

# **FACULTY OF AGRICULTURAL SCIENCES**

## **Syllabus**

**Ph.D. Agonomy**

**(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.

## AGONOMY

**Field of Specialization:** Agrostology, Crop Ecology, Crop Nutrition, Crop Physiology, Crop Production, Water Management, Weed Science.

**Major:**

Course Code	Old Code	Course Title	Credits	Semester
11020101*	AGRON 601*	CURRENT TRENDS IN AGRONOMY	3+0	II
11020102	AGRON 602	CROP ECOLOGY	2+0	II
11020103*	AGRON 604*	ADVANCES IN CROP GROWTH AND PRODUCTIVITY	2+1	II
11020104	AGRON 605	IRRIGATION MANAGEMENT	2+0	II
11020105	AGRON 606	ADVANCES IN WEED MANAGEMENT	2+0	I
11020106	AGRON 607	INTEGRATED FARMING SYSTEMS FOR SUSTAINABLE AGRICULTURE	2+0	II
11020107	AGRON 609	STRESS CROP PRODUCTION	2+1	I
11020108	AGRON 691	DOCTORAL SEMINAR I	1	I, II
11020109	AGRON 692	DOCTORAL SEMINAR II	1	I, II
11020110	AGRON 699	DOCTORAL RESEARCH	45	

\*Compulsory courses.

### COURSE CONTENT

<b>11020101</b>	<b>Advanced trends in Agronomy</b>	<b>3+0</b>	<b>Sem- II</b>
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#### Objective

To acquaint the students about recent advances in agricultural production.

#### Theory

##### UNIT-I

Agro-physiological basis of variation in yield, recent advances in soilplant-waterrelationship.

##### UNIT-II

Globalization of agriculture and WTO, precision agriculture, contract farming, organic farming, marketing and export potential of organic products, certification, labelling and accreditation procedures.

##### UNIT-III

Crop residue management in multiple cropping systems; latest developments in plant management, weed management, cropping systems, grassland management, agro-forestry, allelopathy.

##### UNIT-IV

GIS, GPS and remote sensing for crop management, global warming, GM crops, seed production technology; seed certification, seed multiplication, hybrid seed production etc.

##### UNIT-V

Concepts of system agriculture; holistic approach of farming systems, dryland farming, sustainable agriculture and research methodology in Agronomy.

#### Suggested Readings

Agarwal RL. 1995. Seed Technology. Oxford & IBH.



- Dahiya BS & Rai KN. 1997. Seed Technology. Kalyani.
- Govardhan V. 2000. Remote Sensing and Water Management in Command Areas: Agroecological Prospectives. IBDC.ICAR. 2006. Hand Book of Agriculture. ICAR.
- Narasaiah ML. 2004. World Trade Organization and Agriculture. Sonali Publ.
- Palaniappan SP & Annadurai K. 2006. Organic Farming - Theory and Practice. Scientific Publ.
- Sen S & Ghosh N. 1999. Seed Science and Technology. Kalyani.
- Tarafdar JC, Tripathi KP & Mahesh Kumar 2007. Organic Agriculture Scientific Publ.

<b>11020102</b>	<b>Advanced crop ecology</b>	<b>2+0</b>	<b>Sem - II</b>
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### **Objective**

To acquaint the students about the agricultural systems, agro-ecological regions, and adaptation of crops to different agro-climatic conditions.

### **Theory**

#### UNIT-I

Concept of crop ecology, agricultural systems, ecology of cropping systems, principles of plant distribution and adaptation, crop and world food supply.

#### UNIT-II

Ecosystem characteristics, types and functions, terrestrial ecology, flow of energy in ecosystem, ecosystem productivity, biomass, succession and climax concept.

#### UNIT-III

Physiological response of crop plants to light, temperature, CO<sub>2</sub>, moisture and solar radiation; influence of climate on photosynthesis and productivity of crops; effect of global climate change on crop production.

#### UNIT-IV

Exploitation of solar energy in crops; vertical distribution of temperature; efficiency in crop production.

