SCHEME OF STUDIES

AND OUTLINES

FOR

BS 4-YEAR

UNDERGRADUATE PROGRAM IN STATISTICS

(Semester/Term System)

Session 2023 –Onward

DEPARTMENT OF STATISTICS
UNIVERSITY OF SARGODHA

1. **Title of Degree Program:** BS in Statistics
2. **Program Learning Objectives:** The main objective is to equip the graduates with the knowledge of statistical theory, statistical software and techniques of data collection and analysis so that they can compete in the job market and contribute towards the economic development of Pakistan. To provide a sound footing of the subject matter of statistical theory so that they can pursue higher degrees and research in the field of statistics.
3. **Program Structure:**

Duration	Minimum 4-Years (8-Semesters), Maximum 6-Years (12-Semesters)
Admission Requirements:	At least 45% marks in HSSC, Pre-Engineering / Pre-Medical / ICS / FA/ I.Com / D.Com. or A-Level or equivalent or DAE.
Degree Completion Requirements:	120-144 Credit Hours

4. **General Education (Gen Ed) Requirements:(Mandatory/Core Curses):**
   The minimum requirement for Gen Ed is 30 credits hours and will be offered in first four semesters only.

Sr. No.	Semester	Course Code	Course Title	Credit Hours	Prerequisite
1.	2	URCG-5112	Fables, Wisdom Literature and EPICS	2(2-0)	Nil
2.	4	URCG-5114	Basic Science	3(2-1)	Nil
3.	2	URCG-5116	Science of Society-I	2(2-0)	Nil
4.	1	URCG-5118	Functional English	3(3-0)	Nil
5.	3	URCG-5119	Expository Writing	3(3-0)	Nil
6.	2	URCG-5120	Exploring Quantitative Skills	3(3-0)	Nil
7.	3	URCG-5121	Tools for Quantitative Reasoning	3(3-0)	Nil
8.	1	URCG-5105 URCG-5126	Islamic Studies (OR) Religious Education/Ethics	2(2-0)	Nil
9.	4	URCG-5122	Ideology and Constitution of Pakistan	2(2-0)	Nil
10.	1	URCG-5123	Applications of Information and Communication Technologies (ICT)	3(2-1)	Nil
11.	4	URCG-5124	Entrepreneurship	2(2-0)	Nil
12.	4	URCG-5125	Civics and Community Engagement	2(2-0)	Nil
13.	1-8	URCG-5111	Translation of Holy Quran*	NC	Nil
14.	2	URCG-5127	Seerat of the Holy Prophet (SAW)*	1(1-0)	Nil
			GE Courses Credit Hours Total	31	

   *For Muslim students only
5. **Single Major Courses:**

Sr. No.	Course Code	Course Title	Credit Hours	Prerequisite
1.	STAT-5101	Introductory Statistics	3(3-0)	*Nil*
2.	STAT-5102	Applied Statistics	3(3-0)	Nil
3.	STAT-5103	Official Statistics	3(3-0)	Nil
4.	STAT-5104	Introduction to Probability Distributions	3(3-0)	Nil
5.	STAT-5105	Computer Applications in Statistics	3(3-0)	Nil
6.	STAT-5106	Introduction to Regression Analysis and Experimental Design	3(3-0)	Nil
7.	STAT-5107	Basic Statistical Inference	3(3-0)	Nil
8.	STAT-5108	Population Studies	3(3-0)	Nil
9.	STAT-5109	Research Methods	3(3-0)	Nil
10.	STAT-5110	Non-Parametric Methods	3(3-0)	Nil
11.	STAT-5111	Bio-Statistics	3(3-0)	Nil

12.	STAT-6101	Regression Analysis	3(3-0)	STAT-5106
13.	STAT-6102	Probability and Probability Distributions-I	3(3-0)	STAT-5104
14.	STAT-6103	Sampling Techniques-I	3(3-0)	Nil
15.	STAT-6104	Design and Analysis of Experiments-I	3(3-0)	STAT-5106
16.	STAT-6105	Econometrics	3(3-0)	Nil
17.	STAT-6106	Probability and Probability Distributions-II	3(3-0)	STAT-6102
18.	STAT-6107	Sampling Techniques-II	3(3-0)	STAT-6103
19.	STAT-6108	Design and Analysis of Experiments-II	3(3-0)	STAT-6104
20.	STAT-6109	Statistical Packages	3(3-0)	Nil
21.	STAT-6110	Statistical Inference-I	3(3-0)	Nil
22.	STAT-6111	Statistical Quality Control	3(3-0)	Nil
23.	STAT-6112	Time Series Analysis	3(3-0)	Nil
24.	STAT-6113	Statistical Inference-II	3(3-0)	STAT-6110
25.	STAT-6114	Applied Multivariate Analysis	3(3-0)	Nil
26.	STAT-6115	Categorical Data Analysis	3(3-0)	Nil
Major Courses Credit Hours Total			**78**	

6. **Interdisciplinary/Allied courses: minimum 12 credit hours:**
   Interdisciplinary/Allied courses will be offered after 4th semester

1.	MATH-5101	Calculus-I	3(3-0)	Nil
2.	MATH-5103	Calculus-II	3(3-0)	MATH-5101
3.	BUSB-5106	Advanced Accounting and Auditing	3(3-0)	Nil
4.	GEOL-5101	Introduction to Geology	3(3-0)	Nil
Interdisciplinary Courses Credit Hours Total			**12**	

7. **Field experience/internship: Minimum 03 credit hours:**
   Lasting 6-8 weeks and ideally scheduled during summer breaks after 4th semester.

1.	**STAT-61116**	**Field experience/Internship**	**3(3-0)**	Nil

8. **Capstone project: Minimum 03 credit hours:**
   This project, after the sixth semester, requires faculty supervision and evaluation following department guidelines

1.	**STAT-6117**	**Capstone Project**	**3(3-0)**	Nil

Scheme of Studies
BS in *Statistics*

Semester-I

Category	Course Code	Course Title	Credit Hours	Pre-Requisite
GE-1	URCG-5118	Functional English	3(3-0)	Nil
GE-2	URCG-5105 URCG-5126	Islamic Studies (OR) Religious Education/Ethics	2(2-0)	Nil
GE-3	URCG-5123	Applications of Information and Communication Technologies (ICT)	3(2-1)	Nil
Major-1	STAT-5101	Introductory Statistics	3(3-0)	*Nil*
Major-2	STAT-5102	Applied Statistics	3(3-0)	Nil
Major-3	STAT-5103	Official Statistics	3(3-0)	Nil

Semester Total Credit Hours: 17

Semester-II

Category	Course Code	Course Title	Credit Hours	Pre-Requisite
GE-4	URCG-5112	Fables, Wisdom Literature and EPICS	2(2-0)	Nil
GE-5	URCG-5116	Science of Society-I	2(2-0)	Nil
GE-6	URCG-5120	Exploring Quantitative Skills	3(3-0)	Nil
GE-7	URCG-5127	Seerat of the Holy Prophet (SAW)*	1(1-0)	Nil
Major-4	STAT-5104	Introduction to Probability Distributions	3(3-0)	Nil
Major-5	STAT-5105	Computer Applications in Statistics	3(3-0)	Nil
Major-6	STAT-5106	Introduction to Regression Analysis and Experimental Design	3(3-0)	Nil
GE-8	URCG-5111	Translation of Holy Quran*	NC	Nil

*For Muslim students only   Semester Total Credit Hours: 17

Semester-III

Category	Course Code	Course Title	Credit Hours	Pre-Requisite
GE-9	URCG-5119	Expository Writing	3(3-0)	Nil
GE-10	URCG-5121	Tools for Quantitative Reasoning	3(3-0)	Nil
Major-7	STAT-5107	Basic Statistical Inference	3(3-0)	Nil
Major-8	STAT-5108	Population Studies	3(3-0)	Nil
Major-9	STAT-5109	Research Methods	3(3-0)	Nil

Semester Total Credit Hours: 15

Semester-IV

Category	Course Code	Course Title	Credit Hours	Pre-Requisite
GE-11	URCG-5122	Ideology and Constitution of Pakistan	2(2-0)	Nil
GE-12	URCG-5114	Basic Science	3(2-1)	Nil
GE-13	URCG-5124	Entrepreneurship	2(2-0)	Nil
GE-14	URCG-5125	Civics and Community Engagement	2(2-0)	Nil
Major-10	STAT-5110	Non-Parametric Methods	3(3-0)	Nil
Major-11	STAT-5111	Bio-Statistics	3(3-0)	Nil
GE-8	URCG-5111	Translation of Holy Quran*	NC	Nil

*For Muslim students only   Semester Total Credit Hours: 15

Exiting program: *(For student exiting program to have Associate Degree)*
Student who wants to exit must complete minimum 60 credit hours.

Exit requirement
Student who wants to exit must complete minimum 60 credit hours.

Semester-V

Category	Course Code	Course Title	Credit Hours	Pre-Requisite
Major-12	STAT-6101	Regression Analysis	3(3-0)	STAT-5106
Major-13	STAT-6102	Probability and Probability Distributions-I	3(3-0)	STAT-5104
Major-14	STAT-6103	Sampling Techniques-I	3(3-0)	Nil
Major-15	STAT-6104	Design and Analysis of Experiments-I	3(3-0)	STAT-5106
ID-1	MATH-5101	Calculus-I	3(3-0)	Nil

Semester Total Credit Hours: 15

Semester-VI

Category	Course Code	Course Title	Credit Hours	Pre-Requisite
Major-16	STAT-6105	Econometrics	3(3-0)	Nil
Major-17	STAT-6106	Probability and Probability Distributions-II	3(3-0)	STAT-6102
Major-18	STAT-6107	Sampling Techniques-II	3(3-0)	STAT-6103
Major-19	STAT-6108	Design and Analysis of Experiments-II	3(3-0)	STAT-6104
Major-20	STAT-6109	Statistical Packages	3(3-0)	Nil
GE-8	URCG-5111	Translation of Holy Quran*	NC	Nil

*For Muslim students only   Semester Total Credit Hours: 15

Summer semester: *(Internship will be preferably offered in summer break after 6th semester)*

Category	Course Code	Course Title	Credit Hours	Pre-Requisite
Compulsory	STAT-6116	Field Experience/Internship *Internship will be preferably offered in summer break after 6th semester*	3(3-0)	Nil

Semester-VII

Category	Course Code	Course Title	Credit Hours	Pre-Requisite
Major-21	STAT-6110	Statistical Inference-I	3(3-0)	Nil
Major-22	STAT-6111	Statistical Quality Control	3(3-0)	Nil
Major-23	STAT-6112	Time Series Analysis	3(3-0)	Nil
ID-2	MATH-5103	Calculus-II	3(3-0)	MATH-5101
ID-3	BUSB-5106	Advanced Accounting and Auditing	3(3-0)	Nil

Semester Total Credit Hours: 15

Semester-VIII

Category	Course Code	Course Title	Credit Hours	Pre-Requisite
Major-24	STAT-6113	Statistical Inference-II	3(3-0)	STAT-6110
Major-25	STAT-6114	Applied Multivariate Analysis	3(3-0)	Nil
Major-26	STAT-6115	Categorical Data Analysis	3(3-0)	Nil
Compulsory	STAT-6117	Capstone Project	3(3-0)	Nil
ID-4	GEOL-5101	Introduction to Geology	3(3-0)	Nil
GE-8	URCG-5111	Translation of Holy Quran*	NC	Nil

*For Muslim students only   Semester Total Credit Hours: 15

Degree Program Total: 127

STAT-5101 **Introductory Statistics** **3(3-0)**

Course Brief

Introductory Statistics is a foundational course that introduces students to the fundamental principles and techniques of statistical analysis. This course covers basic concepts in probability theory and statistical inference, providing students with the necessary tools to summarize and interpret data, make informed decisions, and draw meaningful conclusions. Topics include data collection, descriptive statistics, and basic probability theory.

Course Learning Objectives

By the end of the course, students should be able to:
- Understand Basic Statistical Concepts: Define key statistical terms such as population, sample, variable, data, and distribution.
- Organize and Summarize Data: Collect and organize data using appropriate methods.
- Calculate and interpret measures of central tendency and dispersion (mean, median, mode, range, variance, standard deviation).
- Visualize Data: Create and interpret various types of graphs and charts (histograms, bar charts, box plots, and scatterplots) to represent data effectively.
- Probability Concepts: Understand the fundamental principles of probability. Calculate probabilities for simple events and apply probability rules.

Contents

1. The importance and scope of the Statistics
2. Variables and their types
3. Data and its sources
4. Scales of measurements
5. Tabulation and classification of data
6. Graphs and Charts: Stem-and leaf diagram, Box and Whisker plots and their interpretation
7. Measures of Central Tendency, Quantiles
8. Measures of Dispersion: Their properties, usage, limitations and comparison
9. Moments, Measures of Skewness and Kurtosis and distribution shapes
10. Rates and ratios, Standardized scores
11. Probability Basics, Events
12. Rules of Probability; Addition Rule, Multiplication Rule

Recommended Books

1. Chaudhary, S. M. (2014). *Introduction to Statistical Theory* (8th ed.) Lahore: Ilmi Kitab Khana.
2. Clark, G.M. and Cooke, D. (1998). *A Basic Course of Statistics* (4th Ed.) London.

Suggested Books

1. Weiss, N.A. (2015). *Introductory Statistics* (10th ed.).London: Pearson.
2. Spiegel, M. R., Schiller, J.L. &Sirinivasan, R.L. (2000). *Probability and statistics* (2nd Ed.) New York: McGraw Hill.

Course Brief

This course provides a comprehensive introduction to key concepts and techniques in the fields of sampling theory, index numbers, and time series analysis. Students will develop a strong foundation in statistical methods essential for making informed decisions in various fields, including economics, finance, social sciences, and more.

Course Learning Objectives

- Understand the principles of sampling and different sampling methods.
- Study the construction and interpretation of index numbers.
- Gain insights into the use of index numbers in economics, business, and policy-making.
- Compute and compare various index numbers, such as Laspeyres, Paasche, and Fisher.
- Examine the concepts of time series data and their applications.

Contents

1. Importance of sampling: Sample versus population
2. Census and survey problem, questionnaire development.
3. Concepts of statistic and population parameter.
4. Random and nonrandom sampling
5. Sampling and Non-Sampling Errors
6. Sampling techniques: Simple Random, Stratified, Cluster and Systematic random sampling.
7. Index numbers: construction and uses of index numbers
8. Un-weighted index numbers (simple aggregative index, average of relative price index numbers).
9. Weighted index numbers (Laspayers, Paaches and Fishers ideal index numbers). Consumer price index (CPI) and Sensitive Price Indicators.
10. Time Series Analysis: Examine the concepts of time series data and their applications
11. Develop skills in data visualization, including time plots and seasonal decomposition
12. Perform time series forecasting using methods such as moving averages and exponential smoothing

Recommended Books

1. Chaudhary, S.M. (2014). *Introduction to statistical theory* (8th Ed.). Lahore: Ilmi Kitab Khana.
2. Clark, G.M. and Cooke, D. (2009). *A basic course of statistics* (5th Ed.). Wiley.

Suggested Books

1. Cochran, W. G. (1977). *Sampling techniques*. (3rd Ed.). New York: John Wiley & Sons.
2. Walpole, R.E., Myers, R. H. & Myers, S. L. (1998). *Probability and statistics for engineers and scientist* (6th Ed.) New York: Prentice Hall.

Course Brief

Official Statistics refers to the collection, analysis, interpretation, and dissemination of data by government agencies or other authorized organizations. These statistics are crucial for informed decision-making in various aspects of society, such as policymaking, economic planning, public health, and more. Official Statistics is a comprehensive course that explores the principles, methods, and applications of collecting, analysing, and disseminating statistical data by government bodies and authorized agencies. This course provides students with a deep understanding of the role of official statistics in shaping public policy, monitoring societal trends, and supporting evidence-based decision-making. It covers the various aspects of official statistical practices, including data collection, processing, analysis, and communication.

Course Learning Objectives

- Understand the significance of official statistics in modern society.
- Explore various data collection methods, including surveys, censuses, administrative data, and data from digital sources.
- Understand the advantages and limitations of different data collection approaches.
- Explore methods to ensure the accuracy, reliability, and integrity of official statistics.
- Learn how to effectively communicate statistical findings to various stakeholders, including policymakers, the public, and researchers.

Course Contents

1. Design and planning of a Statistical Investigation. Data collection approach and operation; Role of sampling in generation of statistics. Sampling plans and survey designs.
2. Sources of Errors, types of Errors, methods of their control. Data processing, presentation, and publication of statistics.
3. Different modes of data dissemination. Official statistics, statistics systems and standards, sources of official statistics, their role, working and publication. Role of official statistics, official publications.
4. Setup of official organizations in Pakistan their role, working & publication, statistics division,
5. Federal Bureau of statistics, Agricultural Census Organization, Population Census Organization, Ministry of Food , and Agriculture and Livestock;
6. National Data Bade and Registration Authority (NADRA). Provincial Bureaus of statistics.
7. Financial statistics: Ministry of Finance, state Bank of Pakistan-Department of statistics, their working publications and responsibilities.
8. Other organization's statistical output, National and International series, classification and standards.
9. Use of statistics in administration and planning.
10. Concepts and evaluation of GDP, GNP, NNP, balance of trade and payments.
11. Measurement of income Distribution,
12. Use of index numbers, and time series, Deflation and inflation of series.
13. National sample surveys and censuses conducted in Pakistan.
14. Assignment: Visit of major statistical organizations will be a part of the course.
15. An assignment will have to be submitted on any topic given by the course incharge.

