SYLLABUS FOR THE BATCH FROM YEAR 2025 TO 2026

FOR

Certificate Course in Business Analytics
(Credit Based Evaluation and Grading System)

Semester: I
EXAMINATIONS: 2025-2026

The Certificate Programme Offered:

- **Certificate Course in Business Analytics (6 Months duration)**

Program Outcomes:

- **Fundamental Knowledge of Statistical Methods** – Learners will gain a comprehensive understanding of core statistical concepts, inferential techniques, and research methodologies, enabling them to analyze and interpret data effectively.
- **Enhanced Analytical Skills** – The program emphasizes the application of statistical methods, hypothesis testing, and primary data analytics to support data-driven decision-making across various industries.
- **Proficiency in Data Analysis & Visualization Tools** – Participants will develop hands-on expertise in using statistical software and visualization tools such as R, Power BI, PSPP, Blue sky, GRETL, STATA, and Excel for data analysis, reporting, and presentation.
- **Research and Problem-Solving Abilities –** The course will equip learners with the ability to design research studies, analyze trends, and apply statistical approaches to real-world problem-solving in diverse domains.
- **Career Readiness & Employability** – By acquiring industry-relevant analytical and research skills, students will enhance their employability in fields such as business analytics, finance, healthcare, social sciences, and policy research, making them valuable assets in data-driven environments.

Name of the Department: University School of Financial Studies
In collaboration with
Directorate of Open & Distance Learning and Online Studies

GURU NANAK DEV UNIVERSITY AMRITSAR

Certificate Course in Business Analytics (SEMESTER SYSTEM) Offered by Department of University School of Financial Studies in collaboration with Directorate of Open & Distance Learning, Guru Nanak Dev University, Amritsar

Eligibility:

- +2 in any stream with at least 45% marks in aggregate (40% for SC/ST candidates).
- Any student doing Bachelor Degree, Master Degree, M.Phil., Ph.D. from GNDU.

SEMESTER-I

Paper Code	Subject	Marks			Credits
		Internal Assessment	End Term	Total	
ODBA101T	Introductory Statistics	30	70	100	4
ODBA102T	Inferential Statistics	30	70	100	4
ODBA103T	Primary Data Analytics	30	70	100	4
ODBA104T	Data Visualization Through R and Power BI	30	70	100	4
	Total Marks & Credits	**120**	**280**	**400**	**16**

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INTRODUCTORY STATISTICS

Subject Code: ODBA101T

(Semester – I)

Time: 03 Hours **Max. Marks: 100 Marks**

Internal Assessment: 30 Marks

End Term: 70 Marks

Instructions for the Paper-Setter/examiner:

1. Question paper shall consist of **Four sections**.
2. Paper setter shall set **Eight questions** in all by selecting **Two questions** of equal marks from each section. However, a question may have sub-parts (not exceeding four sub-parts) and appropriate allocation of marks should be done for each sub-part.
3. Candidates shall attempt **Five questions** in all, by at least selecting **One question** from each section and the **5th question** may be attempted from any of the **Four sections**.
4. The question paper should be strictly according to the instructions mentioned above. In no case a question should be asked outside the syllabus.

Section A

Introduction to Statistics: Definition, Scope, and Importance. Types of Data: Structured and Unstructured, Qualitative and Quantitative, Cross-sectional & Time-series

Measures of Central Tendency: Application and Computation of Mean-Arithmetic, Geometric, Harmonic Mean; Median, Mode, Quartiles, Deciles and Percentiles.

Section B

Measures of Variation: Range, Inter-Quartile Range, Mean Deviation, Standard Deviation, Variance, Coefficient of Variation.

Measures of Shape: Skewness- Types and Measures. Kurtosis- Leptokurtic, Mesokurtic, and Platykurtic Distributions.

Section C

Basics of Probability: Definitions- Random Experiment, Sample Space, Event; Probability estimation using relative frequency, Axioms of probability, Theorems of Probability: Addition, Multiplication and Bayes Theorem

Probability Distributions: Binomial, Poisson, and Normal Distributions.