#### UNIT-V

Competition in crop plants; environmental pollution, ecological basis of environmental management and environment manipulation through agronomic practices; improvement of unproductive lands through crop selection and management.

### **Suggested Readings**

- Ambasht RS. 1986. A Text Book of Plant Ecology. 9th Ed. Students' Friends & Co.
- Chadha KL & Swaminathan MS. 2006. Environment and Agriculture. Malhotra Publ. House.
- Dwivedi P, Dwivedi SK & Kalita MC. 2007. Biodiversity and Environmental Biotechnology. Scientific Publ.
- Hemantarajan A. 2007. Environmental Physiology. Scientific Publ.
- Kumar HD. 1992. Modern Concepts of Ecology. 7th Ed. Vikas. Publ.
- Lenka D. 1998. Climate, Weather and Crops in India. Kalyani.
- Misra KC. 1989. Manual of Plant Ecology. 3rd Ed. Oxford & IBH.
- Pandey SN & Sinha BK. 1995. Plant Physiology. Vikas Publ.
- Sharma PD. 1998. Ecology and Environment. Rastogi Publ.
- Singh J & Dhillon SS. 1984. Agricultural Geography. Tata McGraw Hill
- Taiz L & Zeiger E. 1992. Plant Physiology. Benjamin/Cummings Publ.

<b>11020103</b>	<b>Advances in crop growth &amp; productivity</b>	<b>2+1</b>	<b>Sem - II</b>
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### **Objective**

To study the physiology of vegetative and reproductive growth in relation to productivity of different crops in various environments.

### **Theory**

#### UNIT-I:

Plant density and crop productivity; plant and environmental factors, yield, plant distribution, strategies for maximizing solar energy utilization; leaf area; interception of solar radiation and crop growth; photosynthesis: the photosynthetic apparatus, factors essential for photosynthesis; difference in photosynthetic rates among and within species; physiological limitations to crop yield; solar radiation concept and agro-techniques for harvesting solar radiation.

#### UNIT-II:

Growth analysis: concept, CGR, RGR, NAR, LAI, LAD, LAR; validity and limitations in interpreting crop growth and development; growth curves: sigmoid, polynomial and asymptotic; root systems; root-shoot relationship; principles involved in inter and mixed cropping systems under rainfed and irrigated conditions; concept and differentiation of inter and mixed cropping; criteria in assessing the yield advantages.

#### UNIT-III:

Competitive relationship and competition functions; biological and agronomic basis of yield advantage under intercropping; physiological principles of dry land crop production, constraints and remedial measures; heat unit concept of crop maturity: concept and types of heat units.

#### UNIT-IV:

Concept of plant ideotypes: crop physiological and new ideotypes; characteristics of ideotype for wheat, rice, maize, etc.; concept and types of growth hormones; their role in field crop production; efficient use of resources.

### **Practical**

- Field measurement of root-shoot relationship in crops at different growth stages
- Estimation of growth evaluating parameters like CGR, RGR, NAR, LAI etc., at different stages of crop growth
- Computation of harvest index of various crops
- Assessment of crop yield on the basis of yield attributing characters
- Construction of crop growth curves based on growth analysis data
- Computation of competition functions, viz. LER, IER aggressivity competition index etc in intercropping
- Senescence and abscission indices
- Analysis of productivity trend in un-irrigated areas
- Analysis of productivity trend in irrigated areas

### **Suggested Readings**

Chopra VL & Paroda RS. 1984. Approaches for Incorporation of Drought and Salinity Resistance in Crop Plants. Oxford & IBH.

Delvin RM & Vitham FH. 1986. Plant Physiology. CBS Publ.

Evans LT. 1975. Crop Physiology. Cambridge Univ. Press.

Evans LT. 1996. Crop Evolution, Adaptation and Yield. Cambridge Univ. Press.

Gupta US. (Ed.). 1995. Production and Improvement of Crops for Drylands. Oxford & IBH.