Recommended Books

1. Kish, L. (1982). *Survey sampling*. New York: John Wiley and Sons.
2. Statistics, D. (2005). *Activity report government of Pakistan*. Islamabad: Statistics division.

Suggested Books

1. Statistical institute for Asia & Pacific SIAP. (1984). *Training of trainers in statistical operations and procedure.* Part-1, II. Tokyo, UNDP.
2. Murthy, M. N. (1979). *Quality of data, country course on sample survey*, Karachi: Statistics bureau.

Course Brief

Introduction to Probability Distributions is a course designed to provide students with a comprehensive introduction to probability theory and its practical applications. The course explores various types of probability distributions, their properties, and their significance in modelling real-world phenomena. Through lectures, practical exercises, and real-world examples, students will gain a solid understanding of probability distributions and their role in statistics, data analysis, and decision-making.

Course Learning Objectives

- To introduce students to the fundamental concepts of probability, including sample spaces, events, and probability axioms.
- To demonstrate real-world applications of probability distributions in fields like finance, engineering, and science.
- To develop students' ability to solve problems involving probability distributions, both analytically and computationally.
- To equip students with the skills needed to analyze and interpret data that follows different probability distributions.
- Depending on the course, students may also be expected to gain proficiency in using statistical software or programming languages for working with probability distributions.
- To encourage critical thinking and the ability to apply probability concepts to real-world scenarios

Contents
1. Basic probability concepts
2. Sample spaces and events
3. Probability axioms and rules
4. Combinatorial probability
5. Conditional Probability, Bayes' Rule
6. Probability mass functions (PMFs)
7. Expected value (mean) and variance
8. Bernoulli distribution
9. Binomial distribution
10. Poisson distribution
11. Hypergeometric distribution
12. Probability density functions (PDFs)
13. Cumulative distribution functions (CDFs)
14. Expected value (mean) and variance for continuous random variables
15. Uniform distribution
16. Normal distribution
17. Exponential distribution
18. Gamma distribution
19. Beta distribution

Recommended Books

1. Spiegel, M. R., Schiller, J. L. & Sirinivasan, R.L. (2000). *Probability and statistics.* (2nd Ed.). New York: McGraw Hill.
2. Clark, G. M. & Cooke, D. (1998). *A basic course in statistics.* (4th Ed.). London: Arnold.
3. Hogg, R. V., Tanis, E. A. and Zimmerman, D. L. (2015) Probability and Statistical Inference, 9th Ed. Pearson, USA.

Suggested Books

1. Walpole, R. E., Myers, R. H & Myers, S. L. (1998). *Probability and statistics for engineers and scientist.* (6th Ed.). New York: Prentice Hall.
2. Mclave, J.T., Benson, P. G. & Snitch, T. (2005). *Statistics for business & economics* (9th Ed.). United States: Prentice Hall.

STAT-5105 **Computer Applications in Statistics** **3(3-0)**

Course Brief

Computer Applications in Statistics is a comprehensive course designed to introduce students to the essential role of computers in modern statistical analysis. This course focuses on the practical aspects of using computer software and programming languages to collect, analyze, and interpret statistical data. Through a combination of theoretical concepts and hands-on practical exercises, students will gain proficiency in utilizing various statistical software packages and programming tools to solve real-world problems.

Course Learning Objectives

1. Teach students the fundamental components of a computer system, including hardware and software. Understand the fundamental components of a computer system, including hardware and software.
2. Teach students how to collect, organize, and manage data for statistical analysis using computer tools and software.
3. Enable students to calculate descriptive statistics such as mean, median, mode, variance, and standard deviation using computer software.
4. Introduce students to various data visualization techniques, including creating histograms, box plots, scatterplots, and other graphical representations of data using software like Excel, etc
5. Explain different probability distributions (e.g., normal, binomial, Poisson) and how to use computer applications to calculate probabilities and percentiles.
6. Teach students how to perform hypothesis tests, such as t-tests and chi-square tests, using statistical software.
7. Train students in writing clear and concise reports of statistical analyses to prepare its presentation slides.
8. Ensure that students gain hands-on experience with statistical software by working on datasets and conducting analyses independently.

Contents

1. Historical development of computers, the role of computers in modern society.
2. Basics of computer hardware and software.
3. Overview of computer components (CPU, RAM, storage devices, input/output devices) and how these components work together to process and store data.
4. Introduction to operating systems (e.g., Windows, macOS, Linux). Application software vs. system software and Basics of programming languages.
5. Common computer security threats (viruses, malware, phishing), how to protect your computer and data. Online privacy and safe internet practices
6. The ethical use of computers and technology, Issues related to privacy, copyright, and intellectual property.
7. Explore web browsers and their features. Understand how to navigate the internet, conduct online research, and evaluate online sources.
8. Introduction to current and emerging technologies in computing (e.g., AI, IoT, blockchain).
9. Introduction to statistical software such as R or specialized statistical software like SPSS.
10. Data import/export, data manipulation, and basic scripting.

11. Using computer software (e.g., Excel, R, Python) for creating charts and graphs. Histograms, bar charts, scatterplots, box plots, etc.
12. Finding Measures of central tendency (mean, median, and mode), Measures of dispersion (range, variance, and standard deviation), Percentiles and quartiles using software or language.
13. Basic probability concepts. Probability distributions (e.g., normal distribution, binomial distribution). Probability calculations using software.
14. Random sampling using software or language.
15. Conducting hypothesis tests (e.g., t-tests, chi-square tests) and confidence intervals using computer software.
16. Regression analysis using software.
17. Conducting a small statistical research project using computer software.

Recommended Books

1. Lebenon, G. & El-Geish, M. (2018). *Computing with data: An introduction to data industry.* USA: Springer.
2. Herkenhoff, L. and Fogli, J. (2013). *Applied statistics for business and management using microsoftexcel.* USA: Springe

Suggested Books

1. Foley, J. D., Van Dam, A., Feiner, S. K., Hughes, J. F., & Phillips, R. L. (1994). *Introduction to computer graphics*. Addison-Wesley: Laurie Ann Ulrich,

STAT-5106   Introduction to Regression Analysis and Experimental Design   3(3-0)

Course Brief

This course is designed to introduce students to fundamental concepts and techniques in regression analysis and experimental design, with a focus on their applications in various fields, including statistics, social sciences, engineering, and natural sciences. Regression analysis is a powerful statistical tool for examining relationships between variables, making predictions, and understanding the underlying patterns in data. Experimental design is essential for planning, conducting, and analyzing experiments efficiently and effectively.

Course Learning Objectives

By the end of the course, students should be able to:
- Students will gain a solid understanding of simple linear regression and multiple regression, including assumptions, interpretation of coefficients, and hypothesis testing.
- Students will learn the fundamentals of experimental design, including the identification of research questions, selection of experimental and control groups, and the planning of randomized experiments.
- Students will acquire the knowledge and tools to analyze experimental data using appropriate statistical tests and techniques, including analysis of variance (ANOVA) and hypothesis testing.

Contents

1. Introduction to regression analysis
2. Simple linear regression and multiple regression
3. Diagnostics of assumptions of regression analysis
4. Inference regarding regression parameters.
5. Linear correlation: simple, partial and multiple correlation.
6. Correlation, correlation coefficient, inference regarding correlation coefficient.
7. Coefficient of determination.
8. One-way and two-way ANOVA
9. Introduction to design of experiments, basic principles of design of experiments.
10. Analysis of completely randomized design, randomized complete block and Latin square design.
11. Multiple comparisons (LSD and Duncan's test).

Recommended Books

1. Chaudhary, S. M. (2014). *Introduction to statistical theory*. (8th Ed.). Lahore: Ilmi Kitab khana.
2. Clarke, G. M., & Kempson, R. E. (1994). *Introduction to the design and analysis of experiments*. New York: John Wiley & Sons.

Suggested Books

1. Gujrati, D. (2004). *Basic econometrics*. New York: John Wiley & Sons.
2. Walpole, P.E., Myers, R.H., & Myers, S. L. (2007). *Probability and statistics for engineers and scientists* (8thed.). India: Pearson Prentice Hall.

Course Brief

Basic Statistical Inference is a fundamental course designed to introduce students to the core principles and techniques of statistical inference. This course equips students with the knowledge and skills necessary to make informed decisions and draw meaningful conclusions from data. Through a combination of theoretical concepts and practical applications, students will gain a solid foundation in statistical inference, which is essential for various fields such as science, business, social sciences, etc.

Course Learning Objectives

By the end of this course, students will be able to:
- Explain the principles of random sampling and understand the properties of sampling distributions, including the central limit theorem.
- Describe point estimation and interval estimation and learn how to calculate and interpret confidence intervals for population parameters, such as means and proportions.
- Understand the concept of hypothesis testing and perform hypothesis tests for means, proportions, and variances.
- Understand the Chi-Square distribution and its applications.
- Learn how to compare means and proportions between two or more groups using hypothesis tests.
- Familiarize with nonparametric tests for situations where assumptions of normality are not met.

Contents

1. Sampling and sampling distribution of sample mean, proportion, difference between means and difference between proportions.
2. Point and interval estimate, properties of good point estimator.
3. Testing of hypothesis for population mean, difference between two population means and difference between two population proportions, difference between means for paired data and equality of several means.
4. Single population variance, ratio of two variances.
5. Non-parametric methods; The sign test, Wilcoxon's signed rank test, Mann-Whitney U test, Kolmogrorov-Smirnov test.

Recommended Books

1. Walpole, R.E., Myers, R. H. & Myers, S. L. (2007). *Probability and statistics for engineers and scientists* (8th Ed.). India: Pearson Prentice Hall.
2. Weiss, N. A. (2017). *Introductory statistics.* (10th ed.). United States: Pearson Education.

Suggested Books

1. Spiegel, M. R., Schiller, J. L. &Sirinivasan, R.L. (2000). *Probability and statistics* (2nd ed.).New York: McGraw Hill.
2. Clark, G. M. & Cooke, D. (1998). *A basic course in statistics* (4th ed.). London: Arnold.
3. Mclave, J. T., Benson P.G. & Snitch, T. (2005). *Statistics for business and economics.* (9th ed.). Indian: PearsonPrentice Hall.

Course Brief

Population Studies is an interdisciplinary field that examines the dynamics, trends, and consequences of human populations. This course provides an in-depth exploration of the theories, methodologies, and key issues in population studies, with a focus on demographic analysis, population growth, distribution, and their implications for social, economic, and environmental systems. Through a combination of lectures, readings, case studies, and research projects, students will gain a comprehensive understanding of the complex interplay between population factors and societal development.

Course Learning Objectives

By the end of this course, students will be able to:
- Understand the fundamentals of demographic analysis: Explain key demographic concepts such as fertility, mortality, migration, population pyramids, and life expectancy, and apply demographic methods to analyse and interpret population data.
- Identify and analyze population trends: Recognize and interpret global, regional, and local population trends, including population growth, aging, urbanization, and their implications for society and policy.
- Examine the determinants of population change: Evaluate the factors influencing demographic transitions, including socio-economic, cultural, and political factors, and analyze how these determinants differ across various regions and countries.
- Assess the impact of population dynamics on society: Analyze the effects of population growth, distribution, and structure on social issues such as healthcare, education, labor markets, and housing, and critically assess policy responses.

Contents

1. Meaning of vital statistics, registrations of birth and death in Pakistan.
2. Uses of vital statistics, short comings of vital statistics, rates and ratios (Sex ratio, child women ratio, birth and death ratio, population growth rate, classification of natal rates, death rates or mortality rates, crude death rate, specific death rate, infant mortality rate, case fatality rate, fertility rates, crude birth rate, specific birth rate, standardized death rate, reproduction rates, morbidity or sickness rates, marriage rates, divorce rates etc. general; fertility rate, total fertility rate.)
3. Basic concepts of demography, Sources of demographic data: The population and housing census, registration of vital events.
4. Demographic surveys, components of population growth, composition of population and vital events. Types and sources of errors, data quality testing procedures, testing the accuracy of age and sex distribution, Fertility and mortality measures.
5. Estimation from incomplete data
6. Construction of complete and abridged life tables, Different types of life tables, Graphs of l_x, q_x and e_x, Description and uses of life table columns.

Recommended Books

1. Weinstein, J. &Pillai, V. K. (2001). *Demography: The science of population*. England: Allyn and Bacon.
2. Hinde, A. (2014). *Demographic method* (2nd Ed.).London: Routledge.

Suggested Books

1. United, N. (1998). *World population assessment*. New York: UNFPA.
2. Govt. of Pakistan (1998). *National, provincial and district census reports and other supplementary reports with respect to 1998 census*. Islamabad: PCO.
3. United, N. (1996). *Added years of life in Asia*. Thailand: ESCAP U.N.

Course Brief

The Research Methods course is designed to provide students with the foundational knowledge and skills necessary to conduct high-quality research in various academic disciplines and professional settings. This course will introduce students to the principles and techniques of research design, data collection, analysis, and interpretation. It will also explore ethical considerations in research and help students develop a critical understanding of existing research literature. Through a combination of lectures, readings, discussions, and practical exercises, students will gain a comprehensive understanding of research methods and how to apply them effectively.

Course Learning Objectives

By the end of this course, students should be able to:
- Understand the fundamentals of research: Define and explain key research concepts, including research questions, hypotheses, variables, and the research process itself.
- Develop a research proposal: Formulate a clear and well-defined research question or hypothesis, design a research plan, and outline the steps necessary to conduct a research project.
- Select appropriate research methods: Evaluate different research methodologies, such as qualitative, quantitative, and mixed-methods approaches, and choose the most suitable method for a given research question.
- Collect and analyse data: Learn how to collect and organize data using various data collection techniques, such as surveys, interviews, observations, and experiments. Explore data analysis methods, including descriptive statistics and inferential statistics.
- Interpret research findings: Analyse and interpret research results critically, drawing meaningful conclusions and implications from the data.
- Review and critique existing research: Conduct a literature review to identify relevant scholarly articles, critically assess the strengths and weaknesses of existing research, and identify gaps in the literature.

Contents

1. Introduction to Research: The importance of research, Types of research (e.g., qualitative, quantitative, mixed methods), The research process Ethical considerations in research
2. Research Design: Formulating research questions and hypotheses, Variables and their measurement, Experimental and non-experimental research designs, Sampling methods and techniques
3. Data Collection Methods: Surveys and questionnaires, Interviews (structured, semi-structured, and unstructured), Observation, Content analysis, Case studies, Experiments, Secondary data analysis
4. Data Analysis: Descriptive statistics (mean, median, mode, standard deviation, etc.), Inferential statistics (hypothesis testing, t-tests, ANOVA, regression analysis, etc.), Qualitative data analysis methods (thematic analysis, content analysis, etc.), Data visualization techniques
5. Research Ethics: Informed consent, Confidentiality and privacy, Institutional Review Board (IRB) and ethical approval processes, Avoiding plagiarism and academic integrity
6. Research Proposal Writing: Components of a research proposal, Literature review, Research methods and design, Data analysis plan, Budget and timeline, Data Interpretation and

7. Reporting: Interpreting research findings, Drawing conclusions, Writing research reports and papers
8. Research Tools and Software: Introduction to statistical and data analysis software (e.g., SPSS, R, NVivo), Bibliographic management tools (e.g., EndNote, Zotero), Research in specific disciplines (e.g., psychology, sociology, biology)

Recommended Books

1. Hashmi, N. (1989). *Research, foundations and methodology*. Islamabad: Western Press. Style Manual of Technical Writings, USAID/NARC
2. Crowther, D. & Lancaster, G. (2012). *Research methods*. London: Routledge.

Suggested Books

1. Bernard, H. R. & Bernard, H. R. (2013). *Social research methods: Qualitative and quantitative approaches*. England: Sage.
2. Gimbaled, J. & Acuter, W.S. (1988). *MLA handbook for writers of research papers*.America: McGraw the Modern Language Association of America.

Course Brief

Non-parametric methods are a class of statistical techniques used for analyzing data when the underlying probability distribution of the data is unknown or when the data does not meet the assumptions of parametric methods (which assume a specific distribution, such as normal distribution). This course introduces students to non-parametric statistical methods, a powerful set of tools for analyzing data without making strong distributional assumptions. Non-parametric methods are essential for researchers and analysts working with real-world data, as they provide robust alternatives to traditional parametric techniques. Through theoretical explanations, practical examples, and hands-on exercises, this course equips students with the skills to apply non-parametric methods effectively in various research and practical contexts.

Course Learning Objectives

By the end of this course, students will be able to:
- Define the concept of non-parametric statistics and understand when to use non-parametric methods.
- Differentiate between parametric and non-parametric approaches in statistics.
- Understand the importance of ranks in non-parametric tests and learn how to rank data and calculate various order statistics.
- Conduct one-sample tests such as the Wilcoxon signed-rank test and sign test.
- Perform two-sample tests like the Mann-Whitney U test and the Kolmogorov-Smirnov test.
- Compare two independent samples without assuming a normal distribution and explore paired data analysis using the Wilcoxon signed-rank test.
- Learn about chi-square tests for independence and goodness-of-fit and apply chi-square tests to analyze categorical data without parametric assumptions.

Contents

1. Introduction to Non-Parametric Statistics: Definition and advantages of non-parametric methods, When to use non-parametric methods.
2. Data Types: Nominal data, Ordinal data, Interval data, Ratio data.
3. Rank-Based Tests: Wilcoxon signed-rank test, Mann-Whitney U test (Wilcoxon rank-sum test), Kruskal-Wallis test (non-parametric ANOVA), Friedman test (non-parametric repeated measures ANOVA).
4. Goodness-of-Fit Tests: Chi-square goodness-of-fit test, Kolmogorov-Smirnov test., Anderson-Darling test.
5. Two-Sample Tests: Wilcoxon signed-rank test for matched pairs, Mann-Whitney U test for independent samples.
6. Non-Parametric Tests for Categorical Data: Chi-Square Test for Homogeneity, Fisher's Exact Test, McNemar's Test, Log-Linear models
7. Correlation and Association: Spearman's rank correlation coefficient Kendall's tau rank correlation coefficient.
8. Contingency tables and association tests.

