STATISTICS

Course Structure

Course type	Course Code	Course Title	Course Type	Maximum Marks			Credit Distribution			Credits
				Internal*	Final	Total	L	T	P	
Core	RPE900C	Research and Publication Ethics	Core	25	25	50	2	0	0	2
	STA901C	Research Methodology	Core	50	50	100	3	1	0	4
	STA902C	Statistical Inference	Core	50	50	100	3	1	0	4
Research Centric	STA903C	Seminar on Recent Developments in the Area of Research	Core	Write-up-50 Presentation-30 Viva-20		100				2
Discipline Centric Electives	STA904E	Advanced Distribution Theory	Elective	50	50	100	3	1	0	4
	STA905E		Elective							
Total credits										16

Common Course for all disciplines

Course Title : Research and Publication Ethics

Course Code	:	RPE900C
Credits	:	2
Marks	:	100

UNIT 1:

Part A: Philosophy and Ethics

1. Introduction to philosophy: definition, nature and scope, concept, branches
2. Ethics: definition, moral philosophy, nature of moral judgements and reactions.

Part B: Scientific Conduct

1. Ethics with respect to science and research
2. Intellectual honest and research integrity
3. Scientific misconducts: falsification, fabrication, and plagiarism.
4. Redundant publications: duplicate and overlapping publications, salami slicing
5. Selective reporting and misrepresentation of data.

UNIT 2: Publication Ethics

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, concept, problems that lead to unethical behavior and vice verse, types
5. Violation of publication ethics, authorship and contributor ship
6. Identification of publication misconduct, complaints and appeals
7. Predatory publishers and journals

UNIT 3:

Part A: Open Access Publishing

1. Open access publications and initiatives
2. SHERPA/RoMEO online resource to check publisher copyright and self-archivingpolicies.
3. Software tool to identify predatory publications developed by SPPU
4. Journal finder/ journal suggestion tools viz. JANE, Elsevier Journal Finder, SpringerJournal Suggested, etc.

Part B: Publication Misconduct

Subject specific ethical issues, FFP, authorship, Conflicts of interest, Complaints and appeals: examples and fraud from India and abroad, Use of plagiarism software like Turnitin, Urkund and other opensource software tools.

Unit 4:

Part A: Databases

Indexing databases, Citation databases: Web of Science, Scopus, etc.

Part B. Research Metrics

Impact Factor of journal as per journal citation report, SNIP, SJR, IPP, Cite Score.Metrics: h-index, g index, i10 index, altmetrics

Books Recommended:

1. Indian National Science Academy (INSA) Ethics in Science and Education, research and government (2019) ISBN: 978-81939482-1-7 http://www.insaindia.res.in/pdf/Ethics_Books.pdf
2. P.Chaddah, (2018) Ethics in competitive Research , Do not get scooped; do not get plagiarized, ISBN: 978-9387480865
3. Beall, J (2012). Predatory publishers are corrupting open access, Nature ,(489 (7415), 179-179, http://doi.org/10.1038/489179a
4. Resnik, D.B(2011) What is ethics in research and why it is important , National Institute of Environmental Health Sciences , 1-10, retrieved from, http://niehs.nih.gov/research/resources/bioethics/whatis/index.cfm
5. National Academy of Sciences, National Academy of Engineering and Institute of Medicine(2009) on being a scientist : guide to Responsible conduct in research : Third Edition, National Academies Press
6. Bird,A. (2006) Philosophy of Science. Routledge
7. MacIntyre, Alasdair (1967) A short story of Ethics, London

CORE (C) COURSES

Course Title: Research Methodology

Course Code: STA901C
Credits: 4
Marks: 100

Unit I

Concept of research in statistics- selection of topic for research, review of literature and its use in designing a research topic. Methods of data collection and preparation Mode of literature survey-books and monographs, journals, conference proceedings, abstracting and indexing journals, e-journals/books. thesis writing – computer application in scientific research, web searching; scientific articles-statistical data base.

Unit II

Basic concepts concerning testing of hypotheses, important parametric and non parametric tests. Hypothesis testing of means, differences between means, comparing two related samples, proportions, difference between proportions, comparing a variance to some hypothesized population variance, variances of two normal populations, correlation coefficients. Limitations of tests of hypotheses. Measurement in research, measurement scales.

