UNIVERSITY OF SARGODHA
OFFICE OF THE REGISTRAR
(ACAD BRANCH)

NOTIFICATION

On the recommendations of Academic Council made in its 24th (1/2025) meeting held on 26.08.2025, the Syndicate in its 72nd (4/2025) meeting held on 12.09.2025 has approved the curriculum of BS in Data Analytics for implementation w.e.f. **Fall 2025** (Annex-'**A**').

(WAQAR AHMAD)
Additional Registrar (General)

No. SU/Acad/25/1285 Dated: 24.11.2025

Distribution:

- Chairman, Department of Statistics
- Controller of Examinations
- Director Academics

C.C:

- Dean Faculty of Sciences
- Director, QEC
- Secretary to the Vice-Chancellor
- Additional Registrar (A & R)
- PA to Registrar
- Notification File

SCHEME OF STUDIES AND OUTLINES

FOR

BS 4-YEAR

UNDERGRADUATE PROGRAM IN DATA ANALYTICS
(Semester/Term System)

Session Fall-2025 Onward

DEPARTMENT OF STATISTICS
UNIVERSITY OF SARGODHA

Title of Degree Program: BS in Data Analytics

1. Introduction and Rationale

In today's data-driven world, the demand for professionals with data analytics skills is increasing across industries such as business, healthcare, finance, and public policy. Traditional statistical methods are no longer sufficient to address the complexity of modern data challenges. Data analytics bridges statistics, computer science, and domain knowledge to uncover meaningful insights from data and support evidence-based decision-making.

This program aims to equip students with both theoretical knowledge and practical skills in data analytics, combining classical statistics with modern machine learning, data mining, and visualization techniques. The BS in Data Analytics under the Department of Statistics will offer a robust foundation in statistical theory while emphasizing analytical tools, programming, and industry-relevant applications.

2. Program Objectives

The BS in Data Analytics aims to:

1. Develop students' expertise in statistical and machine learning tools for data analysis.
2. Equip students with skills in data management, programming, and visualization.
3. Teach students to solve real-world problems using analytical tools and statistical reasoning.
4. Prepare students for careers in business intelligence, healthcare analytics, financial modelling, and public policy analysis.

3. Program Learning Outcomes

Graduates of this program will be able to:

1. Collect, preprocess, and manage large datasets using computing languages and statistical software.
2. Apply statistical and machine learning models to derive insights from data.
3. Design effective data visualizations to communicate insights to non-technical audiences.
4. Use data analytics to support decision-making in a variety of fields.
5. Work effectively in cross-disciplinary teams to address complex problems.

4. Career Opportunities for Graduates

Graduates will be prepared for roles such as:

- ✓ Data Analyst
- ✓ Business Intelligence Analyst
- ✓ Machine Learning Engineer
- ✓ Data Scientist
- ✓ Financial Data Analyst
- ✓ Healthcare Data Analyst
- ✓ Risk Analyst
- ✓ Market Research Analyst
- ✓ Consultant in Analytics
- ✓ Policy Analyst

5. Program Structure:

Minimum Credit Hours (including all program related requirements)	134 credit hours
General Education Courses	35 credit hours (15 courses)
Major/ Discipline Related Courses	81 credit hours. (27 courses including 7 mandatory elective courses)
Interdisciplinary / Allied Courses	12 credit hours (4 courses)
Internship	3 credit hours
Capstone Project	3 credit hours
Program Duration	Minimum: 4 Years Maximum: 6 Years (further extendable by another year subject to approval of the university's statutory body)
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.
Semester Duration	16-18 weeks for regular semesters (1-2 weeks for examination) 8-9 weeks for summer semesters (1 week for examination)
Course Load (per semester)	15-18 credit hours for regular semesters Up to 8 credit hours for summer semesters (for remedial/deficiency/failure/repetition courses only)
3 Credit Hours (Theory)	3 classes (1 hour each) OR 2 classes (1.5 hour each) OR 1 class (3 hours) per week throughout the semester

6. 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.	Course Code	Course Title	Credit Hours	Prerequisite
1.	URCG-5112	Fables, Wisdom Literature and EPICS	2(2-0)	Nil
2.	URCG-5114	Basic Science	3(2-1)	Nil
3.	URCG-5116	Science of Society-I	2(2-0)	Nil
4.	URCG-5118	Functional English	3(3-0)	Nil
5.	URCG-5119	Expository Writing	3(3-0)	Nil
6.	URCG-5120	Exploring Quantitative Skills	3(3-0)	Nil
7.	URCG-5121	Tools for Quantitative Reasoning	3(3-0)	Nil
8.	URCG-5105	Islamic Studies	2(2-0)	Nil
9.	URCG-5126	Ethics (For Non-Muslims)	2(2-0)	Nil
10.	URCG-5128	Pakistan Studies	2(2-0)	Nil
11.	URCG-5122	Ideology and Constitution of Pakistan	2(2-0)	Nil
12.	URCG-5123	Applications of Information and Communication Technologies (ICT)	3(2-1)	Nil
13.	URCG-5124	Entrepreneurship	2(2-0)	Nil
14.	URCG-5125	Civics and Community Engagement	2(2-0)	Nil
15.	URCG-5129	Understanding of Holy Quran/Fehm-e-Quran-I	1(0-1)	Nil
16.	URCG-5130	Understanding of Holy Quran/Fehm-e-Quran-II	1(0-1)	Nil
17.	URCG-5127	Seerat of the Holy Prophet (SAW)	1(1-0)	Nil
18.	URCG-5131	Ethics-I (For Non-Muslims)	1(0-1)	Nil
19.	URCG-5132	Ethics-II (For Non-Muslims)	1(0-1)	Nil

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GE Courses Credit Hours Total	35

