M.PHIL. SYLLABUS – 2015

STATISTICS

DEPARTMENT OF STATISTICS
ST. JOSEPH'S COLLEGE (Autonomous)
Accredited at A Grade (3rd cycle) by NAAC
College with Potential for Excellence by UGC
Tiruchirappalli – 620 002

GUIDELINES FOR FULL TIME M.PHIL.

1. **Duration:** The programme runs for one year consisting of two semesters. The Semester- I is from August to February and the Semester- II runs from March to August, of the following year.

2. **Course Work:**

Semester - I			Semester - II		
Course	**Title**	**Cr**	**Course**	**Title**	**Cr**
C1	Professional Skills for Teaching – Learning	3	C5	Dissertation (Topic selected should be relevant to the topic of the Guide Paper)	8
C2	Research Methodology	4			
C3	Core Course	5			
C4	Guide Paper	5			
	Total	17		Total	8

2. a) Each Course should contain 5 units, covering the subject requirements of the courses offered.

Marks for CIA and SE are in the ratio 40 : 60.

The CIA components are **Mid Semester Test (25), End Semester Test (25), Seminar (15), Objective Type Assignment Test (15)**. The total mark 80 will be converted into 40 marks. **The tests and Semester Examination are centrally conducted by COE for 3 hours.**

CIA & SE	Tentatively on
Mid Semester Test	December 2nd Week
End Semester Test	February 2nd Week
Semester Examinations	February 4th Week

Scholar should acquire **a minimum of 20 marks from CIA to appear for SE.** The Scholar should acquire a minimum of 30 marks in Semester Examination. He / She will be declared to have passed in the various courses in Semester I, provided he/she secures not less than 50 marks on an aggregate (CIA+SE).

2. b) (i) In course C1 on **'Professional Skills for Teaching – Learning'** the first three units are common to all the Departments of the College. The Academic Council has granted permission to incorporate some modifications in the C1 Course by Physics, Computer Science and Mathematics Departments. The first three unit titles are **Soft Skills, E-teaching, E-learning, Elements of Technology of Teaching and Learning.** The remaining two units are department specific to make use of the above mentioned skills & techniques to teach the Core Course.

The C1 Course is (to be) designed to exploit the various Teaching – Learning – Research Skills to be imbibed / cultivated to make the research scholars to be fit for the profession they are likely to acquire in the Education Industry. Thus only for the course (C1) the written component is 60% and Practical component is 40% both in CIA and SE.

b) (ii) **Evaluation for C1:**

Theory Component: For both CIA & SE, there will be a 2 hour test only from the first THREE units. The CIA components are Mid Semester Test (35), End Semester Test (35) and Assignment (30). The total 100 will be converted into 25 marks.

Practical Component: The last TWO units are department specific. There is no Mid and End Semester Tests. But the CIA for the same are assessed continuously by the teacher(s) concerned totaling 15 marks. For SE, the Practical evaluation is done by an external examiner.

c) Question papers for C1, C2 & C3 are set by External Examiners.

d) Question paper for C4 will be set and valued by the Research Advisor only.

e) Departments will be permitted to offer either paper 2 or paper 3 as Open Online Course to the M.Phil. students. The evaluation method will be the same for both C2 and C3 Courses.

3. Credits:

	Courses	Title		Contact Hrs.	Library Hrs.	Total Hrs.	Cr	CIA Mk.	SE Mk.	Total Mk.
SEMESTER – I	C1	Professional Skills for Teaching – Learning	T	3	2	5	2	25	35	60
			P	2	2	4	1	15	25	40
	C2	Research Methodology		5	4	9	4	40	60	100
	C3	Core Course		5	5	10	5	40	60	100
	C4	Guide Paper		5	5	10	5	40	60	100
	Total			**20**	**18**	**38**	**17**	**160**	**240**	**400**

		INTERNAL			EXTERNAL		
			Cr	**Mk**		**Cr**	**Mk**
SEMESTER – II	**C5 – DISSERTATION**	Seminar & Review of Related Literature	2	15	Dissertation Evaluation	6	75
		Mid Term Review Presentation	2	15	*Viva-voce*	2	25
		Dissertation Work	3	60			
		Viva-Voce	1	10			
Total			**8**	**100**		**8**	**100**

