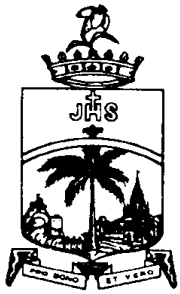
MASTER OF PHILOSOPHY IN STATISTICS

SYLLABUS - 2007-09



ST. JOSEPH'S COLLEGE (AUTONOMOUS)

(Nationally Reaccredited with A+ Grade / College with Potential for Excellence)

TIRUCHIRAPPALLI - 620 002

TAMIL NADU, INDIA

ST. JOSEPH'S COLLEGE (AUTONOMOUS), TIRUCHIRAPPALLI - 620 002
DEGREE OF MASTER OF PHILOSOPHY (M. PHIL.)
FULL TIME - AUTONOMOUS REGULATIONS

GUIDELINES

1. ELIGIBILITY

- ✧ A Candidate who has qualified for the Master's Degree in any Faculty of this University or of any other University recognized by the University as equivalent there to (including old Regulations of any University) subject to such conditions as may be prescribed therefore shall be eligible to register for the Degree of Master of Philosophy (M.Phil.) and undergo the prescribed course of study in a Department concerned.
- ✧ A candidate who has qualified for Master's degree (through regular study / Distance Education mode / Open University System) with not less than 55% of marks in the concerned subject in any faculty of this university or any other university recognized by Bharathidasan University, shall be eligible to register for M.Phil. SC / ST candidates are exempted by 5% from the prescribed minimum marks.

2. DURATION

The duration of the M.Phil. course shall be of one year consisting of two semesters for the full-time programme.

3. COURSE OF STUDY

The course of study shall consist of

Part - I : 3 Written Papers
Part - II : 1 Written Paper and Dissertation.

The three papers under Part I shall be :

Paper I : Research Methodology
Paper II : Advanced / General Paper in the Subject
Paper III : Advanced Paper in the subject

Paper I to III shall be common to all candidates in a course. Paper I, II, III & IV shall consist of 5 units each covering the subject requirements of the course offered. The Board of Studies shall approve the Syllabi for Papers. The syllabus for paper IV shall be prescribed by each Research Advisor, which is also to be approved by the Board of Studies. The number of specialized papers by the research advisor can be more than one.

Question papers for Papers I to III shall be set externally and valued by two examiners, one internal and one external. The concerned HOD will be in the Board of Examiners to pass the results. Paper IV shall be set and valued by the Research Adviser. The Controller of Examinations shall conduct the examinations for all papers and dissertation.

4. SCHEME OF EXAMINATION

4.1 Part-I (First Semester)

Paper I : Research Methodology
Paper II : Advanced / General paper in the subject
Paper III : Advanced paper in the subject

Part-II (Second Semester)

Paper IV : Field of specialization
Paper V : Dissertation

4.2 Written Examination

The examinations for Papers-I, II and III shall be taken at the end of the first semester and Paper-IV at the end of the second semester. Each paper shall have 100 marks for the semester examination (written) and 100 marks for Continuous Internal Assessment.

The CIA components are:

Seminar-I	:	15 marks
Mid semester	:	35 marks
Seminar-II	:	15 marks
End semester	:	35 marks
Total	:	100 marks

Both the CIA marks and the external marks should be mentioned separately in the mark sheets. The duration for each semester examination shall be 3 hours. A candidate shall be declared to have passed Part-I & II examinations if he/she secures not less than 50 of the marks each in the CIA and the semester examination respectively. The aggregate of the marks secured in the semester examinations and CIA marks taken together must be 50% in each of the Papers I to IV and Dissertation.