Section D

Random Variables: Definition of random variable, discrete and continuous random variable, Functions of random variable, Probability mass and density function with illustrations. Distribution function and its properties.

Software Used: All practical problems will be solved through Open source softwares like Gretl, Bluesky, Jamovi.

Course Outcome:

On the completion of course, students will be able to analyze statistical data by using measures of central tendency and dispersion. Students will develop an understanding of probability concepts, and apply them to real-world scenarios. They will also analyze and utilize probability distributions such as binomial, Poisson, and normal distributions. Additionally, students will be able to define and compute functions of discrete and continuous random variables, along with their probability mass and density functions. • Compute and interpret the results of descriptive statistics and used it for describing the data.

Suggested Readings:

1. Levin, Richard and David S. Rubin. "Statistics for Management", Prentice Hall of India, New Delhi, 8th Edition, 2019.
2. Render, B. and Stair, R. M. Jr., "Quantitative Analysis for Management", Prentice– Hall of India, New Delhi, 13th Edition, 2017.
3. Gupta C B, Gupta V, "An Introduction to Statistical Methods", Vikas Publications,2004.
4. Berenson, L.M., Krehbiel, T.C., Vishwanathan, P.K. and Levine, D.M., "Business Statistics: A First Course", Pearson Education,7th edition, 2015.
5. Leekley, Robert M. "Applied Statistics for Business and Economics". Illinois Wesleyan University, Bloomington, Illinois, USA.

Note: Latest editions to be followed

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INFERENTIAL STATISTICS

Subject Code: ODBA102T

(Semester – I)

Time: 03 Hours **Max. Marks: 100 Marks**

Internal Assessment: 30 Marks

End Term: 70 Marks

Instructions for the Paper-Setter/examiner:

1. Question paper shall consist of **Four sections**.
2. Paper setter shall set **Eight questions** in all by selecting **Two questions** of equal marks from each section. However, a question may have sub-parts (not exceeding four sub-parts) and appropriate allocation of marks should be done for each sub-part.
3. Candidates shall attempt **Five questions** in all, by at least selecting **One question** from each section and the **5th question** may be attempted from any of the **Four sections**.
4. The question paper should be strictly according to the instructions mentioned above. In no case a question should be asked outside the syllabus.

Section-A

Data Preparation and Cleaning: Data Entry and Editing, Selecting Cases, Handling Missing Values, Outlier Detection, Data Transformation

Hypothesis Testing: Concept of hypothesis testing, null and alternative hypotheses, level of significance, p-value, critical region, one-tailed and two-tailed tests, Type I and Type II Error.

Section-B

Parametric Tests: Conceptual framework, assumptions and application, One-sample t-test, Independent sample t-test, paired sample t-test, ANOVA (One-Way ANOVA including post-hoc analysis and Two-Way ANOVA including interaction effect). Repeated Measures One-Way ANOVA

Non-Parametric Tests: Mann Whitney U-test, Wilcoxon signed rank test, Kruskal Wallis test, Chi-square goodness of fit, Chi-square test of association.

Section-C

Correlation Analysis: Introduction, Pearson Correlation Coefficient, Spearman Rank Correlation, Point Bi-Serial Correlation and Phi-Coefficient.

Regression Analysis: Introduction, Simple and Multiple regressions, Regression with Dummy variables, Diagnostic tests in Regression: Normality of Residuals (Shapiro-Wilk Test, Kolmogorov-Smirnov Test) Autocorrelation (Durbin-Watson Test), Hetroskedasticity (White's Test**,** Breusch-Pagan Test), Multicollinearity

Section-D

Time Series Data Analysis- Characteristics, Stationarity of Data-Unit roots and spurious regressions, testing for unit roots, Autoregressive time series models, Moving average models, ARIMA, Granger Causality Test.

Panel Data Analysis: Estimation, Pooled Least Squares, Panel data: Introduction, Panel data models - The fixed effects and random effects model.

Note: Open source softwares like Gretl, Bluesky, Jamovi, R-Commander, Student Version of Eviews will be used to solve practical question.