Recommended Books

1. Gibbons, J. D.& Chakraborti, S. (2011). *Nonparametric statistical inference*. Berlin: Springer.
2. Annette, J. D. (1991). *Introduction to generalized linear models*. London: Chapman and Hall.
3. Anderson, E. B. (1990). *The statistical analysis of categorical data*.New York: Springer-Verlag.

Suggested Books

1. Conover, W.J. (1984). *Practical non-parametric statistics*. New Jersey: John Willey.
2. Sprent, P. (1984). *Applied non-parametric statistics*. New Jersey: John Willey
3. Fienberg, S. E. (2007). *The analysis of cross-classified categorical data*. Berlin: Springer.

STAT-5111 **Bio-Statistics** 3(3-0)

Course Brief

Biostatistics is an interdisciplinary field that combines principles of statistics with biological and health sciences. This course provides students with the knowledge and skills needed to apply statistical methods to analyze data in biological and health-related research. Topics covered include data collection, data management, exploratory data analysis, hypothesis testing, regression analysis, survival analysis, and the interpretation of statistical results in the context of health and biology. Practical applications and case studies in various areas, such as epidemiology, clinical trials, and genetic studies, will be emphasized.

Course Learning Objectives

By the end of this course, students will be able to:
- By the end of the course, students should be able to:
- Define key biostatistical terms and concepts and explain the role of biostatistics in various fields, including medicine, epidemiology, and genetics.
- Design data collection processes, including selecting appropriate sampling methods and measurement techniques. Also manage and preprocess biological and health-related data for analysis.
- Conduct EDA to summarize and visualize data and identify outliers, missing data, and potential sources of bias.
- Formulate research hypotheses and null hypotheses and apply appropriate statistical tests for hypothesis testing.
- Perform simple and multiple regression analyses to model relationships between variables and interpret regression coefficients and assess model fit.
- Understand and apply survival analysis techniques, such as Kaplan-Meier curves and Cox proportional hazards models, for time-to-event data.
- Interpret statistical results in the context of biological and health-related research and communicate findings effectively to both technical and non-technical audiences.
- Gain proficiency in using statistical software packages commonly used in biostatistical analysis, such as R or SAS.

Contents

1. Introduction to the basic concepts and terminology of Biostatistics
2. Role of sampling in biostatistics, Sample size estimation.
3. Review of Basic Statistical Concepts: Descriptive statistics, Probability distributions, Hypothesis testing and Confidence intervals
4. Contingency table analysis, Fisher's exact test, 2x2 tables, rxc tables, Simpson's paradox, Confounding, G-Test.
5. Proportions, rates and ratios; incidence, prevalence, Odds Ratio, Relative Risk, Rate Ratio, Sensitivity and specificity.
6. Linear and Nonlinear Regression Analysis: Simple linear regression, Multiple linear regression, Logistic regression and Nonlinear regression models
7. Analysis of Variance (ANOVA) and Experimental Design: One-way ANOVA, Two-way ANOVA and Randomized controlled trials (RCTs)

8. Survival Analysis: Kaplan-Meier survival curves, Cox proportional hazards model, Life tables and Log-rank test
9. Meta-analysis

Recommended Texts

1. Zar, J. (2000). *Bio statistical analysis* (5th ed.). New York: John Wiley and Sons.
2. Shoukri, M. M. & Pause, C. C. (1998). *Statistical methods for health sciences* (2nd ed.). Florida: CRC press.

Suggested Books

1. Daniel, W.W. (1996). *Biostatistics: A foundation for the health sciences*(6thed.). New York: John Wiley & Sons.
2. Diggle, P., Diggle, P. J., Heagerty, P., Liang, K. Y., Heagerty, P. J. & Zeger, S. (2002). *Analysis of longitudinal data*. Oxford University: Press.
3. Dunn, G. & Everit, B. (1995). *Clinical biostatistics*. London: Edward Arnold.

STAT-6101   **Regression Analysis**   **3(3-0)**

Course Brief

Regression Analysis is a statistical technique used to understand the relationship between one or more independent variables (also called predictors or features) and a dependent variable (also known as the outcome or target). Regression Analysis is a comprehensive course designed to provide students with a solid understanding of the theory, application, and interpretation of regression models. Through a combination of lectures, hands-on exercises, and real-world examples from various fields such as economics, finance, social sciences, and natural sciences, students will learn how to model and analyse relationships between variables, make predictions, and evaluate the reliability of their models.

Course Learning Objectives

By the end of this course, students will be able to:
- Define and explain key regression concepts, including dependent and independent variables, linear and non-linear relationships, and the assumptions underlying regression analysis.
- Develop an understanding of simple and multiple linear regression models.
- Estimate model parameters (slope and intercept) using least squares and interpret the coefficients and assess model fit.
- Evaluate the assumptions of regression analysis, including linearity, independence of errors, homoscedasticity, and normality.
- Implement diagnostic tests to identify violations of assumptions.
- Explore methods for model validation and dealing with outliers and influential points.
- Conduct hypothesis tests related to regression coefficients and calculate and interpret confidence intervals for parameter estimates.
- Introduce non-linear regression models and understand the application of exponential, logarithmic, and polynomial regression.
- Explore case studies and examples from various domains, such as economics, finance, and healthcare.
- Gain hands-on experience with statistical software (e.g., R, Python, or specialized regression software) to perform regression analysis.

Pre-requisite: STAT-5106

Contents

1. Linear regression and its assumptions.
2. Least squares estimators.
3. Maximum Likelihood Estimator.
4. Tests of significance for regression model and regression parameters.
5. Confidence interval for regression parameters.
6. Use of extraneous information in linear regression model.
7. Checking for linearity, independence, homoscedasticity, and normality of residuals and dealing with violations of assumptions
8. Detection and study of outliers and influential observations.
9. Dummy variables and categorical predictors
10. Polynomial regression, orthogonal polynomial, orthogonal regression analysis and specification of models

Recommended Books

1. Draper, N. R. & Smith, H. (2004). *Applied regression analysis*. New York: John Wiley & Sons.
2. Montgomery, D. C., Peck, E. A. & Vining, G. G. (2012).*Introduction to linear regression analysis*.New York: John Wiley & Sons.

Suggested Books

1. Rawlings, J. O., Pantula, S. G. & Dickey, D. A. (2001).*Applied regression analysis: A research tool*. USA: Springer.
2. Dielman, T. E. (2001).*Applied regression analysis for business and economics*. Pacific Grove.
3. Yan, X., & Zu, X. G. (2009).*Linear regression analysis: Theory and computing*. World Scientific Publications.

STAT-6102   **Probability and Probability Distributions-I**   **3(3-0)**

Course Brief

This course provides an in-depth study of probability distributions, which are mathematical models used to describe the likelihood of different outcomes in random experiments or processes. Students will explore various probability distributions, their properties, and applications in real-world scenarios. The course will emphasize both theoretical foundations and practical applications, equipping students with the tools to analyze and interpret data with uncertainty.

Course Learning Objectives

Here are some common course objectives:
- Introduction to Probability Theory: To introduce students to the fundamental concepts of probability theory, including sample spaces, events, and basic probability rules.
- Understanding Random Variables: To help students understand what random variables are, their types (discrete and continuous), and how to work with them.
- Probability Distribution Functions: To teach students about probability distribution functions (PDFs) and probability mass functions (PMFs) for discrete random variables and probability density functions (PDFs) for continuous random variables.
- Common Probability Distributions: To cover various common probability distributions, such as the Bernoulli, Binomial, Poisson, and Geometric, etc/ distributions.
- Properties of Distributions: To explore the properties of probability distributions, including mean, variance, moments, and moment-generating functions.
- Transformations of Random Variables: To teach students how to perform transformations on random variables and determine the resulting probability distributions.
- Joint Distributions: To introduce students to joint probability distributions and the concept of independence and correlation between random variables.
- Central Limit Theorem: To explain the Central Limit Theorem and its significance in statistical inference.

Pre-requisite: STAT-5104

Course Contents

1. Probability as a set function, Conditional Probability, Bayes' theorem and Chebychev's inequality.
2. Random Variables, Distribution function and Probability density function
3. Probability density functions of two or more random variables
4. Mathematical expectations, stochastic independence, conditional expectations, Variance and moments
5. Marginal and conditional distributions
6. Probability generating functions and moment generating functions
7. Characteristics function and their existence properties.
8. Relation between moments and cumulants
9. Bernoulli and Poisson process.
10. Standard Probability distributions, Binomial, Poisson, Hyper geometric, Multinomial, Negative Binomial, Geometric.

Recommended Books

1. Hogg, R. M. & Craig, A. T. (2013). *Introduction to mathematical statistics* (7th ed.). New York: Prentice Hall.
2. Stuart, A.& Ord, J. K. (1998). *Kendal's advanced theory of mathematical statistics*(1st ed.). London: Charles Coriffi and Co.
3. Mood, A. M, Graybill, F. A. &Boes, D.C. (1997). *Introduction to the theory of Statistics*. New York: McGraw Hill.

Suggested Books

1. John, R. 2006). *Mathematical statistics and data analysis*. Duxbury Press.
2. Khan, M. K. (1996). *Probability with applications*.Lahore: Maktiba Ilmi.
3. Scheaffer, R.L. (1990*). Introduction to probability and its applications*. Kent: PWS.

STAT-6103   **Sampling Techniques-I**   **3(3-0)**

Course Brief

This course provides a comprehensive overview of the principles, methods, and applications of sampling techniques in research and statistics. Students will gain a deep understanding of how to select and analyze samples from populations to make accurate and meaningful inferences. The course covers both theoretical concepts and practical aspects of sampling, equipping students with the knowledge and skills needed for conducting effective and unbiased sampling in various research contexts. The course aims to equip students or participants with the knowledge and skills needed to apply appropriate sampling techniques effectively in a wide range of contexts, whether in research, business, or quality control.

Course Learning Objectives

By the end of this course, students will be able to:
- Understand the importance of sampling in research and its role in generalizing findings to populations.
- Differentiate between various sampling methods and their appropriateness for different research situations.
- Design and implement well-known random and non-random sampling techniques.
- Evaluate the sources of bias and error in sampling and develop strategies to minimize them.
- Calculate and interpret sampling error and confidence intervals.
- Apply sampling techniques to real-world research problems in various fields.
- Make informed decisions about sample size, sampling frames, and survey design.

Course Contents

1. Introduction to sampling, advantages and disadvantages of sampling
2. Requirements of a good sample, bias, sampling and non-sampling errors
3. Steps and problems involved in planning and conduct of census and their sources, sample surveys, selection and estimation procedures.
4. Description and properties of simple random sampling
5. Sampling for proportions and percentages
6. Estimation of variances, standard errors and confidence limits
7. Sample size determination under different conditions, description and properties of stratified random sampling.
8. The formation of strata, different methods of allocation of sample size.
9. Ratio and regression estimators in simple and stratified random sampling.

Recommended Books

1. Cochran, W.G. (1977). Sampling Techniques. John Wiley and Sons, 3rd ed, New York.
2. Lohr, S. (2010). Sampling: Design and Analysis. Brooks/Cole.

3. Bethelem, J. (2009). Applied Survey Methods: A Statistical Perspective. Wiley.
4. Des Raj and Chandhok P. (1998). Sample Survey Theory. Narosa Publishing House, New Delhi.
5. Kish, L. (1992). Survey Sampling. John Wiley, New York.
6. Singh, R. and Singh N, (1996). Elements of Survey Sampling. Kulwar, Dodrecht.

Suggested Books

1. Taherdoost, H. (2016). Sampling Methods in Research Methodology; How to Choose a Sampling Technique for Research. International Journal of Academic Research in Management, 5, 18-27. doi:10.2139/ssrn.3205035
2. Omair, A. (2014). Sample size estimation and sampling techniques for selecting a representative sample. Saudi Commission Journal of Health Specialties, 2, 142-147. doi:10.4103/1658-600X.142783
3. Delgado-Rodríguez, M., & Llorca, J. (2004). Bias. Journal of Epidemiology and Community Health, 58(8), 635. doi:10.1136/jech.2003.008466

STAT-6104   **Design and Analysis of Experiments-I**   **3(3-0)**
Course Brief

Experimental Designs is a course that delves into the principles, methods, and applications of designing experiments to investigate scientific hypotheses. Experimental designs play a crucial role in research, allowing researchers to systematically investigate the effects of various factors on a dependent variable. This course is particularly relevant in the fields of statistics, research methodology, and various scientific disciplines where controlled experimentation is crucial for drawing valid conclusions.

Course Learning Objectives

- Introducing students to the basic concepts associated with experimental designs, such as independent and dependent variables, control groups, and randomization.
- Providing an overview of various experimental designs, including completely randomized designs, randomized block designs and Latin square designs.
- Teaching students how to choose the most appropriate experimental design based on the research question and the nature of the variables involved.
- Introducing statistical techniques relevant to analyzing data obtained from experimental designs, such as analysis of variance (ANOVA) and other methods.
- Providing examples and case studies to illustrate the application of experimental designs in real-world research scenarios.
- Developing students' ability to critically evaluate the strengths and limitations of different experimental designs in published research.
- Guiding students through the process of planning and designing their experiments, including the formulation of hypotheses and the development of a detailed experimental protocol.
- Demonstrating how experimental designs can be adapted to various fields of study, including psychology, biology, medicine, and social sciences.

Pre-requisite: STAT-5106

Contents

1. Introduction to experimental design and its terminology.
2. Planning and designing of experiment and research.
3. Aspects of experimental design, basic principles of experimental design, fixed, random and mixed effects models.
4. Analysis of variance, estimation of model parameters.
5. Checking model adequacy, inference beyond ANOVA multiple comparisons, contrast analysis, orthogonal polynomial contrasts and trend analysis.
6. Basic experimental designs; completely randomized design, randomized complete block design and Latin square design. Relative efficiency of these designs. Estimation of missing observations in basic designs.
7. Greco Latin square design and cross-over designs
8. Incomplete block designs (IBD), balanced incomplete block designs (BIBD) and partially balanced incomplete block designs (PBIBD). Intra-block and Inter-block analysis of IBD.

Recommended Books

1. Montgomery, D. C. Sons (2019). *Design and analysis of experiments* (10th Ed.). New York: John Wiley &Sons.
2. Clarke, G. M. &Kempthon, R. E. (1997). *Introduction to the design and analysis of experiments*. London: Edward Annold.

Suggested Books

1. Bland, M. (2015). *An Introduction to medical statistics* (4th Ed.). Oxford: University Press.
2. Matthews, N. S. (2006).*Introduction to randomized controlled clinical trials* (2nd Ed.).London: Chapman and Hall.
3. Boniface, D. R. (1995). *Experiment design and statistical methods*. London: Chapman and Hall.

STAT-6105   **Econometrics**   **3(3-0)**

Course Brief

Econometrics is the application of statistical methods to economic data in order to give empirical content to economic relationships. This course introduces students to the fundamental principles and techniques used in econometric analysis. Emphasis is placed on both the theoretical underpinnings and practical applications of econometric methods.

Course Learning Objectives

- Provide students with a solid understanding of the basic concepts and tools used in econometrics, including regression analysis, hypothesis testing, and model specification.
- Equip students with the ability to apply statistical techniques to economic data, enabling them to test economic theories and make informed predictions.
- Teach students how to construct, estimate, and interpret econometric models that capture the relationships between economic variables.
- Develop skills in handling economic data, understanding data limitations, and conducting meaningful analyses to derive relevant economic insights.
- Encourage critical thinking and evaluation of econometric results, including an awareness of potential biases, endogeneity issues, and the limitations of various models.

Contents

1. Definition and scope of econometrics, the role of data in economic analysis, types of economic data.
2. Problems of autocorrelation, multicollinearity, heteroscedasticity and their solution in regression analysis.
3. Model specification and selection, functional form and transformations, dummy variables and interactions
4. Ridge regression, Lagged variables, Autoregressive models.
5. Errors in Variables, Instrumental variables.
6. System of simultaneous linear equations.
7. Identification-Estimation method, indirect and two-stage least squares methods, restricted least squares.
8. Test of identifying restrictions; Estimation with stochastic regressor, generalized least squares estimators.
9. Weighted least square estimation method
10. Auto-correlation: Definition, reasons, consequences, tests and remedial measures
11. Specification of the econometric model
12. Error in variables problems
13. Simultaneous equations systems
14. Identification
15. Autoregressive and distributed lagged models.
16. Seemingly unrelated Regression. Simultaneous equations models
17. Two-stage and three-stage Least Squares.
18. Econometrics modeling with EViews and R.

Recommended Books

1. Gujrati, D. (2004). *Basic econometrics.* (4th Ed.). New York: John Wiley & Sons.
2. Draper, N. R. & Smith, H. (2004). *Applied regression analysis*. New York: John Wiley & Sons.
3. Gujrati, D. (2004). "*Basic Econometrics*", John Wiley, New York.
4. Koutsoyiannis, A. (1980), "*Theory of Econometrics*", Macmillan.
5. Salvatore, D. and Reagle, D. (2002). Theory and Problems of Statistics and Econometrics, 2nd Edition. McGraw-Hill, New York.

