

Post Graduate Curriculum Framework

With effect from the Academic Session 2026–27, the M.A./M.Sc. STATISTICS programme in the Universities of Bihar shall be offered in accordance with the UGC Curriculum and Credit Framework for Postgraduate Programmes (PGCF) and the provisions of the National Education Policy (NEP), 2020.

The programme provides flexibility to students to pursue either a Two-Year Master's Degree Programme or a One-Year Master's Degree Programme for candidates who have completed a four-year undergraduate degree with the requisite credits and qualifications as prescribed by UGC.

The curriculum is designed under the Choice Based Credit System (CBCS) and comprises a combination of Core Courses (CCs), Discipline Specific Electives (DSEs), Generic Electives (GEs), Skill Enhancement Courses (SECs), Ability Enhancement Courses (AECs), and Value Added Courses (VACs). The programme seeks to impart advanced theoretical knowledge, computational proficiency, research aptitude, and practical skills in Statistics and its applications.

Each academic year shall consist of two semesters. Students shall be required to successfully complete the prescribed combination of Core, Elective (Discipline/Generic/Open), Skill Enhancement, Ability Enhancement, and Value Added Courses in each semester to fulfil the credit requirements of the programme.

The curriculum incorporates contemporary developments in Statistics, including Probability, Distribution theory, Inference theory, Sample survey. The syllabus and reading materials shall be reviewed periodically to ensure alignment with emerging developments in academia, research, industry, and public policy.

Teaching-learning methodologies may include lectures, tutorials, seminars, laboratory sessions, statistical computing exercises, case studies, project work, field-based applications, and research assignments. Practical training shall provide hands-on experience in the use of statistical software packages, data analysis techniques, computational tools, and real-world problem-solving.

Assessment shall be conducted through a combination of continuous evaluation and end-semester examinations, including assignments, presentations, practical examinations, projects, viva-voce examinations, and written tests, as prescribed by the authorities concerned from time to time.

Students shall have the opportunity to choose elective and generic courses in accordance with their academic interests, subject to the availability of courses and institutional regulations, thereby promoting interdisciplinary learning and specialization within the broad domain of Statistics.



24/07/26
(Kalpana Srivastava)
Officer-On-Special Duty (Judl.)

Syllabus
For
Master of Arts/Science Programme
in
STATISTICS
Under Choice Based Credit System
(CBCS)
(2026-27 onwards)
of
NEW EDUCATION POLICY-2020



24/07/26

(Kalpana Srivastava)
Officer-On-Special Duty (Judl.)

Statistics

Course Structure of two-Year M.A. / M.Sc. Course in Statistics

1. Programme Details

Course of Statistics	
M.A./M.Sc. Statistics	
Programme Level	Master of Arts/Master of Science in Statistics
Subject	Statistics
Faculty	Faculty of Social Sciences/ Science
University	Universities of Bihar Established under the BSU AC 1976/PU Act 1976.
Duration	Two Years / Four Semesters
NHEQF Level	Level 6.5
Effective From	2026-27 onwards

A

PART A — PROGRAMME OVERVIEW & OBJECTIVES

A.1 Graduate Attributes (GAs)

The programme nurtures the following Graduate Attributes in alignment with the National Higher Education Qualifications Framework (NHEQF) Level 6.5: **Students completing a postgraduate programme in Statistics should develop the following Graduate Attributes:**

- Demonstrate a strong understanding of statistical theories, methods, and applications.
- Use statistical software and programming tools effectively for data collection, management, analysis, and visualization.
- Apply statistical methods to address real-world problems in health, social sciences, business, industry, and public policy.

A postgraduate Statistics graduate should be able to interpret data, conduct high-quality research, solve complex problems, use modern statistical tools, communicate findings effectively, and statistical knowledge ethically for societal benefit.

A.2 Programme Outcomes (POs)

1. **PO:1** Demonstrate advanced knowledge of core and emerging areas of Statistics.
2. **PO:2** Offering exposure to a range of statistical software packages, enhancing proficiency in both analysis and programming.



Kalpana

24/07/26



(Kalpana Srivastava)
Officer-On-Special Duty (Judl.)

3. **PO:3** To inculcate and develop aptitude to understand and apply statistical tools at a number of data generating fields in real life problems.

4. **PO:4** To teach a wide range of statistical skills, including problem-solving, project work and presentation so as enable students to take prominent roles in a wide spectrum of employment and research.

A.3 Programme Specific Outcomes(PSOs)

Upon successful completion of this programme, a student shall demonstrate the following learning outcomes.

5. PSO 1 — [Disciplinary Knowledge] Demonstrate comprehensive knowledge of the theories, concepts, and evolving paradigms of Statistics.

6. PSO 2 — [Critical Thinking & Analysis] Apply principles of scientific inquiry and critical thinking to solve problems and make informed decisions, systematically finding, analysing, evaluating, and applying information.

7. PSO 3 — [Research Competence] Apply statistical principles effectively in managing projects both individually and within diverse teams, fostering multidisciplinary collaboration.

8. PSO 4 — [Communication] Effectively communicate statistical concepts and activities to peers and society, including comprehension of writing effective reports, designing documentation, and delivering presentations.

9. PSO 5 — [Ethics & Social Responsibility] Analyse ethical issues relevant to academia, profession, and research, adhering to ethical norms in data analysis and research practices.

B

PART B — COURSE STRUCTURE (CBCS/NHEQF FRAMEWORK)

B.1 Semester-wise Course Structure

The following table presents the full four-semester course structure. Column headings: L = Lectures per week; T = Tutorials per week; P = Practicals per week; CC = Core Course; DSE = Discipline Specific Elective; GE/OE = Generic/Open Elective; SEC = Skill Enhancement Course; PROJ = Project/Dissertation.

Semester-I								
Sl. No	Paper Code	Title of the Paper	L	T	P	Credits	Max. Marks	Type
1	MSSTA-CC-101	Measure Theory & Probability	3	1	0	4	100	CC
2	MSSTA-CC-102	Time Series Analysis and Forecasting	3	1	0	4	100	CC



K. Sudan

24/07/26 

(Kalpana Srivastava)
Officer-On-Special Duty (Judl.)

3	MSSTA-CC-103	Liner Models & Regression Analysis	3	1	0	4	100	CC
4	MSSTA-PR-104	Practical	0	0	4	4	100	PR
5	MSSTA-GE-105/106	General Elective Course (select one from the basket)	3	1	0	4	100	GE
6		VAC-1/AEC-1/SEC-1	2	0	0	2	100	VAC/AEC/SEC
		Total – Semester I	14	4	4	22	600	

Semester-II

Sl. No	Paper Code	Title of the Paper	L	T	P	Credits	Max. Marks	Type
1	MSSTA-CC-201	Advanced Distribution Theory & Order Statistics	3	1	0	4	100	CC
2	MSSTA-CC-202	Advanced Inference Theory	3	1	0	4	100	CC
3	MSSTA-CC-203	Advanced Sampling Theory	3	1	0	4	100	CC
4	MSSTA-PR-204	Practical	0	0	4	4	100	PR
5	MSSTA-GE-205/206	General Elective Course (select one from the basket)	3	1	0	4	100	GE
6		VAC-1/AEC-1/SEC-1	2	0	0	2	100	VAC/AEC/SEC
		Total – Semester II	14	4	4	22	600	

General Elective Course for Other Departments

Particulars	Semester	Course Code	Course Title
Basket I	I	MAECO-GE105	Advanced Statistical Methods
		MAECO-GE106	Statistical Computing in R
Basket II	II	MAECO-GE205	Statistical Inference Theory
		MAECO-GE206	Sample Survey & Design of Experiment






24/07/26

(Kalpana Srivastava)
Officer-On-Special Duty (Judl.)

C.1 Paper Identification

PAPER PROFILE	
Paper Code	MSSTA-CC101
Title of the Paper	Measure Theory & Probability
Programme / Subject	[MSc] — [Statistics]
Semester	Semester I
Nature of Course	Core Course (CC)
L – T – P	3 – 1 – 0
Credits	4
Maximum Marks	100 (ESE: 70 + Internal Assessment: 30)
Duration of Examination	3 Hours

C.2 Marks Distribution

Component	Paper	IA	Total (ESE+IA/ESE)
End Semester Examination	70	—	70
Internal Assessment	—	30	30
Maximum Marks	70	30	100
Passing Marks	32	13	45 (45%)

Note: Internal Assessment shall be conducted on the basis of attendance, class tests, seminars, assignments, and viva voce as provided in the regulation.

C.3 Course Objectives(COBs)

COB No.	Course Objectives
COB 1	The objective for this course is to learn the theory and methods of probability theory.





(Kalpana Srivastava)
Officer-On-Special Duty (Judl.)

24/07/26

COB 2	Understand the basic theory on the basis of examples and applications.
COB 3	Able to apply and communicate them in practice.
COB 4	Use abstract methods to solve problems and to use a wide range of references and critical thinking.