4. Question Pattern:

	Course	Mid & End Semester Tests and Semester Examinations		
Science	**C1**	Section A : Short Answers Section B : Either / Or – Essay Type	7/9 3	7 x 2 = 14 3 x 7 = 21
	C2	Section A : Short Answers Section B : Either / Or – Essay Type	10 5	10 x 2 = 20 5 x 8 = 40
	C3	Section A : Short Answers Section B : Either / Or – Essay Type	10 5	10 x 2 = 20 5 x 8 = 40
	C4	Open Choice : Comprehensive Type	5/8	5 x 12 = 60
	Course	**Mid & End Semester Tests and Semester Examinations**		
Arts	**C1**	Section A : Short Answers Section B : Either / Or – Essay Type	7/9 3	7 x 2 = 14 3 x 7 = 21
	C2	Open Choice : Comprehensive Type	5/8	5 x 12 = 60
	C3	Open Choice : Comprehensive Type	5/8	5 x 12 = 60
	C4	Open Choice : Comprehensive Type	5/8	5 x 12 = 60

5. Dissertation

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

5.1. 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/Mid Term Review just before the submission of the final draft of the dissertation

5.2. Submission

Candidates shall submit the Dissertations to the Controller of Examinations **not earlier than five months but within six months** from the date of the start of the Semester –II. The above said time limit shall start from the 1st of the month which follows the month in which Semester - 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 **four** months in the first instance and another **four** months in the second instance with penalty fees. If a candidate does not submit his/her Dissertation even after the two extensions, his/her registration shall be treated as cancelled and he/she 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.

At the time of Submission of Dissertation, the guide concerned should forward the marks for 90% as stated above to the COE in a sealed cover

5.3. All the M.Phil. Scholars (along with their Guides) have to submit at least one Research articles for publication, at the time of submitting the dissertation.

Departments (with the constituted Expert Committee) will scrutinize; select and recommend the best articles for a publication either in RETELL or in School-based Journals.

5.4. Requirement

For the valuation of dissertation it is mandatory to have passed in all the four courses. 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.

5.5. *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/she 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* and Dissertation valuation. A student can undertake dissertation in the second semester whether or not he/she has passed the first semester.

6. Classification of Successful Candidates

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

S. No.	Total Marks secured in Semester – I and Semester–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	II Class

Note: Mathematics, Statistics and Computer Science/Application shall be treated as Science Subjects

6.2. Candidates who have failed in the courses may take the supplementary exams conducted by the COE immediately. Even then if they could not complete the course(s), they will be given two more chances only to appear for those courses along with the next batch scholars. The maximum duration for the completion of the M.Phil. Programme is 2 Years.

7. Attendance:

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

8. The Scholar must obtain 80% of attendance per semester in order to appear for the Semester Examinations/*Viva-Voce.*

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M.PHIL. STATISTICS COURSE PATTERN – 2015

Sem	Code	Title of the paper
I	15 MST 101	Course – C1 : General Skills for Teaching and Learning
	15 MST 102	Course – C2 : Research Methodology
	15 MST 103	Course – C3 : Advanced Statistical Inference
	15 MST 104A	Course – C4 : Advanced Applied Multivariate Analysis
	15 MST 104B	Course – C4 : Advanced Statistical Quality Control
	1 MST 104C	Course – C4 : Advanced Design of Experiments
II	15 MST 205	Course – C5 : Dissertation

15 MST 101

C1: PROFESSIONAL SKILLS FOR TEACHING – LEARNING

Objectives:

i. To empower scholars with soft skills
ii. To introduce the techniques and dynamics of teaching
iii. To facilitate e-learning/e-teaching with the ICT tools
iv. To know the material resources for classroom teaching
v. To introduce soft skill for class room teaching

Unit – I: Soft Skills

a. Introduction to soft skills, soft skills vs hard skills, types of soft skills
b. Communicative skills – basics in communication, structure of written and oral sentences, verbal, non-verbal, body language, JOHARI Window, intrapersonal and interpersonal communications, activities in effective communication
c. Behavioural skills – leadership skills, time management, creativity and lateral thinking
d. Interview skills – resume writing, different types of interviews, etiquettes in interviews, mock interviews
e. Team building and group discussion – progressive stages of team building, parameters of GD (special reference to attending, listening, responding skills), mock group GDs

Unit – II: Techniques and dynamics of teaching – learning

a. Emerging trends in educational psychology – meaning, scope and methods
b. Learning different theories of learning, approaches to learning (classical conditioning – Ivan Pavlov, operant conditioning – b f skinner); kinds of learning, factors affecting learning
c. Motivation: intrinsic and extrinsic motivation, development of memory and intelligence