Gupta US. 1988. Progress in Crop Physiology. Oxford & IBH.  
 Kramer PJ & Boyer JS. 1995. Water Relations of Plant and Soils. Academic Press.  
 Mukherjee S & Ghosh AK. 1996. Plant Physiology. Tata McGraw Hill  
 Narwal SS, Politycka B & Goswami CL. 2007. Plant Physiology: Research Methods. Scientific Publications.

<b>11020104</b>	<b>Irrigation management</b>	<b>2+0</b>	<b>Sem- II</b>
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### **Objective**

To teach students about optimization of irrigation in different crops under variable agroclimatic conditions.

### **Theory**

#### UNIT-I

Water resources of India, irrigation projects; irrigation needs, atmospheric, soil, agronomic, plant and water factors affecting irrigation need; water deficits and crop growth.

#### UNIT-II

Soil-plant-water relationships, transpiration and evapotranspiration, significance of transpiration, energy utilization in transpiration, physiological processes and crop productivity.

#### UNIT-III

Infiltration; water movement under saturated and unsaturated conditions; management practices for improving water use efficiency of crops.

#### UNIT-IV

Application of irrigation water, conveyance and distribution system, irrigation efficiency; agronomic considerations in the design and operation of irrigation projects; characteristics of irrigation and farming systems affecting irrigation management.

#### UNIT-V

Strategies of using limited water supply; factors affecting ET, control of ET by mulching and use of anti-transpirants; fertilizer use in relation to irrigation; optimizing the use of given irrigation supplies.

#### UNIT-VI:

Land suitability for irrigation, land irrigability classification; integrated water management in command areas, institution of water management in commands, farmer's participation in command areas; irrigation legislation.

### **Suggested Readings**

FAO. 1984. Irrigation Practice and Water Management. Oxford & IBH.  
 Michael AM. 1978. Irrigation: Theory and Practice. Vikas Publ.  
 Mishra RR & Ahmad M. 1987. Manual on Irrigation and Agronomy. Oxford & IBH.  
 Panda SC. 2003. Principles and Practices of Water Management. Agrobios.  
 Reddy SR. 2000. Principles of Crop Production. Kalyani.  
 Sankara Reddy GH & Yellamananda Reddy 1995. Efficient Use of Irrigation Water. In: Gupta US. (Ed.). Production and Improvement of Crops for Drylands. Oxford & IBH.  
 Singh SS. 2006. Principles and Practices of Agronomy. In: Gupta US.(Ed.). Production and Improvement of Crops for Drylands. Oxford & IBH.

<b>11020105</b>	<b>Advances in weed management</b>	<b>2+0</b>	<b>Sem- I</b>
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**Objective**

To teach about the changing weed flora, new herbicides, their resistance, toxicity, antidotes and residue management under different cropping systems.

**Theory**

UNIT-I

Crop-weed competition in different cropping situations; changes in weed flora, various causes and effects.

UNIT-II

Physiological and biological aspects of herbicides, their absorption, translocation, metabolism and mode of action; selectivity of herbicides and factors affecting them.

UNIT-III

Climatic factors and phytotoxicity of herbicides; fate of herbicides in soil and factors affecting them, residue management of herbicides, adjuvants.

UNIT-IV

Advances in herbicide application techniques; herbicide resistance; antidotes and crop protection compatibility of herbicides of different groups; compatibility of herbicides with other pesticides.

UNIT-V

Development of transgenic herbicide resistant crops; herbicide development, registration procedures.

UNIT-VI

Relationship of herbicides with tillage, fertilizer and irrigation; bioherbicides, allelochemical herbicide bioassays.

**Suggested Readings**

- Aldrich RJ & Kramer R.J. 1997. Principles in Weed Management. Panama Publ.  
 Ashton FM & Crafts AS. 1981. Mode of Action of Herbicides. 2nd Ed. Wiley-Inter Science.  
 Gupta OP. 2000. Weed Management – Principles and Practices. Agrobios.  
 Mandal RC. 1990. Weed, Weedicides and Weed Control - Principles and Practices. Agro-Botanical Publ.  
 Rao VS. 2007. Principles of Weed Science. Oxford & IBH.  
 Ross MA & Carola Lembi A. 1999. Applied Weed Science. 2nd Ed. Prentice Hall.  
 Subramanian SAM & Kumar R.J. 1997. All About Weed Control. Kalyani.  
 Zimdahl RL. 1999. Fundamentals of Weed Science. 2nd Ed. Academic Press.

