COURSES OF STUDIES

M.Phil. (STATISTICS), 2021

Choice Based Credit System

P.G. DEPARTMENT OF STATISTICS
SAMBALPUR UNIVERSITY
JYOTI VIHAR, SAMBALPUR
ODISHA
768019

POST GRADUATE DEPARTMENT OF STATISTICS
SAMBALPUR UNIVERSITY, JYOTI VIHAR
BURLA- 768019, ODISHA

OUTLINE OF COURSE STRUCTURE

MPHIL IN STATISTICS (Session: 2021)

MPHIL IN STATISTICS-2021
STRUCTURE OF THE COURSE

SEMESTER – I (January-June)	Title of Paper	Credit Hours (Hrs Semester)
MPH 611	Probability Theory and Stochastic Processes	4 CH(40-48 Hrs)
MPH 612(A)	Statistical Inference (Theory Elective)	4 CH(40-48 Hrs)
MPH 613	Research Methodology	4 CH(40-48 Hrs)
MPH 614	Field Studies	4 CH(40-48 Hrs)
MPH 615	Review of Research Paper published in referred Journals 　　i)　Review Report – 2CH 　　ii)　Seminar - 2CH	4 CH
MPH 616	Research & Publication Ethics	2 CH
	Total	22 CH
SEMESTER – II (July –December)		
MPH 621	Seminar(At least two) 2 CH	2 CH
MPH 622	Dissertation (Interim 8CH+Final 10 CH)	18 CH
	Total	20 Credits
	Grand Total	42 Credits

The electives will be chosen from the Electives in Schedule A.

SCHEDULE-A

ELECTIVES

The Statistics students will choose any one elective from the following:

A. STATISTICAL INFERENCE
B. STOCHASTIC INFERENCE
C. ADVANCED STOCHASIC PROCESSES
D. QUEING THEORY

STATS 611: PROBABILITY THEORY & STOCHASTIC PROCESSES   (4CH)

I.   Sigma field, Borel field, Measurable space, Product space, additive set function, Measure and Probability space, Induced measure and distribution function.

II.   Independence of sequence of events and random variables, multiplication properties, random allocation of balls into cells, Borel-Cantelli theorem and characterization of independence, Tail sigma field, 0-1 law, Different types of convergence and its applications.

III.   Random walk, Gambler's Ruin Problem,
Markov Chains:- Definition, Transition Problem, classification of states, Recurrence, Examples of Recurrence Markov Chain.

IV   Birth and Death Process:
General birth and death process, Poisson Process, Differential equations of birth and death process
Martingales: - Definition and examples, upper Martingales, Super martingale and sub-Martingales, optimal sampling theorem, Martingale convergence theorem.

1. Bhat, B.R. (1985): Modern probability theory (Wiley).
2. Billingsley, P. (1986): Probability and measure (Wiley).
3. Feller, W. (1969): Introduction to probability theory and applications, Vol . II (Wiley)
4. Rohatgi, V.K. (1976): Introduction to theory of probability and mathematical Statistics (Wiley).
5. H.G. Tucker (1967): A graduate course in probability theory (AP)
6. Y.S. Chow and H Teicher(1979): Probability theory (Springer-Verlag),
7. Karlin, S and Taylor, H.M (1975): A First Course in Stochastic Processes. Academic Press.
8. Hoel, P.G., Port, S.C. and Stone, C.J. (1972): Introduction to Stochastic Processes, Houghton Miffin & Co.
9. Medhi, J. (1982): Stochastic Processes, Wiley Eastern.
10. Parzen, E. (1962): Stochastic Processes, Holden-Day.

SHEDULE-A

ELECTIVE PAPERS

MPH 612 (A) STATISTICAL INFERENCE   4 CH

I.   Experimental family of distribution, Sufficient Statistics, Rao Blackwell theorem and its applications, Convex Functions, Complete family of distribution, Bayes Theorem, Unbiased estimation, Uniformly Minimum Variance, Unbiased estimators, Information inequalities of chi square parameter and multiparameter cases.

II. Large sample comparison of estimators, Consistent and efficient Estimators , Asymptotic Efficiency .

III. Minimum Likelihood Estimators, Uniparameter and Multiparameter Cases, Bayes estimation, Minimum Estimation, Admissible estimators.

IV. Neyman and Pearsonian Test, Sequential Probability Ratio Test and its properties, Likelihood Ratio Test and its application .