7. **Single Major Courses:**

Sr. No.	Course Code	Course Title	Credit Hours	Prerequisite
1.	DATA-5201	Introduction to Data Analytics	3(3-0)	Nil
2.	DATA-5202	Basic Mathematics for Data Analytics	3(3-0)	Nil
3.	DATA-5203	Introduction of Probability Theory	3(3-0)	Nil
4.	DATA-5204	Linear Algebra for Data Analytics	3(3-0)	Nil
5.	DATA-5205	Introduction to Data Science	3(3-0)	Nil
6.	DATA-5206	Distribution Theory	3(3-0)	DATA-5203
7.	DATA-5207	Data Visualization	3(3-0)	Nil
8.	DATA-5208	Research Methods in Data Analytics	3(3-0)	Nil
9.	DATA-5209	Statistical Inference	3(3-0)	DATA-5206
10.	DATA-5210	Computing Tools for Data Analytics	3(3-0)	Nil
11.	DATA-5211	Survey Theory and Practice	3(3-0)	Nil
12.	DATA-6201	Regression Modeling Strategies	3(3-0)	Nil
13.	DATA-6202	Bayesian Analysis and Statistical Decision Making	3(3-0)	Nil
14.	DATA-6203	Design of Experiments	3(3-0)	Nil
15.	DATA-6204	Applied Time Series Analysis	3(3-0)	Nil
16.	DATA-6205	Programming in R and Python	3(3-0)	CSDE-5101
17.	DATA-6206	Multivariate Data Analysis	3(3-0)	Nil
18.	DATA-6207	Introduction to Big Data Technologies	3(3-0)	Nil
19.	DATA-6208	Introduction to Machine Learning	3(3-0)	Nil
20.	DATA-6209	Simulation Techniques in Data Analytics	3(3-0)	Nil
21.	DATA-6210	Business Analytics	3(3-0)	Nil
22.	DATA-6211	Social Media Analytics	3(3-0)	Nil
23.	DATA-6212	Data Driven Process Monitoring	3(3-0)	Nil
24.	DATA-6213	Cloud Computing for Data Analytics	3(3-0)	Nil
25.	DATA-6214	Introduction to Deep Learning	3(3-0)	Nil
26.	DATA-6215	Healthcare Analytics	3(3-0)	Nil
27.	DATA-6216	Geospatial Analytics	3(3-0)	Nil
		Major Courses Credit Hours Total	**81**	

8. **Interdisciplinary/Allied courses: minimum 12 credit hours:**

Interdisciplinary/Allied courses will be offered after 4th semester

1.	CSDE -5101	Introduction to Programming	3(3-0)	Nil
2.	CSDE -5102	Introduction to Artificial Intelligence	3(3-0)	Nil
3.	CSDE -5103	Database Management Systems and Applications	3(3-0)	Nil
4.	CSDE -5104	Data Structures and Algorithms	3(3-0)	Nil
		Interdisciplinary Courses Credit Hours Total	**12**	

9. **Field experience/internship: Minimum 03 credit hours:**

Lasting 6-8 weeks and ideally scheduled during summer breaks after 4th semester.

1.	**STAT-6225**	**Field experience/Internship**	**3(0-3)**	Nil

10. **Capstone project: Minimum 03 credit hours:**

This project, after the fifth semester, requires faculty supervision and evaluation following department guidelines

1.	**STAT-6250**	**Capstone Project**	**3(0-3)**	Nil

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SCHEME OF STUDIES

BS in Data Analytics

Semester-I

Sr. N.	Course Code	Course Title	Credit Hours	Pre-Req.	Category
1.	URCG-5118	Functional English	3(3-0)	Nil	GE
2.	URCG-5105	Islamic Studies	2(2-0)	Nil	GE
3.	URCG-5123	Applications of Information and Communication Technologies (ICT)	3(2-1)	Nil	GE
4.	URCG-5112	Fables, Wisdom Literature and EPICS	2(2-0)	Nil	GE
5.	DATA-5201	Introduction to Data Analytics	3(3-0)	Nil	Major
6.	DATA-5202	Basic Mathematics for Data Analytics	3(3-0)	Nil	Major
7.	URCG-5126	Ethics	2(2-0)	Nil	GE

Semester Total Credit Hours: **16**

Semester-II

Sr. N.	Course Code	Course Title	Credit Hours	Pre-Req.	Category
1.	URCG-5116	Science of Society-I	2(2-0)	Nil	GE
2.	URCG-5120	Exploring Quantitative Skills	3(3-0)	Nil	GE
3.	URCG-5127	Seerat of the Holy Prophet (SAW)*	1(1-0)	Nil	GE
4.	URCG-5122	Ideology and Constitution of Pakistan	2(2-0)	Nil	GE
5.	URCG-5125	Civics and Community Engagement	2(2-0)	Nil	GE
6.	DATA-5203	Introduction of Probability Theory	3(3-0)	Nil	Major
7.	DATA-5204	Linear Algebra for Data Analytics	3(3-0)	Nil	Major
8.	URCG-5129	Understanding of Holy Quran/Fehm-e-Quran-I	1(0-1)	Nil	GE
9.	URCG-5131	Ethics-I (For Non-Muslims)	1(0-1)	Nil	GE

Semester Total Credit Hours:**17**

Semester-III

Sr. N.	Course Code	Course Title	Credit Hours	Pre-Req.	Category
1.	URCG-5119	Expository Writing	3(3-0)	Nil	GE
2.	URCG-5121	Tools for Quantitative Reasoning	3(3-0)	Nil	GE
3.	URCG-5128	Pakistan Studies	2(2-0)	Nil	GE
4.	DATA-5205	Introduction to Data Science	3(3-0)	Nil	GE
5.	DATA-5206	Distribution Theory	3(3-0)	DATA-5203	GE
6.	DATA-5207	Data Visualization	3(3-0)	Nil	Major
7.	URCG-5130	Understanding of Holy Quran/Fehm-e-Quran-II*	1(0-1)	Nil	GE-10
8.	URCG-5132	Ethics-II (For Non-Muslims)	1(0-1)	Nil	GE