Unit III

Scientific word processing with LaTeX and MS-word: article, thesis report and presentation-power point features, slide preparation. Statistical programming with R: simple manipulations using numbers, vectors, objects & their attributes. Arrays, matrices, lists and data frames. Grouping loops and conditions. User defined functions, probability distributions and statistical models in R.

Unit IV

Simulation: Concepts and Advantages of Simulation-Event Type Simulation-Random Variable Generation-U(0,1), Exponential, Gamma and Normal Random Variables–Monte Carlo simulation. The MCMC Principle, Algorithms and its Variants. Computer Oriented Numerical Methods-Algorithms for Solving Algebraic Equations-Numerical Integration-Matrix operations.

Suggested Readings:

1. Anderson, J., Durston, B.H., Pooole, M. (1970). Thesis and Assignment Writing, Wiley Eastern. Ltd., New Delhi.

2. Beveridege, B. (1979). The Art of Scientific Investigation, W.E. Norton & Co., New York.

3. Braun, J., Duncan, W. and Murdock, J. (2008). A First Course in Statistical Programming with R, Cambridge University Press, London.

4. Chambers, J. (2008). Software for Data Analysis. Programming with R, Springer, New York.

5. Crewley, M.J. (2007). The R-.Book, John Wiley, New York.

6. Dalgaard, P. (2008). Introductory Statistics with R, Springer Science, New York.

7. Ghosh, J.K., Mitra, S.K. and Parthasarathy, K. R. (1992). Glilmpses of India's Statistical Heritage, Wiley Eastern Limited, New Delhi.

8. Hald, A. (1998). A History of Mathematical Statistics from 1750 to 1930, John Wiley & Sons, New York.

9. Kantiswarup, S., Gupta P.K. and Man Mohan (2008). Operations Research, Sultan Chand & Sons, New Delhi.

10. Kothari, C.R. and Garg, G. (2014). Research Methodology: Methods and Techniques, 3rd Edn., New Age International Publishers.

11. Lamport, L. (1999). LATEX: A Document Preparation System, Addison, Wesley, 2nd edition, New York.

12. Pannerselvan, R. (2006). Research Methodology, Prentice-Hall of India Pvt., New Delhi.

13. Robert, C.P. and Casella, G. (2004). Monte Carlo Statistical Methods, Springer Science, New York.

14. Venkataraman, M.K. (1998). Numerical Methods in Science and Engineering, The National Publishing Company, Chennai.

Course Title: Statistical Inference

Course Code: STA902C
Credits: 4
C Marks: 100

Unit I

Introduction and criteria of a good estimator, methods of estimation- point and interval estimation. Testing of hypotheses, null and alternative, simple and composite. Type I and Type II errors, Test function, size and power function. Concept of p-value. Review of standard one and two-sample significance tests. Most powerful tests, Neyman-Pearson lemma, Monotone Likelihood ratio property, Uniformly most powerful test.

Unit II

Likelihood Ratio (LR) Test. Construction of LR tests for normal mean and variance, one and two sample problems. Asymptotic distribution of LR test statistic. Sequential Analysis: Definition of Sequential Probability Ratio Test (SPRT). Fundamental relations among α, β, A and B. Determination of A and B in practice. Wald's fundamental identity and the derivation of O.C and ASN functions. Proof of the ultimate termination of SPRT for simple hypothesis

Unit III

Overview classical and Bayesian paradigms; Bayes theorem and its applications. Advantage of Bayesian inference, Prior distribution, Posterior distribution, Subjective probability and its uses for determination of prior distribution. Importance of non–informative priors, improper priors, invariant priors. Conjugate priors, construction of conjugate families using sufficient statistics, hierarchical priors, Parametric Empirical Bayes.

Unit IV

Bayes estimation: Concept of Loss functions, type of loss functions: Types: 0-1; Absolute error; Squared error loss functions; Asymmetric loss functions such as LINEX and General Entropy loss functions; Mixture of loss functions, risk function. Bayes credible intervals, highest posterior density intervals, Bayes testing, prior and posterior odds ratio, Bayes factor. Comparison with classical procedures. Simulation studies.

