Patna University

Courses of Study
for
B.A./B.Sc.(STATISICS)

Honours Courses

PART – I

Part I consist of two theory papers and a practical examination. The distribution of marks is as follows

Paper I (Theory)	75
Paper II (Theory)	75
Practical examination	50

(Practical to be carried over using Computers/Calculators)

Part – I 20 (based on practical problems from General Statistics of Paper – I (Theory)

Part – II 20 (based on Practical problems from Numerical Analysis I of Paper – I and Paper – II (Theory)

Practical Note-book -10

Each of the theory and practical examinations will be of three hours duration

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PAPER 1 (Theory)
(75 Marks)

The examinees will be required to answer 5 out of 10 questions selecting at least two from each Group.

Group A: General Statistics (six Questions)

Definition of statistics and its application in various fields Frequency distribution. Measures of location and dispersion. Moment, Skewness and Kurtosis and their measures. Regression and the principle of least square, Correlation coefficient, Rank correlation coefficients, Intra-class correlation coefficient, Correlation Ratio, Partial and Multiple Correlation and Regression for n variables.
Theory of Attributes including measures of association.

Group B: Numerical Analysis (Four Questions)

Introduction to difference operators and their relationship, Interpolation with equal as well as unequal intervals, Newton's and Lagrange's formulae-their derivation and uses, Central difference formulae, Gauss's Forward and Backward formulae, Stirling's and Bessel's formulae, Zero differences.
Numerical integration – Trapezoidal, Simpson's one – third, three-eight and weddle's rules Euler –Maclaurin formulae.

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PAPER II (Theory)
(75 marks)

The examinees will be enquired to answer 5 out of 10 questions in this paper.

Probability and probability distribution Algebra of sets, Set Functions. Probability as set functions. Probability as set function Critical evaluation of various definitions of probability Random variables. Probability density function, Distribution function, Generating function – PGF, MGF and CF.

Mathematical expectation, Conditional probability, Marginal and Conditional distributions, Stochastic Independence, Some special distribution viz- Binomial, Poisson, Geometric, Negative Binomial, Multinomial, Hypergeomtric, Rectangular, Normal, Exponential, Tchebychev's Inequality. Stochastic convergence, Weak law of large numbers, Central limit theorem (Lindberge Lavy's versions).

Practical Examination 50

The Practical examination will be conducted in two parts. The distribution of marks and topics part – wise will be as follows

Part – I (20 marks)

Topic: Practical problems from General Statistics of paper – I

Part – II (20 marks)

Topic – practical problems from Numerical Analysis – I of Paper – I and II
Practical Note Book: 10
Interpolation Problem based on Newton and Lagrange's formula
Mean, variance, Skewness and kurtosis

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B.A. /B.Sc. Part II Honours Course

Part II

Part II consists of two theory papers and a practical examination. The distribution or marks is as follows

Paper III (Theory)	75
Paper IV (Theory)	75
Practical: Examination	
(Practical to be carried over using Computers/Calculators)	50

The practical examination will be conducted in two parts with distribution of 50 marks as follows:

Parts I - 20 [Based on problems from Paper (III)] (Theory)
Parts II – 20 [Based on problems from Paper (IV)] (Theory)
Practical Note – book -10
Each of theory and practical examination will be of three hours duration.

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PAPER - III (Theory)

The examinees will be required to answer 5 out of 10 questions, selecting at least one question from each group

GROUP A: NUMERICAL ANALYSIS II (THREE QUESTIONS)
Inverse interpolation solutions of algebraic and transcendental equations, Difference equations with coefficients, Simple cases of numerical solutions of differential equation - Euler and modified Euler.

GROUP B: SAMPLING DISTRIBUTION (FOUR QUESTIONS)
Concept of sampling Distribution. Gamma and Beta distribution, X^2 distribution, Distribution of Sampling mean and variance, Students 't' & Snedecors' F distributions and their inter-relations, Distributions of correlation coefficient in a random sample from an uncorrelated population , Non central X^2 Distribution.

