



SARDAR PATEL UNIVERSITY

Vallabh Vidyanagar

NAAC 'A' Grade (10-01-2023 To 09-01-2028)

NEP-2020 aligned Curriculum with effect from Academic Year 2026-27

Master of Science Applied Statistics and Predictive Data Science Semester-II

Course Type	Course Code	Course Title	Teaching-Learning Scheme	Total Notional Hours	Course credits
			L-P-T		
DSC	P2S02NCASP01	Regression Modelling	4-0-0	120	04

• Course Learning Outcomes (CLOs)

On completion of this course, students will be able to:

CLO1: Demonstrate understanding and apply fundamental concepts of simple and multiple linear regression models

CLO2: Analyze regression models using appropriate estimation methods and interpret model coefficients effectively.

CLO3: Evaluate regression models through diagnostic techniques and apply suitable remedial measures.

CLO4: Build generalized linear models to analyze categorical and count data using appropriate link functions, estimation methods, and inferential techniques.

CLO5: Evaluate and implement advanced generalized linear models including Poisson, Gamma, and Loglinear models for real-world data analysis and decision-making.

Unit	Course Content	Learning Pedagogies*	CLO(s)
I	Fundamentals of Linear Regression Models <ul style="list-style-type: none"> Simple and Multiple Linear Regression Models: Review of Linear Statistical Models, Simple Linear Regression (OLS estimation, assumptions, inference, prediction), Measures of Goodness-of-Fit (R^2, Adjusted R^2) Diagnostic Analysis and Remedial Measures: Residual Analysis (Residual plots, Q-Q plots, scale-location), Outliers and Influence (Cook's Distance, DFFITS, DFBETAS, Hat Matrix), 	CL CBL ICT EL	1 2
II	Model Building and Diagnostic Techniques in Regression <ul style="list-style-type: none"> Model Building and Selection Methods: Best Subset Selection, Forward and Backward Stepwise Regression, Model Selection Criteria (AIC, BIC, Mallows' C_p) Multicollinearity and heteroscedasticity: Detection and Remedial Measures 	CL PBL ICT EL	2 3
III	Introduction to Generalise linear models <ul style="list-style-type: none"> Exponential Family and Link Functions, linear predictors, IRLS method of estimation, Deviance for testing, residual analysis Binary and categorical Models: Logistics, Multinomial, and Cumulative logit models estimation and applications 	CBL MP PBL ICT EL	4
IV	Models for counts, non-normal response and non-parametric models <ul style="list-style-type: none"> Discreate and rate models: Poisson Regression with count and rates, models with constant CV, models for time to event data 	CL PBL CBL MP ICT EL	5



SARDAR PATEL UNIVERSITY

Vallabh Vidyanagar

NAAC 'A' Grade (10-01-2023 To 09-01-2028)

NEP-2020 aligned Curriculum with effect from Academic Year 2026-27

Master of Science Applied Statistics and Predictive Data Science Semester-II

	<ul style="list-style-type: none"> • Non-Parametric Regression: Lass Regression, L1 Regularization, Coefficient Shrinkage • Quantile Regression: Minimizing the pinball loss, inference, and applications in heteroscedastic data 		
--	---	--	--

- **Learning Pedagogies/Methods**

- Classroom Lecture (CL)
- Case-Based Learning (CBL)
- Micro-Projects (MP)
- Problem-Based Learning (PBL)
- ICT-Enabled Learning through Digital Resources/ Virtual Labs/Webinars (ICT EL)

- **Assessment Methodologies**

(A) Internal Assessment

a. Internal Formative assessment (25 Marks)

- MCQ and Objective question Quiz: Students select or give the correct answer from the list of options four /none for a given questions.
- Assignment: A practical task or setup questions given to measure a student's knowledge, skill and ability in subject or field.
- Seminar: A student-led academic activity designed to evaluate student's ability to research, understand, and present a specific topic.
- Group Discussion: An interactive method to asses a student's personality and inter- personal skills in team setting. It typically involves 5 to 15 participants discussing a topic for 15 to 30 minutes in presence of an observer.

b. Internal Summative Assessment (25 Marks)

- Mid-term tests
A test conducted roughly halfway through an academic term or semester.
- Laboratory performance
Students demonstrate their laboratory hands-on performance skills, knowledge and ability to apply concepts in subjects.
- Viva-voce
An oral examination conducted to evaluate a student's in-depth knowledge, understanding, and critical thinking regarding a subject or project.

(B) Weightage of Learning Efforts for External Assessment

Unit	Aligned CLOs	Total Learning Hours	Approximate weightage (Marks) to Learning levels (BT)			Total Marks
			Remember (R)	Understanding (U)	Application/ Analyse & above (A)	
I	1,2	30	4	5	3	12
II	2,3	30	4	5	4	13
III	4	30	4	5	4	13
IV	5	30	3	5	4	12
		120	15	20	15	50



SARDAR PATEL UNIVERSITY

Vallabh Vidyanagar

NAAC 'A' Grade (10-01-2023 To 09-01-2028)

NEP-2020 aligned Curriculum with effect from Academic Year 2026-27

Master of Science Applied Statistics and Predictive Data Science Semester-II

• Assessment and Evaluation

Sr.No.	Assessment/Evaluation	Component	Weightage (%)
1	Continuous Internal Evaluation	FA: Seminars, Assignments, Quizzes, Group Discussion	25%
		SA: Mid Term Test	25%
2	End-Semester Examination	Written Exam	50%

(C) CLOs – PLOs Matrix

CLO	PLO														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CLO1	3	2	3	2	3	-	-	1	2	1	-	-	-	-	-
CLO2	3	3	2	3	3	-	-	2	2	1	-	-	-	-	-
CLO3	3	2	2	3	3	-	-	3	2	2	-	-	-	-	-
CLO4	3	2	2	3	3	2	-	3	3	2	-	-	-	-	-
CLO5	3	2	2	3	3	3	-	3	3	3	1	1	1	-	2