Unit – III: e-Learning and e-Teaching

An overview of MS Office 2007, MS WORDS-2007, MS EXCELL-2007-MS Powerpoint-2007, concepts in e-resources and e-design: world wide web concepts – making use of web resources – website creation concepts – creating web page editions – creating web graphics – creating web audio files

Unit – IV: Teaching Practice – I: Statistical Theory

Suggested Topics

Descriptive statistics – Probability theory, Distribution theory - Statistical Inference - Sampling theory - Design of experiments - Applied statistics – Engineering statistics - Bio Statistics

Unit – V: Teaching practice – II: Statistical Packages

Suggested Topics

SPSS - SYSTAT- Descriptive statistics – Frequencies tables – Compare means – Correlation and regressions – Non Parametric methods – Graphics – ANOVA – Any two advanced models.

For unit IV and V – Preparation of lesson plan – Preparation of Assignments – Setting Objective type questions – Preparation of Teaching Aids – Hands on experience – Teaching for UG Classes using different teaching methods such as chalk and talk method, PowerPoint – LCD – OHP – Numeric Puzzles etc.

References:

Unit – I:

1. JASS (2013). Winners in the making. Introduction to Soft Skills. St. Joseph's College, Trichy
2. Murphy, Raymond. (1998). Essential English Grammer. 2nd ed. Cambridge University Press
3. Trishna (2004). Knowledge system how to do well in GDs and interviews. Reprographic and printing services, Secunderabad

Unit – II:

1. Covey, Stephen. (2004). 7 habits of highly effective people, free press.
2. Driscoll, M P (1994). Psychology of learning for instruction, Needham, Ma: Allyn and Bacon.
3. Gardner, Howard (1983; 1993). Frames of mind: the theory of multiple intelligences, new York; basic books.

Unit – III:

1. Joyce cox, curtisfrye etc (2007), step by 2007 microsoft office system, Prentice Hall of India Pvt Ltd, new Delhi.

15 MST 102

C2 : RESEARCH METHODOLOGY [OOC]

Objective:
1. Revisiting of important basic concepts of statistics along with Research Methodology.
2. Using of Statistical Packages and their interpretations of the results

Unit – I:

Definitions of Research and Methodology – 7 stages in research – Types of research – Research design planning. Formulation of research problem – Data Collection : Experimental methods of collecting data – Reducing experimental error through CRD, RBD, LSD, incomplete experiments (concept only). Survey Methods: Primary Source and Secondary Source – Methods of collection of primary data – Interview method, Telephone Survey, ICT based survey local correspondents – Enumeration and Questionnaire method. Questionnaire development process: Points to remember, evaluating the questions – measurement and sealing – reliability and validity of measurements – pretest.

Sampling process and selection: Probability sampling SRS, Stratified, systematic and multistage sampling (No derivations). Non Probability sampling Judgment Sampling, Quota sampling, Convenience sampling, Sample size determination(only concepts)

Unit – II:

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 – III:

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

Unit – IV:

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 – V:

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

Web URLs for Reference:

Unit I : http://www.sjctni.edu/department/ST/RM/unit1.jsp

Unit II : http://www.sjctni.edu/department/ST/RM/unit2.jsp

Unit III : http://www.sjctni.edu/department/ST/RM/unit3.jsp

Unit IV : http://www.sjctni.edu/department/ST/RM/unit4.jsp

Unit V : http://www.sjctni.edu/department/ST/RM/unit5.jsp

Books for Study:

1. Tripathy, P.C., "A Textbook of Research Methodologies in Social Sciences", Sultan Chand, 2005.
2. Johnson, R.A. and Wichern, D.W., "Applied Multivariate Statistical Analysis" PHI, 2003.
3. Damodar N. Gujarati, "Basic Econometrics", Third Edition, McGraw Hill, 1995.

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15 MST 103

C3 : ADVANCED STATISTICAL INFERENCE

Unit – I:

Parametric Point Estimation - Properties of Estimators - Sufficient statistics - Factorization Theorem - Sufficient estimators for parameters of different distributions - Minimum variance unbiased estimation - Cramer-Rao Inequality - Rao-Blackwell Theorem - Minimal sufficient statistics - sufficiency and completeness - sufficiency and invariance - Unbiased estimation of location and scale parameters(concept only).

