6

Education and Training

DEGREE COURSES

The Institute continued to conduct the following degree courses in collaboration with the Post Graduate School of Indian Agricultural Research Institute (IARI) which has the status of a Deemed University:

(i) Ph.D. (Agricultural Statistics)

(ii) M.Sc. (Agricultural Statistics)

(iii) M.Sc. (Computer Application)

Both Ph.D. and M.Sc. students are required to study courses not only in Agricultural Statistics but also in Agricultural Sciences like Genetics, Agronomy, Agricultural Economics, etc. The courses in Mathematics, Agricultural Statistics and Computer Application are offered at this Institute while the courses in Agricultural Sciences are offered at IARI.

The eligibility qualification for admission to Master's degree in Agricultural Statistics is a Bachelor's degree with atleast 60% marks or its equivalent overall grade point average (OGPA) in Agriculture/Horticulture/Forestry/Agroforestry/Sericulture/Agricultural Marketing/B.Sc. (10+2+3 System). For admission to Master's degree in Computer Application, the eligibility qualification is a Bachelor's degree with atleast 60% marks or its equivalent overall grade point average (OGPA) in Agriculture/Computer Science/Agricultural Engineering/B.Sc. (Horticulture), Veterinary Science, Home Science, B.Sc. (Forestry)/B.Sc. with Maths./Statistics/Physics/Biology/B.Sc. (10+2+3 System).

Further, for admission to Doctor's degree in Agricultural Statistics, the eligibility qualification is a Master's degree with atleast 60% marks or its equivalent overall grade point average (OGPA) in Agricultural Statistics/Statistics/Mathematical Statistics/Bio-Statistics of IVRI/Professional Statisticians' Certificate Course (PSCC) from IASRI.

Number of students admitted/completed various courses are:

(a) **Ph.D. (Agricultural Statistics)**

Admitted	:	5
Completed	:	3

(b) **M.Sc. (Agricultural Statistics)**

Admitted	:	6
Completed	:	5

(c) **M.Sc. (Computer Application)**

Admitted	:	8
Completed	:	1

Brief of work done by students completed various courses during 2008-09 is as follows:

Ph.D. (Agricultural Statistics)

i) Susheel Kumar Sarkar

Computer aided search of linear trend free multifactor designs

Designs for factorial experiments have been widely used in agricultural, biological and industrial experiments. The experimental units in a design of a factorial experiment may exhibit a trend over space or time. Such situations may occur in agricultural experiments when there is a slope in the field and there is sequential application of the treatments to the same experimental unit over time periods. This may also happen when the land is irrigated, the nutrients supplied by the fertilizers may not be equally distributed and trend in experimental units may be due to slope. In such situations, a common polynomial trend within experimental units may occur. In factorial experiments the interest of the experimenter is in the estimation of main effects, two-factor interactions, three-factor interactions, and so on and testing the hypothesis with respect to these effects. In the presence of trends among the experimental units, it may be desirable to estimate the main effects and interactions of interest free from trend effects. The trend may be represented by a polynomial of appropriate degree smaller than the block size minus one. Generally, we consider the presence of a linear trend among the experimental units within a block. In the presence of linear trends among the experimental units within a block of a factorial experiment, it is desired to allocate the treatment combinations to experimental units such that the main effects and interactions of interest are estimated free from the trend effects. In other words, the estimates of the main effects and the interactions of interest are orthogonal to linear trend effects. Such designs are called as *linear trend-free designs for factorial experiments* for estimating the effects of interest and the ordered application of treatments to experimental units is called *run order*.

This research work is devoted to the development of computer algorithms for construction of trend-free designs for multifactor experimental settings. The algorithms developed are helpful in generating the complete and confounded factorial experiments that are linear trend-free for main effects. A search has been made to identify the two and three factor interactions that are estimable free or nearly free from linear trend effect. The algorithms are developed using the criterion of component-wise product. This algorithm has been translated in Microsoft Visual C++ program. From this program, one can obtain the design for factorial experiment for any number of factors k (≥ 3) each at two levels. The catalogue of the obtained designs for 2^k factorial experiment (k = 3, …, 7) that are linear trend-free for main effects along with two and three factor interactions has been given for complete and confounded factorial experiments, separately.