C.4 Course Outcomes (COs)

CLO No.	Course Learning Outcomes
CLO 1	A student will be able to: Recognize the role of probability theory in the sciences, communicate the ideas and results of probability.
CLO 2	Graduate students will also be able to formulate and apply the definitions of convergence in distribution and in probability, formulate scientific problems involving randomness in mathematical terms, and use probability in their careers.
CLO 3	Understand the concept and role of inequalities.
CLO 4	Use weak and strong law of large numbers in statistical theory.

C5. Course Name: Measure Theory & Probability (MSSTA-CC101)		
Unit	Content	Suggested Lectures hours
I	Fields, sigma-fields and generators, semi-fields, Borel sigma-field on $\mathbb{R}$. Monotone classes, monotone class theorem, π - λ theorem. Measures, finite, sigma-finite measures. Probability measures, properties. Independence of events, Borel-Cantelli lemmas. Measurable functions and properties, Generated sigma-fields. Induced measures Compositions. Examples.	11
II	Product sigma-fields, Borel sigma-field on Euclidean spaces. Extensions of measures, Caratheodory's theorem (statement). Lebesgue measure on $\mathbb{R}$ and $\mathbb{R}^k$: construction, properties.	07
III	Random variables and vectors, probability distributions, distribution functions. Convergence in measure, almost everywhere and their connection.	06
IV	Integration: simple, nonnegative, general measurable functions, integrability, Monotone Convergence Theorem, Dominated	11







(Kalpana Srivastava)
Officer-On-Special Duty (Judl.)

	Convergence Theorem, Fatou's lemma. Change of variables. Lp spaces, Holder's and Minkowski's inequalities. Expectations, Moment inequalities – Chebychev, Markov, Liapunov, Minkowski, Cauchy-Schwartz, Kolmogorov and Jensen. Generating functions.	
V	Absolute continuity and singularity of measures. Radon-Nikodym Theorem (Statement). Discrete and absolutely continuous distributions. Lebesgue's differentiation theorem (statement), probability densities. Strong law of large numbers, Central limit theorem – Lindberg-Levy, Liapunov & Lindberg	10
	Total Suggested Lectures	45

C.6. Prescribed Books:

1. Barra, G.D. (1981), Measure Theory and Integration, New Age International (P)Ltd. Publisher, New Delhi.
2. Bhat, B.R. (2014). Modern Probability Theory, 04th edition, New Age International.

C.7. Reference Books & Readings:

1. Billingsley, P. (2012) , Measure Theory and Probability , Wiley.
2. Rohatagi, V.K. and Saleh, A.K. Md . E. (2015), An Introduction to Probability and Statistics, Wiley.

C.7. Suggested E-Resources/Digital Repositories:

SWAYAM / NPTEL: Measure Theoretic Probability
(https://onlinecourses.nptel.ac.in/noc23_ma47/preview?tm_source=chatgpt.com)

e-PG Pathshala: Mathematics Portal (Probability, Measure Theory and related postgraduate modules) [e-PG Pathshala Mathematics Portal](#)

C.8 Assessment Pattern & Question Paper Design

The End-Semester shall be conducted as per the following question paper design:

Section A: Short Answer Questions (10×2 marks = 20 marks)- Covering all units (mandatory)

Section B: Medium Answer Questions (4×5 marks = 20 marks) - Attempt any 4 out of 6

Section C: Long Answer / Essay Questions (3×10 marks = 30 marks)- Attempt 3 out of 5.

Internal Assessment (30 marks) breakdown:

Written Test(s): 20 marks

Seminar / Assignment / Project: 05 marks





24/07/26

(Kalpana Srivastava)
Officer-On-Special Duty (Judl.)

Attendance & Class Participation: 05 marks

C.1 Paper Identification

PAPER PROFILE	
Paper Code	MSSTA-CC102
Title of the Paper	Time Series Analysis and Forecasting
Programme / Subject	[MSc] — [Statistics]
Semester	Semester I
Nature of Course	Core Course (CC)
L – T – P	3 – 1 – 0
Credits	4
Maximum Marks	100 (ESE: 70 + Internal Assessment: 30)
Duration of Examination	3 Hours

C.2 Marks Distribution

Component	Paper	IA	Total (ESE+IA/ESE)
End Semester Examination	70	—	70
Internal Assessment	—	30	30
Maximum Marks	70	30	100
Passing Marks	32	13	45 (45%)

Note: Internal Assessment shall be conducted on the basis of attendance, class tests, seminars, assignments, and viva voce as provided in the regulation.

C.3 Course Objectives(COBs)

COB No.	Course Objectives
COB 1	The objective of this course is to provide students with a solid foundation in time series analysis and forecasting techniques.
COB 2	By covering the most basic and essential concepts and using hands-on practice the course intends to instill the proficiency of analyzing and forecasting business



24/07/26

(Kalpana Srivastava)
Officer-On-Special Duty (Judl.)

	and economic time series data.
COB 3	Students Acquired the Skills to Measure and Analyze the Cyclic Component of Time Series Data using Methods such as Harmonic and Periodogram Analysis.
COB 4	Students Attained the Knowledge and Understanding of equipping them to model, analyze, and predict time-dependent data effectively .

C.4 Course Outcomes (COs)

CLO No.	Course Learning Outcomes
CLO 1	Acquire knowledge of various advanced econometric models, estimation methods and related econometric theories.
CLO 2	Conduct econometric analysis of data
CLO 3	Understand Auto-covariance, auto-correlation function and Vector Autoregression.
CLO 4	Understand the use of auto regressive models for stochastic volatility.

C.5 Syllabus Course Name: Time Series Analysis and Forecasting (MSSTA-CC102)

Course Name: Time Series Analysis and Forecasting (MSSTA -CC102)		
Unit	Content	Suggested Lectures hours
I	Introduction to time series, its various applications, , Autocorrelation and serial correlation, Effect of autocorrelation on OLS estimators, Detection of presence of autocorrelation in time series: Graphical method, run test, Durbin-Watson test, The Wallis Test, Breusch-Godfrey Test, Box-Pierce-Ljung Statistic, Autocorrelation function (ACF) and Partial Autocorrelation function (PACF), Yule-walker equation.	10
II	Introduction to Autoregressive processes (AR), AR(1) and AR(2) processes. White Noise, Introduction to Moving Average process (MA), MA(1) and MA(2) processes. Introduction to Auto regressive moving average processes (ARMA), ARMA (1,1) process, Estimation of parameters of AR, MA and ARMA processes	09
III	Stationarity in Time Series, trend stationary and difference stationary time series, Detection of stationarity in time series: by using graphical	10




24/07/26



(Kalpana Srivastava)
Officer-On-Special Duty (Judl.)

	inspection method, using integrated series, using unit root test, Dickey-Fuller test for unit root hypothesis, Augmented Dickey-Fuller (ADF) test for difference stationarity against trend stationarity. Introduction to Auto regressive integrated moving average processes (ARIMA), Identification of order for ARIMA models, Introduction to Seasonal Autoregressive Integrated Moving Average (sARIMA) process.	
IV	Vector Auto Regression (VAR) model, Testing of order of VAR, the Granger Causality Test, Impulse response function, variance decomposition and forecasting using VAR models, VAR(1) and VAR(2) processes.	08
V	Introduction of Stochastic Volatility Models, Autoregressive Conditional Heteroscedastic (ARCH) Models, Order determination for ARCH models, Generalized ARCH (GARCH) Models, properties of GARCH models, Forecasting in ARCH and GARCH models.	08
Total Suggested Lectures		45

C.6. Prescribed Books:

- 1.Box GEP, Jenkins GM and Reinsel GC. (2007): Time Series Analysis, Forecasting and Control, Pearson Educaion.
2. Chatfield C., (2001): Time Series Forecasting, Chapman & Hall/CRC Press.
3. Mills TC. (2019): Applied Time Series Analysis: A practical Guide to Modelling and Forecasting, Academic Press

C.7. Reference Books & Readings:

1. Cryer JD., Chan KS. (2008): Time Series Analysis with Applications in R, Springer
2. Chatfield C. (2016), The Analysis of Time Series: An Introduction, CRC Press.
3. Makridakis S., Wheelwright S.C., Hyndman R.J. (1998): Forecasting: Methods and Applications, Wiley Publications

C.7. Suggested E-Resources/Digital Repositories:

SWAYAM / NPTEL: Introduction to Time series (<https://onlinecourses.nptel.ac.in/>)

e-PG Pathshala: Mathematics – Introduction to Econometric w (<https://epgp.inflibnet.ac.in/>)

C.8 Assessment Pattern & Question Paper Design

The End-Semester shall be conducted as per the following question paper design:

Section A: Short Answer Questions (10 × 2 marks = 20 marks)- Covering all units (mandatory)

Section B: Medium Answer Questions (4 × 5 marks = 20 marks) - Attempt any 4 out of 6





(Kalpana Srivastava)
Officer-On-Special Duty (Judl.)