4.3 Credits for Papers I to IV

Paper	Name	Contact Hours	Library Hours	Total Hours	Credits	CIA Marks
I	Research Methodology	6	6	12	10	100
II	Core Subject	6	6	12	10	100
III	Core Subject	6	6	12	10	100
IV	Optional Subject	2	4	6	5	100
	Total			42	35	400

Credits for Dissertation

Internal Examination (the split up for CIA)

Project	Credits	Marks	Total Marks
Seminar on review of related literature	3	30	200
Seminar on Data Analysis / Results	2	20	
Dissertation Evaluation	15	150	
Viva - voce	5	100	100
Total	**25**	**300**	**300**

External Examination

	Credits	Marks
Dissertation Evaluation	20	200
Viva-voce	5	100
Total	**25**	**300**

4.4 Dissertation

For carrying out the dissertation the mandatory requirement is strictly adhering to the rules of the college as given below:

4.4.1a Requirement

Every student is expected to give two seminars one concerning Review of Related Literature within the four weeks from the beginning of the second semester and the other on Data Analysis / Result just before the submission of the final draft of the dissertation

4.4.1b Submission

Candidates shall submit the Dissertations to the Controller of Examination not earlier than five months but within six months in the full time programme. The above said time limit shall start from 1st of the month which follows after the month in which Part-I examinations are conducted. If a candidate is not able to submit his/her Dissertation within the period stated above, he/she shall be given an extension time of three months in the first instance and another three months in the second instance with penalty fees. If a candidate does not submit his Dissertation even after the two extensions, his registration shall be treated as cancelled and he has to re-register for the course subject to the discretion of the Principal. However the candidate need not write once again the theory papers if he / she has already passed these papers.

4.4.1c Requirement

For the valuation of dissertation the mandatory requirement is a pass in papers I to IV. One external examiner and the Research Adviser shall value the Dissertation. The external examiner should be selected only from outside the college and shall be within the colleges affiliated to Bharathidasan University. In case of non-availability, the panel can include examiners from the other university / colleges in Tamil Nadu. The external examiner shall be selected from a panel of 3 experts suggested by the Research Adviser. However, the Controller of Examination may ask for another panel if he deems it necessary. Both the internal and external examiner will evaluate the Dissertation and allot the marks separately. However the viva-voce will be done by both of them. The average marks will be considered.

4.4.2 Viva-voce

The external examiner who valued the Dissertation and the Research Adviser shall conduct the Viva-Voce for the candidate for a maximum of 100 marks. A Candidate shall be declared to have passed in viva-voce if he secures not less than 50% of the marks prescribed for Dissertation and 50% of the marks in the aggregate of the marks secured in viva-voce test and Dissertation valuation. A student can undertake project in the second semester whether or not he /she has passed the first semester.

5. QUESTION PAPER PATTERN

5.1 Internal (Mid & End)

5.1a For Science

There are two sections A and B:

Section A contains 8 short answer Questions	8 × 4	= 32
Section B contains 4 Essay Question	4 × 17	= 68
		100

5.1b For Arts

Only one section of Essay type questions 5 × 20 = 100

5.2 External Exam (Semester)

5.2a For Science

Section A - 10 short answer Questions	10 × 3	= 30
Section B - 5 Essay type Questions either or	5 ×14	= 70
		100

5.2b For Arts

Only one section of Essay type questions 5 out of 8 (5 × 20 = 100)

5.2c For the Paper-IV (Optional/Research Adviser's paper)

The Question paper pattern for Paper IV is common for both Science and Arts. The pattern is only one section with Essay type Questions 5 out of 8 (5 × 20 = 100)

There may be two separate mark sheets for the first and second semester respectively. The marks allotted by the guide and that by the External Examiner must be shown in separate columns of the 2nd Semester mark sheet.

6. CLASSIFICATION OF SUCCESSFUL CANDIDATES

6.1 The candidates who pass the Part - I and Part - II examinations in their first attempt shall be classified as follows:

No.	Total Marks secured in Part - I and Part - II Examinations	Classification
1.	80% and above in the case of Science Subjects & 75% and above in the case of Arts and Social Science Subjects	I Class with Distinction
2.	60% to 79% in the case of Science Subjects & 60% to 74% in the case of Arts and Social Science Subjects	I Class
3.	50% to 59% in all the subjects (Mathematics, Statistics and Computer Science / Applications shall be treated as Science Subjects)	II Class

6.2 Candidates who pass the course in more than one attempt shall be declared to have completed the programme under II Class.