Semester Total Credit Hours: **18**

Semester-IV

Sr. N.	Course Code	Course Title	Credit Hours	Pre-Req.	Category
1.	URCG-5124	Entrepreneurship	2(2-0)	Nil	GE
2.	URCG-5114	Basic Science	3(2-1)	Nil	GE-
3.	DATA-5208	Research Methods in Data Analytics	3(3-0)	Nil	Major
4.	DATA-5209	Statistical Inference	3(3-0)	DATA-5206	Major
5.	DATA-5210	Computing Tools for Data Analytics	3(3-0)	Nil	Major
6.	DATA-5211	Sampling Theory and Practice	3(3-0)	Nil	Major

Semester Total Credit Hours:**17**

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Semester-V

Sr. N.	Course Code	Course Title	Credit Hours	Pre-Req.	Category
1.	DATA-6201	Regression Modeling Strategies	3(3-0)	Nil	Major
2.	DATA-6202	Bayesian Analysis and Statistical Decision Making	3(3-0)	Nil	Major
3.	DATA-6203	Design of Experiments	3(3-0)	Nil	Major
4.	CSDE-5101	Introduction to Programming	3(3-0)	Nil	ID
5.	CSDE-5102	Introduction to Artificial Intelligence	3(3-0)	Nil	ID

Semester Total Credit Hours:**15**

Semester-VI

Sr. N.	Course Code	Course Title	Credit Hours	Pre-Req.	Category
1.	DATA-6204	Applied Time Series Analysis	3(3-0)	Nil	Major
2.	DATA-6205	Programming in R and Python	3(3-0)	CSDE-5101	Major
3.	DATA-6206	Multivariate Analysis	3(3-0)	Nil	Major
4.	CSDE-5103	Database Management Systems and Applications	3(3-0)	Nil	ID
5.	CSDE-5104	Data Structures and Algorithms	3(3-0)	Nil	ID

Semester Total Credit Hours:**15**

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

Course Code	Course Title	Credit Hours	Pre-Requisite	Category
DATA-6225	Field Experience/Internship *Internship will be preferably offered in summer break after 5th semester*	3(0-3)	Nil	Compulsory

Semester Total Credit Hours: **03**

Semester-VII

Sr. N.	Course Code	Course Title	Credit Hours	Pre-Req.	Category
1.	DATA-6207	Introduction to Big Data Technologies	3(3-0)	Nil	Major
2.	DATA-6208	Introduction to Machine Learning	3(3-0)	Nil	Major
3.	DATA-6209	Simulation Techniques in Data Analytics	3(3-0)	Nil	Major
4.	DATA-6210	Business Analytics	3(3-0)	Nil	Major
5.	DATA-6211	Social Media Analytics	3(3-0)	Nil	Major
6.	DATA-6212	Data Driven Process Monitoring	3(3-0)	Nil	Major

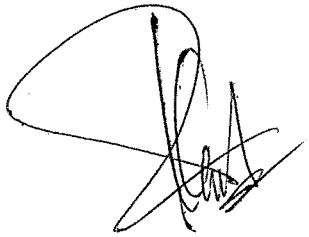
Semester Total Credit Hours:**18**

Semester-VIII

Sr. N.	Course Code	Course Title	Credit Hours	Pre-Req.	Category
1.	DATA-6213	Cloud Computing for Data Analytics	3(3-0)	Nil	Major
2.	DATA-6214	Introduction to Deep Learning	3(3-0)	Nil	Major
3.	DATA-6215	Healthcare Analytics	3(3-0)	Nil	Major
4.	DATA-6216	Geospatial Analytics	3(3-0)	Nil	Major
5.	DATA-6250	Capstone Project	3(3-0)	Nil	Compulsory

Semester Total Credit Hours: **15**

Degree Program Total: 134



Course Outlines for Major Subjects

DATA-5201: Introduction to Data Analytics – 3(3+0)

Course Brief:
This course provides a comprehensive introduction to data analytics, covering the entire analytics pipeline with a focus on practical applications. It bridges foundational statistical techniques with advanced data handling, visualization, and analysis methods used in modern analytics. The course emphasizes working with real-world datasets, introduces data manipulation and exploratory analysis, and equips students with tools such as Computing languages and statistical software. Students will explore topics like data wrangling, correlation, and regression analysis, as well as gain familiarity with basic machine learning concepts. By the end of the course, students will be prepared to leverage data insights to support strategic decisions and solve business and research problems.

Course Learning Objectives:
By the end of the course, students will be able to:

1. Understand the data analytics lifecycle and its relevance across industries.
2. Identify and work with various types of data, including structured and unstructured data.
3. Perform data wrangling tasks such as cleaning, transforming, and reshaping datasets.
4. Conduct exploratory data analysis (EDA) to detect trends, patterns, and outliers.
5. Apply statistical techniques such as correlation and regression analysis for data interpretation.
6. Use data visualization tools to create effective visual representations of data.
7. Understand the basics of supervised and unsupervised learning techniques.
8. Interpret and present data-driven insights to support decision-making processes.