GROUP C: STANDARD ERRORS AND TEST OF SIGNIFICANCE (THREE QUESTIONS)
Standard errors of sample proportion and mean, Large sample test of significance of proportion and mean. Test of significance based on X^2, t and F distribution, fisher Z – transformation and test of significance of sample correlation coefficient from a correlated population

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PAPER IV (Theory) (75 Marks)

The examinees will be required to answer 5 questions selecting at least two from each group.

GROUP A – Design of Experiment (Five Questions)
Principles of experimentation. Meaning and purpose of randomization, replication and local control, Analysis of variance, Fixed and random effect models, Lay out and analysis of Completely randomized, randomized Block and Calm square designs, Missing plot technique when one observation is missing. Factorial experiment including two & three factors each at 2 levels, Confouading: Total, Partial and Balanced.

GROUP B – Sample Survey (Five Questions)
Sample survey versus complete enumeration, problems connected with sampling at the stage of planning, execution and analysis of large scale sample survey. Simple random sampling, Stratified random sampling, Cluster sampling with equal cluster size. Systematic sampling. Two stage sampling, Ratio and regression methods of estimation. Sources of errors in sample surveys.

Practical Examination **50 Marks**

(Practical to be carried out using Computer/Calculator)

The practical examination of 50 marks in two parts with distribution of 50 marks as follows:

Part I – 20 (Based on problems from paper III)
Part I – 20 (Based on problems from paper IV)
Practical Note book: 10

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B.A./B.Sc. Part III Honours Course

STATISTICS Honours

Part III will consist of four papers, - three theory papers viz. paper V. paper VI and Paper VII and one practical Paper. i.e. Paper VIII, each carrying 100 marks. Each of the theory papers will be of three hours duration and each of the two parts of practical examination will also be of three hours duration.

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PAPER V (Theory 100 Marks)

The examinees will be required to answer 5 out of 10 questions selecting at least one from each group.

Group A – Estimation (Five questions)

Problem of estimation, fisher's criteria of a good estimator, minimum variance unbiased estimators, Rao- Cramer Inequality. MVB estimators, Concept of sufficient statistics, Rao - Black well theorem

Properties of ML estimators (without proof) Interval estimation, Concept of confidence interval, confidence intervals for means and variance of a normal population

GROUP B - Testing of Hypothesis (Three Questions)
Problem of testing hypothesis, Definition of various hypotheses (statistical, null, simple, composite etc.) types I and type II errors, power of a test Neyman- pearson Lemma. Most powerful. UMP Test.

Sequential Probability ratio test (SRP) of a simple hypothesis against a simple alternative. O.C function and ASN function of SPRT

GROUP C: Non – Parametric Tests (Two Questions)
Concept of non parametric tests , sign tests, median test. Run test. Man whitney test, Wilcoxon test.

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Paper VI (Theory 100 Marks)

The examinees will be required to answer 5 out of 10 questions, selecting at least one from each group.

Group A - Introduction to Demography (Two questions)
Definitions and scope, Sources of data Various measures of mortality and fertility. Construction of complete and abridged life tables.

Group B- Economic statistics (five questions)
Index number their definition and purposes. Construction of index numbers Laspeyre's pasche's, Marshall-Edgeworth and fisher's Index number, cost of living and whole sale price index numbers, Time reversal and factor reversal tests.
Time series and purpose of its analysis, component of a time - series method of semi average method of moving averages, spencer 15 & 21 point formulae. Construction of seasonal indices, Elimination of trend and seasonality from original time series. Variate difference method.

Group C- Statistical Quality Control (three questions)

Concept of quality and its measurement Meaning of statistical quality control. Causes of quality variation; $\bar{X}$, R, σ (sigma), β and c controls charts. Single and double sampling inspection plans and their O C curves, amount of inspection, AOQ A.S.N and ATI Curves.