CLO – PLO correlation	Value
Strong	3
Moderate	2
Low	1
No correlation	-

• Suggested Learning Materials Books:

Sr.No.	Title	Author(s)	Edition/Year	Publisher
1	Applied Regression Analysis	Draper, N. R. and Smith, H.	Third Edition / 1998	Wiley India Ltd.
2	Regression Analysis and its Applications -A Data Oriented Approach.	Gunst, R. F. and Mason, R. L.	Third/1980	Macel and Dekker
3	Linear Statistical Inference and its Applications	Rao, C. R.	Edition II/2001	Wiley Eastern
4	Applied Linear Regression	Weisberg's	1985	Wiley Series in Probability and Statistics, Wiley
5	Introduction to Linear Regression Analysis	Montgomery, D. C., Peck, E. A and Vinning, G. G.	Edition III/ 2010	Wiley
6	Generalized linear models.	McCullagh, P.	First/1983	Chapman and Hall

• Online Resources (Open Source)

Sr. No.	Description of Resource(s)	Weblink
1	Regression analysis By Prof. Soumen Maity IISER PUNE	https://onlinecourses.nptel.ac.in/noc19_ma32/preview



SARDAR PATEL UNIVERSITY

Vallabh Vidyanagar

NAAC 'A' Grade (10-01-2023 To 09-01-2028)

NEP-2020 aligned Curriculum with effect from Academic Year 2026-27

Master of Science Applied Statistics and Predictive Data Science Semester-II

Course Type	Course Code	Course Title	Teaching-Learning Scheme	Total Notional Hours	Course credits
			L-P-T		
DSC	P2S02NCASP02	Market Research	4-0-0	120	04

• **Course Learning Outcomes (CLOs)**

On completion of this course, students will be able to:

CLO1: Demonstrate comprehensive understanding of marketing research concepts, processes and their role in managerial decision-making.

CLO2: Analyze marketing research problems and apply appropriate research designs, methodologies and approaches in different business contexts.

CLO3: Apply measurement, scaling, questionnaire design, and sampling techniques for accurate and reliable primary data collection.

CLO4: Analyze and evaluate data using appropriate statistical and multivariate techniques for effective interpretation and decision-making.

CLO5: Evaluate and present structured research reports with clear interpretation, visual presentation and ethical considerations.

Unit	Course Content	Learning Pedagogies*	CLO(s)
I	Fundamentals of Marketing Research and Problem Definition <ul style="list-style-type: none"> Introduction to Marketing Research (MR): Definition and classification of MR, The MR process, The Role MR in Decision Making, Management Information System and Decision Support System, A case Study. Defining MR problem and Developing an Approach: Importance of Defining MR problem, the process of defining the problem and developing an approach, Tasks involved, Environmental context of the problem-Buyers Behaviour, Legal and Economic Environment. Marketing and Technological Skills. 	CL PBL ICT EL	1 2
II	Research Design in Marketing Research <ul style="list-style-type: none"> Research Designs: Exploratory research design using secondary data, comparison of primary and secondary data. Advantages, uses and disadvantage of secondary data. Classification and sources of secondary data. Qualitative Research using (a) Focus Group interview (b) Depth interviews (c) Projective Techniques. Descriptive Research Design: Descriptive research through survey and observations –Telephone Methods, Personal Methods, Mail Methods, Electronic Methods and Observational Method. Causal research – Basic experimental designs – internal and external validity of experiments. 	CL PBL ICT EL CBL	2 3



SARDAR PATEL UNIVERSITY

Vallabh Vidyanagar

NAAC 'A' Grade (10-01-2023 To 09-01-2028)

NEP-2020 aligned Curriculum with effect from Academic Year 2026-27

Master of Science Applied Statistics and Predictive Data Science Semester-II

III	<p>Primary Data Collection, Measurement, Sampling Techniques and Report Writing:</p> <ul style="list-style-type: none"> • Primary Data Collection, Measurement Scaling and Sampling Design: Primary Data Collection Methods Comparative and Non comparative Scaling Techniques, Questionnaire and Form Design, Sampling Designs-Probability and non-probability, Initial and Final Sample size determination. • Data Collection, Preparation, Analysis and Reporting: Field Work, Data Preparation, Review of data compilation, data presentation and data analysis 	<p>CL ICT EL PBL CBL</p>	<p>3 4</p>
IV	<p>Applications of Multivariate Techniques and Research Reporting</p> <ul style="list-style-type: none"> • Applications of Multivariate Techniques: Brief Discussion on uses of multivariate techniques, multiple regression, discriminant and Logit Analysis, Factor Analysis, Cluster Analysis, Multidimensional scaling and conjoint analysis, structural equations and Path Analysis. • Report Preparation and Presentation: Structure of a Research Report, Data Interpretation and Presentation, Use of Tables, Charts, and Graphs, Report Writing Techniques, Oral Presentation Skills, Ethical Considerations in Reporting 	<p>CL CBL MP ICT EL</p>	<p>4 5</p>

- **Learning Pedagogies/Methods**

- (f) Classroom Lecture (CL)
- (g) Case-Based Learning (CBL)
- (h) Micro-Projects (MP)
- (i) Problem-Based Learning (PBL)
- (j) ICT-Enabled Learning through Digital Resources/ Virtual Labs/Webinars (ICT EL)

- **Assessment Methodologies**

- (D) **Internal Assessment**

- a. **Internal Formative assessment (25 Marks)**

- v. MCQ and Objective question Quiz: Students select or give the correct answer from the list of options four /none for a given questions.
- vi. Assignment: A practical task or setup questions given to measure a student's knowledge, skill and ability in subject or field.
- vii. Seminar: A student-led academic activity designed to evaluate student's ability to research, understand, and present a specific topic.
- viii. Group Discussion: An interactive method to assess a student's personality and inter- personal skills in team setting. It typically involves 5 to 15 participants discussing a topic for 15 to 30 minutes in presence of an observer.