Course Contents:

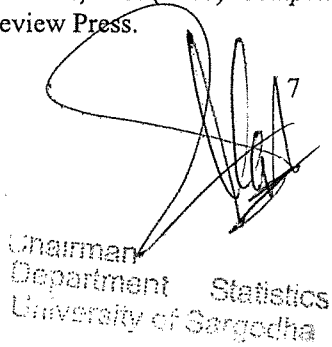
1. *Introduction to Data Analytics*: Understanding data analytics, its role in decision-making, and key differences from data science.
2. *Types of Analytics*: Overview of descriptive, diagnostic, predictive, and prescriptive analytics with real-world examples.
3. Understanding Business Problems: Framing business questions for data-driven decision-making.
4. Data Collection Methods: Gathering data through surveys, transactional databases, and APIs, focusing on business-oriented data sources.
5. Data Cleaning and Transformation: Techniques for cleaning, filtering, and structuring data to make it usable for analysis.
6. Basic Exploratory Analysis: Identifying trends, anomalies, and relationships in data using summaries and visualizations.
7. Communicating Insights: Presenting findings through effective visualizations, storytelling, and reporting.
8. Real-World Case Studies: Examples of how data analytics solves business problems in marketing, finance, and operations.

Recommended Textbooks:

1. Kinley, P. (2017). *Data Analytics for Beginners: Your Ultimate Guide to Learn and Master Data Analysis*. CreateSpace Independent Publishing.
2. Maheshwari, A. (2017). *Data Analytics Made Accessible*. Amazon Digital Services.
3. Pinder, J. P. (2016). *Introduction to Business Analytics Using Simulation*. Academic Press.

Suggested Readings:

1. McKinney, W. (2017). *Python for Data Analysis: Data Wrangling with Pandas, NumPy, and IPython* (2nd ed.). O'Reilly Media.
2. Siegel, E. (2016). *Predictive Analytics: The Power to Predict Who Will Click, Buy, Lie, or Die* (2nd ed.). Wiley.
3. Davenport, T. H., & Harris, J. G. (2007). *Competing on Analytics: The New Science of Winning*. Harvard Business Review Press.



DATA-5202: Basic Mathematics for Data Analytics – 3(3+0)

Course Brief:
This course provides a foundational understanding of essential mathematical concepts and techniques, designed to equip students with the skills needed to solve a wide range of problems in mathematics and related disciplines. Topics include algebra, geometry, trigonometry, calculus (including limits, derivatives, and integration), and sequences and series. Emphasis is placed on developing analytical thinking, problem-solving strategies, and mathematical reasoning. By the end of the course, students will have a solid foundation in mathematics, preparing them for more advanced studies and practical applications in various fields.

Course Learning Objectives:
By the end of the course, students will be able to:

1. Understand and apply fundamental principles of algebra and geometry.
2. Solve equations and inequalities using algebraic methods.
3. Work with functions, graphs, and transformations.
4. Use trigonometric identities and solve trigonometric equations.
5. Apply concepts of limits, derivatives, and integration in calculus.
6. Calculate areas and volumes of geometric shapes.
7. Analyze and interpret mathematical sequences and series.

Course Contents:

1. *Algebra:* Basic operations, exponents and radicals, solving linear and quadratic equations, inequalities, and systems of equations.
2. *Functions and Graphs:* Understanding functions, domain and range, types of functions (linear, quadratic, polynomial, rational, exponential, logarithmic), and graph transformations.
3. *Geometry:* Properties of shapes, theorems, and proofs, coordinate geometry, and the study of congruence and similarity.
4. *Trigonometry:* Trigonometric ratios and identities, solving right and non-right triangles, the unit circle, and trigonometric functions and their applications.
5. *Calculus:* Introduction to limits, continuity, differentiation, and integration.
6. *Limits:* Understanding the concept of limits, evaluating limits analytically, and exploring limits involving infinity.
7. *Differentiation:* Basic differentiation techniques and applications.
8. *Integration:* Fundamental concepts of integration, definite and indefinite integrals, and applications such as calculating areas under curves.
9. *Sequences and Series:* Arithmetic and geometric sequences, summation notation, and series.

Recommended Textbooks:

1. Stewart, J. (2015). *Precalculus: Mathematics for Calculus* (7th ed.). Cengage Learning.
2. Larson, R., & Edwards, B. (2018). *Calculus of a Single Variable* (11th ed.). Cengage Learning.
3. Blitzer, R. (2017). *Algebra and Trigonometry* (6th ed.). Pearson.
4. Lay, D. C. (2015). *Linear Algebra and Its Applications* (5th ed.). Pearson.
5. Thomas, G. B., & Weir, M. D. (2016). *Thomas' Calculus* (14th ed.). Pearson.

Suggested Readings:

1. Strang, G. (2016). *Introduction to Linear Algebra* (5th ed.). Wellesley Cambridge Press.
2. Larson, R. (2014). *College Algebra* (10th ed.). Cengage Learning.
3. Devore, J. L. (2015). *Probability and Statistics for Engineering and the Sciences* (9th ed.). Cengage Learning.
4. Burger, E. B., & Starbird, M. (2012). *The Elements of Effective Thinking*. Princeton University Press.
5. Nielsen, M. (2015). *Neural Networks and Deep Learning*. Determination Press.

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DATA-5203: Introduction to Probability Theory– 3(3+0)

Course Brief:
This course introduces the fundamental principles of probability theory, providing a strong foundation for understanding uncertainty and randomness in data analytics. The course covers basic concepts such as probability rules, conditional probability, Bayes' theorem, and random variables. Students will also learn about probability distributions, expectation, variance, and moment-generating functions, with practical applications in data analytics and decision-making. By the end of the course, students will be equipped with the probabilistic tools necessary for statistical inference, machine learning, and predictive analytics.

Course Learning Objectives:
By the end of the course, students will be able to:

1. Understand the role of probability theory in data analytics and decision-making.
2. Apply the axioms and rules of probability to solve real-world problems.
3. Use Bayes' theorem to update probabilities based on new information.
4. Work with discrete and continuous random variables and their distributions.
5. Calculate expectation, variance, and higher moments for random variables.
6. Analyze joint, marginal, and conditional distributions.
7. Use moment-generating functions for computing moments.
8. Apply probability theory in data analytics for statistical modeling and prediction.