BOOKS RECOMMENDED
1. Theory of Point Estimation : E.L Lehman
2. Statistical Inference : S. Jacks
3. Sequential Analysis: A. Wald
4. Testing of Hypothesis : E.L Lehman

MPH 612 (B) STOCHASTIC INFERENCE   4CH

I.   Introduction to stochastic process, Markov Chain, Birth and Death process, Martingale, Brownian Motion .
II. Large sample theory for discrete parameter stochastic process, Estimation, Efficiency test for simple hypothesis, Large sample tests, optimal asymptotic test.
III. Large sample theory for continuous stochastic process, Ito process, MLE for Ito type process,the linear case, least square estimation, study of consistency and efficiency, testing of simple hypothesis.
IV. M/M/1 , M/G/1 , G/M/1 Queue , MLE in a single server queue, Large sample inference from a single server queue, Rate of convergence , Estimation of traffic intensity .

BOOK RECOMMENDED
1. Statistical inference for stochastic processes. I.V Basawa and BLS Prakasa Rao. AP.1980
2. Statistical inference for Markov Processes. P.Billingsley . The Chicago university press,1961 .
3. Fundamentals of Queueing theory. D.Gross and C.M Harris. Willey. New York.1985. Second edition
4. A First course in Stochastic process. S. Karlin and H.M Tayler.

MPH 612 (C) ADVANCED STOCHASTIC PROCESSES   **4CH**

I. Renewal Theory, Examples, Renewal equations and elementary renewal theorem, study of residual life time, discrete time renewal theory.

II. Martingales: Definitions with examples, optimal sampling theorem, martingale convergence theorem.
Branching processes: Galton-Watson branching processes, probability of ultimate extinction.

III. Brownian motion: Joint probability for Brownian motion by martingale methods.

IV. Stationary processes: Wise sense and weak sense stationary, mean square distance, mean square error prediction, prediction of covariance, stationary processes.

BOOK RECOMMENDED
1. A first course in stochastic processes by S.Karlin and H.M.Taylor.
2. Stochastic processes: J.Medhi.
3. Elements of Applied Stochastic processes: U.N.Bhat, John Willey.

MPH 612 (D) QUEUING THEORY   **4CH**

I. The general queuing problem, Characteristics of queuing process, Deterministic queuing models, Poisson and Exponential distribution, Steady state solution, M/M/1 model, Measures of effectiveness, Waiting time distribution, Little's formula.

II. Single server queue with truncation(M/M/1/K), Transient behaviour of M/M/1 queue, busy period, Simple Markovian queue- M/M/C and M/M/C/K, Erlang's formula, Steady state rules for M/M/∞ queue, finite source queue, state dependent service.

III. Advances Markovian models- M (x)/M/1, M/M(y)/1, models and E_K/M/1,M/E_K/1, new networking.

IV. Queueing models with general arrival and service pattern- M/G/1, The Pollaczek-Khintchine formula, departure point, steady state system size probability, prove that G1/M/1 queue, Some simulations.

BOOK RECOMMENDED:
1. Queueing Theory: Gross and Harris
2. Stochastic Process: J.Medhi

MPH 613   **RESEARCH METHODOLOGY**   **4CH**

I.   Application of statistical concept/ procedures. Data, diagrammatic representation of data. Probability, Measure of Central Tendency, Measure of Dispersion, Skewness and Kurtosis, Normal Distribution, Simple Correlation, Regression Analysis, Sampling: Simple Random Sampling, Stratified Random Sampling, Systematic Sampling.

II. Testing of hypothesis tests, X^2 (chi square), F and T test: Analysis of Variance, covariance, principal component analysis; Experimental design: completely randomized block design, randomized block design, Latin square design. One-Way Analysis of Variance, Two-Way Analysis of Variance, follow up tests: Non parametric procedures; Writing of research reports.

III. Windows and/or Linux operating system; Programming fundamentals: basics of a high-level programming language C: Editing, compiling and running a program-storing data: Elementary numerical methods (as per requirement of the subject). Plotting graph: Preparing paper type using Latex.

IV. Learning software packages SPSS

BOOKS RECOMMENDED:

1. Research Methodology C.R. Kothari
2. Fundamentals of Mathematical Statistics; S.C. Gupta
3. Programming in C; Balguruswami

MPH 616   RESEARCH AND PUBLICATION ETHICS   2CH

Course Title:
- **Research and Publication ethics:** Course for awareness about publication ethics and Publication misconduct.

- **Course Level:** 2 Credit Course(30 Hrs)

- **Eligibility:**M.Phil ,Ph.D students and interested faculty members (It will made available to post graduate students at later date).