Unit – II:

Methods of Point Estimation - Maximum likelihood estimators - Properties of MLEs - Maximum Likelihood Estimators for parameters of different distributions - Strong consistency - asymptotic efficiency of maximum likelihood estimators - Inference based on censored data (concept only).

Unit – III:

Neyman-Pearson theory of testing of hypothesis - Basic Definitions - NP Lemma - Most powerful tests for parameters in Normal, Binomial, and Poisson distributions using NP Lemma - Confidence Estimation.

Unit – IV:

Families with Monotone Likelihood Ratio - Exponential Family of distributions - Uniformly Most Powerful tests for the parameters of Normal distribution using MLR property.

Unit – V:

Likelihood Ratio test - Uniformly Most Powerful test for the parameters of Normal distribution (Single Mean, Difference of Means, Single Variance, Difference of Variances) Unbiased Tests, Symmetry and Invariance .

Books for Study:

Introduction to mathematical statistics, V.K. Rohatgi, Wiley eastern, 1984

Unit I : Chapter 8 (Sec 8.1 – 8.5), Unit II : Chapter 8 (Sec 8.6 – 8.7)

Unit III : Chapter 9 (Sec 9.1 – 9.3) Unit IV : Chapters 5& 9 (Sec 5.5, Sec 9.4)

Unit V : Chapters 9 & 10 (Sec 9.5, Sec 10.2)

Books for 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. Zacks, S., “Theory of Statistical Inference”, John Wiley & Sons, 1991.
4. Ferguson, T.S., “Mathematical Statistics - A decision theoretic approach”, Academic Press, 1967.
5. Kale, B.K., “A first course on parametric inference”, Narosa Publication, New Delhi, 1999.

15 MST 104A

C4 : ADVANCED APPLIED MULTIVARIATE ANALYSIS

Prof. K. A. Jayakumar, Dr. C. Muthu, Dr Lilly George and Dr. R.Vijayakumar

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 dafa reduction procedures.

Unit – III:

Introduction to Cluster Analysis - Similarity measures - Clustering techniques - Hierarchical and partitioning methods - Graphical methods - Pseudograms - 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) : Introduction – path analysis – testing Causal model. LISREL : Notation, concepts and examples. Evaluating LISREL solutions. Caveats concluding remark.

Latent Structure Analysis : The logic behind latent Structure Analysis - Latent class modeling – Restricted Latent class models – multiple –Indicator, Multiple – cause models Simultaneous Latent class Analysis – Concluding remarks.

Books for Study:

1. Dillon, W.R. and Goldstein, M., "Multivariate Analysis Methods and Applications", John Wiley & Sons, 1984.
2. Hair, J.F., Anderson, R.E. Jr., and Tatham, R.L., "Multivariate Data Analysis with Readings", Macmillan Publications, New York, 1987.
3. Johnson, R.A. and Wichern, D.W., "Applied Multivariate Statistical Analysis", PHI, 2003.
4. Singh and Parashar and Singh, H.P., "Econometrics", S. Chand and Sons.

15 MST 104B

C4 : ADVANCED STATISTICAL QUALITY CONTROL

Dr. Lilly George and Dr. R. Vijayakumar

Unit – I:

Cumulative - Sum Control Chart - Basic Principles - Tabular or Algorithmic Cusum for Monitoring Process Mean - Recommendations for Cusom Design - The standardized Cusum - Rational subgroups - One Sided Cusum - A Cusum Monitoring Process Variability - Cusum for Other Sample Statistics - 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 – II:

$\bar{X}$ and R Charts for Short Production Runs - Attribute Control Charts for Short Production Runs - Modified Control Limits for the $\bar{X}$ chart - Acceptance Control Charts - Group Control Charts for Multiple Stream Processes - Multivariate Quality Control - SPC with Correlate Data - Interfacing Statistical Process Control and Engineering Process Control - Economic Design of Control Charts - An Economic Model of the $\bar{X}$ Control Chart.

Unit – III:

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 – IV:

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 (ANSIZ 1.4, ISO 2859) - The Dodge - Roaming Sampling Plans - AOQL Plans - LTPD Plans.

Unit – V:

Other Acceptance Sampling by Variables - Advantages and disadvantages of Variables Sampling - Designing a Variable Sampling Plan with a Specified OC Curve - MIL STD 414 (ANSI / ASQCZ 1.9) - 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.

15 MST 104C

C4 : ADVANCED DESIGN OF EXPERIMENTS

Dr. C. Muthu and Dr. R. Vijayakumar

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 - Equivalence 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", Macmillan 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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