Course Contents:

1. Introduction to Probability Theory: Importance and applications in data analytics; Basic terminology (experiment, outcome, event, sample space)
2. Axioms of Probability: Classical, empirical, and subjective probability; Axiomatic definition of probability
3. Rules of Probability: Addition, multiplication, and complement rules; Conditional probability
4. Bayes' Theorem: Concept and applications in analytics and decision-making
5. Random Variables and Probability Distributions: Discrete and continuous random variables;
6. PMF and PDF
7. Expectation and Variance: Calculation of expected value, variance, and standard deviation 7. Joint, Marginal, and Conditional Distributions: Joint distributions; Marginal and conditional probabilities
8. Law of Total Probability: Application in complex probability calculations
9. Moment Generating Functions: Definition and use in finding moments
10. Applications in Data Analytics: Probability concepts for statistical modeling and prediction

Recommended Textbooks:

1. Ross, S. (2014). *A First Course in Probability* (9th ed.). Pearson.
2. Grimmett, G., & Stirzaker, D. (2001). *Probability and Random Processes* (3rd ed.). Oxford University Press.
3. Hogg, R. V., McKean, J. W., & Craig, A. T. (2019). *Introduction to Mathematical Statistics* (8th ed.). Pearson.
4. Papoulis, A., & Pillai, S. U. (2002). *Probability, Random Variables, and Stochastic Processes* (4th ed.). McGraw-Hill.
5. Blitzstein, J. K., & Hwang, J. (2019). *Introduction to Probability*. CRC Press.

Suggested Readings:

1. Feller, W. (1968). An Introduction to Probability Theory and Its Applications (Vol. 1). Wiley.
2. Stirzaker, D. (1999). Probability and Random Variables: A Beginner's Guide. Cambridge University Press.
3. Pitman, J. (1993). Probability. Springer.
4. Bertsekas, D. P., & Tsitsiklis, J. N. (2008). Introduction to Probability. Athena Scientific.
5. Casella, G., & Berger, R. L. (2002). Statistical Inference (2nd ed.). Duxbury Press.

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DATA-5204: Linear Algebra for Data Analytics – 3(3+0)

Course Brief:
This course provides students with essential knowledge of linear algebra concepts and techniques, focusing on their application in data analytics. It covers topics such as vectors, matrices, linear transformations, eigenvalues, and matrix factorization, emphasizing how these concepts are used in data preprocessing, machine learning algorithms, and dimensionality reduction techniques like PCA. The course offers a blend of theoretical foundations and practical applications, preparing students to handle large-scale datasets and apply linear algebra techniques to solve real-world analytical problems.

Course Learning Objectives:
By the end of the course, students will be able to:

1. Understand the role and importance of linear algebra in data analytics and machine learning.
2. Perform matrix operations, including addition, multiplication, inversion, and transposition.
3. Solve systems of linear equations using matrix techniques.
4. Understand and apply the concepts of vector spaces, orthogonality, and subspaces.
5. Compute eigenvalues and eigenvectors and use them in applications like PCA.
6. Use matrix factorizations such as SVD and QR for dimensionality reduction and data transformations.
7. Apply linear transformations in data analytics tasks and feature extraction.

Course Contents:

1. Introduction to Linear Algebra: Importance and role in data analytics
2. Vectors and Matrices: Basic operations, properties, and applications
3. Systems of Linear Equations: Gaussian elimination, matrix inversion, determinants
4. Vector Spaces and Subspaces: Linear combinations, span, basis, rank
5. Orthogonality and Projections: Inner products, orthogonal vectors, least squares method
6. Eigenvalues and Eigenvectors: Computation and applications in machine learning (e.g., PCA)
7. Matrix Factorization: SVD, QR, and LU decompositions, dimensionality reduction
8. Linear Transformations: Matrix representation, data transformations, and feature extraction
9. Applications of Linear Algebra in Data Analytics: Case studies and practical examples

Recommended Textbooks:

1. Lay, D. C., Lay, S. R., & McDonald, J. J. (2016). *Linear Algebra and Its Applications* (5th ed.). Pearson.
2. Strang, G. (2016). *Introduction to Linear Algebra* (5th ed.). Wellesley-Cambridge Press.
3. Boyd, S., & Vandenberghe, L. (2018). *Introduction to Applied Linear Algebra: Vectors, Matrices, and Least Squares*. Cambridge University Press.
4. Axler, S. (2015). *Linear Algebra Done Right* (3rd ed.). Springer.
5. Meyer, C. D. (2000). *Matrix Analysis and Applied Linear Algebra*. SIAM.

Suggested Readings:

1. Kolter, Z. (2019). *Linear Algebra and Optimization for Machine Learning*. Springer.
2. Deisenroth, M. P., Faisal, A. A., & Ong, C. S. (2020). *Mathematics for Machine Learning*. Cambridge University Press.
3. Gilbert, J. R., & Moler, C. (2011). *Numerical Computing with MATLAB*. SIAM.

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DATA-5205: Introduction to Data Science – 3(3+0)

Course Brief:
This foundational course provides an overview of data science principles, methodologies, and tools. It covers the end-to-end data science process, including data collection, data wrangling, exploratory data analysis, and basic machine learning models. Emphasis is placed on practical applications across various domains, enabling students to derive actionable insights from data. Students will gain hands-on experience with computing languages and statistical software for data manipulation, analysis, and visualization, setting a strong foundation for advanced data science topics.