Algorithms have been developed to obtain fractional factorial plans that are linear trend-free for main effects and to identify two factor interactions that are linear trend-free/ nearly linear trend-free using the criterion of complement foldover. Algorithm has also been developed to obtain computer aided linear trend-free Box-Behnken response surface designs with the help of a given BIB design. The catalogue for fractional factorial plans for k = 5 to 8 factors each at 2 levels and for linear trend-free Box-Behnken response surface designs for k taking values as 2, 3, 4 and 5 has been prepared.

Guide: Dr. Krishan Lal

ii) Nishanti Rupika Abeynayake (Foreign student from Sri Lanka)

A study on neighbour-balanced designs

Neighbour-balanced designs, wherein the allocation of treatments is such that every treatment occurs equally often with every other treatment as neighbours, are used when the treatment applied to one experimental plot may affect the response on neighbouring plots besides the response to which it is applied. These designs ensure that no treatment is unduly disadvantaged by its neighbours and help in estimating the neighbour

effects besides the direct effects of treatments. Under the Neighbour Balanced Block (NBB) design setting, it may sometimes be desired to compare a set of test treatments with a control or a set of controls. The main interest here is to estimate the contrasts pertaining to tests (with respect to direct and neighbours) versus control(s) with high precision. Some series of NBB (complete and incomplete) designs for comparing a set of test treatments to control(s) have been developed. The information matrix for estimating direct effects, left and right neighbour effects for all these class of designs have been derived. The designs obtained are totally balanced in the sense that all the contrasts among test treatments for direct effects, left and right neighbour and all the contrasts pertaining to test versus control effects are estimated with same variance. In experimentation using NBB designs, there may arise the possibility that some of the observations could become unavailable for analysis. The robustness of NBB designs have been examined against missing observation(s). The information matrix for estimating direct treatment effects of the resultant design under one-sided neighbour effects model against a missing observation from the last plot of a block has been derived and the efficiency of resulting design is investigated. Robustness of various classes of NBB designs under one-sided and two-sided neighbour model, with complete and incomplete blocks have been studied against missing observation(s) and the efficiency of these designs have been calculated. The NBB designs are found to be robust/fairly robust against missing of observations for number of treatments more than 5. NBB designs have also been studied when the treatment form a factorial structure. Complete NBB designs and incomplete partially NBB designs for two factors have been constructed that are balanced for one factor.

Guide: Dr. Seema Jaggi

iii) Ranjit Kumar Paul

A study of some parametric and nonparametric approaches for nonlinear time-series models

The basic concepts of various statistical modelling techniques are introduced, Generalized autoregressive conditional heteroscedastic (GARCH) nonlinear time-series model along with its estimation procedures are thoroughly studied. As an illustration, autoregressive integrated moving average (ARIMA) and GARCH models are employed for modelling and forecasting of all-India export data of spices. Superiority of GARCH model over ARIMA approach is demonstrated for the data under consideration. A very important extension of GARCH model, viz. Exponential GARCH (EGARCH) model is thoroughly studied. A heartening feature of this model is that, it is capable of describing asymmetric volatility present in the data sets. Procedure for estimation of parameters of this model is also discussed. As an illustration, GARCH and EGARCH models are applied for modelling and forecasting of all-India monthly export data of fruits and vegetables seeds. It is concluded that, for data set under consideration, EGARCH model has performed better than GARCH model for both modelling and forecasting purposes.

For periodic and ARCH effects, best predictor and prediction error variance for carrying out out-of-sample forecasting up to three-steps ahead are derived analytically by recursive use of conditional expectation and conditional variance. As an illustration, modelling and forecasting of monthly rainfall data of Sub-Himalayan West Bengal meteorological subdivision, India is carried out. The study reveals that for the data under consideration, the Periodic autoregressive (PAR) model with AR-GARCH errors has performed better than the Seasonal ARIMA (SARIMA) model for modelling as well as forecasting. The powerful methodology of "Wavelet analysis in frequency domain" is studied for analyzing time-series data. The procedure for estimating the trend and modelling of time-series data through generation of long memory process by Haar and Daubechies (D4) wavelets is thoroughly discussed. As an illustration, Indian monsoon rainfall time-series data is considered. The discrete wavelet transform (DWT) and multiresolution analysis (MRA) of the data are computed and behaviour at different scales is analyzed. By using bootstrap method, size and power of the test for testing significance of trend in the data is computed. It is concluded that there is a declining trend in the Indian monsoon rainfall data. This feature, however, is not able to be captured by ARIMA approach. Finally, a very versatile nonparametric nonlinear time-series model, viz. Functional-coefficient autoregressive (FAR) model, in which the coefficient function changes gradually rather than abruptly, is investigated. This model is applied to India's annual export lac data during the period 1900 to 2000. Superiority of FAR model over Self exciting threshold autoregressive (SETAR) model and ARIMA approaches is demonstrated for the data under consideration.

