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**Proposed
National Education Policy 2020 Inserted Pre-Ph.D.
Course Work for**

**Doctor of Philosophy in
Agronomy**

(Session 2022-23 onwards)



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Pre-Ph.D. Course work for Ph.D. in Agronomy

The Pre-Ph. D. course work for **Doctor of Philosophy in Agronomy** shall comprise of only one semester (i.e., I-semester) in which there shall be three compulsory papers and one major research project.

Distribution of courses in I Semester

I-Semester					
Course Code	Type of course	Paper	Title of the course	Credit Hr	Total Marks
AGR-601	Compulsory	I	Research Methodology, Statistics And Computer Application	4(4+0)	100
AGR-602	Compulsory (Major Subject)	II	Advances in Crop Growth, Productivity and Weed Sciences	6(4+2)	100
AGR-603	Compulsory (Major Subject)	III	Stress Crop Production And Irrigation Management	6(4+2)	100
AGR-604	Compulsory	--	Major Research Project	Non-credit /qualifying	-----

Name of the Subject : Agronomy					
Course/ paper code:	AGR-601	Course/ paper title:	Research Methodology, Statistics and Computer Application	Credit assigned	4(4+0)
Type of course	Compulsory	Semester	I	M.M.	100
Course objective & Outcomes:	<p>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. . 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. The students shall develop basic working knowledge of computers.</p>				
Unit	Topic (Theory)				
I	<p>Meaning , objective, concept and scope of research in Indian agriculture, types, criteria, process of research and characteristics of good research, selection of problem and review of literature, Hypothesis, their meaning and types, characteristics and testing of hypothesis, Major problems encountered in the area of agricultural research in India.</p>				
II	<p>Collection, classification, tabulation and analysis of data by measures of central tendency, dispersions, coefficient of correlations and regression and different test i.e. Z, F, t and Chi square (X^2). Interpretation of analyzed data and presentation of report and thesis.</p>				
III	<p>Formulation and identification of research in Agriculture. Basic and modern concept and principles of experimental design, study about different types of experimental design i.e. CRD, RBD, LSD, Factorial design, augmented design, Split Plot Design and missing plot technique. Features of good design.</p>				
IV	<p>Basic knowledge of computer and its application, input, output and storage devices, application and working skill in M.S. Office,</p>				
Suggested readings	<p>Chandel; S.R.S. (2007). " A handbook of Agricultural Statistics" Achal Prakation Mandir, Pandu Nagar, Kanpur-208005. Dhondyal; S.P. (1994). "Social Science Research and Thesis Writing" Shiwani Press, Vishnupuri, Kanpur-2 Kothari; C.R. (1999). "Research Methodology, Methods and Techniques" WishwaPrakashan, New Delhi Panse; V.G. and Sukhatme; P.V.(1967). " Statistical Methods for Agricultural Workers" 2ndEdn. ICAR, New Delhi. Rangaswami; R. (2010). " A Text Book of Agricultural Statistics" New Age Publications, New Delhi. Turban, Volonino, Woods. Wali OP. 2015. Information Technology for Management, Advancing Sustainable, Profitable Business Growth, Wiley Jaiswal M and Mittal M. 2005. Management Information System, Oxford.</p>				