Suggested Books

1. Baltagi, B. H. (2011). *Econometrics* (5th Ed.). USA: Springer.
2. Johnston, J. & Nardo, J. (1997). *Econometric method (*4th Ed.). New York: McGraw Hill.
3. Koutsoyiannis, A. (1980). *Theory of econometrics.* Macmillan.
4. Draper, N.R. and Smith, H. (2004). *Applied Regression Analysis.* John Wiley, New York.
5. Baltagi, B. H. (1999). *Econometrics*, 2nd Edition, Springer Varlog.
6. Heiss, F. (2020). *Using R Introductory Econometrics,* 2nd Edition. German Publisher.

STAT- 6106 **Probability and Probability Distributions-II** **3(3-0)**

Course Brief

This course provides an in-depth study of probability distributions, which are mathematical models used to describe the likelihood of different outcomes in random experiments or processes. Students will explore various probability distributions, their properties, and applications in real-world scenarios. The course will emphasize both theoretical foundations and practical applications, equipping students with the tools to analyse and interpret data with uncertainty.

Course Learning Objectives

The course objectives typically include:
- Define and explain what continuous random variables are and how they differ from discrete random variables.
- Introduce the concept of probability density functions and understand how they describe the probability distribution of continuous random variables.
- Study and analyze common continuous probability distributions such as the normal distribution, exponential distribution, uniform distribution, and gamma distribution, etc.
- Understand the characteristics, parameters, and applications of these distributions.
- Identify and interpret properties of continuous probability distributions, including mean, variance, standard deviation, skewness, and kurtosis.
- Learn how to transform continuous random variables, including finding the probability distribution of functions of random variables.
- Apply techniques such as the method of transformations and the convolution theorem.
- Understand the Central Limit Theorem and its significance in statistics.
- Explore real-world applications of continuous probability distributions in various fields, such as engineering, economics, biology, and social sciences.
- Develop the ability to use statistical software or programming languages (e.g., R, Python, MATLAB) to perform calculations and simulations involving continuous probability distributions.

Pre-requisite: STAT-6102

Contents

1. Overview of the continuous random variables,
2. Uniform,
3. Beta,
4. Lognormal,
5. Exponential,
6. Gamma,
7. Laplace,
8. Rayleigh and Weibull distributions with their properties;
9. Bivariate Normal distribution and its properties,

10. Distributions of functions of random variables: Chi-square, t and F distributions, their derivations and properties.
11. Central limit and Chebyshev's theorems,
12. Weak and Strong Laws of large numbers and their applications,
13. Order statistics, Distributions of r-th and s-th order statistics.

Recommended Books

- Hogg, R. V., Tanis, E. A. and Zimmerman, D. L. (2015) Probability and Statistical Inference, 9th Ed. Pearson, USA.
- Wackerly, D. D., Mendenhall III, W. and L. Scheaffer, R. L. (2008) Mathematical Statistics with Applications, Thomson Learning, Inc., USA
- Hogg, R.M., McKean, J. and Craig, A.T. (2013). Introduction to Mathematical Statistics. Prentice Hall, New Jersey, USA.
- Mood, A.M, Graybill, F.A. and Boes, D.C. (2007). Introduction to the Theory of Statistics, McGraw Hill, New York, USA.
- Sen, P.K. and Singer, J.O. (1993). Large Sample Methods in Statistics. Chapman & Hall, Inc., New York.
- Casella, G. and Berger, R. L. (2008). Statistical Inference, Cengage Learning, New York, USA.
- Johnson, N.L., Kotz, S. and Balakrishnan, N. (1994). Continuous Univariate Distributions, John Wiley & Sons, New York, USA.
- Johnson, N.L., Kotz, S. and Kemp, A.W. (1993). Univariate Discrete Distributions, John Wiley & Sons, New York, USA.
- D. R. Cox, Principles of statistical inference, Cambridge University Press

Suggested Books

- Journal of Statistical Distributions and Applications | Articles (springeropen.com)
- Mathematics | Special Issue : Probability Distributions and Their Applications (mdpi.com)
- Understanding and Choosing the Right Probability Distributions - Advanced Analytical Models - Wiley Online Library
- Probability distribution - Wikipedia

Course Brief

This course provides a comprehensive overview of the principles, methods, and applications of sampling techniques in research and statistics. Students will gain a deep understanding of how to select and analyze samples from populations to make accurate and meaningful inferences. The course covers both theoretical concepts and practical aspects of sampling, equipping students with the knowledge and skills needed for conducting effective and unbiased sampling in various research contexts. The course aims to equip students or participants with the knowledge and skills needed to apply appropriate sampling techniques effectively in a wide range of contexts, whether in research, business, or quality control.

Course Learning Objectives

- Understand the importance of sampling in research and its role in generalizing findings to populations.
- Differentiate between various sampling methods and their appropriateness for different research situations.
- Deal will non-sampling errors, like nonresponse, measurement error.
- Apply sampling techniques to real-world research problems in various fields.

Pre-requisite: STAT-6103

Contents

1. Introduction to systematic sampling and cluster sampling.
2. Estimation in systematic sampling and cluster sampling.
3. Probability proportion to size sampling (PPS) and estimation in PPS.
4. Two-Phase, Multistage and Multiphase sampling
5. Thomson Hurwitz estimator and its properties
6. Comparison of different sampling designs
7. Non-response, its sources and estimation considering nonresponse.
8. Measurement error, its models and estimation considering measurement error.
9. Randomized response techniques.

Recommended Books

1. Cochran, W.G. (1977). Sampling Techniques. John Wiley and Sons, 3rd ed, New York.
2. Lohr, S. (2010). Sampling: Design and Analysis. Brooks/Cole.
3. Bethelem, J. (2009). Applied Survey Methods: A Statistical Perspective. Wiley.
4. Des Raj and Chandhok P. (1998). Sample Survey Theory. Narosa Publishing House, New Delhi.
5. Kish, L. (1992). Survey Sampling. John Wiley, New York.

6. Singh, R. and Singh N, (1996). Elements of Survey Sampling. Kulwar, Dodrecht.

Suggested Books

1. Taherdoost, H. (2016). Sampling Methods in Research Methodology; How to Choose a Sampling Technique for Research. International Journal of Academic Research in Management, 5, 18-27. doi:10.2139/ssrn.3205035
2. Omair, A. (2014). Sample size estimation and sampling techniques for selecting a representative sample. Saudi Commission Journal of Health Specialties, 2, 142-147. doi:10.4103/1658-600X.142783
3. Delgado-Rodríguez, M., & Llorca, J. (2004). Bias. Journal of Epidemiology and Community Health, 58(8), 635. doi:10.1136/jech.2003.008466

STAT-6108   **Design and Analysis of Experiments-II**   **3(3-0)**

Course Brief

Experimental Designs is a course that delves into the principles, methods, and applications of designing experiments to investigate scientific hypotheses. Experimental designs play a crucial role in research, allowing researchers to systematically investigate the effects of various factors on a dependent variable. This course is particularly relevant in the fields of statistics, research methodology, and various scientific disciplines where controlled experimentation is crucial for drawing valid conclusions.

Course Learning Objectives

- The objectives of a course on experimental designs typically include:
- Introducing students to the basic concepts associated with experimental designs, such as independent and dependent variables, control groups, and randomization.
- Providing sound knowledge of various advance experimental designs, including factorial designs, lattice squares, split plot designs and response surface methodology.
- Teaching students how to choose the most appropriate experimental design based on the research question and the nature of the variables involved.
- Introducing statistical techniques relevant to analyzing data obtained from experimental designs, such as analysis of variance (ANOVA) and other methods.
- Providing examples and case studies to illustrate the application of experimental designs in real-world research scenarios.
- Developing students' ability to critically evaluate the strengths and limitations of different experimental designs in published research.
- Guiding students through the process of planning and designing their experiments, including the formulation of hypotheses and the development of a detailed experimental protocol.
- Demonstrating how experimental designs can be adapted to various fields of study, including psychology, biology, medicine, and social sciences.

Pre-requisite: STAT-6104

Contents

1. Introduction to factorial experiments, simple, main and interaction effects. Hidden replication.
2. 2k and 3k series and mixed level factorial experiments and their analysis.
3. Analysis of Covariance (ANCOVA).
4. Confounding in factorial experiments, complete and partial confounding;
5. Single replication of factorial experiments. Fractional factorial experiments.
6. Lattice squares; models and Analysis, Balanced Lattices
7. Split plot design and its variations. Split-Split plot and split block designs.
8. Introduction of response surface methods; first and second order designs, central composite designs, fitting of response surface models and estimation of optimum response.
9. Youden Squares; models and Analysis,

Recommended Books

1. Montgomery, D. C. Sons (2019). *Design and analysis of experiments* (10th Ed.). New York: John Wiley &Sons.

2. Clarke, G. M. &Kempthon, R. E. (1997). *Introduction to the design and analysis of experiments*. London: Edward Annold.

Suggested Books

1. Bland, M. (2015). *An Introduction to medical statistics* (4th Ed.). Oxford: University Press.
2. Matthews, N. S. (2006).*Introduction to randomized controlled clinical trials* (2nd Ed.).London: Chapman and Hall.
3. Boniface, D. R. (1995). *Experiment design and statistical methods*. London: Chapman and Hall.

STAT-6109   **Statistical Packages**   **3 (3-0)**

Course Brief

This course provides an in-depth exploration of popular statistical packages used in data analysis. Students will gain hands-on experience with statistical software tools, learning to manipulate, analyze, and visualize data. Emphasis will be placed on real-world applications and the interpretation of results.

Course Learning Objectives

- The course objectives for learning statistical packages may include:
- Understand the purpose and importance of statistical packages in data analysis.
- Familiarize yourself with popular statistical software tools.
- Learn how to import various types of data into the statistical software.
- Explore techniques for cleaning and preprocessing data to ensure accuracy in analysis.
- Understand and apply descriptive statistics to summarize and describe key features of datasets.
- Use the graphical capabilities of statistical packages to visualize data effectively.
- Learn use of statistical software for analyzing data using different statistical models and techniques.
- Develop skills in writing code to perform statistical analysis.

Contents

1. Overview of statistical packages such as Minitab, Eviews, SPSS and R.
2. Understanding the advantages and limitations of each software.
3. Importing data from various sources.
4. Cleaning and transforming data for analysis.
5. Descriptive statistics and graphical representations.
6. Identifying patterns and trends in data.
7. Parametric and non-parametric tests.
8. Regression analysis, ANOVA, and hypothesis testing.
9. Time-series analysis.
10. Statistical quality control
11. Design of experiments
12. Simulation using different probability models
13. Creating meaningful visualizations for effective communication of results.
14. Case studies and real-world projects.

Recommended Books

1. Ryan, B. F., Joiner, B. L. & Cryer, J. D.(2005). *Minitab handbook* (5th ed.). California: Duxbury Press.
2. Delwiche, L. D. & Slaughter, S. J. (1998).*The little SAS book:A primer*(2nd ed.). North Carolina: SAS institute.

Suggested Books

1. Crawley, M. J. (2007). *The R book*. New York: John Wiley& Sons.
2. IBM SPSS. (2011). *IBM SPSS statistics 19.0 core system user's guide*. Prentice Hall.

3. Vogelvang, B. (2005). _Econometrics: Theory and applications with eviews_. Financal Times Management.

STAT-6110   **Statistical Inference-I**   **3(3-0)**

Course Brief

Statistical Inference is designed to provide students with a solid foundation in the principles and methods of drawing conclusions about populations from sample data. The course covers key concepts, techniques, and applications of point estimation.

Course Learning Objectives

- To introduces students to the basic theory behind the development of statistical techniques related to inferential statistics.
- To understand the techniques in the areas of point estimation and the properties of a good estimator.
- To provide students with a solid foundation in statistical inference, enabling them to make informed decisions based on data and draw meaningful conclusions about populations.

Contents

1. Sampling distribution and its role in statistical inference. Estimation of parameters. Role of LCT in statistical inference.
2. Properties of Estimators: unbiasedness, consistency, sufficiency, efficiency, Invariance, completeness.
3. Minimum variance unbiased estimator.
4. Cramer-Rao inequality, Rao-Blackwell and Lehmann - Scheffe Theorems.
5. Methods of Estimation: Moments, Maximum likelihood, least-squares, minimum Chi-square and Bayes' method.

Recommended Books

1. Hogg, R. M. & Craig, A. T. (2019). *Introduction to mathematical statistics.* (7th ed.).New York: MacMillan Co.
2. Mood, A. M., Graybill, F. A. &Boes, D.C. (1997). *Introduction to the theory of statistics.* London: McGraw Hill

Suggested Books

1. Lehmann, E. L. (1986).*Testing statistical hypotheses.* New York: John Wiley & Sons.
2. Hirai, A. S. (1973). *Estimation of statistical parameters.* Pakistan: IlmiKhana.
3. Lindgren, B.W. (1998). *Statistical theory.* New York: Chapman and Hall.
4. Stuart, A. & Ord, J. K. (1998). *Kendall's' advanced theory of statistics* (2nd ed.) London: Charles Griffin.

STAT-6111   **Statistical Quality Control**   **3(3-0)**

Course Brief

The aim of this course is to provide a strong mathematical and conceptual foundation in the methods of statistical quality control, with an emphasis on practical aspects of the interpretation and communication of statistically based conclusions in research. It deals with the construction of control charts for monitoring location and dispersion parameters. It also discusses the performance measures, such as average run length and probability of detection, of the control charts. This covers the process capability analysis, process improvements using modern statistical techniques.

Course Learning Objectives

- This course is designed to provide conceptual and practical knowledge of techniques for quality control.
- This course is structured to monitor the process control via control charts.
- This course is designed to determine most appropriate sample size needed to accept or reject a lot of material.

Contents

1. Overview and concept of quality dimension of quality, variability in quality, quality terminology, and statistical methods in quality Improvement.
2. Describing variability through different measures and probability distributions,
3. Statistical process control (SPC), statistical quality control, control charts, consumer risk and producer risk, Phase I and Phase II.
4. Shewhart control charts: philosophy, construction and advantages
5. Location control charts, their construction with practical examples
6. Dispersion control charts with known and unknown parameters
7. Performance measures of control charts, false alarm rate (FAR), probability of detection, average run length (ARL)
8. Attribute control chart: fraction non-conforming chart, counts charts
9. Moving average control charts
10. Process capability analysis, process capability ratios and confidence intervals
11. Case studies using real life data
12. Role of statistical packages in quality control
13. Simulation and its uses in control charting techniques

Recommended Books

1. Montgomery, D. C (2013). Introduction to Statistical Quality Control, 7th ed., McGraw Hill, New York
2. Qiu, P. (2013). Introduction to Statistical Process Control, 1st ed., Taylor and Francis, New York

Suggested Books

1. Ryan, T.P (2011). Statistical Methods for Quality Improvement, 3rd ed., Wiley Sons
2. Juran, J. M., and DeFoe, J.A., (2010). Juran's Quality Handbook, 6th ed.,McGraw-Hill Education,

STAT- 6112   **Time Series Analysis**   **3(3-0)**

Course Brief

Time Series Analysis is a comprehensive course designed to provide students with the necessary tools and techniques for analyzing and modeling time-dependent data. Time series data, which is prevalent in various fields such as finance, economics, environmental science, and engineering, requires specialized methods for understanding its temporal patterns and making informed predictions.

Course Learning Objectives

- Explore the characteristics of time series data, including trends, seasonality, and cyclical patterns. Learn to identify different types of time series and their applications.
- Develop skills in exploratory data analysis techniques specific to time series data. Visualize time series data, identify outliers, and assess stationarity.
- Introduce classical statistical models for time series analysis, including autoregressive (AR), moving average (MA), and autoregressive integrated moving average (ARIMA) models. Understand the principles of model selection and fitting.
- Learn methods for decomposing time series data into its trend, seasonal, and residual components. Understand the importance of decomposition in understanding underlying patterns.
- Delve into time series forecasting techniques, including simple and exponential smoothing methods. Explore the principles of model evaluation and validation.
- Apply time series analysis to real-world problems in diverse fields. Explore case studies and projects to reinforce theoretical concepts and practical applications.

Contents

1. Time series analysis: concepts and components,
2. Stochastic Process, Stationary Time-Series,
3. Exponential smoothing techniques, auto-correlation and auto-covariance, estimation of auto-correlation function (ACF) and Partial autocorrelation function (PACF) and standard errors. Periodogram, spectral density functions, comparison with ACF,
4. Linear stationary models: Auto Regressive Moving Average (ARMA) and mixed models, Non-stationary models, general ARIMA notation and models, minimum mean square forecasting.
5. ARIMA Seasonal Models

Recommended Books

1. Chatfield, C. (1996). *The analysis of time series, an introduction.* London: Chapman and Hall,
2. Cox, D.R., Hinklev, D .V. & Nielsen, O .E. B. (1996). *Time series models in econometrics finances and other fields.* London: Chapman Hall.

Suggested Books

1. Andy, P., West, M. & Harrison, P .J. (1994*). Applied bayesian forecasting and time series analysis*. New York: Chapman Hall.

2. Harvey, A. C. (1990). *Forecasting structural time series models and the kalman filter*. Cambridge University: Press.
3. Harvey, A.C. (1981). *Econometric analysis of time series*. London: Philip Allan.

STAT-6113   **Statistical Inference-II**   **3(3-0)**

Course Brief

The aim of this course is to introduce the theory behind the development of statistical inference. It provides a strong mathematical and conceptual foundation in the methods of statistical inference, with an emphasis on development of tests concerning different parameters of distributions. This further extends the theory, methods and mechanics that underpin standard statistical methods to compare the tests. It also involves derivation of power functions of different tests for comparing and evaluation of the tests. This also focuses on how to decide a suitable statistical test for problems of real world. This covers the contents from theory of classical and Bayesian statistics.