Section C: Long Answer / Essay Questions (3×10 marks = 30 marks)- Attempt 3 out of 5.

Internal Assessment (30 marks) breakdown:

Written Test(s): 20 marks

Seminar / Assignment / Project: 05 marks

Attendance & Class Participation: 05 marks

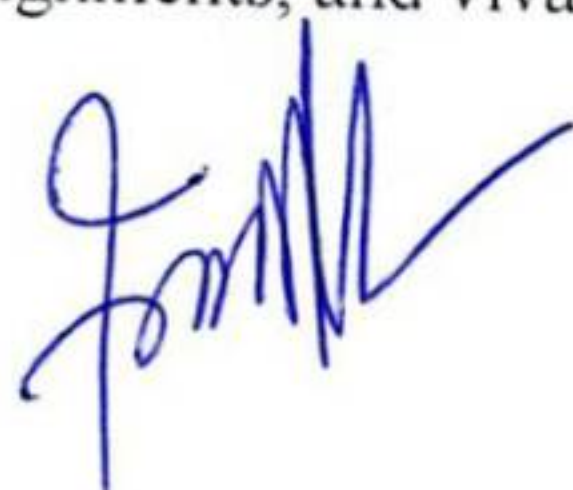
C.1 Paper Identification

PAPER PROFILE	
Paper Code	MSSTA-CC103
Title of the Paper	Linear Models & Regression Analysis
Programme / Subject	[MSc] — [Statistics]
Semester	Semester I
Nature of Course	Core Course (CC)
L – T – P	3 – 1 – 0
Credits	4
Maximum Marks	100 (ESE: 70 + Internal Assessment: 30)
Duration of Examination	3 Hours

C.2 Marks Distribution

Component	Paper	IA	Total (ESE+IA/ESE)
End Semester Examination	70	—	70
Internal Assessment	—	30	30
Maximum Marks	70	30	100
Passing Marks	32	13	45 (45%)

Note: Internal Assessment shall be conducted on the basis of attendance, class tests, seminars, assignments, and viva voce as provided in the regulation.



24/07/26
(Kalpana Srivastava)
Officer-On-Special Duty (Judl.)

C.3 Course Objectives(COBs)

COB No.	Course Objectives
COB 1	This course is intended to train students to get knowledge in theoretical and practical applications of regression techniques.
COB 2	Gain insights into transaction management and query processing techniques, facilitating effective data manipulation and retrieval within a database environment.
COB 3	Comprehend the principles of regression analysis and the fundamental assumptions underlying it

C.4 Course Outcomes (COs)

CLO No.	Course Learning Outcomes
CLO 1	A student will be able to: understand the basic concepts and assumptions of linear models. Develop an understanding of estimation and testing of in linear model.
CLO 2	Students will be able to perform predictive analytics for real life problems.
CLO 3	Evaluate the goodness-of-fit of regression models using appropriate metrics
CLO 4	Identify and address specification errors in regression models through rigorous testing procedures

C.5 Syllabus Course Name: Linear Models & Regression Analysis (MSSTA-CC103)

Course Name: Linear Models & Regression Analysis (MSSTA -CC103)		
Unit	Content	Suggested Lectures hours
I	Gauss-Markov linear Models, theory of linear estimation, Estimability of linear parametric functions, method of least squares, normal equations, Gauss-Markov theorem, Estimation of error variance. Distribution of quadratic forms.	09
II	Simple linear regression model. Least-squares estimation of parameters. Hypothesis testing on the slope and intercept. Interval	08



24/07/26

(Kalpana Srivastava)
Officer-On-Special Duty (Judl.)

	estimation in simple linear regression. Prediction of new observations. Coefficient of determination	
III	Estimation by maximum likelihood. Multiple linear regression: Multiple linear regression models. Estimation of the model parameters. Hypothesis testing in multiple linear regression. Confidence intervals in multiple regression. Coefficient of determination and Adjusted R^2	09
IV	Checking of linearity between study and explanatory variable, Residual Analysis, Detection and treatment of outliers, Residual plots. The PRESS statistic. Outlier test based on Studentized Residual ($R_{student}$). Test for lack of fit of the regression model	08
V	Transformation and Weighting to Correct Model Inadequacies: Variance stabilizing transformations. Transformations to linearize the model. Analytical methods for selecting a transformation on study variable. Diagnostic for Leverage and Influence: Leverage, measures of influence. Polynomial Regression Models: Polynomial models in one variable. Computational techniques for variable selection. Logistic Regression: Introduction, Linear predictor and link functions, logit, probit, odds ratio, test of hypothesis.	11
	Total Suggested Lectures	45

C.6. Prescribed Books:

1. Bapat, R.B. (2012). Linear Algebra and Linear Models, Hindustan Book Agency.
2. Montgomery, D.C., Peck, E.A. & Vining, G.G. (2015). Introduction to Linear Regression Analysis, Wiley.

C.7. Reference Books & Readings:

1. Khuri, A.I. (2010). Linear Model Methodology. CRC Press.
2. Rao, C.R. (2009). Linear Statistical Inference and its Applications, Wiley.
3. Draper, N.R. & Smith, H. (2011). Applied Regression Analysis, Wiley

C.7. Suggested E-Resources/Digital Repositories:

SWAYAM / NPTEL: Linear Regression Analysis and Forecasting
(https://nptel.ac.in/courses/111104098?utm_source=chatgpt.com)

e-PG Pathshala: Regression Analysis (<https://epgp.inflibnet.ac.in/>)

C.8 Assessment Pattern & Question Paper Design

The End-Semester shall be conducted as per the following question paper design:





(Kalpana Srivastava)
Officer-On-Special Duty (Judl.)

24/07/26

Section A: Short Answer Questions (10×2 marks = 20 marks)- Covering all units (mandatory)

Section B: Medium Answer Questions (4×5 marks = 20 marks) - Attempt any 4 out of 6

Section C: Long Answer / Essay Questions (3×10 marks = 30 marks)- Attempt 3 out of 5.

Internal Assessment (30 marks) breakdown:

Written Test(s): 20 marks

Seminar / Assignment / Project: 05 marks

Attendance & Class Participation: 05 marks

C.1 Paper Identification

PAPER PROFILE	
Paper Code	MSSTA-PR104
Title of the Paper	Practical
Programme / Subject	[MSc] — [Statistics]
Semester	Semester I
Nature of Course	Core Course (CC)
L – T – P	0– 0 – 4
Credits	4
Maximum Marks	100 (ESE: 70 + Internal Assessment: 30)
Duration of Examination	3 Hours

C.2 Marks Distribution

Component	Practical	IA	Total (ESE+IA/ESE)
End Semester Examination	70	—	70
Internal Assessment	—	30	30
Maximum Marks	70	30	100
Passing Marks	32	13	45 (45%)



24/07/26
(Kalpana Srivastava)
Officer-On-Special Duty (Judl.)

Note: Internal Assessment shall be conducted on the basis of attendance, class tests, seminars, assignments, and viva voce as provided in the regulation.

C.3 Course Objectives(COBs)

COB No.	Course Objectives
COB 1	This course is intended to train students to get knowledge in theoretical and practical applications of regression techniques.
COB 2	Hands-on skills to model, analyze, and forecast sequential data.
COB 3	Comprehend the principles of regression analysis and the fundamental assumptions underlying it

C.4 Course Outcomes (COs)

CLO No.	Course Learning Outcomes
CLO 1	Plotting data to identify patterns, missing values, and outliers and forecast.
CLO 2	Students will be able to perform predictive analytics for real life problems.
CLO 3	Evaluate the goodness-of-fit of regression models using appropriate metrics
CLO 4	Identify and address specification errors in regression models through rigorous testing procedures

C.5 Syllabus Course Name: Practical (MSSTA-PR104)

Course Name: Practical (MSSTA -PR104)		
Unit	Content	Suggested Lectures hours
I	Exercises/Problems: Introduction to R/Python, environment and R Studio, installation, data types and data structures, simple manipulations of data, vectors and vector arithmetic, arrays and matrices, lists and data frames, Statistics Methods and techniques in R. Descriptive statistics and tables. loops and conditional execution, writing R functions, different types of graphs,	26





24/07/26

(Kalpana Srivastava)
Officer-On-Special Duty (Judl.)

	plots etc.	
II	Exercises/Problems: Compute least squares estimates from given data. Illustrate distribution of quadratic forms. Fit regression models to real-life data (height–weight, sales–advertising). Compute and interpret regression diagnostics. Based on Calculator, Excel & R or Python Programming as per suitability.	22
III	Exercises/Problems: Apply Box–Cox transformation to correct non-normality. Identify high-leverage points in a dataset. Fit polynomial regression to growth data. Based on Calculator, Excel & R or Python Programming as per suitability.	20
IV	Exercises/Problems: Fit logistic regression to binary outcome data (e.g., disease/no disease vs. age, smoking). Based on Calculator, Excel & R or Python Programming as per suitability.	24
V	Exercises/Problems: Fitting linear, quadratic, and exponential curves using the Method of Least Squares. Calculating moving averages for trend smoothing. Identifying, estimating, and diagnosing AR, MA, ARMA, ARIMA, and SARIMA models. Based on Calculator, Excel & R or Python Programming as per suitability.	28
	Total Suggested Lectures	120

C.6. Prescribed Books:

1. Bapat, R.B. (2012). Linear Algebra and Linear Models, 3rd Edition. Hindustan Book Agency.
2. Montgomery, D.C., Peck, E.A. & Vining, G.G. (2015). Introduction to Linear Regression Analysis, 5th Edition. Wiley.