Books Recommended:

1. Lehman, E.L. (1986): Theory of Point Estimation (Student Edition)
2. Lehman, E.L. (1986): Testing Statistical Hypothesis (Student Edition)
3. Rao, C.R. (1973): Linear Statistical Inference
4. Zacks, S (1971). Theory of Statistical Inference, John Wiley and Sons, New York.
5. Robert, C.P. (1994): The Bayesian Choice: A Decision -Theoretic Motivation (Springer Verlag New York)
6. Berger, J.O. (1985): Statistical Decision Theory and Bayesian Analysis (Springer)
7. Upadyaya, S.K:, Singh, U. and Dey, D.K. eds. (2007). Bayesian Statistics and its applications. Anamaya Publisher, New Delhi.
8. Koch, K. R. (2010). Introduction to Bayesian Statistics, 2nd ed. Springer.

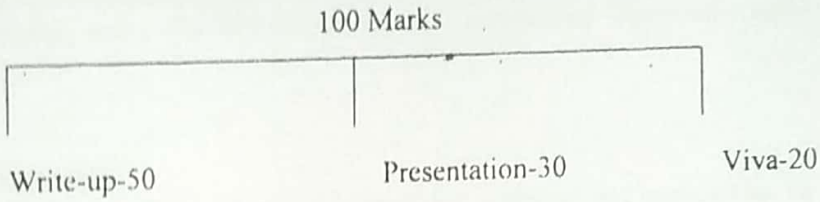
Bansal, A.K. (2007): Bayesian parametric inference, Narosa Publishing

Course Title: Seminar on Recent Developments in the Area of Research

Course Code: STA903C
Credits: 2
Marks: 100

Review of Recent literature:

Preparation of a comprehensive and critical review of the already published literature (recent 10 papers) in the proposed field of his/her study. The candidate will be evaluated on the basis of this review report and a seminar to be delivered at the end of the semester.



Discipline Centric Elective (E) Courses

Course Title: Advanced Distribution Theory

Course Code: STA904E
Credits: 4
Marks: 100

Unit I

Lagrangian Probability Distributions

Lagrangian expansion, some interesting properties of Lagrangian probability distribution (LPD), Use of Lagrangian expansion for generating probability distributions. Family of Lagrangian probability distributions (LPD), generalized Poisson distribution (GPD), generalized negative binomial distribution (GNBD), generalized geometric series distribution (GGSD) and generalized logarithmic series distribution (GLSD).

Unit II

Modified Power Series Distributions

Modified power series distributions (MPSD) – Some of its structural properties and applications, its relationship to Lagrangian probability distributions (LPD), generalized Poisson distribution (GPD), generalized negative binomial distribution (GNBD), generalized logarithmic series distribution (GLSD), generalized geometric series distribution (GGSD), Truncation of MPSD, Size-biased MPSD and its applications. Maximum Likelihood estimation and moment method of estimation of MPSD and its particular classes. Confidence interval of MPSD and its particular classes, Goodness of fit of MPSD. Bayesian estimation of MPSD.

Unit III

Inflated and Misclassified Modified Power Series Distributions

Introduction, inflated modified power series distributions (IMPSD), Structural properties of inflated modified power series distributions, Recurrence relations of inflated modified power series distributions, maximum likelihood estimation and Bayesian estimation of inflated modified power series distributions. Applications of inflated modified power series distributions.
Misclassified modified power series distributions, structural properties, estimation and their applications

Unit IV

Generalized Continuous Distributions

Genesis, definition and interpretation of generalized exponential distribution, generalized gamma distribution, generalized Weibull distribution: Structural properties- survival function and hazard function and reverse hazard rate function, moments, coefficient of variation, index of dispersion. Generating functions-probability generating functions, moment generating function, Methods of Estimation- method of moments (MM), maximum likelihood estimation (MLE).

References:

1. Consul, P.C & Famoye, F. (2006): Lagrangian Probability Distributions, ISBN: 978-0-8176-4365-2, Springer.
2. Norman L. Johnson, Adrienne W. Kemp, Samuel Kotz (2008): Univariate Discrete Distributions, 3rd Edition, John Wiley & Sons.

