ANNAMALAI UNIVERSITY

DEPARTMENT OF STATISTICS

M. Phil - STATISTICS (COURSE WORK)

COURSE CODE SSTA71

REGULATIONS AND SYLLABI

(FROM 2019-2020 ONWARDS)

M.Phil (STATISTICS) – SEMESTER-I
PAPER – I : RESEARCH METHODOLOGY
(COMMON TO ALL)
STATISTICAL INFERENCE

UNIT-I

Unbiasedness and consistency – Point estimation; Highest concentration Criterion; minimum MSE criterion; Unbiased estimators; Quenoulli's Method of reducing the bias in stages, Consistent estimator; BAN estimator; Case of several parameters; Sufficiency and Completeness - Sufficient Statistics; Fisher Information measure; Neyman-Fisher Factorization Theorem; minimal sufficient statistics; Complete Statistics; exponential family of distributions; Pitman's family of distributions.
(Contents as in Chapter -2 and 3 of Book-1)

UNIT-II

Minimum Variance Unbiased Estimators- Case of a single parameter; Lower bounds for variance of Unbiased estimators (Cramar-Rao Inequality) UMVUE; Bhattacharya Inequality; Chapman-Robin's Inequalit; Rao-Blackwell theorem; Lehman- Sheffee Theorem; Use of sufficient and complete statistics; case of several parameters; Method of Estimation - Method of moments; method of maximum likelihood; Fisher's iteration technique of MLE; Properties of MLE.
(Contents as in Chapter -4 and 5 of Book-1)

UNIT-III

Tests of Hypotheses – Concepts; Non-randomized and randomized tests; Critical region; Two types of errors;level of significance ; size and power of the test; Neyman Pearson Theory and Lemma, Test functions; MP tests when H and K are simple; UMP tests; monotone likelihood ratio property; Generalized NP lemma; Tests for one parameter exponential family of distributions.
(Contents as in Chapter -7 and 8of Book-1)

UNIT-IV

Locally most powerful tests UMPU tests for Multi-parameter exponential family of distribution; Tests with Neyman's structure; Likelihood ratio (LR) tests; Asymptotic distribution of the LR test criterion; LR test for testing the mean and variance of the Normal distribution based on K-samples($K \geq 1$); LR test for categorized data.
(Contents as in Chapter -8 and 9 of Book-1)

UNIT-V

Bayesian Approach -Prior and posterior distributions; non-informative priors; point estimation; interval estimation; hypothesis testing; decision theory approach; application to point estimation problems.
(Contents as in Chapter -11 of Book-1)

Books for Study and Reference:

1. **Rajagopalan,M and P.Dhanavanthan., Statistical inference, PHI Learning Private Limited, New Delhi,2012).**
2. **Gibbons, J.D. and S.Chakraborty, Nonparametric Statistical Inference, 3rd ed., Marcel Dekker,2010.**
3. **Lehman, E.L. and J.P. Romano, Testing Statistical Hypotheses, 3rd ed., Springer 2005.**
4. **Lehman, E.L. and G.Casella, Theory of Point Estimation, 2nd ed., Springer – Verlag, 1998.**
5. **Rao, C.R., Linear Statistical Inference and Its Applications, 2nd ed., Wiley, New York, 1973.**
6. **Zack, S., Parametric Statistical Inference: Basic Theory and Modern Approach, Pergamon Press 1981.**
7. **Zacks, S., The Theory of Statistical inference, John Wiley, New York, 1971.**
8. **Santhakumaran, A (2004), Probability Models and Their Parametric Estimation, K.P.Jam Publication, Chennai.**

M.Phil (STATISTICS) – SEMESTER-I

PAPER – II: AREA OF SPECIALIZATION

(COMMON TO ALL)

STOCHASTIC MODELLING

UNIT – I

Stochastic Processes- Definition and examples; Classification of stochastic processes with illustrations; Gambler's ruin problem Markov Chains ; Definition and examples; One and two dimensional random walk; Transition probabilities; Classification of States; Recurrent Markov chains; Necessary and sufficient condition for a state to be recurrent ; Basic limit theorems on recurrence; Statistical inference for Markov chains. (Section 1.2, 1.3, and 1.4 of chapters 1 and 2 of Book No.4).

UNIT – II

Basic limit thermos of Markov chains; Theorem establishing the stationery probability distribution of a positive recurrent; a periodic class of states; Absorption probabilities; Criteria for recurrence; examples. (Section 3.1, 3.3, 3.4, 3.5 and 3.7 of chapter -3 of Book No.4).

UNIT – III

Continuous time Markov chains; Examples; General pure birth process; Poisson process; its definition and properties; Birth and death processes with absorbing states; Finite state continuous time Markov Chains. (Chapter 4 of Book No.4).

UNIT – IV

Branching process; Discrete time branching process; Generating function relation; mean and variance generations – Extinction probabilities and theorems; Renewal processes ; renewal function ; renewal equation ;renewal theorems.
(Section 8.1, 8.2, 8.3, of Chapter 8), (Section 5.1, 5.2, 5.3, 5.4, 5.5 of Chapter 8 of Book No. 4).

UNIT V

Concept of reliability; components and systems; coherent systems; reliability of coherent systems; Life distributions; reliability function; hazard rate; common life distribution; Exponential; Weibull; Gamma distributions; Estimation of parameters; IFR and DFR distributions; Reliability of system with independent components; Basic idea of maintainability.

Books for Study and Reference:

1) **Medhi , J. (2002). Stochastic processes, Wiley Eastern, New York**
2) **Sheldon M.Ross (2004). Stochastic processes, John Wiley & sons**
3) **Bhat, B.R (2002). Stochastic models: Analysis and applications**
4) **Karlin, S. and H.W. Taylor, (1975), A First course in Stachastic processes, Academic Press, 2nd edn, London.**
5) **Karlin.S and H.M.Taylor (1979), A second course in Stochastic processes, Academic Press, London.**
6) **Chung, K.L. (1967) Markov chains with stationary transition probabilities, Springer Verlages NY, 2nd edition.**
7) **Prabhu.N.U, (1965) Stochastic Processes McMillan, New York.**
8) **Bharucha Reid, A.T.(1960) Markov chain with applications, John Wiley, New York.**
9) **Pandey, B.N(2007) Statistical Techniques in Life Testing, Reliability, Sampling Theory and Quality Control, Narosa Publishing House Pte. Ltd.**

M.Phil (STATISTICS) – SEMESTER-II

COURSE – III: FIELD OF RESEARCH AREA

(SYLLABUS WILL BE FRAMED AND PROVIDED BY THE RESPECTIVE GUIDE DEPENDS ON THEIR SPECIFIC RESEARCH AREA)