Course Outcome: On the completion of course, students will be able to prepare and clean data for analysis, ensuring accuracy and reliability. They will develop a strong understanding of hypothesis testing and effectively apply both parametric and non-parametric tests. Additionally, students will gain hands-on experience in analyzing time series and panel data using various statistical techniques. The course will also enhance their proficiency in statistical analysis through open-source software, equipping them with the skills to adapt to emerging data science technologies.

Suggested Readings:

1. Damodar N. Gujarat and S.Sangeeta, "Basic Econometrics", Tata McGraw Hill Publishers, New Delhi, Fourth Edition, 2008.
2. A.K. Sharma, "Text Book of Correlations and Regression", Discovering Publishing House, New Delhi, Fourth Edition, 2005.
3. Navarro DJ and Foxcroft DR, "Learning Statistics with Jamovi: a tutorial forpsychology students and other beginners", 2022 (Version 0.70). Available at:http://learnstatswithjamovi.com.
4. Chris Brooks, "Introductory Econometrics for Finance", Cambridge University Press, Cambridge, New York, Second Edition, 2002.
5. Hair, Black, Babin, Anderson and Tatham, Multivariate Data Analysis, New Delhi: Pearson Education, Seventh Edition, 2010.

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PRIMARY DATA ANALYTICS

Subject Code: ODBA103T

(Semester – I)

Time: 03 Hours **Max. Marks: 100 Marks**

Internal Assessment: 30 Marks

End Term: 70 Marks

Instructions for the Paper-Setter/examiner:

1. Question paper shall consist of **Four sections**.
2. Paper setter shall set **Eight questions** in all by selecting **Two questions** of equal marks from each section. However, a question may have sub-parts (not exceeding four sub-parts) and appropriate allocation of marks should be done for each sub-part.
3. Candidates shall attempt **Five questions** in all, by at least selecting **One question** from each section and the **5th question** may be attempted from any of the **Four sections**.
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PRIMARY DATA ANALYTICS

Section-A

Sampling and Sampling Distribution: Introduction, Population and Sample, Probability sampling methods- Simple random sampling, Multistage sampling, Systematic sampling, Stratified sampling, Cluster sampling, Non-probability sampling methods- Convenience sampling, Judgmental sampling, Quota sampling, Snowball sampling, Sampling Error and Bias, Central Limit Theorem, Sampling Distribution of proportion and Mean

Estimation: Concept of estimation, Point Estimation, Interval Estimation, Confidence intervals for means, proportions and variances.

Section-B

Data Preparation and Cleaning: Data Entry and Editing, Selecting Cases, Handling Missing Values, Outliers Detection, Data Transformation, Logarithmic Transformation, Reciprocal Transformation, Standardization and Normalization, Mathematical Transformation, Transforming Categorical Data.

Questionnaire and Questionnaire design process: Content and structure of questionnaire, Criteria for questionnaire designing

Section-C

Exploratory Factor Analysis: Introduction, Reliability Analysis, KMO and Bartlett Test of Sphericity for Sampling Adequacy, Eigen Values, Communality, Rotated Component Matrix and Interpreting the results

Confirmatory Factor Analysis: Model specification, identification and estimation procedures, Model fit evaluation, measurement invariance testing, Interpretation and Reporting of results

Section-D

Structural Equation Modelling: Conceptual Framework, Application, Analysis and Interpretation of results

Moderation and Mediation Analysis: Foundational concepts of moderation and mediation, Calculating indirect effects in mediation and moderation models.

Course Outcome: The course equips learners with the ability to collect, clean, and analyze data effectively. It enhances their understanding of sampling methods, statistical estimation, and data transformation techniques. By integrating analytical tools and modeling approaches, the course prepares students to draw meaningful insights and make data-driven decisions in research and business environments.