7. QUALIFICATIONS OF RESEARCH ADVISER FOR THE M.Phil. COURSE

7.1 A person eligible to be a Research Adviser shall be required to possess a Ph.D. Degree or two years of Post-Graduate teaching experience after qualifying for M.Phil. / M.Litt. degree. He / She should have obtained recognition from the University.

7.2 In view of the paucity of guides in the newly emerging subjects like Biotechnology, Microbiology, Remote Sensing the research guides in the related areas may be permitted to guide students provided these guides satisfy the qualification requirements.

7.3 Normally a person shall be allowed to guide not more than three candidates.

7.4 Change of guide may be permitted by the Principal based on the merit of the individual cases.

8. ATTENDANCE

- ✧ Daily attendance for 90 working days should be enforced for the students.
- ✧ Periodical report of a student to the guide concerned should be recorded in the register kept by the guide.

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M.PHIL. STATISTICS - COURSE PATTERN - 2007

Sem	Code	Course	Title of the paper
I	07 MST 101	I	Research Methodology
	07 MST 102	II	Sampling Techniques and Design Of Experiments
	07 MST 103	III	Advanced Statistical Inference
II	07 MST 204	IV	Advanced Applied Multivariate Analysis
	07 MST 205	IV	Markov Chains and Time Series
	07 MST 206	IV	Advanced Statistical Quality Control
	07 MST 207	IV	Advanced Applied Multivariate Analysis
	07 MST 208	IV	Advanced Design of Experiments

Paper I : RESEARCH METHODOLOGY

Unit 1

Definition of research - 7 stages in a research - Types of research - Planning the research project - Research objectives and plans - Specifying data and acquisition methods - Experimental methods of data. Collection: Types of experimental methods - Types of experimental designs - Complete experimental designs - Incomplete experimental designs.

Survey methods: Basic concepts of measurement and scaling - Reliability and validity of measurements - Questionnaire design - Sampling process and selection - The sample size decision.

Collection of data: Questionnaire method, interview method, Telephone survey, ICT based survey.

Unit 2

Interpretation: Mistakes commonly committed in interpreting data.

Report writing: Outline of a research project - Title page - Table of contents - Preface - Introduction - Objectives - Methodologies - Findings - Limitations - Conclusions and Recommendations - Appendices - Guidelines for writing the research projects.

Oral presentation: Deciding on the content - Visual aids - the presentation - Handling questions - Writing a research project to a funding agency.

Unit 3

Introduction to Linear equations - Quadratic forms - Canonical reduction - Generalised inverse and its properties - Moore Penrose inverse.

Unit 4

Statistical Test: Basic statistical test - Using normal, t, χ^2 and F distributions - Non-parametric tests - Multiple regression - ARIMA Models concepts only - Implementation of the above tests using Statistical Package

Unit 5

Multivariate Analysis: Logistic regression - Factor analysis - Cluster analysis - Diseriminant analysis - Concepts and applications only - Implementation of the above techniques using Statistical Package

Books for Study

1. Tripathy, P. C., 'A Textbook of Research Methodologies in Social Sciences', Sultan Chand, 2005.
2. Uma Sekaran, 'Research Methods for Business: A skill building approach', John Wiley & Sons, 2003.
3. Ajai S. Gaur and Sanjaya S. Gaur, 'Statistical Methods for Practice and Research: A guide to data analysis using SPSS', Response Books, 2006.
4. Johnson, R. A. and Wichern, D. W., 'Applied Multivariate Statistical Analysis', PHI, 2003.
5. Damodar N. Gujarati, 'Basic Econometrics', Third Edition, McGraw Hill, 1995.
6. Biswass, S., 'Topics in Algebra of Matrices', Academic Publication, 1984.

Paper II : SAMPLING TECHNIQUES AND DESIGN OF EXPERIMENTS

Unit 1

Linear Models - Gauss Markov Theorem - Point and Interval estimation - Testing of hypothesis of full rank case only.