- b. **Internal Summative Assessment (25 marks)**

- iv. Mid-term tests
A test conducted roughly halfway through an academic term or semester.
- v. Laboratory performance
Students demonstrate their laboratory hands-on performance skills, knowledge and ability to apply concepts in subjects.



SARDAR PATEL UNIVERSITY

Vallabh Vidyanagar

NAAC 'A' Grade (10-01-2023 To 09-01-2028)

NEP-2020 aligned Curriculum with effect from Academic Year 2026-27

Master of Science Applied Statistics and Predictive Data Science Semester-II

vi. Viva-voce

An oral examination conducted to evaluate a student's in-depth knowledge, understanding, and critical thinking regarding a subject or project.

(E) Weightage of Learning Efforts for External Assessment

Unit	Aligned CLOs	Total Learning Hours	Approximate weightage (Marks) to Learning levels (BT)			Total Marks
			Remember (R)	Understanding (U)	Application/ Analyse & above (A)	
I	1, 2	30	4	5	3	12
II	2, 3	30	4	5	4	13
III	3, 4	30	4	5	4	13
IV	4, 5	30	3	5	4	12
		120	15	20	15	50

• Assessment and Evaluation

Sr. No.	Assessment/Evaluation	Component	Weightage (%)
1	Continuous Internal Evaluation	FA: Seminars, Assignments, Quizzes, Group Discussion	25%
		SA: Mid Term Test	25%
2	End-Semester Examination	Written Exam	50%

(F) CLOs – PLOs Matrix

CLO	PLO														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CLO1	2	-	3	-	2	-	-	-	-	1	-	-	-	-	-
CLO2	2	3	2	2	3	-	-	-	-	1	1	-	-	-	-
CLO3	2	3	2	2	3	1	3	-	2	-	1	-	-	-	-
CLO4	3	3	2	3	3	2	2	2	3	2	1	1	-	-	-
CLO5	2	2	1	-	2	-	-	-	2	3	3	2	-	1	1

CLO – PLO correlation	Value
Strong	3
Moderate	2
Low	1
No correlation	-

• Suggested Learning Materials Books:

Sr. No.	Title	Author(s)	Edition/Year	Publisher
1	Research for Marketing Decisions	Paul Green, Donald Tull, Gerald Albaurn	Fifth Edition/1988	PHI
2	Marketing Research	Rajendra Nargundkar	2003	Tata McGraw-Hill Education.



SARDAR PATEL UNIVERSITY

Vallabh Vidyanagar

NAAC 'A' Grade (10-01-2023 To 09-01-2028)

NEP-2020 aligned Curriculum with effect from Academic Year 2026-27

Master of Science Applied Statistics and Predictive Data Science Semester-II

3	Marketing Research: An Applied Orientation	Malhotra Naresh K	Sixth Edition/2010	Pearson Education India.
4	Marketing Research – Measurement & Methods	Donald S. Tull, Del I. Hawkins	1990	McMillan
5	Marketing Research	Beri G. C.	Fourth Edition/2008	Tata McGraw Hill

- **Online Resources (Open Source)**

Sr. No.	Description of Resource(s)	Weblink
1	Marketing Research and Analysis By Prof. J. K. Nayak IIT Roorkee	https://onlinecourses.nptel.ac.in/noc25_mg89/preview



SARDAR PATEL UNIVERSITY

Vallabh Vidyanagar

NAAC 'A' Grade (10-01-2023 To 09-01-2028)

NEP-2020 aligned Curriculum with effect from Academic Year 2026-27

Master of Science Applied Statistics and Predictive Data Science Semester-II

Course Type	Course Code	Course Title	Teaching-Learning Scheme	Total Notional Hours	Course credits
			L-P-T		
DSE	P2S02NEASP01	Time Series Analysis	4-0-0	120	04

• Course Learning Outcomes (CLOs)

On completion of this course, students will be able to:

CLO1: Demonstrate a critical understanding of stationarity, autocorrelation and identify components of time series data.

CLO2: Identify and model temporal dependencies using ARIMA and SARIMA.

CLO3: Model and forecast financial volatility using GARCH models.

CLO4: Analyse multivariate time series using VAR and cointegration.

CLO5: Compare and implement modern forecasting approaches using statistical software.

Unit	Course Content	Learning Pedagogies*	CLO(s)
I	Time Series Fundamentals <ul style="list-style-type: none"> • Components: trend, seasonality, cyclicity, irregularity. • Stationarity: strict and weak. • Autocorrelation and partial autocorrelation functions; Plots, Ljung-Box test; Augmented Dickey-Fuller and KPSS tests. • Differencing and detrending; Spectral analysis basics. 	CL PBL ICT EL	1 2 5
II	ARIMA Models <ul style="list-style-type: none"> • Type and Identification: AR, MA, ARMA, ARIMA, SARIMA models; Wold's decomposition theorem; Box-Jenkins methodology; ARIMA identification, estimation, diagnostics. • Model selection: AIC, BIC; Forecasting with prediction intervals; ARIMAX with exogenous variables. 	CL PBL ICT EL	2 5
III	Volatility and Multivariate Time Series <ul style="list-style-type: none"> • Type of Models: ARCH and GARCH models; EGARCH, GJR-GARCH; Realized volatility; VAR and VARMA models; Granger causality, Forecasting returns vs volatility. • Cointegration: Engle-Granger, Johansen tests; Error correction models (VECM); Impulse response and forecast error variance decomposition. 	CL PBL ICT EL	1 3 4
IV	Modern Forecasting Methods <ul style="list-style-type: none"> • Exponential smoothing: SES, Holt-Winters; Prophet model (Facebook); TBATS; NNAR: Neural network autoregression. • LSTM for time series (introduction); Ensemble forecasting; Forecast combination; Intermittent demand models: Croston's method; M-competition insights. 	CL CBL ICT EL	1 2 5



SARDAR PATEL UNIVERSITY

Vallabh Vidyanagar

NAAC 'A' Grade (10-01-2023 To 09-01-2028)