Guide: Dr. Prajneshu

M.Sc. (Agricultural Statistics)

i) Sanjay Kumar Prasad

A study on Bayesian analytical techniques for experimental data

A Bayesian approach to a problem starts with the formulation of a model that is adequate to describe the situation of interest. Then a *prior* distribution over the unknown parameters of the model is formulated, which is meant to capture our beliefs about the situation before seeing the data. After observing some data, Bayes' Rule is applied to obtain a *posterior* distribution for these unknowns, which takes account of both the prior and the data. Bayes' statistics is now rapidly becoming accepted as a way to solve applied statistical problems and has several special features which combine to make it appealing for solving applied problems. In recent times, Bayesian methods are being widely used in designed experiments.The present thesis deals with the development of Bayesian methods of analysis of block designs. In literature, there are several distributions available which can be taken as a form of prior information. Out of the available distributions which can approximate the prior information are divided into two categories namely conjugate and non-conjugate family. Both the categories of distributions have been considered. Under conjugate family we have considered Normal-Gamma and Normal-Chi density for approximating the factors contributing for block design and variance parameter respectively. In case of non-conjugate family, distributions considered are as Multivariate–t and Gamma for assignable and non-assignable causes have been considered respectively. The developed procedures have been applied to a real experimental data set pertaining to Long-Term Fertilizer Experiments conducted at Ranchi under the aegis of AICRP on LTFE. It was observed that some of the treatment pairs which are not significant in classical analysis become significant after Bayesian analysis of the same set of data with the use of respective prior information. It is also found that in some of the cases block effects become significant after applying the Bayesian method. The Bayesian analysis with non-conjugate prior pose the problem of high dimensionality and complexity in integration and is solved by using Gibbs sampling (MCMC method) technique.

Guide: Dr. L.M. Bhar

ii) Kaustav Aditya

Forecasting of crop yield using discriminant function technique

In the present study wheat crop yield forecast models for Kanpur district of Uttar Pradesh have been developed using weekly data on the weather variables such as maximum temperature, minimum temperature, rainfall and morning relative humidity. Discriminant function technique has been used for developing the forecast models. Crop yield forecast models have been developed taking the discriminant scores and trend variable as regressors and crop yield as the dependent variable. Variables (weather indices) used in the discriminant function analysis were derived through different procedures. Evaluation of the performance of the models developed using the various procedures is done by comparing the Percentage Deviations of forecasts obtained from various models with the observed yield, Percent Standard Error (PSE), Root Mean Square Deviation (RMSE) etc. Using these criteria, the model which came out to be most suitable for forecasting is based on the discriminant function approach. In this approach, two discriminant scores have been calculated by taking the data of the weather variables of the first week. Then taking these two scores and the weather data of the second week again two scores have been obtained. This procedure is repeated till the last week and finally two scores have been obtained. Then taking these two scores and trend variable as the regressors, forecast regression model has been fitted. This procedure gave minimum root mean square error among all procedures studied. Thus, this procedure can be used as the most suitable procedure for forecasting of wheat yield for Kanpur district of Uttar Pradesh.

Guide: Dr. Ranjana Agrawal

iii) Bishal Gurung

Construction of supersaturated designs

In factorial experiments, if the number of factors is large the number of treatment combinations becomes very large. While experimenting with such large number of factors, many difficulties are encountered. In such studies 'complete' factorial is not necessary as the interest is generally not in 'higher order interactions'. The experimenter's endeavour is to minimize the number of runs to identify the active factors for efficient

utilization of resources and minimization of cost and time. In the event of large number of factors, one may opt for Supersaturated design (SSD) where the number of factors(parameters) is very large compared to the number of experiments (runs) to be conducted.

Here non-orthogonality is introduced in the design, i.e., the parameters to be estimated are not done independently because of the lesser number of runs compared to the number of factors to be estimated. The experimenter's endeavour is to minimise this non-orthogonality as much as possible. Hence with this motivation, we have proposed a new procedure of computer aided random generation of multi-level as well as mixed-level SSDs. A catalogue of designs generated from the algorithm is also prepared. The proposed method is also compared with the existing designs. The new method proposed is an attempt to make the SSDs with less departure from orthogonality. Further, the designs constructed are evaluated to see the utility of the proposed methods.