Course Learning Objectives

By the end of this course, students will be able to:
- To develop an advanced-level understanding and working knowledge of statistical inference.
- To provide an introduction to the rudiments of statistical inference for population parameters based on a general decision theoretic framework covering estimation and test of hypothesis.
- To introduce some nonparametric methods and their applications.

Pre-requisite: STAT-6110

Contents
1. Statistical inference, hypothesis testing, importance of hypothesis testing,
2. Simple and composite hypotheses, critical regions, types of errors.
3. Power function, size of the test and their uses
4. Randomized Tests and non-randomized tests
5. Likelihood ratio tests, Neymann-Pearson Lemma, most powerful test, uniformly most powerful tests
6. Deriving tests of hypothesis concerning parameters in normal, exponential, gamma distributions.
7. Developing tests of hypothesis for Binomial and Poisson distributions.
8. Power computations and comparisons of tests
9. Unbiased tests and consistent tests
10. Generalized likelihood ratio tests and their asymptotic properties for single mean, equality of means
11. Generalized likelihood ratio tests and their asymptotic properties for single variance, equality of variances
12. Sequential Tests: basics of sequential probability ration tests
13. Interval Estimation: Pivotal and other methods of finding confidence interval, confidence interval in large samples, shortest confidence interval, optimum confidence interval.
14. Bayes Inference
15. Role of statistical packages in statistical inference

Recommended Books

3. Hogg, R, .V. McKean, J. W., and Craig, A. T. (2019). Introduction to Mathematical Statistics, 8th ed. Pearson Prentice Hall, USA.
4. Casella, G., and Berger, R. L. (2002) Statistical Inference, 2nd ed. Duxbury Press, CA, USA.

Suggested Books

1. Mood, A. M. Graybill, F. A. & Boes, D. C. (1973). Introduction to the Theory of Statistics, McGraw Hill,.
2. Stuart, A. and Ord, J .K. Kendall's' (1998). Advanced Theory of Statistics, Vol. I, Charles Griffin, London.
3. Lehman, E.L. (1997). Testing Statistical Hypotheses, Springler - Volga,New York.

STAT-6114   **Applied Multivariate Analysis**   **3(3-0)**

Course Brief

Multivariate analysis is used to study more complex sets of data than what univariate analysis methods can handle. Essentially it is a tool to find patterns and relationships between several variables simultaneously. It lets us predict the effect a change in one variable will have on other variables. Multivariate analysis can reduce the likelihood of Type I errors. Sometimes, univariate analysis is preferred as multivariate techniques can result in difficulty interpreting the results of the test. This course is designed to enlighten the significance of multivariate analysis by entertaining the both mathematical and applied approaches of problems. This course deals with multiple variable analyses simultaneously. To impart skills on the data collection, description measures of data, interpretation of the results, model selection, decision making in the context of multivariate analysis. Nowadays, to accommodating, monitoring, sorting, and filtering, several variables in various fields like in manufacturing industries, social phenomenon, psychology, medical, information technology and biotechnology etc. simultaneously is a big challenge to the world. This is designed to enlighten the significance of multivariate analysis by entertaining the both mathematical and applied approaches of problems. Course also provides the simultaneous model structure, their assumptions and mathematical derivations of multivariate statistical designs.

Course Learning Objectives

By the end of this course, students will be able to:

- This course provides the fundamental knowledge of multivariate data and its applications in different fields of life.
- This course will introduce the students different multivariate techniques through real world problems.
- This course will develop the skill in students to estimate the parameters and drive inference in multivariate cases.

Contents

1. Introduction to multivariate data and its graphical representation.
2. Euclidean and statistical distance.
3. Review of matrix algebra, quadratic form, Eigen analysis, spectral decomposition.
4. Descriptive statistics for multivariate data.
5. Multivariate Normal Distribution.
6. Distribution of linear function of normal variates.
7. Distribution of Quadratic forms
8. MLE of Multivariate Normal Distribution
9. Wishart distribution.
10. Hotelling's T^2-distribution
11. Inferences about mean vector
12. Inferences about covariance matrices
13. MANOVA
14. Inferences about profiles
15. Principle Component Analysis
16. Factor Analysis.
17. Factor analysis versus principle component analysis
18. Cluster Analysis
19. Canonical variates Analysis.
20. Discriminant Analysis

Recommended Books

1. Johnson, R. A., &Wichern, D. W. (2002). *Applied multivariate statistical analysis* (5th ed.). New Jersey: Prentice hall.
2. Gnanadesikan, R. (1997). *Methods for data analysis of multivariate observations* (2nd ed.). New York: John Wiley and Sons.

Suggested Books

1. Anderson, T.W. (1985). *An introduction to multivariate statistical analysis*. New York: John Wiley and Sons.
2. Chatfield, C. & Collin, A. J. (1980). *Introduction to multivariate analysis*. New York: Chapman and Hall.
3. Mardia, K.V., Kent, J. T. & Bibby J. M. (1979). *Multivariate analysis*. London: Academic press.

STAT-6115   **Categorical Data Analysis**   **3(3-0)**

Course Brief

Categorical Data Analysis is a statistical methodology designed to analyze and interpret data that is categorical in nature. Categorical data represents groups or categories, and the analysis of such data involves understanding the relationships between these categories. This course provides a comprehensive overview of the principles, techniques, and applications of categorical data analysis.

Course Learning Objectives

1. Understand the fundamental principles of categorical data analysis.
2. Apply appropriate statistical techniques to analyse categorical data sets.
3. Gain hands-on experience with statistical software (e.g., R, Python) for analyzing categorical data.
4. Apply categorical data analysis techniques to real-world problems and datasets.
5. Emphasize the practical implications of the methods studied.
6. Develop critical thinking skills in interpreting results and drawing meaningful conclusions from categorical data analyses.

Contents
1. A brief history of categorical data analysis,
2. Principles of likelihood-based inference,
3. Sampling distributions for contingency tables,
4. Measures of association for 2x2 tables,
5. Testing independence in contingency tables,
6. Exact inference for two-way tables, Inferences for three-way tables.
7. Introduction to generalized linear models, Logistic regression, Model building.
8. Alternative link functions for binary outcome,
9. Diagnostics, Receiver Operating Characteristic (ROC) Curve Analysis.
10. Exact methods and conditional logistic regression,
11. Methods for analyzing matched case-control data,
12. Multinomial response models for nominal data,
13. Multinomial response models for ordinal data.
14. Poisson regression model, Poisson regression for rates,
15. Log linear models for contingency tables

Recommended Books

1. Agresti, A. (1999). Categorical data analysis. London: John Wiley and Sons.
2. Bishop, Y. V. V., Fienberg, S. E. & Holland, P. W. (1975). Discrete multivariate analysis. Cambridge: MIT Press.

Suggested Books

1. Cox, D. R. & Snell, E. J. (1989). The analysis of binary data. London: Chapman and Hall.
2. Kleinbaum, D. G., Dietz, K., Gail, M., Klein, M. & Klein, M. (2002). Logistic regression. New York: Springer-Verlag.
3. Hosmer, D. W., Lemeshow, S. & Sturdivant, R. X. (2013). Applied logistic regression. New York: John Wiley and Sons.

MATH-5101   **Calculus-I**   **3 (3-0)**

Course Brief

Calculus is the mathematical study of continuous change. If quantities are continually changing, we need calculus to study what is going on. Calculus is concerned with comparing quantities which vary in a non-linear way. It is used extensively in science & engineering, since many of the things we are studying (like velocity, acceleration, current in a circuit) do not behave in a simple, linear fashion. Calculus has two major branches, <u>differential calculus</u> (Calculus–I) & <u>integral calculus</u> (Calculus–II); the former concerns instantaneous rates of change, & the slopes of curves, while integral calculus concerns accumulation of quantities, & areas under or between curves. This is the first course of the sequence, Calculus-I, II & III, serving as the foundation of advanced subjects in all areas of mathematics. The sequence, equally, emphasizes basic concepts & skills needed for mathematical manipulation. It focuses on the study of functions of a single variable. Calculus-I is an introduction to differential & integral calculus: the study of change.

Contents
1. Functions & their graphs, Rates of change & tangents to curves
2. Limit of a function & limit laws, the precise definition of a limit
3. One-sided limits, continuity, Limits involving infinity; asymptotes of graphs
4. Differentiation: tangents & derivative at a point, the derivative as a function
5. Differentiation rules, the derivative as a rate of change
6. Derivatives of trigonometric functions, Chain rule, implicit differentiation
7. Related rates, linearization & differentials, higher derivatives
8. Applications of derivatives: extreme values of functions
9. Rolls' theorem, the mean value theorem, Monotonic functions & the first derivative test
10. Convexity, point of inflection & second derivative test, Concavity & curve sketching
11. Applied optimization, Antiderivatives, integration: area & estimating with finite sums
12. Sigma notation & limits of finite sums, definite integral, the fundamental theorem of calculus
13. Indefinite integrals & the substitution method, Substitution & area between curves
14. Applications of definite integrals: volumes using cross-sections
15. Volumes using cylindrical shells, arc length, Areas of surfaces of revolution
16. Transcendental functions: inverse functions & their derivatives
17. Natural logarithms, exponential functions, Indeterminate forms & L'Hôpital's rule
18. Inverse trigonometric functions, hyperbolic functions

Recommended Books

1. Thomas, G.B., Weir, M. D.,& Hass J. R. (2014).*Thomas'calculus: single variable*(13th ed.). London: Pearson.
2. Stewart, J. (2015).*Calculus*(8th ed.). Boston: Cengage Learning.

Suggested Books
1. Anton, H., Bivens I. C.,& Davis, S. (2016).*Calculus*(11th ed.). New York: Wiley.
2. Goldstein, L. J., Lay, D. C., Schneider, D. I.,& Asmar, N. H. (2017).*Calculus & its applications*(14th ed.). London: Pearson.

3. Larson, R.,& Edwards, B. H. (2013).*Calculus*(10th ed.).New York: Brooks Cole.

MATH-5103   **Calculus-II**   **3(3-0)**

Course Brief

This is the second course of the basic sequence Calculus serving as the foundation of advanced subjects in all areas of mathematics. The sequence, equally, emphasizes basic concepts & skills needed for mathematical manipulation. As continuation of Calculus-I, it focuses on the study of functions of a single variable.This Core Curriculum course is designed to meet the following four learning goals: Students will construct and evaluate logical arguments. Students will apply and adapt a variety of appropriate strategies to solve mathematical problems. Students will recognize and apply mathematics in contexts outside of mathematics. Students will organize and consolidate mathematical thinking through written and oral communication. Students willintegrate transcendental functions, including logarithms, exponential, trigonometry and inverse trigonometric, hyperbolic and inverse hyperbolic functions, apply methods of integration, such as algebraic substitution, trigonometric substitution, partial fractions, integration by parts, and use a table of integrals, solve limit problems involving indeterminate forms with La'Hopital's Rule andconvert parametric representation of curves to rectangular coordinates, represent a curve using polar coordinates, and integrate functions expressed in polar coordinates.

Pre-requisite: **Calculus-I**

Contents

1. Techniques of integration: Using Basic Integration Formulas, Integration by Parts
2. Trigonometric Integrals, Trigonometric Substitutions
3. Integration of Rational Functions by Partial Fractions
4. Integral Tables & Computer Algebra Systems, Numerical Integration, Improper Integrals
5. Sequences & Infinite Series, The Integral Test, Comparison Tests
6. Absolute Convergence, The Ratio & Root Tests
7. Alternating Series & Conditional Convergence
8. Power Series, Taylor & Maclaurin Series, Convergence of Taylor Series
9. The Binomial Series & Applications of Taylor Series
10. Parametrizations of Plane Curves
11. Calculus with Parametric Curves, Polar Coordinates
12. Graphing Polar Coordinate Equations
13. Areas & Lengths in Polar Coordinates, Conic Sections, Conics in Polar Coordinates

Recommended Books

1. Thomas, G. B., Weir, M. D.,& Hass, J. R. (2014). *Thomas' calculus: single variable* (13th ed.).London: Pearson.
2. Stewart, J. (2012). *Calculus*, (8th ed.). New York: Cengage Learning.

Suggested Books
1. Anton, H., Bivens, I. C.,& Davis, S. (2016). *Calculus*, (11th ed.). New York: Wiley.

2. Goldstein, L. J., Lay, D. C., Schneider, D. I.,& Asmar, N. H. (2017). *Calculus &its applications* (14th ed.). London: Pearson.
3. Larson, R.,& Edwards, B. H. (2013). *Calculus* (10th ed.). New York: Brooks Cole.

BUSB-5106   **Advanced Accounting and Auditing**   **3 (3-0)**

Course Brief

Advanced Accounting in the Professional Competence Course concentrates on conceptual understanding of the crucial aspects of accounting and reporting of financial statements. The main objective of the course is to give advance knowledge regarding corporate accounting and auditing procedures. This course presents an in-depth analysis of advanced accounting topics.

Course Learning Objectives

- To understand business combination of Accounting and Auditing.
- To apply accounting techniques and procedures to specific circumstances like leases, branches, departmental stores, consignment and joint venture.
- To understand relationship between auditing and financial statements of joint venture, partnership and branches.

Contents

1. Share issuance and recording, Company Accounting
2. Bonds and debentures. Final Accounts, Consignment and Contract Accounts
3. Hire purchase. Introduction to Auditing: Definition
4. Audit & Accounting Difference, Objects, Errors & Fraud, Advantages of Audit
5. Qualities of an Auditor, Audit Functions
6. Classification of Audit: Statutory Audit, Private Audit, Government Audit, Internal Audit
7. Continuous Audit, Final Audit, Interim Audit, Cost Audit, Management Audit.
8. Audit Standards: Principles, Procedure, Concepts, Techniques, Vouching and Verification Principles
9. Planning the Audit: Pre-requisites of Audit, Audit Program, Audit Note Book
10. Audit Working Papers routine checking, Test checking, Teaming and Leading
11. Internal Control: Definition, Principals, Designing of Internal Control
12. Internal Control over small organization, manufacturing concern
13. Internal Check, Difference between Internal check and Audit
14. Different between internal and external auditor
15. Report on annual accounts. Contents of Audit Report, Liabilities of Company Auditor
16. Criminal Liability, Dual Appointment, Liability of Honorary Auditor, Liability for Libel

Recommended Books
1. Sohail. A &Muhammad.A. (2020). *Advance Accounting*. Lahore: Azeem Academy.

Suggested Books
1. Ghani. S. (2012). *Advanced Accounting.* Lahore:Sulman Publication.

GEOL-5101   **Introduction to Geology**   **3(3-0)**

Course Brief

This course is designed to acquire the knowledge about the basic concepts of geology. This will help the students to get knowledge about various types of rocks, minerals and the processes of their formation. Geology is the core discipline of the earth sciences and encompasses many different phenomena, including plate tectonics and mountain building, volcanoes and earthquakes, and the long-term evolution of Earth's atmosphere, surface and life. The goal of the Geology undergraduate program is to equip students with the fundamental knowledge of the diverse fields of Geology (encompassing Geomorphology & Surface Processes, Hydrology & Low-Temperature Geochemistry, Sedimentology & Paleoecology, and Tectonics and Solid-Earth Processes). In addition, it is critical that students learn to think like a scientist and to apply the scientific method in their coursework and in their lives. It helps to know the geologic time scale and place important geologic events in a temporal framework.

Contents

1. Introduction and scope of geology; importance and relationship with other sciences;
2. History and philosophy of geology; Earth as a member of the solar system;
3. Earth's origin, age, composition and internal structure;
4. Introduction to plate tectonics, Isostasy; mountain building processes;
5. Earthquakes and volcanoes; weathering and erosion;
6. Introduction, identification and classification of rocks and minerals;
7. Sedimentary, igneous and metamorphic structures;
8. Introduction to fossils in sedimentary rocks;
9. Introduction to folds, faults, joints, cleavage, foliation, lineation and unconformities;
10. Geological Time Scale; Law of Superposition, present is key to the past and Law of Faunal Succession;
11. Concept and techniques of geological dating, relative and absolute dating; evolution of life on earth;
12. Use of Brunton Compass and GPS, etc.

Recommended Books

1. Plummer, C. C., Carlson, D. H., & Hammersley, L. (2016). Physical geology. New York, NY: McGraw-Hill/Education, Inc.,.
2. Plummer, C. C., McGeary, D., & Carlson, D. H. (Latest Edition). Physical Geology: Earth Revealed. McGraw-Hill Education.

Suggested Books

1. McGeary, D., Carlson, D. H., & Plummer, C. C. (Latest Edition). Physical geology. McGraw-Hill Science/Engineering/Math.
2. Smith, G., & Pun, A. (2013). How Does Earth Work? Physical Geology and the Process of Science: Pearson New International Edition. Pearson Higher Ed.
3. McClay, K. (Latest Edition). The mapping of geological structures. Geol. Soc. London handbook.

URCG-5112   **Fables, Wisdom Literature, and EPICS**   **2(2-0)**

Course Brief

The course will enable students to explore human experiences, cultivate an appreciation of the past, enrich their capacity to participate in the life of their times, and enable an engagement with other cultures and civilizations, both ancient and modern. But independently of any specific application, the study of these subjects teaches understanding and delight in the highest achievements of humanity. The three components of the course, including fables, wisdom literature and epic, will enable the learners to explore and understand the classic tradition in literature. Development of personal virtue, a deep Sufi ethic and an unwavering concern for the permanent over the fleeting and the ephemeral are some of the key themes explored in the contents that will develop an intimate connection between literature and life.