24/07/26

(Kalpana Srivastava)
Officer-On-Special Duty (Judl.)

C.7. Reference Books & Readings:

1. Brokweil, P.J and Davis. R.A (1987). Time Series: Theory and Methods, Springer - Verlag, New York.
2. Chambers, J. (2008). Software for Data Analysis: Programming with R, Springer.
3. Jones, O., Maillardet, R. and Robinson, A.(2009). Introduction to Scientific Programming and Simulation using R, CRC.

C.8 Assessment Pattern & Question Paper Design

The End-Semester shall be conducted as per the following question paper design:

Lab Problem (25× 2 marks = 50 marks)- Covering all units (mandatory)

Viva-voce 20 marks

Internal Assessment (30 marks) breakdown:

Written Test(s): 20 marks

Seminar / Assignment / Project: 05 marks

Attendance & Class Participation: 05 marks

C.1 Paper Identification

PAPER PROFILE	
Paper Code	MSSTA-CC201
Title of the Paper	Advanced Distribution Theory & Order Statistics
Programme / Subject	[MSc] — [Statistics]
Semester	Semester II
Nature of Course	Core Course (CC)
L – T – P	3 – 1 – 0
Credits	4
Maximum Marks	100 (ESE: 70 + Internal Assessment: 30)
Duration of Examination	3 Hours

C.2 Marks Distribution

Component	Paper	IA	Total (ESE+IA/ESE)
-----------	-------	----	--------------------



24/07/26
(Kalpana Srivastava)
Officer-On-Special Duty (Judl.)

End Semester Examination	70	—	70
Internal Assessment	—	30	30
Maximum Marks	70	30	100
Passing Marks	32	13	45 (45%)

Note: Internal Assessment shall be conducted on the basis of attendance, class tests, seminars, assignments, and viva voce as provided in the regulation.

C.3 Course Objectives(COBs)

COB No.	Course Objectives
COB 1	This course is intended to train students in mathematical techniques of constructing various univariate, bivariate and multivariate distributions.
COB 2	Understand the basic theory of distribution and applications.
COB 3	Able to apply and communicate them in practice.
COB 4	Use abstract methods to solve problems and to use a wide range of references and critical thinking.

C.4 Course Outcomes (COs)

CLO No.	Course Learning Outcomes
CLO 1	A student will be able to: Recognize the role of probability theory in the sciences, communicate the ideas and results of probability.
CLO 2	Students will learn about the characterizations of univariate, bivariate and multivariate distributions, its applications and theory of order statistics.
CLO 3	Understand the concept and role of order Statistics.
CLO 4	Use of distribution in statistical theory.

C.5 Syllabus Course Name: Advanced Distribution Theory & Order Statistics (MSSTA -CC201)

Course Name: Advanced Distribution Theory & Order Statistics (MSSTA -CC201)




24/07/26



(Kalpana Srivastava)
Officer-On-Special Duty (Judl.)

Unit	Content	Suggested Lectures hours
I	Random variable, pmf, pdf, Joint, marginal and conditional distributions. Computations of probability, expectations and variances by conditioning, generating functions (m.g.f and p.g.f) of random variables, Bivariate and Multivariate p.g.f, their properties and applications.	12
II	Functions of random variables and their distributions using JaCLOian and other tools, convolution and compound distributions; idea of truncated and mixture distributions.	09
III	Some continuous distributions (Exponential, Gamma, Beta, Cauchy, Pareto, Weibull, lognormal), Bivariate normal and bivariate exponential distributions and their properties, multinomial distribution.	09
IV	Central and non - central Chi-square, t- and F-distributions and their properties.	06
V	Order statistics and their distributions and properties. Joint, marginal distributions of order statistics. Distribution of extreme values and range and asymptotic distribution of median.	09
Total Suggested Lectures		45

C.6. Prescribed Books:

1. Hogg, R.V. and Craig, A.L. (1978). Introduction to Mathematical Statistics, McMillan, New York.
2. Mood, A.M., Graybi, F.A. and Boes, D.C. (2001). Introduction to Theory of Statistics, Tata McGraw Hill, New Delhi.

C.7. Reference Books & Readings:

1. Rohatagi, V.K. and Saleh, A.K. Md . E. (2015), An Introduction to Probability and Statistics, Wiley.

C.7. Suggested E-Resources/Digital Repositories:

SWAYAM / NPTEL: Probability and Statistics Courses
(https://nptel.ac.in/courses/111104098?utm_source=chatgpt.com)

e-PG Pathshala: Mathematics – Statistical Distribution Theory (<https://epgp.inflibnet.ac.in/>)

24/07/26

(Kalpana Srivastava)
Officer-On-Special Duty (Judl.)

C.8 Assessment Pattern & Question Paper Design

The End-Semester shall be conducted as per the following question paper design:

Section A: Short Answer Questions (10×2 marks = 20 marks)- Covering all units (mandatory)

Section B: Medium Answer Questions (4×5 marks = 20 marks) - Attempt any 4 out of 6

Section C: Long Answer / Essay Questions (3×10 marks = 30 marks)- Attempt 3 out of 5.

Internal Assessment (30 marks) breakdown:

Written Test(s): 20 marks

Seminar / Assignment / Project: 05 marks

Attendance & Class Participation: 05 marks

C.1 Paper Identification

PAPER PROFILE	
Paper Code	MSSTA-CC202
Title of the Paper	Advanced Inference Theory
Programme / Subject	[MSc] — [Statistics]
Semester	Semester II
Nature of Course	Core Course (CC)
L – T – P	3 – 1 – 0
Credits	4
Maximum Marks	100 (ESE: 70 + Internal Assessment: 30)
Duration of Examination	3 Hours

C.2 Marks Distribution

Component	Paper	IA	Total (ESE+IA/ESE)
End Semester Examination	70	—	70
Internal Assessment	—	30	30



24/07/26

(Kalpana Srivastava)
Officer-On-Special Duty (Judl.)

Maximum Marks	70	30	100
Passing Marks	32	13	45 (45%)

Note: Internal Assessment shall be conducted on the basis of attendance, class tests, seminars, assignments, and viva voce as provided in the regulation.

C.3 Course Objectives (COBs)

COB No.	Course Objectives
COB 1	The objective of the course is to learn the basic concepts in estimation theory like consistency, sufficiency, UMVUE and their applications.
COB 2	To study different methods of estimation and their properties.
COB 3	The present course provides insight to some important concepts that shall provide a solid foundation to several courses taught in this post graduate programme.
COB 4	Use abstract methods to solve problems and to use a wide range of references and critical thinking.

C.4 Course Outcomes (COs)

CLO No.	Course Learning Outcomes
CLO 1	Students will gain knowledge about various statistical estimation methods and their applications.
CLO 2	Appreciate the concepts related to estimation and its applications
CLO 3	To understand the Interval estimation and learn about their various applications.
CLO 4	Appreciate the concept of Maximum likelihood estimation and their asymptotic distribution.

C.5 Syllabus Course Name: Advanced Inference Theory (MSSTA-CC202)

Course Name: Advanced Inference Theory (MSSTA-CC202)		
Unit	Content	Suggested Lectures





24/07/26

(Kalpana Srivastava)
Officer-On-Special Duty (Judl.)

		hours
I	Parametric point estimation, properties of estimators, distributions admitting sufficient statistic – Exponential and Pitman family's procedure for finding minimal sufficient statistic.	07
II	The information measure – Cramer – Rao (CR) inequality – Chapman – Robbins (KCR) inequality (single parameter case only) – Bhattacharya inequality (single parameter case only) minimum variance bound estimator- Invariant (equivariant) estimators (concepts only).	09
III	Uniformly minimum variance unbiased estimators (UMVUE)-condition for the existence of UMVUE- Completeness and Bounded completeness- Relation between complete statistic and minimal sufficient statistic- Rao – Blackwell Theorem- Lehmann – Scheffe's theorem.	10
IV	Methods of estimation – method of moments and its properties – method of maximum likelihood and its properties-large sample properties of MLE - Method of minimum chi- square and its properties – Methods of least squares.	08
V	Interval estimation – Pivotal method of construction – shortest confidence intervals and their construction (minimum average width) – Construction of shortest confidence intervals in large samples. Decision Theory: Simple problems involving quadratic error loss function – Elementary notions of minimax estimation – Simple illustrations.	11
Total Suggested Lectures		45

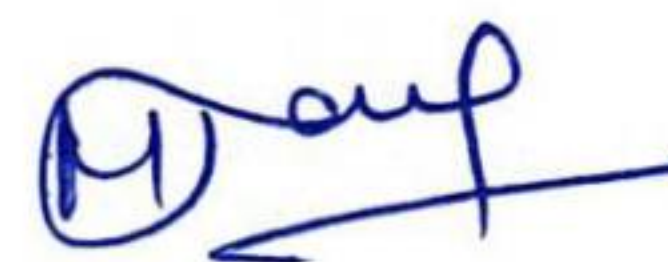
C.6. Prescribed Books:

1. Lehmann, E.L and Casella G(1998): Theory of Point Estimation, Wiley Eastern Ltd.
2. B.K.Kale and K.Muralidharan (2015), Parametric Inference – An Introduction, Narosa Publishing House

C.7. Reference Books & Readings:

1. Kale, B.K. (1999): A First course on Parametric Inference, Narosa Publishing House.
2. Zacks,S. (1981): Parametric Statistical Inference, John Wiley, NY.
3. Srivastava, Khan and Srivastava (2014), Statistical Inference: Theory of Estimation, PHI, India





24/07/26

(Kalpana Srivastava)
Officer-On-Special Duty (Judl.)