Unit 2

Complete block designs - Factorial experiments - Confounding - Methods of construction of confounded designs - Analysis of factorial experiments (2^3, 2^4, 3^2) - Asymmetrical factorials and Split-Plot designs (concept only).

Unit 3

Incomplete block designs - BIBD and PBIBD - Analysis of the above designs - Youden square - Response surface designs - Linear and second order response - Surface designs.

Unit 4

Ratio Estimate - Variance of Ratio estimate - Confidence limits - Comparison of ratio estimate with mean per unit - Best Linear Unbiased Estimator - Bias of Ratio Estimator.

Linear Regression Estimate - Regression estimates computed from sample - Comparison with ratio estimate and mean per unit - Bias of linear regression estimate.

Unit 5

Two Phase Sampling - Mean and Variance in two phase sampling - Sample estimate of variance - Estimate of proportions - Optimum sampling - Sub-sampling with units of unequal sizes.

Double sampling - Double sampling for stratification - Optimum allocation - Estimated variance for stratification - Regression estimators.

Books for Study:

1. Rao, C. R., 'Linear Statistical Inference and Applications', John Wiley & Sons, 1983.
2. Graybill, F. A., 'An Introduction to Linear Models', McGraw Hill, New York, 1961.
3. Montogomory, D. C., 'Design and Analysis of Experiments', John Wiley & Sons, New York, 2nd Edition, 1991.
4. Das, M. N. and Giri, N. C., 'Design and Analysis of Experiments', New Age International Publishers, 2nd ed, 1986.
5. Kempthorne, 'The Design and Analysis of Experiments', John Wiley & Sons, New York, 1952.
6. William G. Cochran, 'Sampling Techniques', John Wiley & Sons, 1999.
7. Sukhatme, P. V. and Sukhatme, B. V., 'Sampling Theory of Surveys with Applications', ISAS Pulishers, 1957.
8. Daroga Singh and Choudary, F. S., 'Theory and Analysis of Sample Survey Designs', New Age International, 1986.

Paper III : ADVANCED STATISTICAL INFERENCE

Unit I

Sufficient statistics – existence and construction of Minimal sufficient statistics – sufficiency and completeness – sufficiency and invariance – Minimum variance unbiased estimation – Unbiased estimation of location and scale parameters.

Unit II

Maximum likelihood estimators – properties – Strong consistency – asymptotic efficiency of maximum likelihood estimators – best asymptotically normal estimators – Inference based on Censored data (concept only).

Unit III

Neymann – Pearson fundamental lemma – distributions with monotone likelihood ratio confidence bounds, UMP tests for the two sided hypothesis – tests for parameters in a normal distribution.

Unit IV

Unbiased tests: Concept of unbiasedness – application to one parameter exponential family – similarly and completeness – UMP unbiased tests for multi parameter exponential families – comparison of two Poisson and Binomial population - Application of unbiasedness.

Unit V

Invariant tests: Symmetry and invariance – maximal invariance - most powerful invariant tests – unbiasedness and invariance.

Books for study and Reference:

1. Lehman E.L. and Casella: Theory of Point Estimation, Springer Verlag, 1988.
2. Lehman E.L. : Testing Statistical Hypothesis, John Wiley & Sons, 1986.
3. Rohatgi V.K. : Introduction to mathematical Statistics, Wiley Eastern, 1984.
   Units 3, 4 and 5 treatments as in Rohatgi V.K.
4. Zacks S.: Theory of Statistical Inference, John Wiley & Sons, 1991
5. Ferguson T.S. : Mathematical Statistics - A decision theoretic approach, Academic Press, 1967.
6. Kale B.k : A first course on parametric inference, Narosa Publication, New Delhi, 1999.

Paper IV: ADVANCED APPLIED MULTIVARIATE ANALYSIS

Dr C Muthu

Unit I

Introduction to Multivariate analysis – Data Reduction – Principle component analysis – Determination of number of principle components to be retained – component scores.

Unit II

Introduction to Factor analysis – Communalities – Comparison of Extraction procedures – Rotation of factors – Factor scores – Introduction to Multidimensional scaling – Proximities and data collection – Relationship with other data reduction procedures.