Contents

1. Fables
   - ✓ The Fables of Bidpai
   - ✓ The Lion and the Bull
   - ✓ The Ring-dove
   - ✓ The Owls and the Crows
   - ✓ Selected poem from Bang-i-Dara

2. Gulistan-e- Sa'di
   - ✓ Ten ḥikāyāt from John T. Platts, The Gulistan

3. Epic
   - ✓ THE SHĀHNĀMA OF FIRDAUSI

Recommended Books

1. John T. P. (1876). The Gulistan; or, Rose Garden of Shaikh Muslihu'd- Dīn Sa'dī of Shīrāz. London: Wm. II. Allen.
      3. Chishti, Y.S. (1991). Sharaḥ-i bāng-i darā. Lāhaur: Maktaba-i taʿmīr-i insāniyat
      4.

Suggested Books

1. Thackston, W. (2000). A Millennium of Classical Persian Poetry. Maryland: Ibex Publishers.
2. Wood, R. (2013). Kalila and Dimna: Fables of Conflict and Intrigue. United Kingdom: Medina Publishing, Limited.

Course Brief

Life, its characteristics, natural science, biology and its branches; Importance of Flora & Fauna in biodiversity; Importance of Natural Compounds in daily life, medicine and human health; Latest developments in natural sciences (Biotechnology); Ecosystem and its components; Environment and its components; Pollutants and their effect on the environment (Greenhouse effect, global warming, acid rains, water pollution and ozone depletions etc); Introduction to micro-organism and its types (bacteria, fungi, viruses)

Practical

1. 1: Field Survey of Flora & Fauna and their identification
2. 2: Study of herbarium
3. 3: Study of Museum

Recommended Books

l. Keddy, P.A. (2017). Plant ecology origins, processes, consequences. Cambridge, University Press.
2. Canadell, J.G., Diaz, S., Heldmaier, G., Jackson, R.B., Levia, D.F., Schulze, E.D. & Sommer, U. (20 19). Ecological studies. Springer.
3. Bhat, S.V., Nagasampagi, B.A. & Sirakumar, M. (2006). Chemistry of Natural Products. Springer Science
4. De, A.K. (2019). Environmental Chemistry. New Age International Press

Suggested Books:

l. Fath, B. (2018). Encyclopedia of' ecology. Elsevier.
2. Ajith, H .. Urmas. P., Pastur, G. M & Iversion L. R. (2018). Ecosystem services from forest landscpes: broadsclaes consideration. 1stEdition. Springer International Publishing AG.
3. Xu, R., Ye, Y. & Zhao, W. (2011). Introduction to Natural Product Chemistry. CRC Press
4. Tayler, D.J., Green, N.P.O. & Stout, G.W. (1997). Biological Science 1&2. Cambridge University Press
5. Tayler, M.R., Simon, E.J., Dickey, D.J. & Hogan, K.A. (2020). Campbell Biology: Concepts & Connections (10th Edition). Pearson

URCG-5116   **Science of Society-I**   **2 (2-0)**

Course Brief

This course will introduce students with the subject matter of social science, its scope, nature and ways of looking at social phenomenon. It will make the participants acquaintance with thefoundations of modern society, state, law, knowledge and selfhood. While retaining a focus on Pakistani state and society, students will encounter theoretical concepts and methods from numerous social science disciplines, including sociology, politics, economics anthropology and psychology and make them learn to think theoretically by drawing on examples and case studies from our own social context. Students will be introduced to the works of prominent social theorists from both western andnon-western contexts. Instruction will include the use of written texts, audio-visual aids and field visits.

Learning Outcomes

- Introduce student with the nature of human social behavior and foundations of humangroup life
- Analyze the reciprocal relationship between individuals and society.
- Make student aware with the nature of societies existing in modern world
- Make students familiar with the philosophy of knowledge of social sciences
- Introduce students with the works of prominent theories explain human group behavior
- Help students to understand the foundations of society including culture, socialization,politics and economy
- Introduce students with various dimensions of social inequalities with reference to gender,race, ethnicity and religion
- Make them aware about the understanding of various themes pertains to social science inlocal context
- Help them recognize the difference between objective identification of empirical facts,and subjective formulation of opinionated arguments

Contents

1. **Introduction to Social Sciences**
   - Social world, Human Social behavior, Foundations of society
   - Evolution of Social sciences
   - Philosophy of Science
   - Scope and nature of social sciences
   - Modernity and social sciences
   - Branches of social science: Sociology, Anthropology, Political Science, Economics

   Society and Community, Historical evolution of Society
   - Types of Societies
   - Foraging society, Horticultural society, Pastoralist society
   - Agrarian societies, Industrial society, Postindustrial society

2. **Philosophy of Knowledge in social Science and social inquiry**
   - Understanding social phenomenon
   - Alternative ways of knowing
   - Science as a source to explore social reality

- Objectivity, Value-Free research
- Positivism vs Interpretivism
- Qualitative vs Quantitative

3. **Culture and Society**
   - Idea of Culture, Assumptions of Culture
   - Types, Components, Civilization and culture
   - Individual and culture. Cultural Ethnocentrism, Cultural Relativism
   - Outlook of Pakistani culture
   - Global Flows of culture, Homogeneity, Heterogeneity

4. **Social Stratification and Social inequality**
   - Dimensions of inequality, Social class
   - Gender, Race, Religion, Ethnicity, Caste
   - Patterns of social stratification in Pakistan
   - Class, caste system in agrarian society
   - Ascription vs Achievement, Meritocracy
   - Global stratification in modern world, Global patterns of inequality

5. **Personality, Self and Socialization**
   - Concept of self, Personality
   - Nature vs Nurture, Biological vs Social
   - Development of Personality
   - Socialization as a process, Agents of socialization
   - Socialization and self/group identity

6. **Gender and Power**
   - Understanding Gender
   - Social construction of Patriarchy
   - Feminism in Historical context, Gender Debates
   - Gender and Development
   - Gender issues in Pakistani society, Women Participation in politics, economy andeducation
   - Toward a gender sensitive society, Gender mainstreaming

   Pakistan: State, Society, Economy and Polity
   - Colonialism, colonial legacy, National identity
   - Transformation in Pakistani society: Traditionalism vs Modernism
   - Economy, Informality of Economy, Modern economy and Pakistan
   - Political Economy, Sociology of Economy

Recommended Textbooks and Reading Materials:

1. Giddens, A. (2018). Sociology (11th ed.). UK: Polity Press.
2. Henslin, J. M. (2018). Essentials of Sociology: A Down-to-Earth Approach.(18th Edition)Pearson Publisher.
3. Macionis, J. J. (2016). Sociology (16th ed.). New Jersey: Prentice-Hall.
4. Qadeer, M. (2006) Pakistan - Social and Cultural Transformation in a Muslim Nation.
5. Smelser, N.J. and Swedburg, R., The Handbook of Economic Sociology, Chapter 1 'IntroducingEconomic Sociology', Princeton University Press, Princeton.
6. Systems of Stratification | Boundless Sociology (no date). Available at: https://courses.lumenlearning.com/boundless-sociology/chapter/systems-of-stratification/
7. Jalal, A. (ed.) (1995) 'The colonial legacy in India and Pakistan', in Democracy and Authoritarianism in South Asia: A Comparative and Historical Perspective. Cambridge:

Cambridge University Press (Contemporary South Asia)

8. Zaidi, S. A. (2015) Issues in Pakistan's Economy: A Political Economy Perspective. OxfordUniversity Press. Chapter 26

9. Akhtar, A. S. (2017) The Politics of Common Sense: State, Society and Culture in Pakistan.Cambridge: Cambridge University Press.

10. Smelser, N.J. and Swedburg, R., The Handbook of Economic Sociology, Chapter 1 'IntroducingEconomic Sociology', Princeton University Press, Princeton.

Course BrieF

The course aims at providing understanding of a writer's goal of writing (i.e. clear, organized and effective content and to use that understanding and awareness for academic reading and writing. The objectives of the course are to make the students acquire and master the grammatical academic writing skills. The course would enable the students to develop argumentative writing techniques. The studentswould be able to logically add specific details on the topics such as facts, examples and statistical or numerical values. The course will also provide insight to convey the knowledge and ideas in an objective and persuasive manner. Furthermore, the course will also enhance the students' understanding of ethical considerations in writing academic assignments and topics including citation,plagiarism, formatting and referencing the sources as well as the technical aspects involved in referencing.

Contents

1. Developing Analytical Skills
2. Transitional devices (word, phrase and expressions)
3. Development of ideas in writing
4. Reading Comprehension
5. Precis Writing
6. Developing argument
7. Sentence structure: Accuracy, variation, appropriateness, and conciseness
8. Appropriate use of active and passive voice
9. Organization and Structure of a Paragraph
10. Organization and structure of Essay
11. Types of Essays

Recommended Books

1. Bailey, S. (2011). Academic writing: A handbook for international students (3rd ed.). New York:Routledge.
2. Eastwood, J. (2011). A Basic English grammar. Oxford: Oxford University Press.
3. Swales, J. M., & Feak, C. B. (2012). *Academic writing for graduate students: Essential tasks andskills* (3rd ed.). Ann Arbor: The University of Michigan Press.
4. Swan, M. (2018). *Practical English usage* (8th ed.). Oxford: Oxford University Press.

Suggested Books

1. Biber, D., Johansson, S., Leech, G., Conrad, S., Finegan, E., & Quirk, R. (1999). *Longmangrammar of spoken and written English*. Harlow Essex: MIT Press.
2. Cresswell, G. (2004). *Writing for academic success*. London: SAGE.
3. Johnson-Sheehan, R. (2019). *Writing today*. Don Mills: Pearson.
4. Silvia, P. J. (2019). *How to write a lot: A practical guide to productive academic writing*.Washington: American Psychological Association
5. Thomson, A. J., & Martinet, A. V. (1986). *A Practical English Grammar*. Oxford: OxfordUniversity Press

Course Brief

This course prepares undergraduates to become successful writers and readers of English. The coursehelps students develop their fundamental language skills with a focus on writing so that they can gainthe confidence to communicate in oral and written English outside the classroom. The course is divided into five units and takes a Project-based Learning approach. Unit themes target the development of 21ˢᵗcentury skills and focus on self-reflection and active community engagement. The course completion will enable the students to develop communication skills as reflective and self-directed learners. They will be able to intellectually engage with different stages of writing process, and develop analytical and problem-solving skills to address various community-specific challenges.

Contents

1. Self-Reflection
   - Introduction to the basics of the writing process
   - Introduction to the steps of essay writing
   - Prewriting activities: Brainstorming, listing, clustering and freewriting
   - Practicing Outlining of the essay
2. Personalized Learning
   - Learning Process, Learning Styles, Goal Setting and Learning Plan
3. Oral Presentation
   - Structure and Significance, Content Selection and Slide Presentation, Peer Review
4. Critical Reading Skills
   - Introducing Authentic Reading (Dawn and non-specialist academic books/texts)
   - Reading Strategies and Practice: Skimming, scanning, SQW3R, Annotating, Detailed reading and note-taking, Standard Test Practice: TOEFL and IELTS, Model Review Reports and Annotated Bibliographies
5. Community Engagement
   - Student-led brainstorming on local versus global issues, Identifying research problems
   - Drafting research questions, Drafting interview/survey questions for community research (in English or L1)
   - Engaging students in Critical reading, Presenting interview/ survey information, Field work
   - Writing Community Engagement Project
6. Letter to the Editor
   - Types of letters, Format and purpose of letter to the editor, Steps in writing letter-to-editor

Recommended Books

1. Bailey, S. (2011). Academic writing: A handbook for international students (3rd ed.). NewYork: Routledge.
2. Swales, J. M., & Feak, C. B. (2012). *Academic writing for graduate students: Essential tasksand skills* (3ʳᵈ ed.). Ann Arbor: The University of Michigan Press.

Suggested Books

1. Cresswell, G. (2004). *Writing for academic success*. London: SAGE.
2. Johnson-Sheehan, R. (2019). *Writing today*. Don Mills: Pearson.
3. Silvia, P. J. (2019). *How to write a lot: A practical guide to productive academic writing*.Washington: American Psychological Association.

URCG-5120   **Exploring Quantitative Skills**   **3(3-0)**

Course Brief

Since ancient times, numbers, quantification, statistics and mathematics has played a central role in scientific and technological development. In the 21st century, Quantitative Reasoning (QR) skills are essential for life as they help to better understand socio-economic, political, health, education, and many other issues, an individual now faces in daily life. The skills acquired by taking this course willhelp the students to apply QR methods in their daily life and professional activities. This course will also change student's attitude about statistics and mathematics. It will not only polish their QR skills,but also enhance their abilities to apply these skills.

Course Learning Outcomes:

After completing this course successfully, students will be able to:
- **create and develop quantitative reasoning skills and apply it to daily life challenges involving social and economic issues.**
- **apply the learned principles of quantitative reasoning skills in other disciplines.**
- **acquire and use quantitative reasoning skills in different disciplines.**
- **make decisions in a logical manner.**
- **apply geometrical models to solve real life problems.**

Contents

1. Introduction to quantitative reasoning
2. Overview of contributions of Mathematicians and Statisticians especially Muslim scholars.
3. Types of standard numbers
4. Proportions, rates, ratio and percentages
5. Odds and odds ratio
6. Scale of measurements
7. Number sequence and series
8. Unit analysis as a problem-solving tool
9. Data handling (small and large)
10. Data errors, absolute and relative and their applications
11. Descriptive statistics
12. Rules of counting: multiplication rule, factorial, permutation and combination
13. Probability and its application in real life
14. A graphical perspective through Venn Diagram
15. Financial indicator analysis, and money management (profit, loss, simple and compoundinterest)
16. Practical scenarios involving algebraic expressions: linear and quadratic

Recommended Books

1. Akar, G. K., Zembat, İ. Ö., Arslan, S., & Thompson, P. W. (2023). *Quantitative Reasoning inMathematics and Science Education*. 1st Ed., Springer, USA.
2. Peck, R., Olsen, C., & Devore, J. L. (2015). *Introduction to statistics and data analysis*. 5th Ed.,Brooks Cole, USA.
3. Devlin, K. J. (2012). *Introduction to mathematical thinking*. Palo Alto, CA: Keith Devlin.

Suggested Books

1. Triola, M. F., Goodman, W. M., Law, R., & Labute, G. (2006). *Elementary statistics*. Reading,MA: Pearson/Addison-Wesley.
2. Blitzer, R., & White, J. (2005). *Thinking mathematically*. Pearson Prentice Hal

URCG-5121 **Tools for Quantitative Reasoning** **3(3-0)**

Course Brief

This course is based on quantitative reasoning 1 course. It will enhance the quantitative reasoning skillslearned in quantitative reasoning 1 course. Students will be introduced to more tools necessary for quantitative reasoning skills to live in the fast paced 21st century. Students will be introduced to importance of statistical and mathematical skills in different professional settings, social and natural sciences. These quantitative reasoning skills will help students to better participate in national and international issues like political and health issues. This course will prepare the students to apply quantitative reasoning tools more efficiently in their professional and daily life activities. This course will help them to better understand the information in form of numeric, graphs, tables, and functions.

Course Learning Outcomes

After completing this course successfully, students will be able to:

- demonstrate knowledge of core concepts in a scientific field,
- interpret scientific data from a variety of sources,
- apply the scientific method to solve problems, and
- demonstrate written and oral presentation skills when communicating scientific knowledge.

Contents

1. Types of data and its graphical representation (Histogram, Stem and Leaf display, Box Plot,Scatter diagram, Historigam, Bar chart, etc)
2. Solving practical problems using linear and exponential models
3. Population growth models
4. Analytical approach to solve simultaneous equations
5. Inequalities and their application
6. Comparing quantities using analytical tools
7. Logical reasoning and their application in modern age
8. Logical reasoning and decision making
9. Data tendencies via measure of location
10. Variability and Measure of dispersion
11. Measuring relationships via Regression analysis and correlation
12. Statistical inference: sampling techniques, estimation techniques and hypothesis testing fordecision and policy making

Recommended Books

1. Akar, G. K., Zembat, İ. Ö., Arslan, S., & Thompson, P. W. (2023). *Quantitative Reasoning inMathematics and Science Education*. 1st Ed., Springer, USA.
2. Sharma, A. K. (2005). *Text book of elementary statistics*. Discovery Publishing House.
3. Blitzer, R. (2014). *Precalculus*, 5th Ed.. Pearson Education, Limited. New York

Suggested Books

1. Gupta, S. C., & Kapoor, V. K. (2020). *Fundamentals of mathematical statistics*. 12th Ed, SultanChand & Sons.
2. Aufmann, R. N., Lockwood, J., Nation, R. D., & Clegg, D. K. (2007). *Mathematical thinkingand quantitative reasoning*. Cengage Learning
3. Blitzer, R., & White, J. (2005). *Thinking mathematically*. Pearson Prentice Hall.