Guide: Dr. L.M. Bhar

IV) Sukanta Dash

Some investigations on classificatory techniques in agriculture

The present investigation has been conducted to explore Artificial Neural Network (ANN) methodology for classification of crop genotypes and to compare it with classical clustering methods based on different distance measures. The secondary data of ten morphological characters consisting of seventy seven genotype of maize crop collected from All India Coordinated Maize Improvement Project for the year 2005-06 has been used. The seventy seven genotypes of maize were clustered using different classical methods such as single linkage, average-between linkage, average-within linkage, Ward's method and non-hierarchical K-means method. The five homogeneous groups so obtained from consensus basis were tested for their significant difference using Hotelling's T^2 statistic. Since some of the grouped pairs were non significant, the data were reclassified by considering four and three homogeneous groups. Ultimately three significantly different homogeneous groups were obtained.

Taking the mean vector and dispersion matrix of three distinct homogeneous groups, the multivariate normal samples of different sample sizes were obtained with prior knowledge of cluster identity. These samples were classified using different classical clustering methods and distance measures as well as ANN method. All the methods were compared by the probability misclassification. From the methods studied, ANN is the best method of classification as it gives minimum probability of misclassification irrespective of distance measures used in classical clustering methods and sample sizes. The second best method is non-hierarchical K-means method as it gives less probability of misclassification as compared to hierarchical methods irrespective of distance measures in case of medium and large sample sizes. In case of small sample size, Ward's method with square Euclidean distance is the second best next to ANN as compared to the remaining classical methods.

Guide: Sh. S.D. Wahi

V) Manoj Kumar

A study on development indices and their sensitivity analysis

Development is a multi-dimensional process and its impact cannot be captured fully by any single indicator. An indicator is a quantitative or a qualitative measure derived from a series of observed facts that reveal relative positions in a given area. A composite index is useful in identifying trends and drawing attention to particular issues in the context of policy analysis. There are several methods of construction of composite index but they have certain limitations. Therefore, in this study, an attempt was made to review the methodological issues for the construction of composite index. Agricultural Development Index (ADI) of Bihar State has been constructed using Principal Component Analysis (PCA). The performance of the districts has been compared based on these developed indices. The categorization of developed indices has also been done. An attempt has also been made to generate thematic maps of Bihar based on the Agricultural Development Index and its sub indices like Input, Output and Infrastructure index using Geographical Information System (GIS). The GIS software has been used in generating suitable thematic maps depicting the level of development of each district. Sensitivity analysis of the developed indices have been carried out using empirical method of variance-based technique and also by using a software namely, SIMLAB, that is especially designed for sensitivity analysis. Sensitivity analysis of the Agricultural Development Index over input, output and infrastructure indices and sensitivity analysis of sub-

indices over their variables (available secondary data) have been carried out using both the approaches. The results of sensitivity analysis using empirical method of variance-based technique have been compared with the results obtained using SIMLAB software.

Guide: Dr. Tauqueer Ahmad

M.Sc. (Computer Application)

i) Ramdasi Sanmit Suresh

Design & development of data marts for household amenities from census data (Maharashtra)

The first and foremost need for developing a decision support system on agriculture resources is to integrate the scattered historical information which is spread across the nation into a central data warehouse. Keeping the above need in mind the available data from census of India 2001, regarding the Household Amenities in Maharashtra State have been analyzed to identify possible data marts and the dimensions that can be associated with these data marts. To find out the associated dimensions with the data marts and conformed dimensions, the top-down planning approach called as Data Warehouse Bus Architecture Matrix was used. With the help of this matrix the dimensional models have been designed and subject wise data marts have been created. The data storage has been converted into a form of multidimensional model, known as cube. These cubes have been designed by using fact and dimension tables and deployed on Internet for on-line analysis, which is called as On-Line Analytical Processing (OLAP). The data in the developed cubes can be viewed in cross tab view as well as graphical views including simple bar graph, pie chart, clustered bar graph, stacked bar graph, multiline graph, three dimensional bar graph etc. Drill downs and roll ups can be performed on the data available in the cubes. Another important functionality incorporated in these cubes is Drill Through in which user can find interesting trends or anomalies while analyzing data. The advantage of this approach is that the often query-intensive work of ad hoc data analysis is performed using summarized data in the cube.