NEP-2020 aligned Curriculum with effect from Academic Year 2026-27

Master of Science Applied Statistics and Predictive Data Science Semester-II

- **Learning Pedagogies/Methods**

- (k) Classroom Lecture (CL)
- (l) Case-Based Learning (CBL)
- (m) Micro-Projects (MP)
- (n) ICT-Enabled Learning through Digital Resources/ Virtual Labs/Webinars (ICT EL)

- **Assessment Methodologies**

(G) Internal Assessment

a. Internal Formative assessment

- ix. **MCQ and Objective question Quiz:** Students select or give the correct answer from the list of options four /none for a given questions.
- x. **Assignment:** A practical task or setup questions given to measure a student's knowledge, skill and ability in subject or field.
- xi. **Seminar:** A student-led academic activity designed to evaluate student's ability to research, understand, and present a specific topic.
- xii. **Group Discussion:** An interactive method to assess a student's personality and inter- personal skills in team setting. It typically involves 5 to 15 participants discussing a topic for 15 to 30 minutes in presence of an observer.

b. Internal Summative Assessment

- i. **Mid-term tests**
A test conducted roughly halfway through an academic term or semester.
- ii. **Laboratory performance**
Students demonstrate their laboratory hands-on performance skills, knowledge and ability to apply concepts in subjects.
- iii. **Viva-voce**
An oral examination conducted to evaluate a student's in-depth knowledge, understanding, and critical thinking regarding a subject or project.

(H) Weightage of Learning Efforts for External Assessment

Unit	Aligned CLOs	Total Learning Hours	Approximate weightage (Marks) to Learning levels (BT)			Total Marks
			Remember (R)	Understanding (U)	Application/ Analyse & above (A)	
I	1, 2, 5	30	4	5	3	12
II	2, 5	30	4	5	4	13
III	1, 3,4	30	4	5	4	13
IV	1, 2, 5	30	3	5	4	12
		120	15	20	15	50



SARDAR PATEL UNIVERSITY

Vallabh Vidyanagar

NAAC 'A' Grade (10-01-2023 To 09-01-2028)

NEP-2020 aligned Curriculum with effect from Academic Year 2026-27

Master of Science Applied Statistics and Predictive Data Science Semester-II

• Assessment and Evaluation

Sr. No.	Assessment/Evaluation	Component	Weightage (%)
1	Continuous Internal Evaluation	FA: Seminars, Assignments, Quizzes, Group Discussion	25%
		SA: Mid Term Test	25%
2	End-Semester Examination	Written Exam	50%

(I) CLOs – PLOs Matrix

CLO	PLO														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CLO1	3	-	-	-	3	-	-	3	2	2	-	-	1	1	1
CLO2	3	-	-	3	-	-	-	3	2	-	-	-	-	1	1
CLO3	3	-	-	3	3	-	3	3	3	-	1	-	-	1	1
CLO4	3	-	-	3	3	-	-	3	2	-	-	-	-	1	1
CLO5	3	-	-	-	-	1	-	3	3	3	1	3	1	1	1

CLO – PLO correlation	Value
Strong	3
Moderate	2
Low	1
No correlation	-

• Suggested Learning Materials Books:

Sr. No.	Title	Author(s)	Edition/Year	Publisher
1	Time Series Analysis: Forecasting and Control	Box, G.E.P., Jenkins, G.M. et al.	Fifth/2015	Wiley
2	Time Series Analysis and Its Applications	Shumway, R.H. and Stoffer, D.S.	Fourth/2017	Wiley
3	Applied Statistical Time Series Analysis	Shumway, R.H.	First/2018	Prentice Hall New Jersey
4	Applied Time Series Analysis and Forecasting	Cooray, T.M.J.A.	First/2008	Narosa Publishing House, New Delhi
5	Design and Analysis of Time Series Experiments	Richard McCleary et al.	First/2017	Oxford University Press



SARDAR PATEL UNIVERSITY

Vallabh Vidyanagar

NAAC 'A' Grade (10-01-2023 To 09-01-2028)

NEP-2020 aligned Curriculum with effect from Academic Year 2026-27

Master of Science Applied Statistics and Predictive Data Science Semester-II

Course Type	Course Code	Course Title	Teaching-Learning Scheme	Total Notional Hours	Course credits
			L-P-T		
DSE	P2S02NEASP03	Clinical Trials	4-0-0	120	04

• Course Learning Outcomes (CLOs)

On completion of this course, students will be able to:

CLO1: Apply advanced statistical methods to analyse health-related data, including survival analysis, meta-analysis, and interim analysis.

CLO2: Apply international guidelines in design of CT protocol, select appropriate study designs and determine required sample sizes for trials, including phase I-IV and bioequivalence trials.

CLO3: Implement statistical analysis, data visualization, data presentation and reports as per clinical research standards using industry standard programming languages.

CLO4: Interpret findings from clinical trials, p-values, confidence intervals, effect estimates, and critically appraise medical literature to identify common pitfalls in trial analysis.

CLO5: Effectively report statistical methods and results to multi-disciplinary teams, including non-statistical researchers and clinicians.

Unit	Course Content	Learning Pedagogies*	CLO(s)
I	<p>RCT Overview and Phases</p> <ul style="list-style-type: none"> CT Protocol: Introduction to clinical trials; the need of RCT; cases of protocol of RCT. Blinding: single, double, triple. Data management, cohort and case control studies. Endpoints of clinical trials. Overview of CONSORT, CDISC and SDTM frameworks. Phase I – IV and Sample Size (SS) Estimation: DF trials; Rule based and Model based Phase I designs for MTD. SE trials; 95% CI and CI based SS estimation. CTE trials; TH based SS estimation for three types of clinical responses for three types Superiority, Non-inferiority and equivalence (bioequivalence) of CTs. MS phase overview. 	CL CBL ICT EL	1 2 5
II	<p>Study Design for Phase II and III</p> <ul style="list-style-type: none"> Randomization techniques for group allocation: Fixed (Simple, stratified, blocked) allocation and Adaptive (baseline adaptive: minimization method, response adaptive: optimal RPW) allocation schemes. Design of clinical trials: Parallel vs. cross over designs, cross sectional vs. longitudinal designs, review of factorial designs in context of combo drug RCT. 	CL CBL ICT EL	1 2
III	<p>Statistical Analysis of Clinical Trial Data</p> <ul style="list-style-type: none"> Analysis of outcomes from Phase I- III trials: Analysis of dichotomous, continuous, time-to-event (survival) data from clinical trials; KM, log-rank and Cox model, techniques for Interim analysis. 	CL CBL ICT EL	1 3 4