UQCG-5126   **ETHICS**   **2(2-0)**

1. Meaning and Scope of Ethics.
2. Relation of Ethics with:
        (a) Religion
        (b) Science
        (c) Law
3. Historical Development of Morality:
        (a). Instinctive Moral Life.
        (b). Customary Morality.
        (c). Reflective Morality.
4. Moral Theories:
        (a). Hedonism (Mill)
        (b). Intuitionism (Butler)
        (c). Kant's Moral Theory.
5. Moral Ethics and Society.
        (a). Freedom and Responsibility.
        (b). Tolerance
        (c). Justice
        (d). Punishment (Theories of Punishment)
6. Moral Teachings of Major Religions:
        (a). Judaism
        (b). Christianity
        (c). Islam
7. Professional Ethics:
        (a). Medical Ethics
        (b). Ethics of Students
        (c). Ethics of Teachers
        (d). Business Ethics

REFERENCE BOOKS

1. William Lille. An Introduction to Ethics., London Methuen & Co. latest edition.
2. Titus, H.H. Ethics for Today. New York: American Book, latest edition.
3. Hill, Thomas. Ethics in Theory and Practice. N.Y. Thomas Y. Crowel, latest edition
4. Ameer Ali, S. The Ethics of Islam. Culcutta: Noor Library Publishers, latest edition
5. Donaldson, D.M. Studies in Muslim Ethics. London: latest edition.
6. Sayeed, S.M.A.(Tr.) Ta'aruf-e-Akhlaqiat. Karachi: BCC&T, Karachi University of

URCG-5122   **Ideology and Constitution of Pakistan**   **2(2-0)**

Course Brief

This course focuses on ideological background of Pakistan. The course is designed to give a comprehensive insight about the constitutional developments of Pakistan. Starting from the Government of India Act, 1935 till to date, all important events leading to constitutional developments in Pakistan will be the focus of course. Failure of the constitutional machinery and leading constitutional cases on the subject. Moreover, students will study the process of governance, national development, issues arising in the modern age and posing challenges to Pakistan. It will also cover the entire Constitution of Pakistan 1973. However, emphasis would be on the fundamental rights, the nature of federalism under the constitution, distribution of powers, the rights and various remedies, the supremacy of parliament and the independence of judiciary

Contents

- **Ideology of Pakistan**
   Ideological rationale with special reference to Sir Syed Ahmed Khan, Allama Muhammad Iqbal and Quaid-e-Azam Muhammad Ali Jinnah. Two Nation Theory and Factors leading to Muslim separatism.
- **Constitutional Developments**
   Salient Feature of the Government of India Act 1935
   Salient Feature of Indian Independence Act 1947 Objectives Resolution
   Salient Feature of the 1956 Constitution
   Developments leading to the abrogation of Constitution of 1956
   Salient features of the 1962 Constitution
   Causes of failure of the Constitution of 1962
   Comparative study of significant features of the Constitution of 1956, 1962 and 1973
- **Fundamental rights**
- **Principles of policy**
- **Federation of Pakistan**
   President
   Parliament
   The Federal Government
- **Provinces**
   Governors
   Provincial Assemblies T
   he Provincial Government
- **The Judicature**
   Supreme Court
   High Courts
   Federal Shariat Courts
   Supreme Judicial Council
   Administrative Courts and tribunals
- **Islamic Provisions in Constitution**
- **Significant Amendments of Constitution of Pakistan 1973**

Recommended Books

1. Constitutional and Political History of Pakistan by Hamid Khan
2. Mahmood, Shaukat and Shaukat, Nadeem. Constitution of the Islamic Republic of Pakistan, 3rd re edn. Lahore: Legal Research Centre, 1996.
3. Munir, Muhammad. Constitution of the Islamic Republic of Pakistan: Being a Commentary on the Constitution of Pakistan, 1973. Lahore, Law Pub., 1975.
4. Rizvi, Syed Shabbar Raza. Constitutional Law of Pakistan: Text, Case Law and Analytical Commentary. 2nd re edn. Lahore: Vanguard, 2005.
5. The Text of the Constitution of the Islamic Republic of Pakistan, 1973 (as amended).
6. Fundamental Laws of Pakistan by A.K. Brohi

URCG-5123   Applications of Information and Communication Technologies (ICT)   3(2-1)

Course Brief

The course introduces students to information and communication technologies and their application in the workplace. Objectives include basic understanding of computer software, hardware, and associated technologies. How computers can be used in the workplace, how communications systems can help boost productivity, and how the Internet technologies can influence the workplace. Students will get basic understanding of computer software, hardware, and associated technologies. They will also learn how computers are used in the workplace, how communications systems can help to boost productivity, and how the Internet technologies can influence the workplace.

Contents

1. Introduction, Overview of Information Technology.
2. Hardware: Computer Systems & Components, Storage Devices.
3. Software: Operating Systems, Programming and Application Software.
4. Databases and Information Systems Networks.
5. File Processing Versus Database Management Systems.
6. Data Communication and Networks.
7. Physical Transmission Media & Wireless Transmission Media.
8. Applications of smart phone and usage.
9. The Internet, Browsers and Search Engines.
10. Websites and their types.
11. Email Collaborative Computing and Social Networking.
12. E-Commerce.
13. IT Security and other issues.
14. Cyber Laws and Ethics of using Social media.
15. Use of Microsoft Office tools (Word, Power Point, Excel) or other similar tools depending on the operating system.
16. Other IT tools/software specific to field of study of the students if any.

Recommended Book

1. Discovering Computers 2022: Digital Technology, Data and Devices by Misty E. Vermaat, Susan L. sebok; 17th edition.

Suggested Books

1. Computing Essentials 2021 by Timothy J. O'Leary and Linda I. O'Leary, McGraw Hill Higher Education; 26th edition.
2. Computers: Understanding Technology by Fuller, Floyd; Larson, Brian: edition 2018.

URCG-5124   **Entrepreneurship**   **2(2-0)**

Course Brief

This course addresses the unique entrepreneurial experience of conceiving, evaluating, creating, managing, and potentially selling a business idea. The goal is to provide a solid background with practical application of important concepts applicable to the entrepreneurial environment. Entrepreneurial discussions regarding the key business areas of finance, accounting, marketing and management include the creative aspects of entrepreneurship. The course relies on classroom discussion, participation, the creation of a feasibility plan, and building a business plan to develop a comprehensive strategy for launching and managing a new venture.

Course Learning Objectives

- To enhance the 'entrepreneurial intentions' of the students by improving their natural willingness to start a business.
- To understand the process of entrepreneurship and learn the ways to manage it by working individually in the class and in the form of groups outside the class to conduct field assignments.
- To educate the students about the practical underpinnings of the entrepreneurship with the aid of practical assignments and idea pitching.

Contents

1. **Background:** What is an Organization, Organizational Resources, Management Functions, Kinds of Managers, Mintzberg's Managerial Roles.
2. **Forms of Business Ownership**: The Sole proprietorship, Partnership, Joint Stock Company
3. **Entrepreneurship:** The World of the Entrepreneur, what is an entrepreneur? The Benefits of Entrepreneurship, The Potential Drawbacks of Entrepreneurship, Behind the Boom: Feeding the Entrepreneurial Fire.
4. **The Challenges of Entrepreneurship:** The Cultural Diversity in Entrepreneurship, The Power of "Small" Business, Putting Failure into Perspective, The Ten Deadly Mistakes of Entrepreneurship, How to Avoid the Pitfalls, Idea Discussions & Selection of student Projects, Islamic Ethics of Entrepreneurship.
5. **Inside the Entrepreneurial Mind:** From Ideas to Reality: Creativity, Innovation, and Entrepreneurship, Creativity – Essential to Survival, Creative Thinking, Barriers to Creativity, How to Enhance Creativity, The Creative Process, Techniques for Improving the Creative Process, Protecting Your Ideas, Idea Discussions & Selection of student Projects.
6. **Products and technology, identification opportunities**
7. **Designing a Competitive Business Model and Building a Solid Strategic Plan**: Building a strategic plan, Building a Competitive Advantage, The Strategic Management Process, Formulate strategic options and select the appropriate strategies, Discussion about execution of Students' Project.
8. **Conducting a Feasibility Analysis and Crafting a Winning Business Plan:** Conducting a Feasibility Analysis, Industry and market feasibility, Porter's five forces model, Financial feasibility analysis. Why Develop a Business Plan, The Elements of a Business Plan, What Lenders and Investors Look for in a Business Plan, Making the Business Plan Presentation.

9. **Building a Powerful Marketing Plan**: Building a Guerrilla Marketing Plan, Pinpointing the Target Market, Determining Customer Needs and Wants Through Market Research. Plotting a Guerrilla Marketing Strategy: How to Build a Competitive Edge, Feed Back & Suggestions on Student Project, Islamic Ethics for Entrepreneurial Marketing

10. **E-Commerce and the Entrepreneur:** Factors to Consider before Launching into ECommerce, Ten Myths of E-Commerce, Strategies for E-Success, Designing a Killer Web Site, Tracking Web Results, Ensuring Web Privacy and Security, Feed Back & Suggestions on Student Project.

11. **Pricing Strategies:** Three Potent Forces: Image, Competition, and Value, Pricing Strategies and Tactics, Pricing Strategies and Methods for Retailers, The Impact of Credit on Pricing

12. **Attracting Venture Capitalist**: Projected Financial Statements, Basic Financial Statements, Ratio Analysis, Interpreting Business Ratios, Breakeven Analysis, Feed Back &Suggestions on Student Project,

13. **Idea Pitching**: Formal presentation, 5-minutes pitch, funding negotiation and launching.

Recommended Books

1. Scarborough, N. M. (2011). Essentials of entrepreneurship and small business management. Publishing as Prentice Hall, One Lake Street, Upper Saddle River, New Jersey 07458..

Suggested Books

1. Burstiner, I. (1989). Small business handbook. Prentice Hall Press.

URCG-5125   **Civics and Community Engagement**   **2(2-0)**

Course Brief

The Civics and Community Engagement course is designed to provide students with an understanding of the importance of civic participation, culture and cultural diversity, basic foundations of citizenship, group identities and the role of individuals in creating positive change within their communities. The course aims at developing students' knowledge, skills and attitudes necessary for active and responsible citizenship.

Course Learning outcomes

After completing this course, students will be able to

• Understand the concepts of civic engagement, community development, and social responsibility.

• Understand rights and responsibilities of citizenship

• Understand cultural diversity in local and global context

• Analyze the significance of civic participation in promoting social justice, equity, and

• democracy.

• Examine the historical and contemporary examples of successful civic and community engagement initiatives.

• Identify and assess community needs, assets, and challenges to develop effective strategies for community improvement.

• Explore the ethical implications and dilemmas associated with civic and community engagement.

• Develop practical skills for effective community organizing, advocacy, and leadership.

• Foster intercultural competence and respect for diversity in community engagement efforts.

• Collaborate with community organizations, stakeholders, and fellow students to design and implement community-based projects.

• Reflect on personal growth and learning through self-assessment and critical analysis of community engagement experiences.

Course ContentS

Introduction to Civics & Community Engagement
   • Overview of the course: Civics & Community Engagement
   • Definition and importance of civics
   • Key concepts in civics: citizenship, democracy, governance, and the rule of law
   • Rights and responsibilities of citizens

Citizenship and Community Engagement
   • Introduction to Active Citizenship: Overview of the Ideas, Concepts, Philosophy and Skills
   • Approaches and Methodology for Active Citizenship

Identity, Culture, and Social Harmony
   • Concept and Development of Identity, Group identities
   • Components of Culture, Cultural pluralism, Multiculturalism, Cultural Ethnocentrism, Cultural relativism, Understanding cultural diversity, Globalization and Culture, Social Harmony,
   • Religious Diversity (Understanding and affirmation of similarities & differences)

- Understanding Socio-Political Polarization
- Minorities, Social Inclusion, Affirmative actions

Multi-cultural society and inter-cultural dialogue
- Inter-cultural dialogue (bridging the differences, promoting harmony)
- Promoting intergroup contact/ Dialogue
- Significance of diversity and its impact
- Importance and domains of Inter-cultural dialogue

Active Citizen: Locally Active, Globally Connected
- Importance of active citizenship at national and global level
- Understanding community
- Identification of resources (human, natural and others)
- Utilization of resources for development (community participation)
- Strategic planning, for development (community linkages and mobilization)

Human rights, constitutionalism and citizens' responsibilities
- Introduction to Human Rights
- Human rights in constitution of Pakistan
- Public duties and responsibilities
- Constitutionalism and democratic process

Social Institutions, Social Groups, Formal Organizations and Bureaucracy
- Types of Groups, Group identities, Organizations
- Bureaucracy, Weber's model of Bureaucracy
- Role of political parties, interest groups, and non-governmental organizations

Civic Engagement Strategies
- Grassroots organizing and community mobilization
- Advocacy and lobbying for policy change
- Volunteerism and service-learning opportunities

Social issues/Problems of Pakistan
- Overview of major social issues of Pakistani society

Social Action Project

Recommended Books

1. Kennedy. J. K., & Brunold, A. (2016). Regional context and Citizenship education in Asia and Europe. New Yourk: Routledge, Falmer.
2. Henslin, James M. (2018). Essentials of Sociology: A Down to Earth Approach (13th ed.). New York: Pearson Education
3. Macionis, J. J., & Gerber, M.L. (2020). Sociology. New York: Pearson Education

Suggested Books

1. Glencoe McGraw-Hill. (n.d.). Civics Today: Citizenship, Economics, and Youth.
2. Magleby, D. B., Light, P. C., & Nemacheck, C. L. (2020). Government by the People (16th ed.). Pearson.
3. Sirianni, C., & Friedland, L. (2005). The Civic Renewal Movement: Community-Building and Democracy in the United States. Kettering Foundation Press.

4. Bloemraad, I. (2006). Becoming a Citizen: Incorporating Immigrants and Refugees in the United States and Canada. University of California Press.

5. Kuyek, J. (2007). Community Organizing: Theory and Practice. Fernwood Publishing.

6. DeKieffer, D. E. (2010). The Citizen's Guide to Lobbying Congress. TheCapitol.Net.

7. Rybacki, K. C., & Rybacki, D. J. (2021). Advocacy and Opposition: An Introduction to Argumentation (8th ed.). Routledge.

8. Kretzmann, J. P., & McKnight, J. L. (1993). Building Communities from the Inside Out: A Path Towards Finding and Mobilizing a Community's Assets. ACTA Publications.

9. Patterson, T. E. (2005). Engaging the Public: How Government and the Media Can Reinvigorate American Democracy. Oxford University Press.

10. Love, N. S., & Mattern, M. (2005). Doing Democracy: Activist Art and Cultural Politics. SUNY

Translation of the Holy Quran – I   **URCG-5111**   **Non-Credit**

Topic	Details
Semester/Level	In some discipline 1st semester and in some discipline 2nd Semester/ ADP Program 1st Year
Course Code	URCG-5111
Course Title	Translation of the Holy Quran – I
Credit Hours	Non-Credit
Objectives	- To familiarize the students to keys and fundamentals of recitation of the holy Quran. - To develop the skill of the students of recitation the last revelation. - Students will learn the basic Arabic grammar in a practical way. - To develop an eagerness among the students to explore the last divine Book.
Course Contents:	- ئیسواں پارہ - ناظرہ مع تجوید - بنیادی عربی گرامر اسم اور اسکے متعلقات : اسم فاعل ،مفعول ،ئفضیل ،مبالغہ فعل اور اسکی اقسام : ماضی ،مضارع ،امر ، نہی حرف اور اسکی اقسام : حروف علت ،حروف جارہ ،مشبہ بالفعل
Memorization:	ئیسویں پارے کی آخری بیس سورئیں) حفظ مع ترجمہ (

Translation of the Holy Quran- II **URCG-5111** **Non-Credit**

Topic	Details
Semester/Level	In some discipline 3rd semester and in some discipline 4th Semester/ ADP Program 2nd Year
Course Code	URCG-5111
Course Title	Translation of the Holy Quran – II
Credit Hours	Non-Credit
Objectives	▪ Students will come to know about the real nature, significance and relevance of the Islamic beliefs in light of the text of the Holy Quran. ▪ Students will seek knowledge of translation and transliteration of the Holy Book Quran. ▪ To familiarize the students with the concept of Ibādah (Its significance, scope and relevance) and its types in Islam. ▪ Students will learn literal and idiomatic way of translation of the Holy Book. ▪ Students will learn about the polytheism and its incompatibility in Islam highlighted by the Holy Quran. ▪ To highlight the significance of learning through using all human faculties provided by the almighty Allah and familiarize the students about condemnation of ignorance mentioned in the Quranic text. ▪ To develop Awareness among the students about rights and duties of different circles of society in the light of Holy Quran. ▪ To introduce the students to Quranic Arabic grammar in practical manner.