Course Learning Objectives:
By the end of the course, students will be able to:

1. Understand the core concepts of data science and its applications across industries.
2. Perform data wrangling and preprocessing to prepare datasets for analysis.
3. Conduct exploratory data analysis (EDA) to identify patterns, trends, and outliers.
4. Implement basic statistical methods to interpret and analyze data.
5. Build and evaluate simple machine learning models for predictive analytics.
6. Use data visualization techniques to communicate data-driven insights effectively.
7. Understand and apply ethical considerations in data science. 8. Utilize computing languages and statistical software programming languages for data science tasks.

Course Contents:

1. *Introduction to Data Science: Overview, history, and applications of data science across industries.*
2. *Data Science Workflow: Understanding the data science lifecycle, including data collection, cleaning, exploration, modeling, and interpretation.*
3. *Programming for Data Science: Basics of Python/R for data manipulation, visualization, and analysis.*
4. *Data Wrangling: Techniques for cleaning and preparing data for analysis using tools like Pandas, NumPy, or Tidyverse.*
5. *Data Visualization: Principles and tools (Matplotlib, Seaborn, ggplot2, etc.) to create effective visual representations of data.*
6. *Machine Learning Basics: Introduction to supervised and unsupervised learning, key algorithms (e.g., regression, clustering, decision trees).*
7. *Big Data: Basics of handling large datasets.*

Recommended Textbooks:

1. Provost, F., & Fawcett, T. (2013). *Data Science for Business: What You Need to Know About Data Mining and Data-Analytic Thinking.* O'Reilly Media.
2. McKinney, W. (2017). *Python for Data Analysis: Data Wrangling with Pandas, NumPy, and IPython (2nd ed.).* O'Reilly Media.
3. James, G., Witten, D., Hastie, T., & Tibshirani, R. (2021). *An Introduction to Statistical Learning with Applications in R (2nd ed.).* Springer.

Suggested Readings:

1. Han, J., Pei, J., & Kamber, M. (2011). *Data Mining: Concepts and Techniques (3rd ed.).* Morgan Kaufmann.
2. Grolemund, G., & Wickham, H. (2016). *R for Data Science: Import, Tidy, Transform, Visualize, and Model Data.* O'Reilly Media.
3. Wickham, H. (2014). *Advanced R.* CRC Press.

DATA-5206: Distribution Theory– 3(3+0)

Course Brief:
This course provides an in-depth understanding of probability distributions and their applications in data analytics and statistical modeling. It covers both discrete and continuous distributions, including their properties, functions, and applications. Students will learn how to use these distributions to model real-world data and make statistical inferences. Emphasis will be placed on the theoretical aspects, parameter estimation, and applications of key distributions in analytics and predictive modeling. By the end of the course, students will develop proficiency in working with probability distributions and applying them to solve analytical problems.

Course Learning Objectives:
By the end of the course, students will be able to:
1. Understand the importance and role of distribution theory in data analytics and statisticalmodeling.
2. Identify and work with key discrete and continuous distributions.
3. Calculate probabilities, cumulative probabilities, and quantiles using distribution functions.
4. Estimate parameters of probability distributions.
5. Use the Central Limit Theorem (CLT) to approximate distributions.
6. Apply probability distributions to real-world data and analytics problems.
7. Simulate random data using various probability distributions.
8. Use computing languages and statistical software to perform distribution-related calculations and visualizations.

Course Contents:
1. *Introduction to Distribution Theory*: Importance in statistical modeling and analytics
2. *Discrete Distributions*: Binomial, Poisson, Geometric, and Hypergeometric distributions; Probability mass functions (PMFs) and their properties
3. *Continuous Distributions*: Uniform, Exponential, Normal, and Gamma distributions; Probability density functions (PDFs) and cumulative distribution functions (CDFs)
4. *The Central Limit Theorem (CLT)*: Concept and applications in approximating distributions 5. *Joint Distributions*: Joint probability mass and density functions; Marginal and conditional distributions
6. *Moment Generating Functions*: Moments and their calculation; Applications in parameter estimation
7. *Estimation of Distribution Parameters*: Maximum likelihood estimation (MLE) and method of moments
8. *Transformations of Random Variables*: Techniques and applications
9. *Applications in Data Analytics*: Fitting distributions to real-world data and predictive modeling 10. *Simulation Techniques*: Generating random samples from different distributions using computing languages and statistical software

Recommended Textbooks:

1. Hogg, R. V., McKean, J. W., & Craig, A. T. (2019). *Introduction to Mathematical Statistics* (8th ed.). Pearson
2. Casella, G., & Berger, R. L. (2002). *Statistical Inference* (2nd ed.). Duxbury Press
3. Rice, J. A. (2006). *Mathematical Statistics and Data Analysis* (3rd ed.). Cengage Learning
4. Mood, A. M., Graybill, F. A., & Boes, D. C. (1974). *Introduction to the Theory of Statistics* (3rd ed.). McGraw-Hill
5. Blitzstein, J. K., & Hwang, J. (2019). *Introduction to Probability*. CRC Press

Suggested Readings:

1. Feller, W. (1968). *An Introduction to Probability Theory and Its Applications* (Vol. 1). Wiley
2. Lehmann, E. L., & Casella, G. (2006). *Theory of Point Estimation* (2nd ed.). Springer
3. Ross, S. (2014). *A First Course in Probability* (9th ed.). Pearson
4. Papoulis, A., & Pillai, S. U. (2002). *Probability, Random Variables, and Stochastic Processes* (4th ed.). McGraw-Hill
5. Devroye, L. (1986). *Non-Uniform Random Variate Generation*. Springer

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DATA-5207: Data Visualization – 3(3+0)

Course Brief:

This course provides students with essential knowledge and practical skills to create effective data visualizations that communicate insights clearly and accurately. It covers principles of visual perception, best practices in designing charts and dashboards, and the use of modern data visualization tools such as Tableau, Python (Matplotlib, Seaborn), and R (ggplot2). Students will learn how to visualize complex data using interactive dashboards and storytelling techniques, tailoring visualizations for different audiences. Through hands-on exercises with real-world datasets, the course focuses on transforming data into meaningful visuals to support business decisions and analytics.