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PAPER VII
(100 marks)

Group A: Introduction to Operations research (five questions)

Definition development and scope of O.R., Linear programming; formulation of the problem, solution of L.P problems by Graphical method and Simplex method using slack and surplus variables.
Simple transportation problem and its solution through North West corner rule lowest cost cell method and Vogel's Approximation Method (VAM) Game theory. Two persons zero sum game with pure and mixed strategies.
Different types of costs involved in Inventory and production management, lead time, buffer or safety stock. Economic Ordered Quantity (EOQ) and its determination for fixed and known demand rate. Inventory models with shortages.

Elements of queuing system, pure birth and pure death processes, combined birth death process with reference to M/M/I model. transient steady and explosive state.

Group B: PSYCHOLOGICAL AND EDUCATIONAL STATISTICS (two questions)
The problem of measurement, construction of test and battery of test different types of scores- Z score standard score. Normalized score and its scope, concept of validity and reliability, index of reliability, different methods of measuring reliability.

Group C: Computer Application (two questions)
Input and output devices, number system, construction of flow chart, various types of gates, C - language, data type, constants, variables, arrays, functions, structure, union, pointers and simple problems based on C. Dynamic memory allocation and C- Programming.

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Paper VIII (Practical)

The practical examination will be conducted in two parts. The distribution of marks and topics part- wise will be as follows

Part 1- 40 marks
Topic: topics in paper V plus problems from demography of paper VI

Part II - 40 marks
Topic: - Group B and C of paper VI plus paper VII.
Practical notebook: 20 (15+5)

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Paper VIII (Practical)

The practical examination will be conducted in two parts. The distribution of marks and topics part- wise will be as follows

Part 1- 40 marks
Topic: topics in paper V plus problems from demography of paper VI

Part II - 40 marks
Topic: - Group B and C of paper VI plus paper VII.
Practical notebook: 20 (15+5)

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Subsidiary Courses

Subsidiary Part - I

There is one theory paper (75 marks) and a practical paper (25 marks)

Paper I :

GROUP A: General Statistics (Four question)

Definition and scope of statistics, frequency distribution, various measures of location and dispersion, Moments, Measure of skewness and Kurtosis. Scatter diagram, Bivariate table, Regression and method of least squares, correlation Coefficient, Standard Error of Estimate, Partial and Multiple Correlation and Regression Coefficients (for three variables only).

GROUP B: Probability & Probability Distributions (Three questions)

Concept of sample space, Events etc. Definition of Probability, Calculation of Probability by enumeration, Total and Compound theorem of probability, Concept of conditional probability Baye's theorem, Random variable, Distribution Function, Mathematical Expectation, Moment Generating Function, Geometric, Binomial, Poisson Distribution, Rectangular and Normal Distribution with their properties.

Group C: Calculus of Finite Difference (Three questions)

Introduction of Difference operators. Interpolation with equal as well as unequal intervals. Newton's and Lagrange's formulas with their proofs, Central difference formulae; Gauss's forward and Backward formulae, Stirling's formula, Trapezoidal, Simpson's one-third and three- eight rules for integration.

Practical Paper:

Practical paper will be of 25 marks and include problems based on theory paper.

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Subsidiary Part- II

The paper will contain two groups. The examinees will be required to answer in all 5 questions selecting at least two questions from each group.

GROUP A: Concept of sampling distributions, Gamma and Beta distributions, χ^2 (CHI – SQUARE) distributions.

Standard error of proportions and sample mean and their use in large sample tests. Ideas of sampling and composite hypothesis. Two types of errors, Critical region, small sample tests concerning a single mean and single variance, difference of two mean, equality of two variance and correlation coefficient, Fisher's Z transformation. Problem of estimation, Requisites of a good estimator, Maximum likelihood estimation, confidence interval for mean of a normal population.

GROUP B: Design of Experiments and Sample Survey

Principles of experimentations, meaning and purpose, randomization, replication and local control, Methods of analysis of variance (ANOVA) in case of one way and two way classification, Layout and analysis of completely randomized design, randomized block design and Latin square design 2n-factorial experiments (excluding confounding). Advantage of sampling over complete enumeration : Planning and organization of sample survey, sources of errors in sampling, simple random sampling and stratified random sampling.

Practical Paper:

Practical paper will be of 25 marks and include problems based on theory paper.

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