SARDAR PATEL UNIVERSITY

Vallabh Vidyanagar

NAAC 'A' Grade (10-01-2023 To 09-01-2028)

NEP-2020 aligned Curriculum with effect from Academic Year 2026-27

Master of Science Applied Statistics and Predictive Data Science Semester-II

	<ul style="list-style-type: none"> Issues in Data analysis: ITT, PP, and modified ITT analyses. Missing data: multiple imputation in trials; Subgroup analyses; Multiplicity adjustments. 		
IV	<p>Meta-Analyses and Systematic Review</p> <ul style="list-style-type: none"> Fixed- and random-effects meta-analysis; Forest plots; Heterogeneity: Q-test, I^2; Funnel plots and publication bias: Egger's test; Trim-and-fill; Network meta-analysis; Bayesian meta-analysis; GRADE evidence framework; Cumulative meta-analysis; IPD meta-analysis. Multi-center trials, Bioequivalence trials: Case studies in Oncology, Cardiology, Pulmonary. 	CL CBL ICT EL	1 3 4

- Learning Pedagogies/Methods**

- (o) Classroom Lecture (CL)
- (p) Case-Based Learning (CBL)
- (q) Micro-Projects (MP)
- (r) ICT-Enabled Learning through Digital Resources/ Virtual Labs/Webinars (ICT EL)

- Assessment Methodologies**

- (J) **Internal Assessment**

- a. **Internal Formative assessment**

- xiii. **MCQ and Objective question Quiz:** Students select or give the correct answer from the list of options four /none for a given questions.
- xiv. **Assignment:** A practical task or setup questions given to measure a student's knowledge, skill and ability in subject or field.
- xv. **Seminar:** A student-led academic activity designed to evaluate student's ability to research, understand, and present a specific topic.
- xvi. **Group Discussion:** An interactive method to asses a student's personality and inter- personal skills in team setting. It typically involves 5 to 15 participants discussing a topic for 15 to 30 minutes in presence of an observer.

- b. **Internal Summative Assessment**

- iv. **Mid-term tests**
A test conducted roughly halfway through an academic term or semester.
- v. **Laboratory performance**
Students demonstrate their laboratory hands-on performance skills, knowledge and ability to apply concepts in subjects.
- vi. **Viva-voce**
An oral examination conducted to evaluate a student's in-depth knowledge, understanding, and critical thinking regarding a subject or project.



SARDAR PATEL UNIVERSITY

Vallabh Vidyanagar

NAAC 'A' Grade (10-01-2023 To 09-01-2028)

NEP-2020 aligned Curriculum with effect from Academic Year 2026-27

Master of Science Applied Statistics and Predictive Data Science Semester-II

(K) Weightage of Learning Efforts for External Assessment

Unit	Aligned CLOs	Total Learning Hours	Approximate weightage (Marks) to Learning levels (BT)			Total Marks
			Remember (R)	Understanding (U)	Application/ Analyse & above (A)	
I	1, 2, 5	30	4	5	3	12
II	1, 2	30	4	5	4	13
III	1, 3,4	30	4	5	4	13
IV	1, 3,4	30	3	5	4	12
		120	15	20	15	50

• Assessment and Evaluation

Sr. No.	Assessment/Evaluation	Component	Weightage (%)
1	Continuous Internal Evaluation	FA: Seminars, Assignments, Quizzes, Group Discussion	25%
		SA: Mid Term Test	25%
2	End-Semester Examination	Written Exam	50%

(L) CLOs – PLOs Matrix

CLO	PLO														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CLO1	3	-	3	-	3	-	-	-	-	1	-	-	1	2	3
CLO2	3	3	-	3	-	-	-	-	-	-	-	-	-	-	3
CLO3	3	-	2	3	3	-	3	3	3	-	3	-	-	2	3
CLO4	-	-	1	3	3	-	-	-	-	-	-	-	-	1	3
CLO5	-	1	2	-	-	1	-	-	-	3	1	3	-	-	3

CLO – PLO correlation	Value
Strong	3
Moderate	2
Low	1
No correlation	-

• Suggested Learning Materials Books:

Sr. No.	Title	Author(s)	Edition/Year	Publisher
1	Cross – Over Trials in Clinical Research: Statistics in Practice,	Senn, S	Second/2002	John Wiley
2	Clinical Trials –A Methodological Perspective	Piantadosi, S	Third/2005	Wiley
3	Design and Analysis of Clinical Trials with Time-to-Event Endpoints (Edited)	Peace, K. E.	Ninth/2009	CRC Press, T&F



SARDAR PATEL UNIVERSITY

Vallabh Vidyanagar

NAAC 'A' Grade (10-01-2023 To 09-01-2028)

NEP-2020 aligned Curriculum with effect from Academic Year 2026-27

Master of Science Applied Statistics and Predictive Data Science Semester-II

4	Missing Data in Clinical Studies, Statistics in Practice	Molenberghs, G. and Kenward, M. G.	First/2007	John Wiley
5	Medical Statistics	Anil Gore, S. Paranjpe, M. Kulkarni	Second/ 2015	SIPF Academy, Nashik, Maharashtra, India



SARDAR PATEL UNIVERSITY

Vallabh Vidyanagar

NAAC 'A' Grade (10-01-2023 To 09-01-2028)

NEP-2020 aligned Curriculum with effect from Academic Year 2026-27

Master of Science Applied Statistics and Predictive Data Science Semester-II

Course Type	Course Code	Course Title	Teaching-Learning Scheme	Total Notional Hours	Course credits
			L-P-T		
DSC	P2S02NCASP03	Bayesian Statistics and Probabilistic Programming	0-4-0	120	04

• **Course Learning Outcomes (CLOs)**

On completion of this course, students will be able to:

CLO1: Distinguish between frequentist and Bayesian concepts and develop deep understanding of the Bayesian concept, modelling and inference.

