformatics: Concepts, Skills and Applications. CBS.

11020122	Biotic & abiotic stress management in horticultural crops	2+1	Sem- I
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**Objective**

To update knowledge on the recent research trends in the field of biotic and abiotic stress management in horticultural crops.

**Theory**

UNIT-I: Stress – definition, classification, stresses due to water (high and low), temperature (high and low), radiation, wind, soil conditions (salinity, alkalinity, ion toxicity, fertilizer toxicity, etc.).  
 UNIT-II: Pollution - increased level of CO<sub>2</sub>, industrial wastes, impact of stress in horticultural crop production, stress indices, physiological and biochemical factors associated with stress, horticultural crops suitable for different stress situations.  
 UNIT-III: Crop modeling for stress situations, cropping system, assessing the stress through remote sensing, understanding adaptive features of crops for survival under stress, interaction among different stress and their impact on crop growth and productivity.  
 UNIT-IV: Greenhouse effect and methane emission and its relevance to abiotic stresses, use of anti transpirants and PGRs in stress management, mode of action and practical use, HSP inducers in stress management techniques of soil moisture conservation, mulching, hydrophilic polymers.  
 UNIT-V: Rain water harvesting, increasing water use efficiency, skimming technology, contingency planning to mitigate different stress situations, cropping systems, stability and sustainability indices.

**Practical**

Seed treatment /hardening practices, container seedling production, analysis of soil moisture estimates (FC, ASM, PWP), analysis of plant stress factors, RWC, chlorophyll fluorescence, chlorophyll stability index, ABA content, plant waxes, stomatal diffusive resistance, transpiration, photosynthetic rate etc. under varied stress situations, influence of stress on growth and development of seedlings and roots, biological efficiencies, WUE, solar energy conversion and efficiency, crop growth sustainability indices, economics of stress management, visit to orchards and water shed locations.

**Suggested Readings**

Blum A. 1988. Plant Breeding for Stress Environments. CRC.  
 Christiansen MN & Lewis CF. 1982. Breeding Plants for Less Favourable Environments. Wiley Inter. Science.  
 Hsiao TC. 1973. Plant Responses to Water Stress. Ann. Rev. Plant Physiology 24: 519-570.  
 Kramer PJ. 1980. Drought Stress and the Origin of Adaptation. In: Adaptation of Plants to Water and High Temperature Stress. John Wiley & Sons.

Levitt J. 1972. Response of Plants to Environmental Stresses. Academic Press.  
 Maloo SR. 2003. Abiotic Stress and Crop Productivity. Agrotech Publ. Academy.  
 Mussell H & Staples R. 1979. Stress Physiology in Crop Plants. Wiley Inter. Science.  
 Nickell LG. 1983. Plant Growth Regulating Chemicals. CRC.  
 Peter KV. (Ed.). 2008. Basics of Horticulture. New India Publ. Agency.  
 Turener NC & Kramer PJ. 1980. Adaptation of Plants to Water and High Temperature Stress. John Wiley & Sons.

**Minor subject:**

ICAR CODE	CODE	COURSE TITLE	CREDITS
VSC 504	11060213	GROWTH AND DEVELOPMENT OF VEGETABLE CROPS	2+1
VSC 505	11060401	SEED PRODUCTION IN VEGETABLE CROPS	2+1
VSC 507	11060113	PRODUCTION TECHNOLOGY OF UNDER EXPLOITED VEGETABLE CROPS	1+1
VSC 508	11060310	ORGANIC VEGETABLE PRODUCTION TECHNOLOGY	1+1
VSC 509	11060309	FUNDAMENTALS OF PROCESSING OF VEGETABLES	2+1

\*Syllabus available in M.Sc. ordinance

**Supporting subject:**

Course Code (ICAR pattern)	Course Code (SGTU pattern)	Course Title	Credits
STAT 512	11060203	EXPERIMENTAL DESIGNS	3(2+1)
STAT 513	11060308	SAMPLING TECHNIQUES	3(2+1)

**11060203: EXPERIMENTAL DESIGNS 3(2+1)**

**Objective**

This course is meant for students of agricultural and other related sciences. 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.

**Theory**

**UNIT-I**

Need for designing of experiments, characteristics of a good design. Basic principles of designs- randomization, replication and local control.

**UNIT-II**

Uniformity trials, size and shape of plots and blocks; Analysis of variance; Completely randomized design, randomized block design and Latin square design.

**UNIT-III**

Factorial experiments, (symmetrical as well as asymmetrical). orthogonality and partitioning of degrees of freedom, Confounding in symmetrical factorial experiments, Factorial experiments with control treatment.

#### **UNIT-IV**

Split plot and strip plot designs; Analysis of covariance and missing plot techniques in randomized block and Latin square designs; Transformations, crossover designs, balanced incomplete block design, Lattice design, Response surfaces.

#### **UNIT-V**

Bioassays- direct and indirect, potency estimation.

#### **Practical**

Uniformity trial data analysis, formation of plots and blocks, Fairfield Smith Law; Analysis of data obtained from CRD, RBD, LSD; Analysis of factorial experiments without and with confounding; Analysis with missing data; Split plot and strip plot designs; Transformation of data; Fitting of response surfaces and Bioassays.

#### **Suggested Readings**

- Cochran WG & Cox GM. 1957. Experimental Designs. 2nd Ed. John Wiley. Dean AM & Voss D. 1999. Design and Analysis of Experiments. Springer. Federer WT. 1985. Experimental Designs. MacMillan.
- Fisher RA. 1953. Design and Analysis of Experiments. Oliver & Boyd.
- Nigam AK & Gupta VK. 1979. Handbook on Analysis of Agricultural Experiments. IASRI Publication
- Pearce SC. 1983. The Agricultural Field Experiment: A Statistical Examination of Theory and Practice. John Wiley.
- Design Resources Server: [www.iasri.res.in /design](http://www.iasri.res.in/design).