Name of the Subject : Agronomy					
Course/ paper code:	AGR-602	Course/ paper title:	Current Trends in Agronomy and Weed Sciences.	Credit assigned	6(4+2)
Type of course	Compulsory	Semester	I	M.M.	100
Course objective & Outcomes:	To acquaint the students about recent advances in agricultural production. To study the physiology of vegetative and reproductive growth in relation to productivity of different crops in various environments. To teach about the changing weed flora, new herbicides, their resistance, toxicity, antidotes and residue management under different cropping systems.				
Unit	Topic (Theory)				
I	Agro-physiological basis of variation in yield, recent advances in soil plant-water relationship.				
II	Globalization of agriculture and WTO, precision agriculture, contract farming, organic farming, marketing and export potential of organic products, certification, labeling and accreditation procedures and ITK in organic farming.				
III	Physiological limitations to crop yield- leaf area , photosynthesis, dry matter distribution; Solar radiation-concept, agro- techniques for harvesting solar radiation for crop yield ; Cardinal points of vital activities-Schimper's optima, Hopkin's Bioclimatic law ; Physiology of germination and seedling emergence - series/steps of germination;				
IV	Concept of growth analysis- merits and de-merits , LAI, CGR, RGR, NAR, LAR, LAD ; Disadvantages of using leaf area as a basis of growth expression ; Types of growth curves - sigmoid, linear, parabolic and asymptotic				
V	Concepts of system agriculture; holistic approach of farming systems, dryland farming, sustainable agriculture and research methodology in Agronomy. Conservation agriculture, principles, prospects and importance, potential benefits of CA under climate change scenario, policy issues.				
VI	Weed crop competition in different cropping situations, changes in weed flora, various causes and effects. Absorption, translocation and action of herbicides in plants.				
VII	Fate of herbicides in plants and soils and factors affecting them, selectivity of herbicides and factors affecting herbicide and environment interaction, residue management of herbicides, adjuvants, advances in herbicide application techniques, herbicide resistance and their remedial measures; Compatibility of herbicides with other pesticides, synergism and antagonism in herbicides, development of transgenic herbicide resistant crops, relationship of herbicides with tillage, fertilizer and irrigation, bio-herbicide approach in weed management				
Practical					
	<ul style="list-style-type: none"> Field measurement of root-shoot relationship in crops at different growth stages Estimation of growth evaluating parameters like CGR, RGR, NAR, LAI etc., at Physical Sciences: Agronomy 67 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 Identification of important weeds of different crops, Preparation of a weed herbarium, Weed survey in crops and cropping systems, Crop-weed competition studies, Weed indices calculation and interpretation with data, Preparation of spray solutions of herbicides for high and low-volume sprayers, Use of various types of spray pumps and nozzles and calculation of swath width, Economics of weed control, Herbicide resistance analysis in plant and soil, Calculation of herbicidal herbicide requirement 				
Suggested readings	D.J. Watson. 1952. The physiological basis of variation in yield. Advances in Agronomy Vol.4 American Society of Agronomy. Academic Press . Inc. Publishers, New York USA R.W. Willey and S.B. Heath. 1969. Quantitative relationship between plant population and crop				

yield . Advances in Agronomy Vol.4 American Society of Agronomy. Academic Press . Inc. Publishers, New York USA

L.T. Evans. 1975. Crop Physiology, Cambridge University Press, London, U.K.

K.H.W. Klages 1968. Ecological crops geography. The Macmillan Co. New York, USA.

C.P. Wilsie. 1962. Crop Adaptation and Distribution, W.H. Freeman and Company, San Francisco and London.

U.S.Gupta. 1979. Physiological Aspects of Dryland Farming (Ed) Oxford and IBH Publishing Co., New-Delhi.

Scott Russel . 1982. Plant Root Systems, Mc GrawHill Book Company, England.

U.S. Gupta, 1988. Progress in Crop Physiology. Oxford and IBH Publishing Co., New-Delhi.

U.S. Gupta, (Ed.) 1995. Production and Improvement of Crops for Drylands. Oxford & IBH, New Delhi

R.W. Willey. 1979. Intercropping –its importance and research needs Part-I . Field Crop Abstract, CAB,Publication , England, 32-1-9

Z. Sastak, J. Catsky, and P.G. Jarwis. 1971. Plant photosynthetic Production, Manual of Methods, W. Junk, N. V. Publication.

S.C.Verma and M.P.Singh. 1987. Agronomy of New Plant Types. Tara Book Company, Varanasi.

R.M. Delvin and F.H. Witham. 1986. Plant Physiology . CBS Publishers and Distributors, New-Delhi.

G.Singh, J.S. Kolar and H.S. Sekhon 2002. Recent advances in Agronomy. Indian Society of Agronomy,IARI, New-Delhi.

P.J. Redford . 1967. Growth Analysis Formulae : Their Use and Abuse, Crop Science 7:171-175.

A.L. Lehninger. 2006 .Biochmistry . Kalyani Publishers New -Delhi.

B.N.Chatterjee and B.K. mandal 1992. Present Trends in Research on Intercropping .*Indian J. Agric.Sci.*62: 507-518.

R.L.Yadav, Punjab Singh , R. Prasad and IPS Ahlawat 1998. Fifty Years of Agronomy Research in India , IndianSoceity of Agronomy IARI , New-Delhi.

Gupta O.P.2000. Modern Weed Management, Agrobios Publishers.

Gupta O.P.2007. Weed Management, Principles and Practices, Agrobios

Rao V.S. 2007. Principles of Weed Science, Oxford & IBH

Zimdahl RL. 1999. Fundamentals of Weed Sciences 2nd Ed. Academic Press.

Devine, Duke and Fedtke. 1988. Physiology of Herbicide action

U.S.Walia, 1990. Weed management, Kalyani Publishers, New Delhi.

Saraswat VN, Bhan VM & Yaduraju NT, 2003. Weed Management, ICAR

Streibig JC and Kudsk P. 1993. Herbicide Bioassays, CRC Press Inc.