Unit III

Introduction to Cluster analysis – Similarity measures – Clustering techniques – Hierarchical and partitioning methods – Graphical methods – Peudograms – guidelines.

Unit IV

Introduction to canonical correlation analysis – Interpretation of canonical correlation results – Issues in interpretation.

Introduction to Discriminant analysis – Two group problem – variable contribution – Violation of assumptions Logistic discrimination – error rate estimation.

Unit V

Linear structural Relations (LISREL) – Path analysis – Testing casual model – Evaluating LISREL solutions.

Latent Structural analysis – Logic behind Latent structure analysis – Latent class models – Restricted Latent class models.

Books for study:

1. Dillon, W.R. and Goldstein, M.: Multivariate Analysis Methods and Applications, John Wiley & Sons 1984.
2. Hair J.F., Junior Anderson R. E and Tatham R.L, Multivariate Data Analysis with Readings, MacMillan Publications, New York, 1987.

Paper-IV: MARKOV CHAINS AND TIME SERIES

Dr G Stephen Vincent

Unit 1

Introduction of Stochastic Process: Definition – Examples - Classification of Stochastic process awarding to state space, index set and dependence among the random variables-some common stochastic processes (Bernoulli, Poisson Gaussion and wiener - concept only). Marko chain (MC): Chapman kolmogorov's equation - classification of states. A canonical representation of the transition probability matrix. Classification of the states using graph algorithms - Morkov chains as graphs – Martingales - Limiting Probabilities.

Unit 2

Finite Markov chains with recurrent and transient states - irreducible finite Markov chains with ergodic states - First passage times and occupation times - Two states MC (idea only). Reversed Makov chains - Limit theorems (No proof) - Application only.

Unit 3

Markov Processes (MP) – Detailed Study of Poisson process, Pure Birth process, Yule's process, Birth and death process-Application to queues.

Unit 4

Stochastic models for Time Series - General linear filter model-Autoregressive (AR(p)) models - Moving average model (MA(q)) - Autoregressive - Moving average (ARMA(p,q)) models - Autoregressive integrated moving average model (ARIMA(p,d,q)).

Unit 5

Analysing Time Series Model: Spectral Density of AR models, MA, ARMA, models. Relationship between Auto covariance and spectral density - Cyclical Behaviour finding Auto covariance, Auto correlation through Spectral Density. Analysing Spectral Graph-Analysing the Cyclic Behaviour of Time Series - Spectral Density and Linear Filters. Relationship between Markov Process and Time Series - Co integrated Time Series.

Books for study:

1. Bhat. U.N: Elements of Applied Stochastic Processes, Wiley 1972.
2. Karlin.S and Taylor: A first course in Stochastic Processes, Academic Press, New York. 1975.
3. Methi.J: Stochastic Processes, Wiley Eastern, 2nd ed, 1994.

Paper IV: ADVANCED STATISTICAL QUALITY CONTROL

Dr G Stephen Vincent

Unit 1

Cumulative - Sum Control Chart – Basic Principles – Tabular Or Algorithmic Cusum For Monitoring Process Mean – Recommendations For Cusum Design – The Standardized Cusum – Rational Subgroups – One Sided Cusum – A Cusum Monitoring Process Variability – Cusum For Other Sample Statistics – The V- Mask Procedure – The Exponentially Weighted Moving Average Control Chart for monitoring the Process Mean – Design of an EWMA Control Chart – Extensions of the EWMA – The Moving Average Control Char.

Unit 2

$\overline{X}$ and R Charts for Short Production Runs – Attribute Control Charts for Short Production Runs – Modified Control Limits for the $\overline{X}$ Chart – Acceptance Control Charts – Group Control Charts for Multiple Stream Processes – Multivariate Quality Control - S P C With Correlate Data – Interfacing Statistical Process Control and Engineering Process Control – Economic Design of Control Charts – An Economic Model of the $\overline{X}$ Control Chart.