C.7. Suggested E-Resources/Digital Repositories:

SWAYAM / NPTEL: Statistical Inference (<https://nptel.ac.in/courses>)

e-PG Pathshala: Mathematics – Advanced Inference Theory (<https://epgp.inflibnet.ac.in/>)

C.8 Assessment Pattern & Question Paper Design

The End-Semester shall be conducted as per the following question paper design:

Section A: Short Answer Questions (10×2 marks = 20 marks)- Covering all units (mandatory)

Section B: Medium Answer Questions (4×5 marks = 20 marks) - Attempt any 4 out of 6

Section C: Long Answer / Essay Questions (3×10 marks = 30 marks)- Attempt 3 out of 5.

Internal Assessment (30 marks) breakdown:

Written Test(s): 20 marks

Seminar / Assignment / Project: 05 marks

Attendance & Class Participation: 05 marks

C.1 Paper Identification

PAPER PROFILE	
Paper Code	MSSTA-CC203
Title of the Paper	Advanced Sampling Theory
Programme / Subject	[MSc] — [Statistics]
Semester	Semester II
Nature of Course	Core Course (CC)
L – T – P	3 – 1 – 0
Credits	4
Maximum Marks	100 (ESE: 70 + Internal Assessment: 30)
Duration of Examination	3 Hours

C.2 Marks Distribution

Component	Paper	IA	Total (ESE+IA/ESE)
-----------	-------	----	--------------------



24/07/26



(Kalpana Srivastava)
Officer-On-Special Duty (Judl.)

End Semester Examination	70	—	70
Internal Assessment	—	30	30
Maximum Marks	70	30	100
Passing Marks	32	13	45 (45%)

Note: Internal Assessment shall be conducted on the basis of attendance, class tests, seminars, assignments, and viva voce as provided in the regulation.

C.3 Course Objectives(COB s)

COB No.	Course Objectives
COB 1	The objectives of this course are to teach basic ideas of sampling from an applied perspective and to provide uses in real life problems.
COB 2	To create the knowledge understanding census and sample survey sampling methods and applying them in practice.
COB 3	Comprehend the Ratio estimator and Regression estimator.

C.4 Course Outcomes (COs)

CLO No.	Course Learning Outcomes
CLO 1	Recognize the role of sampling theory in the sciences, it helps in learning various probability and non-probability sampling techniques.
CLO 2	which experience how to draw a random sample and what amount of sample with respect to population to be drawn.
CLO 3	which will be useful to the students and confidence building in taking decision of any object of the real-life problems.
CLO 4	Identify and address specification errors in sampling technique.

C.5 Syllabus Course Name: Advanced Sampling Theory (MSSTA-CC203)

Course Name: Advanced Sampling Theory (MSSTA -CC203)




24/07/26



(Kalpana Srivastava)
Officer-On-Special Duty (Judl.)

Unit	Content	Suggested Lectures hours
I	Preliminaries Sampling Designs Simple random sampling, Stratified Random Sampling Allocation problems Systematic Sampling Schemes – Linear, Circular, Balanced and Modified systematic sampling methods.	09
II	Probability Proportional to size sampling- Inclusion Probabilities, Horvitz-Thompson estimator Yates Grundy Form Midzuno Sampling design – PPSWOR- Des-Raj's Ordered estimator Murty's unordered estimators.	08
III	Ratio estimators and their properties in Simple Random Sampling, Ratio estimators in Stratified Random sampling, Regression Estimators, Regression estimators in Stratified Random Sampling Multivariate Ratio estimators and Multivariate Regression Estimators.	10
IV	Cluster Sampling: Equal cluster sampling Estimators of mean and variance, optimum cluster size, Unequal cluster sampling – Estimators of mean and variance two stage sampling – variance of the estimated mean Double Sampling for stratification and Ratio estimation.	10
V	Randomized response methods – Warner's, Simmon's and Two Stage response methods Sources of errors in Surveys – Mathematical model for the effects of call-backs and the errors of measurement.	08
Total Suggested Lectures		45

C.6. Prescribed Books:

1. Cochran W.G. (1984): Sampling Techniques, Wiley Eastern.
2. Sukhatme, P.V., Sukhatme, B.V. Sukhatme, S. Asok, C. (1984). Sampling Theories of Survey With Application, IOWA State University Press and Indian Society of Agricultural Statistics. Analysis, Wiley.

C.7. Reference Books & Readings:

1. Sen Amartya (2003) : Poverty and Famines, Oxford University Pless, New Delhi.
2. Desraj and Chandhok P. (1998): Sampling Theory, Narosa Publications, New Delhi.

C.7. Suggested E-Resources/Digital Repositories:

SWAYAM / NPTEL: Sampling Theory (<https://nptel.ac.in/courses>)





24/07/26

(Kalpana Srivastava)
Officer-On-Special Duty (Judl.)

C.8 Assessment Pattern & Question Paper Design

The End-Semester shall be conducted as per the following question paper design:

Section A: Short Answer Questions (10×2 marks = 20 marks)- Covering all units (mandatory)

Section B: Medium Answer Questions (4×5 marks = 20 marks) - Attempt any 4 out of 6

Section C: Long Answer / Essay Questions (3×10 marks = 30 marks)- Attempt 3 out of 5.

Internal Assessment (30 marks) breakdown:

Written Test(s): 20 marks

Seminar / Assignment / Project: 05 marks

Attendance & Class Participation: 05 marks

C.1 Paper Identification

PAPER PROFILE	
Paper Code	MSSTA-PR204
Title of the Paper	Practical
Programme / Subject	[MSc] — [Statistics]
Semester	Semester II
Nature of Course	Core Course (CC)
L – T – P	0– 0 – 4
Credits	4
Maximum Marks	100 (ESE: 70 + Internal Assessment: 30)
Duration of Examination	3 Hours

C.2 Marks Distribution

Component	Practical	IA	Total (ESE+IA/ESE)
End Semester Examination	70	—	70
Internal Assessment	—	30	30



24/07/26

(Kalpana Srivastava)
Officer-On-Special Duty (Judl.)

Maximum Marks	70	30	100
Passing Marks	32	13	45 (45%)

Note: Internal Assessment shall be conducted on the basis of attendance, class tests, seminars, assignments, and viva voce as provided in the regulation.

C.3 Course Objectives(COB s)

COB No.	Course Objectives
COB 1	This course is intended to train students to get knowledge in theoretical and practical applications of sample techniques.
COB 2	To create the knowledge understanding census and sample survey sampling methods and applying them in practice.
COB 3	This course is intended to train students in mathematical techniques of constructing various univariate, bivariate and multivariate distributions.

C.4 Course Outcomes (COs)

CLO No.	Course Learning Outcomes
CLO 1	A student will be able to: Formulation and solving procedures with sampling
CLO 2	Students will be able to perform predictive analytics for real life problems.
CLO 3	Evaluate the Order statistics using appropriate examples.
CLO 4	Identify and address specification errors sampling technique.

C.5 Syllabus Course Name: Practical (MSSTA-PR204)

Course Name: Practical (MSSTA -PR204)		
Unit	Content	Suggested Lectures hours
I	Exercises/Problems: Compute Order statistics from given data. Fit the different distribution	20





(Kalpana Srivastava)
Officer-On-Special Duty (Judl.)