#### **11060308: SAMPLING TECHNIQUES 3(2+1)**

#### **Objective**

This course is meant for students of agricultural and animal sciences other than Statistics. The students would be exposed to elementary sampling techniques. It would help them in understanding the concepts

involved in planning and designing their surveys, presentation of survey data analysis of survey data and presentation of results. This course would be especially important to the students of social sciences.

## **Theory**

### **UNIT-I**

Concept of sampling, sample survey vs complete enumeration, planning of sample survey, sampling from a finite population.

### **UNIT-II**

Simple random sampling, sampling for proportion, determination of sample size; inverse sampling, Stratified sampling.

### **UNIT-III**

Cluster sampling, PPS sampling, Multi-stage sampling, double sampling, systematic sampling; Use of auxiliary information at estimation as well as selection stages.

### **UNIT-IV**

Ratio and regression estimators. Construction and analysis of survey designs, sampling and non-sampling errors; Preparation of questionnaire Non-sampling errors.

## **Practical**

Random sampling ~ use of random number tables, concepts of unbiasedness, variance, etc.; simple random sampling, determination of sample size; Exercises on inverse sampling, stratified sampling, cluster sampling and systematic sampling; Estimation using ratio and regression estimators; Estimation using multistage design, double sampling and PPS sampling.

## **Suggested Readings**

- Cochran WG. 1977. Sampling Techniques. John Wiley.
- Murthy MN. 1977. Sampling Theory and Methods. 2nd Ed. Statistical Publ. Soc., Calcutta.
- Singh D, Singh P & Kumar P. 1982. Handbook on Sampling Methods. IASRI Publ.
- Sukhatme PV, Sukhatme BV, Sukhatme S & Asok C. 1984. Sampling Theory of Surveys with Applications. Iowa State University Press and Indian Society of Agricultural Statistics, New Delhi.

### **List of Journals & Magazines**

- Replant problems in perennial fruit crops Acta Horticulture
- Haryana Journal of Horticulture Science
- Horticulture Reviews
- HortScience
- Indian Horticulture
- Indian Journal of Arid Horticulture
- Indian Journal of Horticulture
- Journal of American Society of Horticultural Sciences
- Journal of Applied Horticulture
- Journal of Horticultural Sciences
- Journal of Horticultural Sciences & Biotechnology
- Journal of Japanese Society for Horticulture Science
- Journal of Korean Society for Horticulture Science
- Scientia Horticulture
- South Indian Horticulture

### **Suggested Broad Topics for Master's and Doctoral Research**

- Micro-propagation of fruit crops
- Application of genetic engineering in fruit crops
- Use of molecular markers in fruit crops
- Fruit crop improvement
- Crop selection for biotic and abiotic stresses
- Diagnostic and recommended integrated system in cultivation of fruit crops
- Precision farming in fruit crops
- Protected cultivation of fruit crops
- Root distribution studies in fruit crops
- Canopy management in fruit crops
- Organic fruit cultivation
- Post harvest management of fruit crops
- Value addition in fruit crops

Rejuvenation of orchards

# SGT UNIVERSITY

## PROGRAMME OF WORK FOR POST-GRADUATE STUDENTS (Ph.D.)

To be submitted by HOD

To

The Dean  
Faculty of Agricultural Sciences,  
SGTU, Budhera, Gurugram, NCR-Delhi

The Advisory Committee of-----, son/daughter of Sh. -----& Smt. -----  
-----, Registration No. ----- admitted in the ----- in **Ph.D.** programme of  
**Faculty of Agricultural Sciences** during academic year ----- Semester ----, after consulting  
him/her in a meeting, makes the following statements and recommendations:

His/Her major field is:

His/Her field of specialization is:

His/Her minor field is:

His/Her academic qualifications prior to joining this programme are:

Degree	Year of passing	Aggregate %age/ OCPA/Division	Institution	Major Subject
Sr. Secondary				
B.Sc. (Hons.) Agri.				
M.Sc. Agri.				

Head of Department



Name of Student: -----

Registration No. -----

He/She shall be required to complete the following Courses:

Classification of Courses	S. No.	Course No.	Title of the course	Credit Hours
<b>(i) Deficiencies to be completed, if any (non credit)</b>	1.			
	2.			
	3.			
	4.			
<b>(ii) Major</b>	1.			
	2.			
	3.			
	4.			
	5.			
	6.			
	7.			
	8.			
	9.			
<b>(iii) Supporting</b>	1.			
	2.			
<b>(iv) Minor</b>	1.			
	2.			
	3.			

Signature of the student

Name of Student: -----

Registration No. -----

**ADVISORY COMMITTEE**

S. No.	Name	Designation & Department	Signature
1.	(Major Advisor)		
2.	(Co- Major Advisor)		
3.	( Member Minor Subject)		
4.	( Member Supporting Subject)		
5.	(Nominee of Dean)		

**Certified that:**

1. The courses shown under deficiency, major, supporting and minor fields are according to the Ordinance
2. The titles and credit hours shown against each course are correct as per Ordinance.
3. The major and minor fields conform to those approved and mentioned in the Ordinance.
4. The Advisory Committee is in accordance with the provisions of the Ordinance.

(Major Advisor)

(Head of the Department)

Forwarded, in quintuplicate, to the Dean, FASC, SGTU, Budhera, Gurugram, NCR-Delhi.

**Head of the Department**

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**For office use**

Recommended and forwarded to the Dean/Director of Research in quintuplicate.

**Dean**

Approved

**Dean/Director of Research  
(With Seal)**

CC: Registrar, Dean (FASC), HOD, Major Advisor