Unit 3

Process Capability Analysis – Using a Histogram or a Probability Plot – Process Capability Ratios – Process Capability Analysis Using a Control Chart – Process Capability Analysis Using Designed of Experiment – Gauge and Measurement System Capability Studies Setting Specification Limits on Discrete Components – Estimating the Natural Tolerance Limits of a Process.

Unit 4

Acceptance Sampling – Lot-By-Lot Acceptance Sampling By Attributes Advantage And Disadvantage of Sampling – Types of Sampling Plans – Random Sampling – Guidelines for Using Acceptance Sampling – Single-Sampling Plans for Attributes – Double, Multiple and Sequential Sampling – Military Standard 105E (ANSIZ1.4, ISO 2859) – The Dodge – Roming Sampling Plans – AOQL Plans – LTPD Plans .

Unit 5

Other Acceptance Sampling by Variables – Advantage and Disadvantage of Variables Sampling – Designing a Variables Sampling Plan with A Specified OC Curve – MIL STD 414 (ANSI / ASQCZ1.9) – Chain Sampling – Continuous Sampling – CSP -1 – Skip –Lot Sampling Plans – Shanin Lot Pilot Method

Books for Study:

1. Montgomery D.C. : Introduction to Statistical Quality Control , John Willey and Sons 3rd ed, 1996.
2. Grant E.L and Leavenworth R.S, Statistical Quality Control, McGraw Hill, New York 1980.
3. Schilling, E.G, Acceptance Sampling in Quality Control, Marcel Deckar Inc, New York, 1989.

Paper IV: ADVANCED APPLIED MULTIVARIATE ANALYSIS

Prof. K A Jayakumar

Unit I

Introduction to Multivariate analysis – Data Reduction – Principle component analysis – Determination of number of principle components to be retained – component scores.

Unit II

Introduction to Factor analysis – Communalities – Comparison of Extraction procedures – Rotation of factors – Factor scores – Introduction to Multidimensional scaling – Proximities and data collection – Relationship with other data reduction procedures.

Unit III

Introduction to Cluster analysis – Similarity measures – Clustering techniques – Hierarchical and partitioning methods – Graphical methods – Peudograms – guidelines.

Unit IV

Introduction to canonical correlation analysis – Interpretation of canonical correlation results – Issues in interpretation.

Introduction to Discriminant analysis – Two group problem – variable contribution – Violation of assumptions Logistic discrimination – error rate estimation.

Unit V

Linear structural Relations (LISREL) – Path analysis – Testing casual model – Evaluating LISREL solutions.

Latent Structural analysis – Logic behind Latent structure analysis – Latent class models – Restricted Latent class models.

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2. Hair J.F., Junior Anderson R. E and Tatham R.L, Multivariate Data Analysis with Readings, MacMillan Publications, New York, 1987.

Paper-IV: ADVANCED DESIGN OF EXPERIMENTS

Dr N Ramasamy & Prof. K Shanmugavadivel

Unit I

Construction of orthogonal Latin Square Designs – Analysis of designs based on mutually orthogonal Latin Squares - Construction of orthogonal arrays.

Unit II

Construction and analysis of confounded symmetrical and asymmetrical factorial designs, construction and analysis of fractionally replicated factorial experiments

Unit III

Construction and analysis of quasi-factorial experiments - Lattice designs – simple Lattice – Construction and analysis of BIBD, PBIBD and weighing designs.

Unit IV

Second and third order rotatable designs – central composite rotatable designs – Blocking in response surface designs.

Unit V

Continuous optimal designs – Basic properties of the information matrix – Equvalence of D-optimal and minimax designs. Basic properties of these designs – Computational methods for construction of D-optimal designs.

Books for Study:

1. Das M.N. and Giri, N.C., Design and Analysis of experiments, New Age International Publishers, 1986.
2. Federer W.T., Experimental design - Theory and Applications, McMillan Co. New York, 1963.
3. Aloke Dey, T., Fractional factorial designs.
4. Kempthorne, C., Design and analysis of experiments, Wiley Eastern, 1965.
5. Raghava Rao, D., Construction and combinatorial problems in design of experiments.

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