24/07/26

	Based on Calculator, Excel & R or Python Programming as per suitability.	
II	Exercises/Problems: Point estimation. Problems based on unbiased estimator, sufficient statistics, minimal sufficient statistic. Based on Calculator, Excel & R or Python Programming as per suitability.	22
III	Exercises/Problems: Interval estimation and its problems. Based on Calculator, Excel & R or Python Programming as per suitability.	26
IV	Exercises/Problems: Methods of estimation – method of moments and method of maximum likelihood. Based on Calculator, Excel & R or Python Programming as per suitability.	24
V	Exercises/Problems: Different Sampling techniques and different estimation. Based on Calculator, Excel & R or Python Programming as per suitability.	28
	Total Suggested Lectures	120

C.6. Prescribed Books:

1. B.K.Kale and K.Muralidharan (2015), Parametric Inference – An Introduction, Narosa Publishing House

2. Kale, B.K. (1999): A First course on Parametric Inference, Narosa Publishing House.

C.7. Reference Books & Readings:

1. Sukhatme, P.V., Sukhatme, B.V. Sukhatme, S. Asok, C. (1984). Sampling Theories of Survey With Application, IOWA State University Press and Indian Society of Agricultural Statistics.

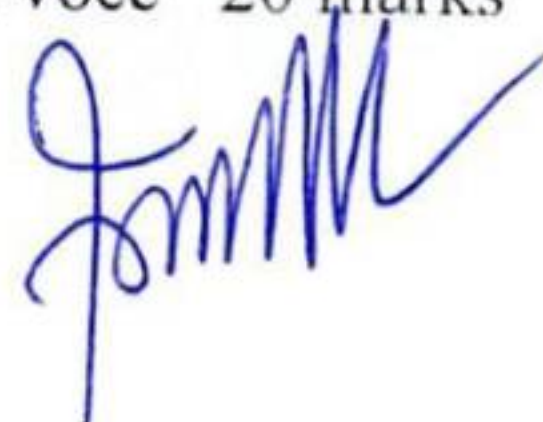
2. Desraj and Chandhok P. (1998): Sampling Theory, Narosa Publications, New Delhi.

C.8 Assessment Pattern & Question Paper Design

The End-Semester shall be conducted as per the following question paper design:

Lab Problem (25 × 2 marks = 50 marks)- Covering all units (mandatory)

Viva-voce 20 marks





24/07/26

(Kalpana Srivastava)
Officer-On-Special Duty (Judl.)

Internal Assessment (30 marks) breakdown:

Written Test(s): 20 marks

Seminar / Assignment / Project: 05 marks

Attendance & Class Participation: 05 marks

C.1 Paper Identification

PAPER PROFILE	
Paper Code	MSSTA-GE105
Title of the Paper	Advanced Statistical Methods
Programme / Subject	[MSc] — [Statistics]
Semester	Semester I
Nature of Course	General Elective (GE)
L – T – P	3 – 1 – 0
Credits	4
Maximum Marks	100 (ESE: 70 + Internal Assessment: 30)
Duration of Examination	3 Hours

C.2 Marks Distribution

Component	Paper	IA	Total (ESE+IA/ESE)
End Semester Examination	70	—	70
Internal Assessment	—	30	30
Maximum Marks	70	30	100
Passing Marks	32	13	45 (45%)

Note: Internal Assessment shall be conducted on the basis of attendance, class tests, seminars, assignments, and viva voce as provided in the regulation.

C.3 Course Objectives(COB s)

COB No.	Course Objectives
---------	-------------------



24/07/26

(Kalpana Srivastava)
Officer-On-Special Duty (Judl.)

COB 1	To focus attention on various statistical methods and to apply them for basic data analysis.
COB 2	To introduce the concept of Correlation and regression
COB 3	To introduce the basic concept of probability and probability distribution.

C.4 Course Outcomes (COs)

CLO No.	Course Learning Outcomes
CLO 1	Identify the basic problem in statistics
CLO 2	Understand the statistical data, graphical presentation,
CLO 3	Use various rules in the theory of elementary probability
CLO 4	Use mathematical expectation and m.g.f and c.f.

C.5 Syllabus Course Name: Advanced Statistical Methods (MSSTA-GE105)

Course Name: Advanced Statistical Methods (MSSTA-GE105)		
Unit	Content	Suggested Lectures hours
I	Definition and scope of Statistics, Collection and classification of data, Frequency tables, Diagrammatic and Graphical representation of data. Measures of central tendency, Measures of, Coefficient of variation and skewness.	09
II	Bivariate data: Definition, scatter diagram, Karl Pearson product moment correlation coefficient and its properties, rank correlation, partial and multiple correlation (3 variables only). Simple linear regression, properties of regression coefficients, principle of least squares and fitting of polynomials and exponential curves.	08
III	Elementary Probability theory: Addition theorem, Conditional probability and Multiplication theorem, Baye's Theorem, Random variables, and probability distributions. Expectation of random variable with properties and moments, moment generating function (m.g.f.) and characteristic function (c.f).	10



K. Srivastava



24/07/26

(Kalpana Srivastava)
Officer-On-Special Duty (Judl.)

IV	Standard probability distributions: Binomial, Poisson, geometric, uniform, normal, exponential, and gamma along with their properties.	08
V	Exact sampling distribution: Definition and derivation of p.d.f. of χ^2 , Student's t and Fishers F-distribution, with their mean, variance, m.g.f., and cumulant generating function, additive property and limiting form of χ^2 , t, F distribution. Relationship between them and their applications.	10
	Total Suggested Lectures	45

C.6. Prescribed Books:

1. Agarwal. B.L(1996): Basic statistics, New Age International (P) Ltd.
2. Sheldon M. Ross (2006): Introductory Statistics, 2/e, Elsevier Publications. Wiley.

C.7. Reference Books & Readings:

1. Murray R. Spiegel and Larry J. Stephens (2005): Schaum's Outline of Theory and Problems of Statistics, Tata Mc Graw Hill Publishing Company Ltd, New Delhi.
2. Myer, P.L. (1970), Introductory Probability and Statistical Applications, Oxford & IBH Publishing, New Delhi
3. Miller, Irwin and Miller, Marylees (2006): John E. Freund's Mathematical Statistics with Applications, Pearson Education, Asia.

C.7. Suggested E-Resources/Digital Repositories:

SWAYAM / NPTEL: Mathematical Statistics (<https://nptel.ac.in/courses>)

e-PG Pathshala: Advanced Statistical Theory (<https://epgp.inflibnet.ac.in/>)

C.8 Assessment Pattern & Question Paper Design

The End-Semester shall be conducted as per the following question paper design:

Section A: Short Answer Questions (10×2 marks = 20 marks)- Covering all units (mandatory)

Section B: Medium Answer Questions (4×5 marks = 20 marks) - Attempt any 4 out of 6

Section C: Long Answer / Essay Questions (3×10 marks = 30 marks)- Attempt 3 out of 5.

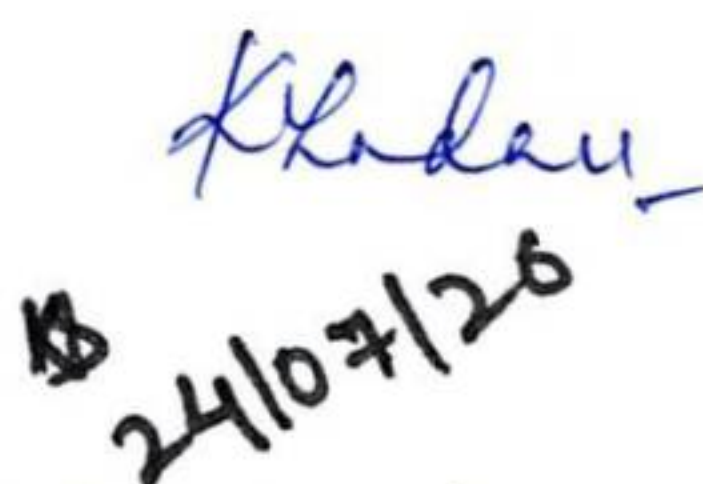
Internal Assessment (30 marks) breakdown:

Written Test(s): 20 marks

Seminar / Assignment / Project: 05 marks

Attendance & Class Participation: 05 marks




24/07/26



(Kalpana Srivastava)
Officer-On-Special Duty (Judl.)

C.1 Paper Identification

PAPER PROFILE	
Paper Code	MSSTA-GE106
Title of the Paper	Statistical Computing in R
Programme / Subject	[MSc] — [Statistics]
Semester	Semester I
Nature of Course	General Elective (GE)
L – T – P	3 – 1 – 0
Credits	4
Maximum Marks	100 (ESE: 70 + Internal Assessment: 30)
Duration of Examination	3 Hours

C.2 Marks Distribution

Component	Paper	IA	Total (ESE+IA/ESE)
End Semester Examination	70	—	70
Internal Assessment	—	30	30
Maximum Marks	70	30	100
Passing Marks	32	13	45 (45%)

Note: Internal Assessment shall be conducted on the basis of attendance, class tests, seminars, assignments, and viva voce as provided in the regulation.

C.3 Course Objectives(COB s)

COB No.	Course Objectives
COB 1	To introduce the basic elements statistical computing using R programming
COB 2	To introduce the concept of R language.
COB 3	To introduce the basic concept of statistics with R.



