Department
of
Mathematics and Statistics

School of Mathematical and Physical Science

Syllabus of
Ph.D. (Statistics) Entrance Test

Session 2023-24 onward

Date of BoS -12/12/2023

Doctor Harisingh Gour Vishwavidyalaya
(A Central University)
Sagar-Madhya Pradesh-470003

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12/12/23

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Ph.D. (Statistics) Entrance Syllabus from Session 2023 onwards
Dr. Harisingh Gour Central University, Sagar (M.P)

Part A: Research Methodology

1. **Foundations of Research**
   Meaning, Objectives, Motivation, Utility. Concept of theory, empiricism, deductive and inductive theory. Characteristics of scientific method - Understanding the language of research - Concept, Construct, Definition, Variable. Research Process
2. **Problem Identification & Formulation**
   Research Question - Investigation Question - Measurement Issues - Hypothesis - Qualities of a good Hypothesis -Null Hypothesis & Alternative Hypothesis. Hypothesis Testing.
3. **Research Design**
   Concept and Importance in Research - Features of a good research design Exploratory Research Design - concept, types and uses, Descriptive Research Designs - concept, types and uses. Experimental Design: Concept of Independent & Dependent variables.
4. **Qualitative and Quantitative Research**
   Qualitative research - Quantitative research - Concept of measurement, causality, generalization, replication. Merging the two approaches.
5. **Awareness with MS-Word**, file operations, text editing operations, various table designs, insertion of tables in text, use of mathematical symbols and equation editor, use page layout and Working practice with MS-Word, Awareness with MS Excel, worksheet creation, Computations using worksheet, Use of mathematical and statistical functions, Awareness about working practice with MS-Excel.

Part B: Statistics

1. **Probability Theory**
   Sample space, discrete probability, independent events, Bayes theorem. Random variables and distribution functions; expectation and moments. Independent random variables, marginal and conditional distributions.
2. **Stochastic Processes**
   Markov chains with finite and countable state space, classification of states, limiting behaviour of n-step transition probabilities, stationary distribution, Poisson and birth-and-death processes.
3. **Probability Distribution**
   Standard discrete and continuous univariate distributions. sampling distributions, standard errors and asymptotic distributions, distribution of order statistics and range.
4. **Statistical Inference**
   Methods of estimation, properties of estimators, confidence intervals. Tests of hypotheses: most powerful and uniformly most powerful tests, likelihood ratio tests. Analysis of discrete data and chi-square test of goodness of fit. Large sample tests.
   Simple nonparametric tests for one and two sample problems, rank correlation and test for independence.
5. **Linear Models**
   Gauss-Markov models, estimability of parameters, best linear unbiased estimators, confidence intervals, tests for linear hypotheses. Analysis of variance and covariance. Fixed, random and mixed effects models. linear regression.
6. **Multivariate Analysis**
   Multivariate normal distribution, Wishart distribution and their properties. Distribution of quadratic forms.
7. **Sampling Survey**
   Simple random sampling, stratified sampling and systematic sampling. Probability proportional to size sampling. Ratio and regression methods.

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8. **Design of experiments**
   Completely randomized designs, randomized block designs and Latin-square designs. Connectedness and orthogonality of block designs.
9. **Operational Research**
   Linear programming problem, simplex methods, duality. Elementary queuing and inventory models.

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(For Department of Mathematics & Statistics)

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Chhatarpur- MP

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External Member
Deptt. of Physics,
University of Lucknow,
Lucknow - UP

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