Naylor REL. 2002. Weed Management Blackwell Publishing Co.

Name of the Subject : Agronomy					
Course/ paper code:	AGRC-603	Course/ paper title:	Stress Crop Production And Irrigation Management	Credit assigned	6(4+2)
Type of course	Compulsory	Semester	I	M.M.	100
Course objective & Outcomes:	To study various types of stresses in crop production and strategies to overcome them. To teach students about optimization of irrigation in different crops under variable agroclimatic conditions.				
Unit	Topic (Theory)				
I	Stress and strain terminology; nature of stress injury and resistance; causes of stress; low temperature; viz., chilling and freezing injury and resistance; high temperature or heat stress injury and resistance; water stress viz; water deficit, excess water or flooding stresses injury and resistance.				
II	Salt stress and its effect on plant growth, stress injury and resistance; practical ways of overcoming various stresses through soil and crop manipulations; environmental pollution viz. air, soil and water and their effect on crop growth and quality.				
III	Water resources of India, irrigation projects, irrigation needs, atmospheric, soil, agronomic, plant and water factors affecting irrigation need, water deficits and crop growth. Soil plant water relationships, transpiration and evapotranspiration, significance of transpiration, energy utilization in transpiration, physiological processes and crop productivity. Infiltration, water movement under saturated and unsaturated conditions, management practices for improving water use efficiency of crops.				
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. Strategies of using limited water supply, factors affecting ET, control of ET by mulching and use of antitranspirants. Fertilizer use in relation to irrigation, optimising the use of given irrigation supplies.				
V	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.				
Practical					
	<ul style="list-style-type: none"> Determination of electrical conductivity of plant cell sap Determination of osmotic potential and tissue water potential Measurement of transpiration rate Measurement of stomatal frequency Measurement of Relative Water Content of leaf Measurement of electrolytic leakage Growing of plants in sand culture under salt stress for biochemical and physiological studies Determination of water infiltration characteristics and water holding capacity of soil profiles. Determination Moisture extraction pattern of crops Determination of water balance component of transplanted rice by drum culture technique Determination of consumptive use and water requirement of a given cropping pattern Determination of crop efficient of one important crop Planning, designing and installation of drip irrigation system Planning, designing and installation of sprinkler irrigation system 				

Suggested readings	<p>Baker FWG.1989. <i>Drought Resistance in Cereals</i>. Oxon, UK.</p> <p>Gupta U.S. (Ed.). 1988. <i>Physiological Aspects of Dryland Farming</i>. Oxford & IBH.</p> <p>Kramer PJ.1983. <i>Water Relations of Plants</i>. Academic Press.</p> <p>Levitt J. 1980. <i>Response of Plants to Environmental Stresses</i>. Vols. I, II. Academic Press.</p> <p>Mavi HS.1994. <i>Introduction to Agro-meteorology</i>. Oxford & IBH.</p> <p>Nilsen ET & Orcut DM. 1996. <i>Physiology of Plants under Stress—Abiotic Factors</i>. John Wiley & Sons.</p> <p>Singh K. 2000. <i>Plant Productivity under Environmental Stress</i>. Agrobios.</p> <p>Somani LL & Totawat KL. 1992. <i>Management of Salt-affected Soils and Waters</i>. Agrotech Publ.</p> <p>Virmani SM, Katyal JC, Eswaran H & Abrol IP.1994. <i>Stressed Ecosystem and Sustainable Agriculture</i>. Oxford & IBH.</p> <p>FAO. 1984. <i>Irrigation Practice and Water Management</i>. Oxford & IBH.</p> <p>Michael AM. 1978. <i>Irrigation: Theory and Practice</i>. Vikas Publ.</p> <p>Mishra RR & Ahmad M. 1987. <i>Manual on Irrigation Agronomy</i>. Oxford & IBH.</p> <p>Panda SC. 2003. <i>Principles and Practices of Water Management</i>. Agrobios.</p> <p>Reddy SR. 2000. <i>Principles of Crop Production</i>. Kalyani.</p> <p>Sankara Reddy GH & Yellamananda Reddy 1995. Efficient Use of Irrigation Water. In: Gupta US. (Ed.). <i>Production and Improvement of Crops for Drylands</i>. Oxford & IBH.</p> <p>Singh SS. 2006. Principles and Practices of Agronomy. In: Gupta US. (Ed.). <i>Production and Improvement of Crops for Drylands</i>. Oxford & IBH.</p> <p>Majumdar, D.K. 2004. Irrigation Water Management: Principles and Practice. Prentice Hall of India, New Delhi</p>
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