24/07/26

(Kalpana Srivastava)
Officer-On-Special Duty (Judl.)

C.4 Course Outcomes (COs)

CLO No.	Course Learning Outcomes
CLO 1	Identify the basic problem in R.
CLO 2	Understand the statistical data, graphical presentation in R,
CLO 3	Describe computer Programs in R related to statistical data analysis
CLO 4	Write computer programs in R related to statistical data analysis.

C.5 Syllabus Course Name: Statistical Computing in R (MSSTA-GE106)

Course Name: Statistical Computing in R (MSSTA-GE106)		
Unit	Content	Suggested Lectures hours
I	Introduction to R environment and R Studio, using the help facility. R as a calculator, data types and data structures, simple manipulations of data, vectors and vector arithmetic, objects, their modes and attributes, ordered and unordered factors, arrays and matrices, lists and data frames.	09
II	Reading data into R from various sources, merging data files. Basics of R syntax, sub setting, loops and conditional execution, writing R functions, logic and flow control, iterations.	08
III	R graphics: low and high level, Data Visualization: Grammar of graphics, ggplot2, scatter plot, line graphs, histograms, boxplots, bar plots, density plots.	10
IV	Statistics Methods and techniques in R. Descriptive statistics and tables. Built-in functions, exploratory analysis, probability distributions and simulations.	08
V	Linear and generalized linear models: lm and glm functions, statistical inference, contingency tables, chi-square goodness of fit, least squares,	10



Shodan

24/07/26



(Kalpana Srivastava)
Officer-On-Special Duty (Judl.)

maximum likelihood, non-linear optimization, resampling.	
Total Suggested Lectures	45

C.6. Prescribed Books:

1. Chambers, J. (2008). Software for Data Analysis: Programming with R, Springer.
2. Jones, O., Maillardet, R. and Robinson, A.(2009). Introduction to Scientific Programming and Simulation using R, CRC.
3. Everitt, B. and Hothorn, T.(2006). A Handbook of Statistical Analyses Using R, CRC.

C.7. Reference Books & Readings:

1. Dalgaard P. Introductory Statistics with R, Springer
2. Braun W J, and Murdoch D J: A First Course in Statistical Programming with R. Cambridge University Press. New York.

C.8 Assessment Pattern & Question Paper Design

The End-Semester shall be conducted as per the following question paper design:

Section A: Short Answer Questions (10×2 marks = 20 marks)- Covering all units (mandatory)

Section B: Medium Answer Questions (4×5 marks = 20 marks) - Attempt any 4 out of 6

Section C: Long Answer / Essay Questions (3×10 marks = 30 marks)- Attempt 3 out of 5.

Internal Assessment (30 marks) breakdown:

Written Test(s): 20 marks

Seminar / Assignment / Project: 05 marks

Attendance & Class Participation: 05 marks

C.1 Paper Identification

PAPER PROFILE	
Paper Code	MSSTA-GE205
Title of the Paper	Statistical Inference Theory
Programme / Subject	[MSc] — [Statistics]
Semester	Semester II
Nature of Course	General Elective (GE)



K. S. Srivastava
24/07/26



(Kalpana Srivastava)
Officer-On-Special Duty (Judl.)

L – T – P	3 – 1 – 0
Credits	4
Maximum Marks	100 (ESE: 70 + Internal Assessment: 30)
Duration of Examination	3 Hours

C.2 Marks Distribution

Component	Paper	IA	Total (ESE+IA/ESE)
End Semester Examination	70	—	70
Internal Assessment	—	30	30
Maximum Marks	70	30	100
Passing Marks	32	13	45 (45%)

Note: Internal Assessment shall be conducted on the basis of attendance, class tests, seminars, assignments, and viva voce as provided in the regulation.

C.3 Course Objectives(COB s)

COB No.	Course Objectives
COB 1	To introduce the basic of inferential statistics theory.
COB 2	To learn the estimation techniques to estimate the parameters of the population.
COB 3	To introduce theory behind test of significance.

C.4 Course Outcomes (Cos)

CLO No.	Course Learning Outcomes
CLO 1	Identify the basic problem in statistics
CLO 2	Identify the estimation and testing problems of real life.
CLO 3	Understand the Different methods of finding point estimators.
CLO 4	To introduce the basic of inferential statistics

24/07/26

(Kalpana Srivastava)
Officer-On-Special Duty (Judl.)

C.5 Syllabus Course Name: Statistical Inference Theory (MSSTA-GE205)

Course Name: Statistical Inference Theory (MSSTA-GE205)		
Unit	Content	Suggested Lectures hours
I	Estimation: Problem of estimation, Properties of a good estimation, Factorization theorem. Cramer-Rao inequality and MVB estimators (statement and applications), Minimum variance unbiased estimator (MVUE), Rao-Blackwell theorem.	09
II	Methods of Estimation: Method of moments, method of maximum likelihood and minimum chi square, properties of maximum likelihood estimators and minimum chi square.	08
III	Confidence interval: Confidence interval for mean, proportion and variance. Bayesian Estimation: Loss function, prior distribution, Bayes theorem, posterior distributions, Bayes risk, Bayes principle, Bayes estimators.	10
IV	Testing of hypothesis: Null and alternative hypotheses, simple and composite hypotheses, Type-I and Type-II errors, critical region, level of significance, size and power of a test, best critical region, most powerful test, uniformly most powerful test.	08
V	Neyman Pearson Lemma (statement and applications to construct most powerful test). Likelihood ratio test, properties of likelihood ratio tests.	10
Total Suggested Lectures		45

C.6. Prescribed Books:

1. Agarwal. B.L(1996): Basic statistics, New Age International (P) Ltd.
2. Sheldon M. Ross (2006): Introductory Statistics, 2/e, Elsevier Publications. Wiley.
3. Gupta, S. C. and Kapoor, V. K. (2020): Fundamentals of Mathematical Statistics, S. Chand & Sons, New Delhi.
4. Goon A.M., Gupta M.K. and Dasgupta B. (2002): Fundamentals of Statistics, Vol. I & II, The World Press, Kolkata.

C.7. Reference Books & Readings:



Khadan



24/07/26

(Kalpana Srivastava)
Officer-On-Special Duty (Judl.)

1. Rohatgi V. K. and Saleh, A.K. Md. E (2009): An Introduction to Probability and Statistics, John Wiley and Sons.
2. Mood A.M, Graybill F.A. and Boes D.C,: Introduction to the Theory of Statistics, McGraw Hill.

C.7. Suggested E-Resources/Digital Repositories:

SWAYAM / NPTEL: Statistical Inference (<https://nptel.ac.in/courses>)

e-PG Pathshala: Mathematics – Advanced Inference Theory (<https://epgp.inflibnet.ac.in/>)

C.8 Assessment Pattern & Question Paper Design

The End-Semester shall be conducted as per the following question paper design:

Section A: Short Answer Questions (10×2 marks = 20 marks)- Covering all units (mandatory)

Section B: Medium Answer Questions (4×5 marks = 20 marks) - Attempt any 4 out of 6

Section C: Long Answer / Essay Questions (3×10 marks = 30 marks)- Attempt 3 out of 5.

Internal Assessment (30 marks) breakdown:

Written Test(s): 20 marks

Seminar / Assignment / Project: 05 marks

Attendance & Class Participation: 05 marks

C.1 Paper Identification

PAPER PROFILE	
Paper Code	MSSTA-GE206
Title of the Paper	Sample Survey & Design of Experiment
Programme / Subject	[MSc] — [Statistics]
Semester	Semester II
Nature of Course	General Elective (GE)
L – T – P	3 – 1 – 0
Credits	4
Maximum Marks	100 (ESE: 70 + Internal Assessment: 30)





24/07/26

(Kalpana Srivastava)
Officer-On-Special Duty (Judl.)

Duration of Examination	3 Hours
--------------------------------	----------------

C.2 Marks Distribution

Component	Paper	IA	Total (ESE+IA/ESE)
End Semester Examination	70	—	70
Internal Assessment	—	30	30
Maximum Marks	70	30	100
Passing Marks	32	13	45 (45%)

Note: Internal Assessment shall be conducted on the basis of attendance, class tests, seminars, assignments, and viva voce as provided in the regulation.

C.3 Course Objectives(COBs)

COB No.	Course Objectives
COB 1	To provide tools and techniques for selecting a sample of elements from a target population keeping in mind the objectives to be fulfilled and nature of population
COB 2	To obtain estimator of the population parameter on the basis of selected sample.
COB 3	To introduce the nuances of designing, conducting, analyzing and extracting information from experimental data.

C.4 Course Outcomes (CLOs)

CLO No.	Course Learning Outcomes
CLO 1	The fundamental concepts of population and sample. (or The basic concepts of survey)
CLO 2	The principles of sample survey and the steps involved in selecting a sample.
CLO 3	Analyze one way and two way classified data set in fixed and random effect model.