Guide: Dr. S.D. Sharma

NATIONAL / INTERNATIONAL TRAINING PROGRAMMES

Senior Certificate Course in Agricultural Statistics and Computing

Senior Certificate Course in Agricultural Statistics and Computing was organized for the benefit of research workers engaged in handling statistical data collection, processing and interpretation and employed in research Institutes of the Council, State Agricultural Universities and State Government Departments, etc. & foreign countries including SAARC countries. The main objective of the course was to train the participants in the use of latest statistical techniques as well as use of computers and software packages. The course was organized during the period 07 July 2008 to 27 December 2008, comprised of two independent modules of three months duration each (Module-I: 07 July - 27 September 2008 and Module-II: 13 October-27 December 2008). Two officers participated in both the modules. Four officers participated in Module-I only. The courses covered under both the modules included Statistical Methods and Official Agricultural Statistics, Use of Computers in Agricultural Research, Sampling Techniques, Econometrics and Forecasting Techniques, Design of Experiments and Statistical Genetics.

A participant receiving the certificate after the completion of 'Senior Certificate Course in Agricultural Statistics and Computing'

Programme under Centre of Advanced Studies in Agricultural Statistics and Computer Applications

- A 21 days training programme on "Development of contents for online e-Learning systems" was organised during 10-30 September 2008. Nineteen participants from ICAR Institutes and State Agricultural Universities attended the training programme. Some of the topics covered were Overview of e-Learning, Content Designing for e-Learning Systems, Content Designing with MS Powerpoint, Data Warehouse and its Applications in Agriculture, Overview of NISAGEnet System,

Introduction to Moodle: e-Learning System, Adobe Photoshop, Macromedia Flash, Audio and Video Capturing and Editing, Cyber Law for IT, Cyber Security: An Overview, PERMISNET and Installing Moodle on Linux and Digital Signatures Integration with Web Applications etc. Shri Sudeep Marwaha was the Course Director for the training programme.

A participant receiving the certificate after the completion of training programme on 'Development of Contents for Online e-Learning Systems'

- A 21 days training program on "Data mining in agriculture" was organised during 04-24 November 2008. Sixteen participants from various ICAR Institutes and State Agricultural Universities attended the training programme. This training programme offered sufficient knowledge about data mining and its applications in agriculture. Ms. Anshu Bharadwaj was the Course Director for the training programme.
- A 21 days training programme on "Advanced quantitative techniques in agricultural research" was organised during 02-22 December 2008. 18 participants attended the training programme. Dr. Aloke Lahiri was the Course Director for the training programme.
- A 21 days training programme on "Recent advances in sample survey and analysis of sample survey data" was organized during 10 February-02 March 2009. Dr. UC Sud was the Course Director and Dr. Hukum Chandra was the Course co-director of the training programme.

Inaugural function of training programme on 'Recent Advances in Sample Survey and Analysis of Sample Survey Data'

Summer/Winter School Organized

A Winter School on "Advances in design and analysis of agricultural experiments" was organized during 14 January - 03 February 2009. The Winter School was aimed at familiarizing the participants with the advances in designing experiments and analysis of data for making valid inferences from agricultural research data and to acquaint the participants with the use of statistical packages SAS/ SPSS/ GenStat for data analysis and also to undertake collaborative research in future. This winter school was intended for the scientific research personnel working in the National Agricultural Research System. It was attended by 25 participants (8 from ICAR Institutes and 17 from State Agricultural Universities), representing 11 different disciplines of Agricultural

Inaugural function of Winter School on 'Advances in Design and Analysis of Agricultural Experiments'

Sciences. The entire course for this programme was structured in a series of six modules namely (i) Computer Usage and Statistical Software Packages; (ii) Designs for Non-factorial Treatment Structure; (iii) Designs for Factorial Treatment Structure; (iv) Diagnostics and Remedial Measures; (v) Designs for Multiple Response Experiments and (vi) Other Useful Statistical Techniques such as Bio-informatics, Statistical Genomics, Precision farming, Microarrays, etc. The course material was distributed to the participants at the beginning of the programme in the form of Reference Manual in two volumes. Dr. A.K. Singh, Deputy Director General (NRM and Engineering) distributed the certificates to the participants. Dr. Rajender Parsad was the Director of this winter school.