CLO2: Use Bayesian model comparison methods, Bayes Factors, LOO-CV, WAIC to select between alternative models.

CLO3: Implement Markov Chain Monte Carlo methods, such as Gibbs sampling to approximate posterior distributions

CLO4: Construct and evaluate Bayesian models using probabilistic programming languages PyMC3, Stan to automate inference.

CLO5: Perform Bayesian regression and Gaussian regression and interpret credible intervals for decision-making.

Unit	Course Content	Learning Pedagogies*	CLO(s)
I	Practice of Bayesian Concepts <ul style="list-style-type: none"> • Bayes theorem problem solving • Posterior distribution visualization and mean, Bayes risk • Model comparison through Bayes factors; LOO-CV, WAIC computing (using R) 	CL PBL ICT EL	1 2 5
II	Practice of MCMC Modelling <ul style="list-style-type: none"> • Monte Carlo integration • RNG of Markov chains • Simple Metropolis Hastings algorithm • Simple Gibbs sampling; convergence diagnostics: R-hat, ESS, trace plot (Using R) 	CL CBL ICT EL	1 3
III	Practice of Bayesian Models <ul style="list-style-type: none"> • Developing the Bayesian Inference Engine • Beta-Binomial model (using R) 	CL CBL ICT EL	4 5
IV	Practice of Bayesian Applications <ul style="list-style-type: none"> • Bayesian regression model: uninformative priors; conjugate priors for linear model; heteroscedasticity; spike-and-slab, horseshoe priors • Gaussian Process regression; Palm Beach County Normal model • Bayesian Hierarchical model; neural networks; Variational inference: ELBO (Using R) 	CL CBL ICT EL	1 4 5



SARDAR PATEL UNIVERSITY

Vallabh Vidyanagar

NAAC 'A' Grade (10-01-2023 To 09-01-2028)

NEP-2020 aligned Curriculum with effect from Academic Year 2026-27

Master of Science Applied Statistics and Predictive Data Science Semester-II

- **Learning Pedagogies/Methods**

- (s) Classroom Lecture (CL)
- (t) Problem-Based Learning (PBL)
- (u) Case-Based Learning (CBL)
- (v) ICT-Enabled Learning through Digital Resources/ Virtual Labs/Webinars (ICT EL)

- **Assessment Methodologies**

(M) **Internal Assessment**

a. **Internal Formative assessment**

- xvii. **Group Discussion:** An interactive method to assess a student's personality and inter-personal skills in team setting. It typically involves 5 to 15 participants discussing a topic for 15 to 30 minutes in presence of an observer.

b. **Internal Summative Assessment**

- vii. **Mid-term tests**
A test conducted roughly halfway through an academic term or semester.
- viii. **Laboratory performance**
Students demonstrate their laboratory hands-on performance skills, knowledge and ability to apply concepts in subjects.

(N) **Weightage of Learning Efforts for External Assessment**

Unit	Aligned CLOs	Total Learning Hours	Approximate weightage (Marks) to Learning levels (BT)			Total Marks
			Remember (R)	Understanding (U)	Application/ Analyse & above (A)	
I	1, 2, 5	30	1	5	6	12
II	1, 3	30	1	5	6	13
III	4, 5	30	1	5	6	13
IV	1, 4, 5	30	1	5	6	12
		120	4	20	24	50

- **Assessment and Evaluation**

Sr.No.	Assessment/Evaluation	Component	Weightage (%)
1	Continuous Internal Evaluation	FA: Seminars, Assignments, Quizzes, Group Discussion	25%
		SA: Mid Term Test	25%
2	End-Semester Examination	Written Exam	50%

(O) **CLOs – PLOs Matrix**

CLO	PLO										
	1	2	3	4	5	6	7	8	9	10	11
CLO1	-	1	-	3	-	-	1	3	3	3	3
CLO2	-	1	-	3	-	-	1	3	3	3	3
CLO3	-	1	-	3	-	-	1	3	3	3	3
CLO4	-	3	-	3	-	-	1	3	3	3	3



SARDAR PATEL UNIVERSITY

Vallabh Vidyanagar

NAAC 'A' Grade (10-01-2023 To 09-01-2028)

NEP-2020 aligned Curriculum with effect from Academic Year 2026-27

Master of Science Applied Statistics and Predictive Data Science Semester-II

CLO5	-	3	-	3	-	-	1	3	3	3	3
------	---	---	---	---	---	---	---	---	---	---	---

CLO – PLO correlation	Value
Strong	3
Moderate	2
Low	1
No correlation	-

• **Suggested Learning Materials Books:**

Sr. No.	Title	Author(s)	Edition/Year	Publisher
1	Bayesian Methods: A Social and Behavioral Sciences Approach (in Dept Lib)	Jeff Gill	Third/2015	CRC Press Taylor & Francis Group
2	Bayesian Analysis with Python	Martin, O.	Second/2021	Packt
3	Bayesian Data Analysis	Gelman A. et al.	Third/2020	CRC Press
4	Statistical Rethinking	McElreath R.	Second/2020	CRC Press



SARDAR PATEL UNIVERSITY

Vallabh Vidyanagar

NAAC 'A' Grade (10-01-2023 To 09-01-2028)

NEP-2020 aligned Curriculum with effect from Academic Year 2026-27

Master of Science Applied Statistics and Predictive Data Science Semester-II

Course Type	Course Code	Course Title	Teaching-Learning Scheme	Total Notional Hours	Course credits
			L-P-T		
DSC	P2S02NCASP04	Natural Language Processing and Text Analytics	0-4-0	120	04

• Course Learning Outcomes (CLOs)

On completion of this course, students will be able to:

CLO1: Demonstrate basic NLP techniques including text preprocessing and language modeling.