Kalpana

24/07/26

(Kalpana Srivastava)
Officer-On-Special Duty (Judl.)



CLO 4	Apply these designs to various fields of applications
-------	---

C.5 Syllabus Course Name: Sample Survey & Design of Experiment (MSSTA-GE206)

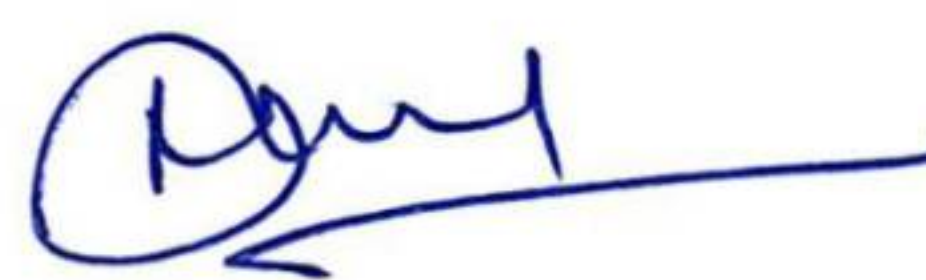
Course Name: Sample Survey & Design of Experiment (MSSTA-GE206)		
Unit	Content	Suggested Lectures hours
I	Simple random sampling with and without replacement, Stratified random sampling: Technique, proportional and optimum allocations and their comparison with SRS, Systematic Sampling: Technique, estimates of population mean and total, variances of these estimates. Comparison of systematic sampling with SRS and stratified sampling.	09
II	Ratio and regression method of estimation, estimate of population mean and total and its variance. Cluster sampling estimation of population means and its variance, comparison. Relative efficiency of cluster sampling with SRS in terms of intra class correlation.	08
III	Introduction to random effects linear models and estimation of variance components, mixed effects models and ANOVA. Concept of various experimental designs, basic principles of experimental designs, CRD, RBD and LSD and their analyses and uses, multiple range tests.	10
IV	Factorial experiments: advantages, notations and concepts, 2^2 , 2^3 ... 2^n factorial experiments, design and analysis. Split Plot Design and Strip Plot Design.	08
V	Total and Partial confounding for 2^n ($n \leq 5$). Analysis of covariance. Analysis of non-orthogonal data. Analysis of missing data.	10
Total Suggested Lectures		45

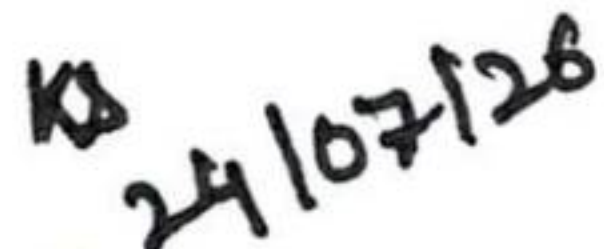
C.6. Prescribed Books:

1. Das, M.N. and Giri, N.C. (1986): Design and Analysis of Experiments. Wiley Eastern Ltd.
2. Cochran W.G. (1984): Sampling Techniques, Wiley Eastern.

C.7. Reference Books & Readings:






 (Kalpana Srivastava)
 Officer-On-Special Duty (Judl.)

1. Goon, A.M., Gupta, M.K. and Dasgupta, B. (2005): Fundamentals of Statistics. Vol. II, World Press, Kolkata.
2. Sukhatme, P.V., Sukhatme, B.V. Sukhatme, S. Asok, C. (1984). Sampling Theories of Survey with Application, IOWA State University Press and Indian Society of Agricultural Statistics.

C.7. Suggested E-Resources/Digital Repositories:

SWAYAM / NPTEL: Sampling theory (<https://nptel.ac.in/courses>)

e-PG Pathshala: Mathematics – Advanced Sample Theory (<https://epgp.inflibnet.ac.in/>)

C.8 Assessment Pattern & Question Paper Design

The End-Semester shall be conducted as per the following question paper design:

Section A: Short Answer Questions (10×2 marks = 20 marks)- Covering all units (mandatory)

Section B: Medium Answer Questions (4×5 marks = 20 marks) - Attempt any 4 out of 6

Section C: Long Answer / Essay Questions (3×10 marks = 30 marks)- Attempt 3 out of 5.

Internal Assessment (30 marks) breakdown:

Written Test(s): 20 marks

Seminar / Assignment / Project: 05 marks

Attendance & Class Participation: 05 marks

Note: Generic/Open Elective–I (Course Code) and II (Course Code) courses in Semester-I and Generic/Open Elective–III (Course Code) and IV (Course Code) courses in Semester- II of 2 Year Postgraduate Programme may be offered by an institution based on student demand, academic interest, and the availability of qualified faculty members. These courses shall be open to students of the concerned discipline as well as students from other disciplines, with the objective of promoting multidisciplinary and interdisciplinary learning in accordance with the principles of the National Education Policy (NEP), 2020.

For fulfilment of the programme requirements, a student shall be required to successfully complete any one of the Generic Elective courses offered during the semester. The institution may decide to offer either or both of the Generic Elective courses, subject to academic feasibility, availability of faculty expertise, and student enrolment.

D

PART D — GENERAL REGULATIONS & PROVISIONS

D.1 Attendance & Eligibility



24/07/26

(Kalpana Srivastava)
Officer-On-Special Duty (Jr.)

- A student must have a minimum of 75% attendance in each paper to be eligible to appear in the Semester / Annual Examination.
- Condonation of attendance deficiency shall be governed by the Regulation..
- A student detained due to shortage of attendance may appear to the examinations of same semester in the next academic session subject to payment of prescribed fees.

D.2 Examination & Promotion Rules

- A student is required to clear **at least** 60% (4 out of 6) papers of a particular Semester before being promoted to the succeeding Semester.
- Back / Ex-Student candidates shall be governed by the rules in force at the time of their original admission unless otherwise specifically notified.
- A candidate who fails in one or more papers shall be required to appear only in the failed paper(s) (Carry Forward System) in subsequent examinations of the same Semester.
- A candidate is required to clear all his papers within a maximum of **Five Years of duration** to qualify for the degree.

D.3 Grading System (CBCS)

Letter Grade	% Range	Grade Point	Performance Description	Remarks
O	≥90-100	10	Outstanding	Pass
A+	≥80<90	9	Excellent	Pass
A	≥70<80	8	Very Good	Pass
B+	≥60<70	7	Good	Pass
B	≥55<60	6	Above Average	Pass
C	≥50<55	5	Average	Pass
P	≥45<50	4	Pass	Pass
F	<45	0	Fail	Fail
Ab/M	0	0	Absent/Malpractice	Fail / Reappear

E

PART E — ABBREVIATIONS & AUTHENTICATION

E.1 List of Abbreviations



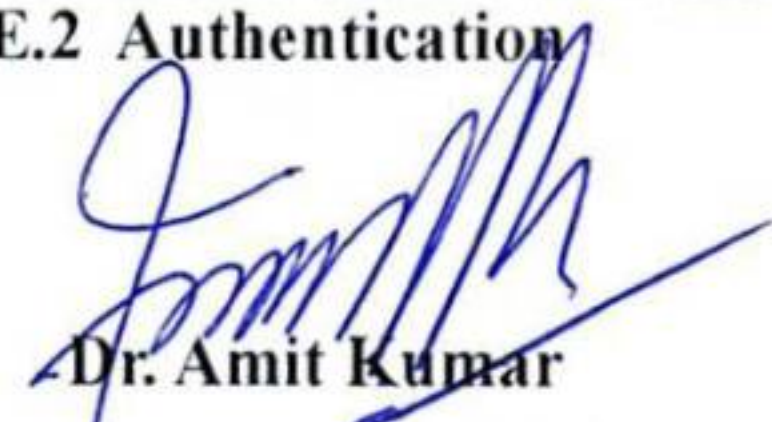


24/07/28

(Kalpana Srivastava)
Officer-On-Special Duty (Judl.)

Abbr.	Expansion	Abbr.	Expansion
CC	Core Course	DSE	Discipline Specific Elective
GE	Generic Elective	OE	Open Elective
AEC	Ability Enhancement Course	VAC	Value Added Course
SEC	Skill Enhancement Course	IKS	Indian Knowledge System
L	Lecture (hours per week)	T	Tutorial (hours per week)
P	Practical (hours per week)	IA	Internal Assessment
CCA	Continuous & Comprehensive Assess.	CLO	Course Learning Outcome
PLO	Programme Learning Outcome	GA	Graduate Attribute
NHEQF	National HE Qualifications Framework	PROJ	Project / Dissertation

E.2 Authentication



Dr. Amit Kumar
Department of Statistics
Patna University
Date: 14.06.2026



Dr. Kumar Satyendra Yadav
Department of Statistics
Patna University
Date: 14.06.2026



Dr. Manoj Kumar Bastogi
Department of Statistics
Patna University
Date: 14.06.2026



(Kalpana Srivastava)
Officer-On-Special Duty (Jd1.)