OTHER TRAINING PROGRAMMES

- A 26 days training programme on "Data analysis with statistical tools" was organised during 02-27 June 2008. This training programme was specialy designed for probabtioners of Indian Statistical Service (XXVIII batch) and was sponsore by Central Statistical Organisation (CSO), Ministry of Statistics & Programme Implementation, GOI, New Delhi. All the topics starting with basics to some advanced topics covering Statistical Methods, Experimental Designs, Sample Surveys, Biometrics and Spatial Statistics were covered. The practicals were done using statistical software like SAS, SPSS and GenStat etc. The course material was distributed to the participants at the beginning of the training programme in the form of Reference Manual in two volumes. Dr.VK Bhatia was the Course Director for the training programme.
- One day training programme was organized on "Familiarization of AFEIS with emphasis on data entry and retrieval system" on 26 August 2008 at GKVK, Bangalore.
- A 10 days training programme was organized on "Price trends and market integration" under the NAIP project "Visioning, Policy Analysis and Gender (V-PAGe)" at IASRI, New Delhi during 16 - 25 October 2008.
- A Study Visit on "Indian Agricultural Statistics System" was organised for Afghanistan nationals sponsored by FAO during 03-17 November 2008. As part of the study four, the participants were taken to DES, Hyderabad (Andhra Pradesh) and DES, Trivandrum (Kerala). Dr. HVL Bathla was the Course Director.
- A one day training programme was organised for ISS Probationers on 12 December 2008.
- A two weeks training programme was organised on "Statistical techniques for research methodology" for scientists of Indian Council of Forestry Research and Education (ICFRE) from 26 December 2008 to 07 January 2009. This training programme was specially designed for scientists of ICFRE undertaking forestry research to equip them with the art of collection, analysis of data and drawing valid interpretation of their results. 18 scientists from various disciplines of forestry and representing seven different Institutes of ICFRE attended this

A participant receiving the certificate after the completion of training programme on 'Data Analysis with Statistical Tools'

Inaugural function of training programme on 'Statistical Techniques for Research Methodology'

training. All the topics useful for forestry research starting with basics to some advanced topics covering Statistical Methods, Experimental Designs, Sample Surveys, Biometrics and Spatial Statistics were covered. The practicals were done using statistical software, mainly SPSS. Course material in the form of Reference Manual and Electronic Manual was provided to all the participants. Dr. Seema Jaggi was the Course Director for the training programme.

- Two days training programme on "New experimental designs for research" was organized at RAR Station, LAM, Guntur during 16-18 March 2009. In the Inaugural session, Associate Director Research and Project Director introduced the overview of the Training Programme and elaborated its usefulness to agricultural scientists. About 80 scientists participated in the training programme. There were many queries of the scientists regarding the planning of the experiments and analysis of data when there is heterogeneity in the experimental material and the same were clarified. Dr. P.K. Batra, Dr. Krishan Lal and Sh. O.P. Khanduri conducted this training programme.

FACULTY MEMBERS OF P.G. SCHOOL, IARI IN AGRICULTURAL STATISTICS

S. No.	Name	Year of induction
1.	Dr. VK Bhatia, Director and Professor (Agricultural Statistics)	1987
2.	Dr. VK Gupta, National Professor	1984
3.	Dr. Prajneshu, Principal Scientist	1984
4.	Dr. VT Prabhakaran, Principal Scientist	1987
5.	Sh. SD Wahi, Principal Scientist	1987
6.	Dr. Ranjana Agrawal, Principal Scientist	1988
7.	Dr. HVL Bathla, Principal Scientist	1991
8.	Dr. UC Sud, Principal Scientist	1995
9.	Dr. KK Tyagi, Principal Scientist	1995
10.	Dr. Rajender Parsad, National Fellow	1995
11.	Dr. Anil Rai, Principal Scientist	1995
12.	Dr. Seema Jaggi, Senior Scientist	1995
13.	Dr. Chandrahas, Principal Scientist	1996
14.	Dr. PK Batra, Principal Scientist	1996
15.	Dr. Jagbir Singh, Principal Scientist	1996
16.	Ms. Asha Saksena, Principal Scientist	1998
17.	Dr. Aloke Lahiri, Senior Scientist	1998
18.	Dr. Amit Kumar Vasisht, Principal Scientist	1998
19.	Dr. Lal Mohan Bhar, Senior Scientist	1998
20.	Dr. Amrit Kumar Paul, Senior Scientist	1998
21.	Dr. Tauqueer Ahmad, Senior Scientist	1998
22.	Dr. AR Rao, Senior Scientist	1998
23.	Dr. Ramasubramanian V, Senior Scientist	1999
24.	Dr. Girish Kumar Jha, Senior Scientist (at IARI)	1999
25.	Dr. Cini Varghese, Senior Scientist	2000
26.	Dr. Prachi Misra Sahoo, Scientist (Sr. Scale)	2002
27.	Dr. RL Sapra, Principal Scientist (at IARI)	2002
28.	Dr. Krishan Lal, Principal Scientist	2003
29.	Sh. Hukum Chandra, Scientist (Sr. Scale)	2003
30.	Sh. Amrender Kumar, Scientist (Sr. Scale)	2003
31.	Md. Wasi Alam, Scientist (Sr. Scale)	2003
32.	Dr. Prawin Arya, Scientist (Sr. Scale)	2003
33.	Dr. Himadri Ghosh, Senior Scientist	2004