CLO2: Apply sequence tagging and parsing techniques for syntactic analysis.

CLO3: Apply semantic analysis methods such as distributional and lexical semantics.

CLO4: Evaluate NLP models and techniques for various tasks.

CLO5: Demonstrate and apply NLP applications like classification, summarization and sentiment analysis.

Unit	Course Content	Learning Pedagogies*	CLO(s)
I	Text Processing and Language Modeling <ul style="list-style-type: none"> Basic text preprocessing (tokenization, stop-word removal) Implement spelling correction using edit distance Build simple unigram and bigram language models Apply smoothing techniques (Laplace smoothing) 	CL PBL ICT EL	1 2
II	Sequence Tagging and Parsing <ul style="list-style-type: none"> Perform POS tagging using NLP libraries Implement sequence tagging using simple probabilistic models Demonstrate constituency parsing Perform dependency parsing 	CL CBL PBL	2 3
III	Semantics and Topic Modeling <ul style="list-style-type: none"> Implement distributional semantics (word co-occurrence matrix) Explore word embeddings (Word2Vec / GloVe basic demo) Perform lexical semantics tasks (synonyms, similarity) Apply topic modeling using LDA 	CL CBL MP	3
IV	NLP Applications <ul style="list-style-type: none"> Perform entity recognition and information extraction Implement text classification (Naive Bayes / Logistic Regression) Perform text summarization (extractive method) Conduct sentiment analysis and opinion mining 	PBL MP ICT EL	4 5



SARDAR PATEL UNIVERSITY

Vallabh Vidyanagar

NAAC 'A' Grade (10-01-2023 To 09-01-2028)

NEP-2020 aligned Curriculum with effect from Academic Year 2026-27

Master of Science Applied Statistics and Predictive Data Science Semester-II

--	--	--	--

- **Learning Pedagogies/Methods**

- (a) Classroom Lecture (CL)
- (b) Case-Based Learning (CBL)
- (c) Micro-Projects (MP)
- (d) Problem-Based Learning (PBL)
- (e) ICT-Enabled Learning through Digital Resources/ Virtual Labs/Webinars (ICT EL)

- **Assessment Methodologies**

(P) Internal Assessment

a. Internal Formative assessment

- xviii. **Group Discussion:** An interactive method to assess a student's personality and inter-personal skills in team setting. It typically involves 5 to 15 participants discussing a topic for 15 to 30 minutes in presence of an observer.

b. Internal Summative Assessment

- ix. **Mid-term tests**
A test conducted roughly halfway through an academic term or semester.
- x. **Laboratory performance**
Students demonstrate their laboratory hands-on performance skills, knowledge and ability to apply concepts in subjects.

(Q) Weightage of Learning Efforts for External Assessment

Unit	Aligned CLOs	Total Learning Hours	Approximate weightage (Marks) to Learning levels (BT)			Total Marks
			Remember (R)	Understanding (U)	Application/ Analyse & above (A)	
I	1, 2	30	4	5	3	12
II	2, 3	30	4	5	4	13
III	3	30	4	5	4	13
IV	4, 5	30	3	5	4	12
		120	15	20	15	50

- **Assessment and Evaluation**

Sr. No.	Assessment/Evaluation	Component	Weightage (%)
1	Continuous Internal Evaluation	FA: Seminars, Assignments, Quizzes, Group Discussion	25%
		SA: Mid Term Test	25%
2	End-Semester Examination	Written Exam	50%

(R) CLOs – PLOs Matrix

CLO	PLO										
	1	2	3	4	5	6	7	8	9	10	11
CLO1	2	-	3	-	1	-	-	-	-	-	-
CLO2	3	2	3	-	-	-	-	-	-	-	-
CLO3	3	3	3	-	-	-	-	-	-	-	-



SARDAR PATEL UNIVERSITY

Vallabh Vidyanagar

NAAC 'A' Grade (10-01-2023 To 09-01-2028)

NEP-2020 aligned Curriculum with effect from Academic Year 2026-27

Master of Science Applied Statistics and Predictive Data Science Semester-II

CLO4	2	2	2	-	3	3	3	3	-	2	-
CLO5	2	2	2	-	3	3	3	3	3	3	3

CLO – PLO correlation	Value
Strong	3
Moderate	2
Low	1
No correlation	-

• Suggested Learning Materials Books:

Sr. No.	Title	Author(s)	Edition/Year	Publisher
1	Natural Language Processing with Python	Steven Bird, Ewan Klein, Edward Loper	1 st Edition/2009	O'Reilly Media
2	Foundations of Statistical Natural Language Processing	Christopher D. Manning, Hinrich Schütze	1 st Edition /1991	MIT Press
3	Practical Natural Language Processing	Sowmya Vajjala, Bodhisattwa Majumder, Anuj Gupta, Harshit Surana	1 st Edition/2020	O'Reilly Media

• Online Resources (Open Source)

Sr. No.	Description of Resource(s)	Weblink
1	Natural Language Processing By Prof. Pawan Goyal IIT Kharagpur	https://onlinecourses.nptel.ac.in/noc19_cs56/preview



SARDAR PATEL UNIVERSITY

Vallabh Vidyanagar

NAAC 'A' Grade (10-01-2023 To 09-01-2028)

NEP-2020 aligned Curriculum with effect from Academic Year 2026-27

Master of Science Applied Statistics and Predictive Data Science Semester-II

Course Type	Course Code	Course Title	Teaching-Learning Scheme	Total Notional Hours	Course credits
			L-P-T		
DSC	P2S02NCASP05	Google Data Analytics	0-2-0	60	02

• Course Learning Outcomes (CLOs)

On completion of this course, students will be able to:

CLO1: Design data preparation workflows using spreadsheet functions to clean, transform, and organize datasets for quality analysis and decision-making.