Note: All practical problems through open source softwares such as BlueSky, PSPP, R-Commander, Jamovi etc

Suggested Readings:

1. Cooper, D.R. and Schindler, P.S, "*Business Research Methods*", 9th Ediction, Tata McGraw Hill, New Delhi.

2. Kothari, C.R. "*Research Methodology*", 2nd Edition, New Age International, 2008.

3. Kline, P, "*The new handbook of factor analysis",* (2nd ed.), Sage Publications, 2013.

4. Tabachnick, B. G. and Fidell, L. S., "*Using multivariate statistics"* (6th ed.), Pearson Education, 2013.

5. Brown, T. A, "*Confirmatory factor analysis for applied research"* (2nd ed.), Guilford Press, 2015.

6. Kline, R. B., "*Principles and practice of structural equation modeling"* (4th ed.), Guilford Press, 2015.

7. Schumacker, R. E. and Lomax, R. G., "*A beginner's guide to structural equation modeling"* (4th ed.). Routledge, 2016.

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DATA VISUALIZATION THROUGH R AND POWER BI

Subject Code: ODBA104T

(Semester – I)

Time: 03 Hours **Max. Marks: 100 Marks**

Internal Assessment: 30 Marks

End Term: 70 Marks

Instructions for the Paper-Setter/examiner:

1. Question paper shall consist of **Four sections**.
2. Paper setter shall set **Eight questions** in all by selecting **Two questions** of equal marks from each section. However, a question may have sub-parts (not exceeding four sub-parts) and appropriate allocation of marks should be done for each sub-part.
3. Candidates shall attempt **Five questions** in all, by at least selecting **One question** from each section and the **5th question** may be attempted from any of the **Four sections**.
4. The question paper should be strictly according to the instructions mentioned above. In no case a question should be asked outside the syllabus.

Section-A

Data Preparation: Basics of R, Variables, Data types, Importing Data, Cleaning Data: Handling missing values and Outliers

Univariate and Bivariate Graphs: Bar Chart, Stacked Bar chart, Grouped Bar Chart, Segmented Bar Chart, Pie Chart, Histograms, Kernel Density Plots, Scatter plots

Section-B

Data Visualization Libraries in R: *ggplot2*- Introduction to ggplot2, geom function for customized visualization, faceting, *R Shiny* for building interactive web applications

Customizing Graphs: Specifying colors manually and using color palettes, Legends- Legend location, legend title, labels, Annotations- Adding text and lines, Themes- Altering theme elements, pre-packages themes.

Section-C

Data Visualization (Power BI): Introduction to Power BI, Creating basic visualizations: Bar Chart, Line Chart, Scatter plots

Building Interactive Dashboards: Inbuilt visuals, custom visuals, Visualization as a Tooltip, Final dashboard, Filter, slicer, bookmarks, buttons

Section-D

DAX: Introduction to Measures, Calculated Columns vs Quick Measures, Creating a Date Table, Time Intelligence Functions

Power BI service: Publishing to Power BI service, Power BI dataflows, Dashboards and Cross Reporting

Course Outcome: The course enables learners to effectively visualize and communicate data insights. It provides hands-on experience with R and Power BI, covering data preparation, graph customization, dashboard creation, and interactive reporting. By mastering key visualization techniques and tools, students will be able to present complex data in a clear and impactful manner for data-driven decision-making.

Suggested Readings:

1. Wickham, H., "*ggplot2: Elegant graphics for data analysis"* (2nd ed.), Springer, 2016.

2. Robinson, D., "*Mastering data visualization with R: A practical guide to data visualization with R*", Packt Publishing, 2015.

3. Healy, K., "*Data visualization: A practical introduction*", Princeton University Press, 2018.

4. Chang, W., "*Interactive data visualization with Shiny",* (2nd ed.), CRC Press, 2018.

5. Ferrari, M., "*Power BI cookbook: Creating business intelligence solutions of analytical data models, reports, and dashboards*", Packt Publishing, 2017.

6. Jansen, J. and Sklar, K., "*Mastering Microsoft Power BI: Expert techniques for effective data analytics and business intelligence*", Wiley, 2018.

7. Duguid, A. and Danziger, M., "*The definitive guide to DAX: Business intelligence for Microsoft Power BI, SQL Server Analysis Services, and Excel",* (2nd ed.), Microsoft Press, 2019.

8. Pardoe, H., "*Power BI: A comprehensive guide to data visualization in Power BI",* Packt Publishing, 2019.