Research Fellowship

During 2008 – 09,13 Ph.D. and 31 M.Sc. students received research fellowship. 11 Ph.D. students received IARI Scholarship at the rate of Rs.10,500 /- p.m. in addition to Rs.10,000/- per annum as the contingent grant and 2 Ph.D students received CSIR fellowship at the rate of Rs.12,000 /- p.m. in addition to Rs. 20,000/- per annum as the contingent grant.

15 M.Sc. students received ICAR Junior Research Fellowship at the rate of Rs. 8640 /- besides Rs. 6000/- per annum as the contingent grant and 16 M.Sc. students received IARI Scholarship at the rate of Rs. 7560 /- p.m. besides Rs. 6000/- per annum as the contingent grant.

FACULTY MEMBERS OF P.G. SCHOOL, IARI IN COMPUTER APPLICATION

S. No.	Name	Year of induction
1.	Dr. SD Sharma, ADG (HRD)	1996
2.	Dr. PK Malhotra, Professor (Computer Application)	1991
3.	Dr. RC Goyal, Principal Scientist	1995
4.	Dr. IC Sethi, Principal Scientist	1995
5.	Dr. VK Mahajan, Principal Scientist	1996
6.	Dr. DK Agarwal, Principal Scientist	1999
7.	Sh. Harnam Singh Sikarwar, Scientist (SG)	1997
8.	Md. Samir Farooqi, Scientist (Sr. Scale)	2001
9.	Ms. Alka Arora, Scientist (Sr. Scale)	2001
10.	Ms. Shashi Dahiya, Scientist (Sr. Scale)	2001
11.	Ms. Sangeeta Ahuja, Scientist	2002
12.	Sh. Sudeep Marwaha, Scientist (Sr. Scale)	2002
13.	Sh. KK Chaturvedi, Scientist (Sr. Scale)	2002
14.	Sh. SN Islam, Scientist (Sr. Scale)	2004
15.	Sh. SB Lal, Scientist (Sr. Scale)	2004
16.	Ms. Anshu Dixit, Scientist (Sr. Scale)	2004
17.	Ms. Anu Sharma, Scientist (Sr. Scale)	2004
18.	Ms. Rajni Jain, Sr. Scientist (at NCAP)	2007

COURSES TAUGHT DURING THE ACADEMIC YEAR 2008–09

Code	Title	Course Instructors
	Trimester – III	
	Agricultural Statistics	
AS-103	Elementary Sampling & Non- Parametric Methods (2+1)	Asha Saksena & K.K.Tyagi
AS-163	Statistical Inference (4+1)	L.M. Bhar & Hukam Chand
AS-164	Design of Experiments – I (3+1)	Seema Jaggi & V.K.Gupta
AS-166	Statistical Genetics – I (3+1)	V.K. Bhatia
AS-302	Advanced Design of Experiments – II (2+1)	P.K. Batra & Krishan Lal
AS-304	Advanced Sample Survey – II (2+1)	U.C.Sud
AS-307	Forecasting Techniques (1+1)	Chandrahas & Ramasubramanian V.
AS-370	Recent Advances in the Field of Specialisation (1+0)	V.K. Gupta
AS-299	Seminar (1+0)	Seema Jaggi
	Computer Application	
CA-131	Data Base Management System (2+2)	R.C. Goyal, Sudeep Marwaha & Anu Sharma
CA-132	Data Structures and Algorithms (2+1)	K.K. Chaturvedi & Shashi Dahiya
CA-134	Modeling and Simulation (2+1)	P.K. Malthotra & Anshu Bhardwaj
CA-135	Computer Networks (2+1)	S.N. Islam & Sudeep
CA-299	Seminar (1+0)	S.N. Islam