CLO2: Analyze datasets using SQL queries and spreadsheet techniques to identify patterns, inefficiencies, and improvement opportunities in organizational processes.

CLO3: Develop data visualizations and dashboards using R and Tableau to present quality metrics and productivity insights effectively.

CLO4: Evaluate analytical results to support data-driven decisions while ensuring accuracy, integrity, and compliance in reporting.

CLO5: Construct end-to-end data analytics solutions by integrating data cleaning, analysis, visualization, and reporting to support productivity improvement and operational excellence.

Unit	Course Content	Learning Pedagogies*	CLO(s)
I	<ul style="list-style-type: none"> Data cleaning and transformation using Google Sheets functions (TRIM, PROPER, VLOOKUP, IF) Building pivot tables and applying conditional formatting for exploratory data analysis in Sheets Writing SQL queries: SELECT, WHERE, GROUP BY, ORDER BY on a sample business dataset Performing SQL JOIN operations to combine multiple tables and extract meaningful insights Introduction to R: importing a dataset, exploring structure, and basic data manipulation using dplyr 	ICT EL	1 2 5
II	<ul style="list-style-type: none"> Creating visualizations in R using ggplot2: bar chart, scatter plot, and histogram with proper labels Connecting a dataset to Tableau and building basic charts: bar, line, treemap, and map visual Designing an interactive Tableau dashboard with filters, parameters, and a KPI summary view Data storytelling exercise: converting analysis output into a structured slide deck or report Capstone mini project: full analytics workflow on a real- 	ICT EL	2 3 4 5



SARDAR PATEL UNIVERSITY

Vallabh Vidyanagar

NAAC 'A' Grade (10-01-2023 To 09-01-2028)

NEP-2020 aligned Curriculum with effect from Academic Year 2026-27

Master of Science Applied Statistics and Predictive Data Science Semester-II

	world dataset (clean → analyze → visualize → present)		
--	---	--	--

- Learning Pedagogies/Methods**

- (w) Classroom Lecture (CL)
- (x) Case-Based Learning (CBL)
- (y) Micro-Projects (MP)
- (z) Problem-Based Learning (PBL)
- (aa) ICT-Enabled Learning through Digital Resources/ Virtual Labs/Webinars (ICT EL)

- Assessment Methodologies**

- (S) **Internal Assessment**

- a. **Internal Formative assessment**

- xix. **MCQ and Objective question Quiz:** Students select or give the correct answer from the list of options four /none for a given questions.
 - xx. **Assignment:** A practical task or setup questions given to measure a student's knowledge, skill and ability in subject or field.
 - xxi. **Seminar:** A student-led academic activity designed to evaluate student's ability to research, understand, and present a specific topic.
 - xxii. **Group Discussion:** An interactive method to asses a student's personality and inter- personal skills in team setting. It typically involves 5 to 15 participants discussing a topic for 15 to 30 minutes in presence of an observer.

- b. **Internal Summative Assessment**

- vii. **Mid-term tests**
A test conducted roughly halfway through an academic term or semester.
 - viii. **Laboratory performance**
Students demonstrate their laboratory hands-on performance skills, knowledge and ability to apply concepts in subjects.
 - ix. **Viva-voce**
An oral examination conducted to evaluate a student's in-depth knowledge, understanding, and critical thinking regarding a subject or project.

(T) Weightage of Learning Efforts for Internal Assessment

Unit	Aligned CLOs	Total Learning Hours	Approximate weightage (Marks) to Learning levels (BT)			Total Marks
			Remember (R)	Understanding (U)	Application/ Analyse & above (A)	
I	1,2,5	30	7	10	8	25
II	2,3,4,5	30	8	10	7	25
		60	15	20	15	50

- Assessment and Evaluation**

Sr. No.	Assessment/Evaluation	Component	Weightage (%)
---------	-----------------------	-----------	---------------



SARDAR PATEL UNIVERSITY

Vallabh Vidyanagar

NAAC 'A' Grade (10-01-2023 To 09-01-2028)

NEP-2020 aligned Curriculum with effect from Academic Year 2026-27

Master of Science Applied Statistics and Predictive Data Science Semester-II

1	Continuous Internal Evaluation	FA: Seminars, Assignments, Quizzes, Group Discussion	25%
		SA: Mid Term Test	25%

(U) CLOs – PLOs Matrix

CLO	PLO												
	1	2	3	4	5	6	7	8	9	10	11	12	13
CLO1	1	1	-	3	-	1	2	1	1	2	1	-	-
CLO2	2	2	-	3	1	1	1	2	1	1	-	-	-
CLO3	1	-	-	2	1	3	1	1	3	3	-	-	-
CLO4	2	1	-	2	-	3	-	-	2	2	3	-	-
CLO5	2	2	-	3	2	2	3	2	2	2	2	3	2

CLO – PLO correlation	Value
Strong	3
Moderate	2
Low	1
No correlation	-

• Suggested Learning Materials Books:

Sr. No.	Title	Author(s)	Edition/Year	Publisher
1	Data Analytics Made Accessible	Anil Maheshwari	2017	CreateSpace Independent Publishing
2	R for Data Science	Hadley Wickham, Garrett Grolemund	2017	O'Reilly Media
3	Storytelling with Data	Cole Nussbaumer Knaflic	2015	Wiley

• Online Resources (Open Source)

Sr. No.	Description of Resource(s)	Weblink
1	Google Data Analytics (Coursera)	https://www.coursera.org/professional-certificates/google-data-analytics
2	SQLBolt	https://www.sqlbolt.com/
3	ThoughtSpot (SQL Tutorial)	https://www.thoughtspot.com/sql-tutorial
4	Free Training Videos – tableau	https://www.tableau.com/learn/training



SARDAR PATEL UNIVERSITY

Vallabh Vidyanagar

NAAC 'A' Grade (10-01-2023 To 09-01-2028)

NEP-2020 aligned Curriculum with effect from Academic Year 2026-27

Master of Science Applied Statistics and Predictive Data Science Semester-II