<b>11020106</b>	<b>Integrated farming systems &amp; sustainable agriculture</b>	<b>2+0</b>	<b>Sem - II</b>
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**Objective**

To apprise about different enterprises suitable for different agro-climatic conditions for sustainable agriculture.

**Theory**

UNIT-I

Farming systems: definition and importance; classification of farming systems according to type of rotation, intensity of rotation, degree of commercialization, water supply, enterprises.

## UNIT-II

Concept of sustainability in farming systems; efficient farming systems; natural resources-identification and management.

## UNIT-III

Production potential of different components of farming systems; interaction and mechanism of different production factors; stability in different systems through research; eco-physiological approaches to intercropping.

## UNIT-IV

Simulation models for intercropping; soil nutrient in intercropping; preparation of different farming system models; evaluation of different farming systems.

## UNIT-V

New concepts and approaches of farming systems and cropping systems and organic farming; case studies on different farming systems.

### Suggested Readings

- Ananthakrishnan TN. (Ed.) 1992. Emerging Trends in Biological Control of Phytophagous Insects. Oxford & IBH.
- Balasubramanian P & Palaniappan SP 2006. Principles and Practices of Agronomy. Agrobios.
- Joshi M & Parbhakarasetty TK. 2005. Sustainability through Organic Farming. Kalyani. Lampin N. 1990. Organic Farming. Farming Press Books.
- Palaniappan SP & Anandurai K. 1999. Organic Farming - Theory and Practice. Scientific Publ.
- Panda SC. 2004. Cropping systems and Farming Systems. Agribios.
- Reddy MV. (Ed.). 1995. Soil Organisms and Litter Decomposition in the Tropics. Oxford & IBH.
- Sharma AK. 2001. A Hand Book of Organic Farming. Agrobios.
- Singh SP. (Ed) 1994. Technology for Production of Natural Enemies. PDBC, Bangalore.
- Trivedi RN. 1993. A Text Book of Environmental Sciences. Anmol Publ.
- Veeresh GK, Shivashankar K & Suiglachar MA. 1997. Organic Farming and Sustainable Agriculture. Association for Promotion of Organic Farming, Bangalore.
- Venkata Rao BV. 1995. Small Farmer Focused Integrated Rural Development: Socioeconomic Environment and Legal Perspective. Publ. 3. Parisaraprajna Parishtana, Bangalore.

<b>11020107</b>	<b>Stress crop production</b>	<b>2+1</b>	<b>Sem- I</b>
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### Objective

To study various types of stresses in crop production and strategies to overcome them.

### Theory

#### UNIT-I

Stress and strain terminology; nature and stress injury and resistance; causes of stress.

#### UNIT-II

Low temperature stress: freezing injury and resistance in plants, measurement of freezing tolerance, chilling injury and resistance in plants, practical ways to overcome the effect of low temperature stress through, soil and crop manipulations.

### UNIT-III

High temperature or heat stress: meaning of heat stress, heat injury and resistance in plants, practical ways to overcome the effect of heat stress through soil and crop manipulations.

### UNIT-IV

Water deficit stress: meaning of plant water deficient stress and its effect on growth and development, water deficit injury and resistance, practical ways to overcome effect of water deficit stress through soil and crop, manipulations.

### UNIT-V

Excess water or flooding stress: meaning of excess water stress, its kinds and effects on crop plants, excess water stress injury and resistance, practical ways to overcome excess water stress through soil and crop manipulations.

### UNIT-VI

Salt stress: meaning of salt stress and its effect on crop growth, salt stress injury and resistance in plants, practical ways to overcome the effect of salt stress through soil and crop manipulations.

### UNIT-VII

Mechanical impedance of soil and its impact on plant growth; measures to overcome soil mechanical impedance.

### UNIT-VIII

Environmental pollution: air, soil and water pollution, and their effect on crop growth and quality of produce; ways and means to prevent environmental pollution.