Course Contents:	○ ایمانیات اور عبادات اللہ پر ایمان ،فرشتوں پر ایمان ،رسولوں پر ایمان ،آسمانی کتابوں پر ایمان یوم آخرت پر ایمان ، تقدیر پر ایمان نماز ،روزہ ،زکوٰۃ،حج ،جہاد ○ معاشرے کے حقوق • خاندان کی تشکیل • حق مہر • رضاعت و حمل • اولاد کو قتل کرنے کے ممانعت • شوہر کی نافرمانی • طلاق • بیوہ کی عدت کے احکام • نکاح کا پیغام بھیجنا • عورت کی وراثت (اس کے شوہر کی طرف سے) • والدین کے حقوق • بہنوں اور اولاد کے بیچ عداوت ○ خاندان کے حقوق • مہمان کی عزت • اجازت طلب کرنے کے اصول • مجلس کے آداب • تعاون اور بھائی چارہ • گروہ بندی • محبت • لوگوں کے درمیان صلح • عفو ودرگزر، غصہ پر قابو اور معاف کرنا • شعوب و قبائل • لوگوں کے بیچ اختلافات • حمایت و نگہبانی
Grammar:	• قرآنی عربی گرامر کے اصول اور انکے اطلاقات)متن قرآنی ہر اطلاق سے

Details of Chapters and verse Numbers:	(ئوضیحات
	▪ منتخب آیات مع ترجمہ وتجوید
	▪ البقره (١١٧)، ٢٣٨، ٤٥، ١١٨، ٢٧٨، ١٧٧، ٤٥، ٣٤٧، ١٥٨، ٧١٨، ٤٢٨، ٥٣، ٤٢٨، ٤٧، ٢٨٧، ٣٤٨، ٢٢، ٨٢، ٢٨٧، ٤٢٨، ٢٤٨، ١١٧، ٢٣٧، ٢٢٧، ١١٨، ٥٢٧، ٣٢٧، ٢٧٨، ٢٤٧، ٢٢٧،٧٥٨، ١٨٨، ١٣٨، ٢٨٨، ١٣٨، ٢٨٨، ٢٨٨، ١٣٨، ٧٣٨، ١٣٨، ٤٣٨، ١٣٨ ، ٨٢ ، ٥٢٧، ٣٣٨، ٨٢٧، ١٢٧، ٣٢)
	▪ النساء (٤٢، ٨٢، ٢٣٧، ٢٤، ١٢، ٢٢، ٣٧، ١٢، ٢٢، ٢٢،١٢، ٢٣، ٢١٧، ٨٧، ٤٣، ٢٨٧، ٥٣، ٧٧، ٥، ٢١٧، ٥٨، ٤٨، ٧٧، ٧٧، ٢٨٧، ٧٢٧، ٤٣، ١٨، ٤٣، ٧٢٧، ٢، ٧، ١٨، ٧، ٢٧، ٢٨٧، ٥٤، ٢٥٧، ٧٢)
	▪ النعام (٨٨، ٥٧،٨٢، ١٣٧، ٧٤٧، ٢٥، ٥٤)
	▪ آل عمران (١٢، ٢٣، ٤٢، ٤٨٧، ٥٢، ٥٥٧، ٢٧،٧)
	▪ المائده (٥٤، ٨، ٨٢، ٢٣،٢٧، ٨٢، ٨، ٤)
	▪ العراف (٤٣، ٢٢٧، ٢٢٧)
	▪ التوبہ (١٨، ٢٧،٧١)
	▪ ہود (٨٧)
	▪ الزمر (٢)
	▪ النور (٥٤، ٨٤، ٢٨، ١٨، ١٢ ، ٢٨)
	▪ محمد (٣٣)
	▪ انفل (٨٢، ١٨)
	▪ الرعد(٣)
	▪ الطالق (٥)
	▪ الحج(٤)
	▪ ابراہیم (٣٨،٥٥)
	▪ السراء (٣٨، ٥٨)
	▪ الحقاف (٤٧)
	▪ المومنون (١٨)
	▪ العنکبوت (٤٨،٢٥، ٢)
	▪ النحل (٨٨)
	▪ لقمان (٤٧،٥، ٥٧)
	▪ الحزاب (٤٣، ١٤،٢٣، ٢٥)
	▪ الشعراء(١)
	▪ الروم (٧٨)
	▪ مریم (٥٧،٢٨)
	▪ المجادلہ (٨٧، ٧٧)

Translation of the Holy Quran - III   **URCG-5111**   **Non-Credit**

Topic	Details
Semester/Level	In some discipline 5th semester and in some discipline 6th Semester/ BS (5th Semester intake) 1st / 2nd
Course Code	URCG-5111
Course Title	Translation of the Holy Quran - III
Credit Hours	Non-Credit
Objectives	- To introduce ethics and highlight its importance, need and relevance for individual and collective life. - To illuminate the students with the Quranic norms of Morality i.e. truthfulness, patience, gratitude, modesty, forgiving, hospitality etc. - To familiarize the students with immoral values like falsify, arrogance, immodesty, extravagance, backbiting etc. - To inculcate ethical and moral values in our youth. - To develop a balanced dynamic and wholesome personality. - To introduce the students to Quranic Arabic grammar in practical manner.

Course Contents:	اخلاق حسنہ : (تعارف، ضرورت و اہمیت ، اقسام، معزویت) اخلاق o • برائی کو نیکی سے مٹانا • نیکی کے کاموں میں مسابقت • لوگوں کے درمیان صلاح • عدل و انصاف • سچائی • ایثار • سلیم قلب • مہمان نوازی • لغویات سے اعراض • عاجزی و انکساری • نگاہ اور آواز کو پست رکھنا • چال میں میانہ روی • شرمگاہوں کی حفاظت • صبر • شکر • امور میں میانہ روی اخلاق سیّئہ : • ظلم اور زیادتی • غرور و تکبر • نفسانی خواہشات کی پیروی • بدگمانی • جھوٹ • چغلی اور تہمت • تمسخر اور شیخی خوری • لہو و لعب • برے ناموں سے پکارنا • احسان جتانا اور تکلیف دینا • فضول خرچی اور حد سے بڑھنا • حسد اور تنگ دل • بے پردگی
Grammar:	• قرآنی عربی گرامر کے اصول اور انکے اطلاقات (مئن قرآنی ہر اطلاق سے توضیحات)

Details of Chapters and verse Numbers:	منتخب آیات مع ترجمہ وتجوید ■ البقرہ)۸۷۷، ۴۵۸، ۳۲، ۸۲۷، ۸۱۷، ۸۴۷، ۸۱۷، ۸۴، ۳۴۷، ۱۱۷، ۱۴۸، ۴۸۷، ۸۸۸، ۱۸، ۱۱، ۲۵۷، ۱۲۷، ۲۱۷، ۵۲۸، ۳۲۸، ۸۲۸، ۸۷۸، ۱۲، ۷۳۸، ۱۷، ۵۳، ۵۸۷، ۲۴۸، ۱۸، ۷۱، ۳۲، ۲۸۸، ۴۲۷، ۲۱(■ آل عمران)۵۴۷، ۵۷، ۵۷، ۵۸، ۸۳۷، ۴۲۷، ۲۵۷، ۵۳۷، ۴۵۷، ۱۷، ۱۱۸، ۴۸۷، ۳۳۷، ۵۷۷، ۵۱۷، ۵۱۷، ۲۸، ۲۱، ۷۵۷، ۱۵۷، ۲۴۷(■ النساء)۴۳۷، ۳۸، ۸۸، ۲۱۷، ۱۱۷، ۴۱۷، ۵۴، ۱۸، ۱۸، ۳۱۷، ۲۳، ۴۸، ۵۸، ۱۵، ۱۴، ۵۸(■ المائدۃ)۲۴، ۱۴، ۳۲، ۳۷، ۲، ۷۵، ۲۷(■ النحل)۱۲، ۲۸۷، ۴۱۷، ۳۷۷، ۱۳، ۲۸۷، ۴۸۷(■ الرعد)۴۸، ۱۸، ۵۸، ۸۸، ۲(■ العراف)۷۳، ۲۲، ۷۴، ۲۵۷، ۱۵، ۵، ۱۸، ۵۵۷، ۲۲۷، ۴۲، ۷۲(■ القصص)۵۴، ۵۲(■ فصلت)۵۳(■ النعام)۸۳، ۱۱، ۱۱، ۱۳۷، ۴۴۷، ۱۲۷(■ النمل)۱۲، ۲۵(■ الحج)۱۳، ۲۴، ۱۲، ۲۲، ۱۱(■ الحجرات)۲، ۷۷، ۲، ۷۷، ۳، ۸۷، ۴۷، ۱۷(■ الحزاب)۳۸، ۱۴، ۲۴، ۲۴، ۸۴، ۲۴، ۴۴، ۳۴، ۵۸، ۳۴(■ الحشر)۲(■ طہ)۸۱(■ النعام)۵۲۷، ۷۵۷، ۲۷۷، ۴۷۷، ۳۲، ۱۸۷(■ ق)۵۳(■ النفل)۱۸، ۲۵، ۷۲(■ الفتح)۴۷(■ یونس)۱۷، ۲۷، ۸۷، ۲۲، ۸۸، ۸۸(■ الفرقان)۳۲، ۸۷، ۱۲، ۳۲(■ النور)۳۸، ۲، ۵، ۱۳، ۳۳، ۳۳، ۷۳، ۷۲، ۷۳، ۸۸(■ لقمان)۲، ۳۳، ۲۷، ۸۳، ۲۷(■ السراء)۱۳، ۱۷۷، ۴، ۱۳(■ المزمل)۲۷(■ المدثر)۲، ۵(■ المدثر)۵۱(■ فاطر)۸۳(■ الفتح)۲۸(■ البلد)۱۷(■ الزمر)۳، ۱۷(■ الحجر)۴۲(■ النجم)۷۳(■ الرحمٰن)۱۲(■ ہود)۲، ۸۱۷، ۳(■ الکہف)۸، ۲۴(■ الشوری)۱۳(■ غافر)۲۸، ۱۸(■ الحدید)۱۸، ۱۸(■ مریم)۲۴(■ النازعات)۷۵(■ التوبہ)۴۲، ۵۲، ۱۱(■ الهمزہ)۷(

Translation of the Holy Quran - IV **URCG-5111** **Non-Credit**

Topic	Details
Semester/Level	In some discipline 7th semester and in some discipline 8th Semester/ BS (5th Semester intake) 3rd / 4th
Course Code	URCG-5111
Course Title	Translation of the Holy Quran - IV
Credit Hours	Non-Credit
Objectives	- To familiarize the students with commandments of trade and inheritancementioned in the Quranic text (with the help of Urdu translation). - Students - To introduce the students to scientific facts and miracles of the Holy Quranand Quranic stress on deep study of Allah's explored universe. - To motivate the students for reading and exploring the last Holy Bookrevealed by Almighty Allah. - Through memorization students will develop their relation with last revelation.
Course Contents :	<div dir="rtl"><p>○ تجارت اور وراثت:</p> - مال کی تقسیم - نادان کا مال - عوام الناس کا مال - عورتوں کا مال - یتیموں کا مال - کفار کا مال - جائز مال - معاہدے - رہن - قرض <p>○ سائنسی حقائق:</p> - تخلیق کائنات - اجرامِ فلکی - شجر و حجر - زمین و آسمان کے اسرار - ہوائیں اور طوفان - بہائم اور مویشی - حشرات الارض - پہاڑ اور سمندر </div>
Grammar :	<div dir="rtl">• قرآنی عربی گرامر کے اصول اور انکے اطلاقات (مئن قرآنی ہر اطلاق سے توضیحات(</div>
Details of Chapters and verse Numbers:	<div dir="rtl"><p>▪ منتخب آیات مع ترجمہ وتجوید</p><p>▪ البقره)۷۲۸، ۴۷۸۸، ۴۲۸، ۲۷۸، ۵۲۸، ۴۱۸، ۲۷، ۴۲۸، ۱۱۷، ۴۲۸، ۲۷، ۴۱۸، ۸۲۸، ۸۲۸، ۵۱۸، ۷۱۸، ۳۲، ۱۱۷، ۴۷۸، ۲۱۸، ۲۱۸، ۲۷، ۱۸، ۳۸۸، ۲۸، ۴۴۸، ۵۲۷، ۲۲۸، ۵۲۷، ۵۲۷، ۱۴، ۱۲، ۵۲۷، ۱۴، ۱۷۸، ۲۷، ۲۸، ۷۱، ۸۲، ۳۲(</p><p>▪ آل عمران)۱۷۷، ۵۳۷، ۱۳۷، ۱۲۷، ۱۸، ۲۴(</p><p>▪ النساء)۲۸، ۸، ۲۸، ۷۲۷(</p><p>▪ المائده)۲۲، ۴۲، ۴۱، ۲۲، ۱۲(</p></div>

		■ التوبه (٢٢، ٥٨، ٢٢، ٥٨، ٥٨، ١٢، ٥) ■ الاعراف (٨١٧، ٤٢٧، ١٤، ٢٤، ٣٢٧، ٣٢٧، ١٢٧، ١٥، ٣٣٧، ٢١٧، ٢٢٧) ■ الرعد (١٧، ٥) ■ الطور (٥٥) ■ النعام (٢٤، ٣٢، ٧٥٧، ٢٥٧، ٢٣) ■ النفل (٢٨، ٢٣، ٧٥)
		■ الكهف (٧٤، ٢١٧، ١٥، ٨٣، ٤٥، ١٧، ٤٥) ■ الجائيه (٤) ■ فاطر (١٨، ٨٧، ٣٧) ■ العنكبوت (١٨، ٣٢، ٧٥) ■ الروم (١٤) ■ الاسراء (١١، ٢٢) ■ الرعد (٨) ■ السبا (١٧، ٣، ٨٨) ■ يونس (٢٢، ٧١٧، ٥٨، ٥٨، ٤، ٨٨) ■ يوسف (٥٢، ٥٧) ■ الفرقان (٨٢، ٣٤) ■ لقمان (٢٨، ٢٧) ■ طه (٥٧٧، ٣٤) ■ النحل (٤١، ٧٧، ٧٢، ٢٥، ٢١، ٢٢، ٢٢، ٤٧٧، ٢، ٢) ■ النمل (٥٢، ٥٢، ٢٢، ١٢، ٨٢، ١٧، ٢٧، ٢٧) ■ السجده (١٨) ■ الحديد (٢) ■ هود (٣٥، ٢) ■ يسين (١٣، ٧٥) ■ الروم (٢٣، ٢٣، ١٤، ٢٧، ٥٨، ٢٥) ■ فصلت (٢٣، ٢٣) ■ الحج (٧٢، ٤٢، ٨٨، ٣١) ■ الحجر (٢٧، ٨٨) ■ النبياء (٧٣، ١٣، ١٥) ■ الزاريات (١٥) ■ الزلزله (٧) ■ القصص (٢١، ٢١، ١٢، ٧٢، ٨٢) ■ النور (١٣، ٨٨، ٨٨، ١٥، ٤٥، ٣٥) ■ الجمعه (٧٧، ٨٢، ١٧، ٧٧، ٤) ■ القمر (١) ■ الواقعه (٢٢) ■ الفاطر (١٨، ٣٧) ■ الملك (٢٧) ■ الصف (١٧) ■ الجن (٣٧) ■ الشورىٰ (٢٨) ■ الزخرف (٧٧) ■ النئل (٧)

مطالعہ سیرت النبی صلی اللہ علیہ وسلم Seerat of the Holy Prophet

Course Code : URCG-5127

Title	Description
Semester	
Nature of Course	
No. of C.Hrs.	1(1-0)
Total Teaching weeks	18
Objectives of the Course	۱۔ طلباء کو مطالعہ سیرۃ طیبہ کی ضرورت واہمیت سے آگاہ کرنا
	۲۔ تعمیر شخصیت میں مطالعہ سیرۃ طیبہ کے کردار کو واضح کرنا
	۳۔ بعثت نبوی کے موقع پر اقوام عالم کی عمومی صورت حال سے آگاہ کرنا
	۴۔ رسول اکرم صلی اللہ علیہ وسلم کی مکی اور مدنی زندگی کا اس طرح مطالعہ کرنا تاکہ طلباء ان واقعات سے نتائج کا استنباط کر سکیں
	۵۔ طلباء کو عہد نبوی کی معاشرت، سیاست، معیشت سے آگاہ کرنا

Course Description

S.No.	Title	Description
1	حضور صلی اللہ علیہ وسلم کے ابتدائی حالاتِ زندگی	۱۔ حضور صلی اللہ علیہ وسلم کا خاندانی حسب ونسب
		۲۔ پیدائش اور ابتدائی تربیت
		۳۔ لڑکپن اور جوانی کے حالاتِ زندگی
2	بعثت نبوی کے وقت دنیا کے حالات (۱)	۱۔ بعثت نبوی کے وقت اہم تہذیبیں
		۲۔ عرب، مصر، حبشہ، بازنطینی، ساسانی
3	بعثت نبوی	۱۔ مکی عہد میں دعوت اسلام
4	بعثت نبوی	۱۔ مدنی عہد میں دعوت اسلام
5	خصائص النبیؐ	آپؐ بطور پیغامبر امن
6	خصائص النبیؐ	بحیثیت استاد و معلم
7	خصائص النبیؐ	بحیثیت تاجر
8	خصائص النبیؐ	بحیثیت سربراہ ریاست
9	خصائص النبیؐ	ذاتی محاسن اور ہمہ گیر اثرات

10	خصائص النبیؐ	ناموس رسالت
11	اسوہ حسنہ اور عصر حاضر	غیر مسلموں سے تعلقات
12	اسوہ حسنہ اور عصر حاضر	اسوہ حسنہ کی روشنی میں گھریلو زندگی
13	اسوہ حسنہ اور عصر حاضر	مستشرقین اور مطالعہ سیرت
15	اسوہ حسنہ اور عصر حاضر	وطن سے محبت اور سیرت
16	اسوہ حسنہ اور عصر حاضر	مستشرقین کے اعتراضات اور ان کے جوابات

نصابی کتب

نام کتاب	نام مؤلف	نمبر شمار
السیرۃ النبویۃ	ابن ہشام	1
سیرۃ النبی صلی اللہ علیہ وسلم	مولانا شبلی نعمانی، سید سلمان ندوی	2
رحمۃ للعالمین	قاضی محمد سلیمان سلمان منصورپوری	3
نبی رحمت صلی اللہ علیہ وسلم	مولانا سید ابوالحسن علی ندوی	4
عہد نبوی کا نظام حکومت	ڈاکٹر یسین مظہر صدیقی	5
انسان کامل	ڈاکٹر خالد علوی	6

حوالہ جاتی کتب

نام کتاب	نام مؤلف	نمبر شمار
سیرت سرور عالم صلی اللہ علیہ وسلم	سید ابوالاعلیٰ مودودی	1
الرحیق المختوم	مولانا صفی الرحمن مبارکپوری	2
ضیاء النبی صلی اللہ علیہ وسلم	پیر محمد کرم شاہ الازہری	3
السیرۃ النبویۃ الصحیحۃ	ڈاکٹر اکرم الضیاء العمری	4
اصح السیر	مولانا عبدالرؤف دانا پوری	5