- **Fees:** As per university Rules

- **Faculty:** Interdisciplinary Studies

- **Qualifications Of Faculty Members of the Course: Ph.D in relevant subject areas having more than 10 years' of teaching experience.**

About the Course
Course Code: CPE-RPE
Over View
- This Course has total 6 units focusing on basics of philosophy of science and ethics, research integrity, publication ethics. Hands-on-sessions are designed to identify research misconduct and predatory publications. Indexing and Citations databases, open access publications, research metrics (citations, h-index, impact factor etc) and plagiarism tools will be introduced in this course.

Pedagogy
- Classroom Teaching, Guest lectures, group discussion and practical sessions.

Evaluation
- Continuous Assessment will be done through tutorials, assignments, quizzes and group discussions. Weightage will be given for active participation. Final End examination will be conducted at the end of the course.

Course Structure
- The course comprises of six modules listed in table below. Each module has 4-5 units.

Modules	Unit Title	Teaching Hours
Theory		
RPE-01	**Philosophy & Ethics**	**4**
RPE-02	**Scientific Conduct**	**4**
RPE-03	**Publication Ethics**	**7**
PRACTICE		
RPE-04	**Open Access Publishing**	**4**
RPE-05	**Publication Misconduct**	**4**
RPE-06	**Databases and Research Metrices**	**7**
	TOTAL	**30**

Syllabus in Detail
THEORY
- **RPE 01:- PHILOSOPHY AND ETHICS(3 Hrs)**

  1. Introduction to Philosophy:-Definition, Nature and scope, Concept, Branches.
  2. Ethics:- Definition, Moral Philosophy, Nature of moral judgement and reactions .

- **RPE 02:- SCIENTIFIC CONDUCT(5 Hrs)**

    1. Ethics with respect to science and research.
    2. Intellectual honesty and research integrity.
    3. Scientific misconducts:- Falsification, Fabrication and Plagiarism(FFP)
    4. Redundant Publications:- Duplicate and overlapping publications, salami slicing .
    5. Selective reporting and misrepresentation of data.

- **RPE 03:- PUBLICATION ETHICS(7 Hrs)**

    1.Publication ethics:- Definition, Introduction and importance.
    2. Best Practices/ Standards setting initiatives and guidelines:- COPE,WAME etc.
    3. Conflicts of interest.
    4.Publication Misconduct:- Definition, concepts, problems that lead to unethical behaviour , types
    5. Violation of publication ethics, authorship and contributorship
    6. Identification of publication misconduct, complaints and appeals .
    7. Predatory publishers and journals

PRACTICE

RPE-04 :-OPEN ACCSESS PUBLISHING(4 Hrs)
1. Open access publication and initatives
2. SHERPA/ROMEO Online resource to check publisher copyright and self-archiving policies.
3. Software tool to identify predatory publication published by SPPU
4. Journal finder/journal suggestion tools i.e JANE, Elsevier journal finder, springer journal suggester etc.

RPE-05:-PUBLICATION MISCONDUCT(4 Hrs)
    A. Group Discussion(2 Hrs)
        1. Subject specific ethical issues, FFP, authorship
        2. Conflicts of Interest
        3. Complaints and appeals:-Examples and fraud from India and abroad

    B. Software Tools(2 Hrs)
    Use of plagiarism software like Turintin, Urkund, and other open tool software tools

RPE-06:- DATABASES AND RESEARCH METRICS(7 Hrs)

    A. Databases(4Hrs)
     1.Indexing Databases
     2. Citation Databases:- Web of Science, Scopus etc.
B.Research Metrics(3Hrs)
1. Impact factor of journal as per journal citation report, SNIP, SJR, IPP
2. Metrics:- h-index,g-index,i-10 index, almetrics

BOOKS RECOMMENDED

Bird, A. (2006). Philosophy of Science. Routledge.

MacIntyre, Alasdair (1967) A Short History of Ethics. London. P. Chaddah, (2018) Ethics in Competitive Research: Do not get scooped; do not get plagiarized, ISBN:978-9387480865 National Academy of Sciences, National Academy of Engineering and Institute of Medicine. (2009). On Being a Scientist: A Guide to Responsible Conduct in Research: Third Edition. National Academies Press. Resnik, D. B. (2011). What is ethics in research & why is it important. National Institute of Environmental Health Sciences, 1-10. Retrieved from https://www.nichs.nih.gov/research/resources/bioethics/whatis/index.cfm Beall, J. (2012). Predatory publishers are corrupting open access. Nature, 489(7415), 179-179. https://doi.org/10.1038/489179a

Indian National Science Academy (INSA), Ethics in Science Education, Research and Governance(2019), ISBN:978-81-939482-1-7. http://www.insaindia.res.in/pdf/Ethics Book.pdf