### **Practical**

- Determination of electrical conductivity of plant cell sap
- Determination of osmotic potential and tissue water potential
- Measurement of transpiration rate
- Measurement of stomatal frequency
- Growing of plants in sand culture under salt stress for biochemical and physiological studies
- Studies on effect of osmotic and ionic stress on seed germination and seedling growth
- Measurement of low temperature injury under field conditions

### **Suggested Readings**

- Baker FWG. 1989. Drought Resistance in Cereals. Oxon, UK.
- Gupta U.S. (Ed.). 1988. Physiological Aspects of Dryland Farming. Oxford & IBH.
- Kramer PJ. 1983. Water Relations of Plants. Academic Press.
- Levitt J. 1980. Response of Plants to Environmental Stresses. Vols. I, II. Academic Press.
- Mavi HS. 1978. Introduction to Agro-meteorology. Oxford & IBH.
- Michael AM & Ojha TP. 1981. Principles of Agricultural Engineering. Vol II. Jain Bros.
- Nilsen ET & Orcut DM. 1996. Physiology of Plants under Stress – Abiotic Factors. John Wiley & Sons.
- Singh K. 2000. Plant Productivity under Environmental Stress. Agribios.
- Singh KN & Singh RP. 1990. Agronomic Research Towards Sustainable Agriculture. Indian Society of Agronomy, New Delhi.
- Somani LL & Totawat KL. 1992. Management of Salt-affected Soils and Waters. Agrotech Publ.
- Virmani SM, Katyal JC, Eswaran H & Abrol IP. 1994. Stressed Ecosystem and Sustainable Agriculture. Oxford & IBH.

### **Minor subject:**

Soil Science and Agro-meteorology are the common subjects taken as minor. The M.Sc. courses of these subjects will complete the requirement of minor courses as decided by the advisory committee of the student and approved by the HOD/ Dean.

**Supporting subject:**

<b>Course Code (ICAR pattern)</b>	<b>Course Code (SGTU pattern)</b>	<b>Course Title</b>	<b>Credits</b>
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**

- Advances in Agronomy
- Agricultural Systems
- Agricultural Water Management
- Agriculture, Ecosystems and Environment
- Agronomy Journal
- Annual Review of Plant Physiology
- Applied Ecology and Environment Research
- Australian Journal of Experimental Agriculture
- Crop Protection
- Environment and Ecology
- European Journal of Agronomy
- Fertilizer Research
- Field Crops Research
- Indian Journal of Agricultural Sciences
- Indian Journal of Agronomy
- Indian Journal of Weed Science
- Irrigation Science
- Japanese Journal of Tropical Agriculture



- Journal of Agricultural Science Cambridge
- Journal of Agronomy
- Journal of Applied Ecology
- Journal of Farming Systems Research
- Journal of Range Management
- Journal of Sustainable Agriculture
- Nutrient Cycling in Agroecosystems
- Pesticide Biochemistry and Physiology
- Plant and Soil
- Plant Production Science
- Soil and Tillage Research
- Weed Research

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

- Crop diversification under different agricultural situations
- Development of farming systems for marginal, small and other farmers
- Agricultural information at door step/click of mouse
- Farm-specific nutrient management
- Weed management in different cropping/farming systems
- Nutrient studies in different cropping/farming systems
- Biodiversity of farming systems for conservation
- Organic farming systems for different regions
- Modelling for different crop situations
- Conservation agriculture for yield sustainability
- Role of edaphic factors on weeds proliferation and management
- Implications of global warming on weed growth and herbicide behaviour
- Ecological implications of using thresholds for weed management
- Effect of cultivation practices and herbicides on weed flora shift
- GM crops and weed management strategies
- Weed management under reduced moisture regime in major summer/kharif crops

# 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:

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

Head of Department

**Name of Student:**-----

**Registration No.** -----

He/She has studied the following courses in major, supporting and minor fields in Master's programme:

<b>Title of Course</b>	<b>Course No.</b>	<b>Credit Hours</b>	<b>Credit point obtained</b>

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