3. Samuel Kotz, N. Balakrishnan and Normal L. Johnson (1994): Continuous Univariate Distributions, Volume 1, 2nd Edition, John Wiley & Sons.
4. Samuel Kotz, N. Balakrishnan and Normal L. Johnson (1995): Continuous Univariate Distributions, Volume 2, 3rd Edition, John Wiley & Sons.
5. Rohatgi V.K & A.K. MD. Ehsanes Saleh (2001): An Introduction to Probability Theory and Mathematical Statistics, 2nd. John Wiley and Sons.
6. Hogg, R.V. and Craig, A.T. (1978): Introduction to Mathematical Statistics, 5/e, Pearsons Education.
7. Consul, P.C. and Shenton, L. R. (1972): Use of Lagrangian expansion for generating generalized probability distributions, SIAM, Journal of Applied Mathematics, 23, 2, 239-248.
8. Consul, P .C. and F. Famoye (1995): On the generalized negative binomial distribution. Communication in Statistics, Theory and Methods, 24(2), 459-472.
9. Gupta, P.L., Gupta, R.C. and Tripathi, R.C. (1995): Inflated modified power series distributions with applications, Communication in Statistics. -Theory and Methods.,24 (9), 2355-2374.
10. Consul, P.C. (1981): Relation of modified power series distributions to Lagrangian probability distributions, Communication in Statistics, Theory and Methods, Ser. A, 10, 2039-2046
11. Gupta, R.C. (1975a). Maximum likelihood estimation of a modified power series distribution and some o f its applications, Communication in Statistics, Theory and Methods 4(7), 689-697.
12. Ahmad, P. B. (2020): Bayesian Analysis of Misclassified Generalized Power Series Distributions Under Different Loss Functions, Journal of Statistical Theory and Applications, 19(2), 173-184.
13. Ahmad, P. B. (2016): On the Bayes Estimators of the Parameters of Size-Biased Generalized Power Series Distributions, Communications in Statistics, Theory and Methods 45(12), 3612-3624.
14. Chakraborty S. (2015), Generating Discrete Analogues of Continuous Probability Distributions—A Survey of Methods and Constructions. J Stat Dist App. 2015; 2(1):
15. Hassan, A. and Ahmad, P. B. (2014): On Bayesian Estimation of Size-Biased Modified Power Series Distributions. Journal of Applied Statistical Science (USA), 20(3), 241-255.
16. Chakraborty S. (2010). On Some Distributional Properties of the Family of Weighted Generalized Poisson Distribution. Communications in Statistics - Theory and Methods, 39 (15), 2767-2788.
17. Hassan, A. and Ahmad, P. B. (2010): On the Bayes Estimators of the Parameters of Zero-Inflated Modified Power Series Distribution. Journal of Statistical Theory and Applications (USA), 9(3), 427-441.
18. Hassan, A. and Ahmad, P. B. (2009): Misclassified Size-Biased Modified Power Series Distribution and its applications. Mathematica Bohemica, 134(1), 1-17.
19. Hassan, A. and Ahmad, P. B (2009): Misclassification in Size-Biased Modified Power Series Distribution and its applications, Journal of the Korean Society for Industrial and Applied Mathematics (South Korea), 13(1), 55-72.
20. Hassan, A. and Ahmad, P.B. (2006): Application of Non-Zero Inflated Modified Power Series Distribution in Genetics, Journal of Probability and Statistical Science (Taiwan, Republic of China), 4(2), 195-205.
21. Angers, J. and Biswas, A. (2003): A Bayesian analysis o f zero-inflated generalized Poisson model. Computational Statistics and Data Analysis, 42, 37-46.
22. Consul, P. C. (1989). Generalized Poisson distribution: Properties and Applications. New York: Marcel Dekker.
23. Consul, P. C., Famoye, F. (1988). Maximum likelihood estimation for the generalized Poisson distribution when sample mean is larger than sample variance. Communications in Statistics: Theory and Methods ; 7(1):299–309.
24. Gupta, R.D and Kundu, D. (2000): Generalized exponential distribution: different method of estimations, Journal of Statistical Computation and Simulation, 1-22.
25. Gupta, R.D and Kundu, D. (2004): Discriminating between gamma and generalized exponential distributions Journal of Statistical Computation and Simulation, 74(2), 107-121.
26. Khodabina, M. and Ahmadabadi ,A. (2010): Some properties of generalized gamma distribution, Mathematical Sciences, 4(1), 9-28.