COURSES TAUGHT DURING THE ACADEMIC YEAR 2007–08

Code	Title	Course Instructors
	Agricultural Statistics	
	Trimester – I	
AS-101	Elementary Statistical Methods (2+1)	K.K. Tyagi & A.K. Gupta
AS-150	Mathematical Methods – I (4+0)	Cini Varghese & Himadri Ghosh
AS-160	Probability Theory (2+0)	P.K. Batra & Anil Kumar
AS-161	Statistical Methods – I (2+1)	V.T. Prabhakaran & Seema Jaggi
AS-167	Applied Multivariate Analysis (2+1)	Ranjana Agrawal & A.R. Rao
As-168	Econometrics (2+1)	A.K.Vasisht & Prawin Arya
AS-169	Planning of Surveys / Experiments (2+1)	R.S. Khatri & Aloke Lahiri
AS-200	Design of Experiments – II (1+1)	Rajender Parsad & Cini Varghese
AS-201	Sampling Techniques – II (1+1)	K.K. Tyagi & Prachi Misra Sahoo
AS-202	Statistical Genetics – II (1+1)	S.D. Wahi & A.K. Paul
AS-203	Regression Analysis (1+1)	L.M. Bhar & Ramasubramanian V.
AS-204	Linear Models (2+0)	Krishan Lal & V.K. Gupta
AS-206	Optimization Techniques (1+1)	U.C. Sud & Prajneshu
AS-299	Seminar (1+0)	Seema Jaggi
	Trimester – II	
AS-102	Elementary Design of Experiments (2+1)	Aloke Lahiri & D.K. Sehgal
AS-151	Mathematical Methods in Statistics – II (4+0)	N.K. Sharma, Anil Kumar & Cini Varghese
AS-162	Statistical Methods – II (2+1)	Seema Jaggi & A.R. Rao
AS-165	Sampling Techniques – I (3+1)	Tauqueer Ahmad & Anil Rai
AS-170	Statistical Modeling (2+1)	Prajneshu
AS-171	Bioinformatics – I	A.R. Rao & Rajender Parsad
AS-207	Stochastic Processes (3+0)	Himadri Ghosh
AS-301	Advanced Design of Experiments – I (2+1)	L.M. Bhar & V.K. Gupta
AS-303	Advanced Sample Survey – I (2+1)	Jagbir Singh & K.K. Tyagi
AS-299	Seminar (1+0)	Seema Jaggi
	Computer Application	
	Trimester – I	
CA-100	Introduction to Computer Application (1+1)	V.H. Gupta & Balbir Singh
CA-111	Computer Organization and Architecture (3+0)	Anil Rai & Sudeep Marwaha
CA- 112	Fundamentals of Computer Programming in C (2+1)	K.K. Chaturvedi & Pal Singh
CA-114	Mathematical Foundations in Computer Application (4+0)	H.S. Sikarwar, P.K. Batra & N.K. Sharma
CA-211	Compiler Construction (2+1)	S.B. Lal
CA-212	Computer Graphics (2+1)	Pal Singh
CA-214	Internet Technologies & Applications (2+1)	Sudeep Marwaha & Rajni Jain
CA-215	Software Engineering (2+0)	Anu Sharma & Rajni Jain
CA-299	Seminar (1+0)	Anu Sharma
	Trimester – II	
CA-101	Computer Fundamentals & Programming (3+1)	Alka Arora & Pal Singh
CA-121	Object Oriented Programming & Design (2+1)	Sangeeta Ahuja
CA-122	Operating System (2+1)	H.O. Agarwal
CA-124	System Analysis & Design (2+1)	I.C. Sethi
CA-221	Data Warehousing and Data Mining (2+1)	K.K. Chaturvedi & Anshu Bhardwaj
CA-222	Multimedia & Applications (1+1)	Shashi Dahiya
CA-224	GIS and Remote Sensing Techniques (2+1)	Prachi Misra Sahoo & M.S. Farooqi
CA-225	Data Analysis in Agriculture (1+2)	V.K. Mahajan & M.S. Farooqi
CA-299	Seminar (1+0)	Anu Sharma

Note: Figures in the parentheses indicate the number of credits (Lectures + Practicals)