Course Learning Objectives:

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

1. Understand the principles of data visualization and visual perception.
2. Create effective visualizations using appropriate chart types and design principles.
3. Use computing languages and statistical software for data visualization through libraries such as Matplotlib, Seaborn, andggplot2.
4. Develop interactive dashboards using Tableau and Plotly.
5. Apply storytelling techniques to create compelling narratives with data.
6. Tailor visualizations for different audiences and stakeholders.
7. Handle large datasets and visualize complex data structures effectively.
8. Apply ethical practices in data visualization to avoid misleading interpretations.

Course Contents:

9. *Introduction to Data Visualization*: Importance and role of data visualization in analytics; Overview of visual perception and cognitive load in visual design.
10. *Principles of Effective Data Visualization*: Chart selection and design principles; Best practices in color selection, labeling, and layout.
11. *Data Visualization with Python*: Creating visualizations using Matplotlib and Seaborn; Advanced visualizations with Plotly.
12. *Data Visualization with R*: Using ggplot2 for static and dynamic visualizations; Interactive graphs and dashboards with Shiny.
13. *Building Dashboards*: Developing interactive dashboards with Tableau; Data integration and storytelling using dashboards.
14. *Storytelling with Data*: Designing narratives and presentation strategies with visual data; Case studies of data storytelling in business and research.
15. *Visualization of Complex Data*: Visualizing time series, geospatial data, and network data; Handling large datasets and streaming data visualization.
16. *Custom Visualizations and Tools*: Creating custom charts and graphics with D3.js (Introduction); Tools for real-time data visualization.
17. *Ethics and Misleading Visualizations*: Avoiding bias and distortion in visual representation; Ethical considerations in visual communication.
18. *Case Studies and Real-World Applications*: Practical applications in business intelligence, healthcare, and public policy; Group projects: End-to-end data visualization project.

Recommended Textbooks:

1. Cairo, A. (2016). *The Truthful Art: Data, Charts, and Maps for Communication*. New Riders
2. Yau, N. (2013). *Data Points: Visualization That Means Something*. Wiley
3. Healy, K. (2018). *Data Visualization: A Practical Introduction*. Princeton University Press 4. Wickham, H., & Grolemund, G. (2016). *R for Data Science: Import, Tidy, Transform, Visualize, and Model Data*. O'Reilly Media
4. McKinney, W. (2017). *Python for Data Analysis: Data Wrangling with Pandas, NumPy, and IPython* (2nd ed.). O'Reilly Media

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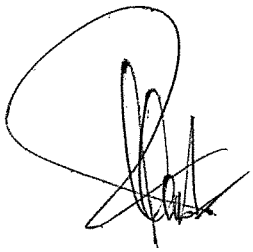
Suggested Readings:

1. Few, S. (2012). Show Me the Numbers: Designing Tables and Graphs to Enlighten (2nd ed.). Analytics Press
2. Tufte, E. R. (2001). The Visual Display of Quantitative Information (2nd ed.). Graphics Press
3. Knaflic, C. N. (2015). Storytelling with Data: A Data Visualization Guide for Business Professionals. Wiley
4. Kirk, A. (2016). Data Visualisation: A Handbook for Data Driven Design. Sage
5. Murray, S. (2017). Interactive Data Visualization for the Web (2nd ed.). O'Reilly Media



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DATA-5208: Research Methods for Data Analytics – 3(3+0)

Course Brief:
This course provides a foundation in research methodologies tailored for data analytics, focusing on techniques for planning, conducting, and evaluating data-driven research. It covers quantitative, qualitative, and mixed methods research approaches and emphasizes data collection, hypothesis formulation, and experimental design. Students will explore statistical methods for analyzing research data and learn how to use analytics tools such as Computing languages and statistical software for effective data analysis. Ethical considerations, reproducibility, and communicating research findings are also key components of the course. By the end, students will be equipped to design research projects and apply data analytics techniques to real-world problems.

Course Learning Objectives:
By the end of the course, students will be able to:

1. Understand the role of research methods in data analytics and decision-making.
2. Differentiate between quantitative, qualitative, and mixed research methodologies.
3. Formulate research questions and hypotheses suitable for data-driven studies.
4. Collect and analyze data using appropriate statistical methods.
5. Apply experimental and observational research designs in analytics projects.6. Use Computing languages and statistical software for data management, analysis, and visualization.
7. Ensure ethical standards and reproducibility in research projects.
8. Communicate research findings effectively through reports and presentations.

Course Contents:

1. *Introduction to Research Methods*: Purpose and scope of research in data analytics
2. *Research Methodologies*: Overview of quantitative, qualitative, and mixed methods approaches
3. *Formulating Research Questions and Hypotheses*: Defining research objectives and hypotheses
4. *Data Collection Techniques*: Surveys, experiments, observational studies, and secondary data sources
5. *Research Design*: Planning and conducting surveys and experiments for data analytics research
6. *Data Analysis Methods*: Statistical analysis using Computing languages and statistical software
7. *Ethical Issues in Research*: Ensuring privacy, transparency, and reproducibility
8. *Communicating Research Findings*: Writing reports and presenting data-driven insights
9. *Practical Applications*: Case studies and group projects in data analytics research
10. *Research Project*: End-to-end research project from data collection to final presentation

Recommended Textbooks:

1. Creswell, J. W., & Creswell, J. D. (2017). *Research Design: Qualitative, Quantitative, and Mixed Methods Approaches* (5th ed.). Sage Publications
2. Saunders, M., Lewis, P., & Thornhill, A. (2019). *Research Methods for Business Students* (8th ed.). Pearson
3. Cooper, D. R., & Schindler, P. S. (2014). *Business Research Methods* (12th ed.). McGraw-Hill Education
4. Montgomery, D. C. (2020). *Design and Analysis of Experiments* (10th ed.). Wiley
5. Trochim, W. M., Donnelly, J. P., & Arora, K. (2016). *Research Methods: The Essential Knowledge Base* (2nd ed.). Cengage Learning

Suggested Readings:

1. Bhattacherjee, A. (2012). *Social Science Research: Principles, Methods, and Practices*. Open
2. Textbook Library
3. Robson, C., & McCartan, K. (2016). *Real World Research* (4th ed.). Wiley
4. Bryman, A. (2016). *Social Research Methods* (5th ed.). Oxford University Press
5. Punch, K. F. (2013). *Introduction to Social Research: Quantitative and Qualitative Approaches* (3rd ed.). Sage Publications
6. Bell, E., Bryman, A., & Harley, B. (2018). *Business Research Methods* (5th ed.). Oxford University Press

DATA-5209: Statistical Inference – 3(3+0)

Course Brief:
This course provides a comprehensive introduction to statistical inference, focusing on the fundamental concepts and techniques used to draw conclusions from data. It covers both theoretical and applied aspects, including point and interval estimation, hypothesis testing, and the use of statistical models for decision-making. Students will learn to apply these concepts using computing languages and statistical software to analyze datasets, test hypotheses, and make predictions. The course also emphasizes understanding the assumptions behind statistical models and the interpretation of results in data analytics contexts.

Course Learning Objectives:
By the end of the course, students will be able to:

1. Understand the role of statistical inference in data analytics and decision-making.
2. Apply methods for point and interval estimation of population parameters.
3. Conduct hypothesis testing and interpret p-values and confidence levels.
4. Use t-tests, chi-square tests, and ANOVA for statistical comparisons.
5. Work with maximum likelihood estimation (MLE) techniques for parameter estimation.
6. Implement resampling methods such as bootstrapping and permutation tests.
7. Use computing languages and statistical software to perform statistical inference on real-world datasets.
8. Interpret statistical results and communicate findings effectively.

Course Contents:

1. *Introduction to Statistical Inference*: Role and applications in data analytics
2. *Point Estimation*: Properties of estimators (unbiasedness, efficiency, consistency)
3. *Interval Estimation*: Confidence intervals for means, proportions, and variances
4. *Hypothesis Testing*: Null and alternative hypotheses; Type I and Type II errors
5. *T-Tests and Chi-Square Tests*: Applications in comparing groups and testing independence
6. *Analysis of Variance (ANOVA)*: Testing differences among multiple group means
7. *Maximum Likelihood Estimation (MLE)*: Parameter estimation using likelihood functions
8. *Resampling Techniques*: Bootstrapping and permutation tests for inference
9. *Applications in Data Analytics*: Testing hypotheses and drawing inferences from real-world data
10. *Practical Implementation*: Performing statistical inference using computing languages and statistical software

Recommended Textbooks:

1. Casella, G., & Berger, R. L. (2002). *Statistical Inference* (2nd ed.). Duxbury Press
2. Hogg, R. V., Tanis, E. A., & Zimmerman, D. L. (2018). *Probability and Statistical Inference* (10th ed.). Pearson
3. Rice, J. A. (2006). *Mathematical Statistics and Data Analysis* (3rd ed.). Cengage Learning
4. Lehmann, E. L., & Romano, J. P. (2005). *Testing Statistical Hypotheses* (3rd ed.). Springer 5. Wasserman, L. (2004). *All of Statistics: A Concise Course in Statistical Inference*. Springer

Suggested Readings:

1. Efron, B., & Tibshirani, R. J. (1993). *An Introduction to the Bootstrap*. CRC Press
2. Agresti, A. (2018). *Statistical Methods for the Social Sciences* (5th ed.). Pearson
3. Davison, A. C., & Hinkley, D. V. (1997). *Bootstrap Methods and Their Application*. Cambridge University Press
4. Montgomery, D. C. (2020). *Design and Analysis of Experiments* (10th ed.). Wiley
5. Miller, I., & Miller, M. (2013). *John E. Freund's Mathematical Statistics with Applications* (8th ed.). Pearson

DATA-5210: Computing Tools for Data Analytics – 3(3+0)

Course Brief:

This course provides a comprehensive introduction to essential and advanced computing tools used in data analytics. Students will gain hands-on experience with computing languages and statistical software for data manipulation, analysis, and reporting, along with tools like Jupyter Notebooks, RStudio, and advanced cloud-based platforms such as AWS, Google Colab, and Microsoft Azure. The course also covers version control with Git, collaborative coding environments, big data tools such as Hadoop and Spark, and containerization with Docker. By the end of the course, students will be equipped to handle end-to-end data analytics workflows, automate processes, and deploy scalable solutions using modern computing tools.

Course Learning Objectives:

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

1. Use computing languages and statistical software for advanced data manipulation and analysis.
2. Automate workflows with Jupyter Notebooks, RStudio, and scripting.
3. Implement database operations with SQL and NoSQL for large-scale data handling.
4. Utilize cloud-based platforms like AWS, Google Colab, and Microsoft Azure for analytics and deployment.
5. Manage code using version control tools like Git and GitHub for collaborative projects.
6. Work with big data tools such as Hadoop and Apache Spark for large-scale data processing.
7. Use Docker for containerization and deployment of analytics workflows.
8. Create interactive dashboards and real-time visualizations with Tableau and Plotly.

Course Contents:

1. *Introduction to Computing Tools for Data Analytics*: Overview of essential and advanced tools 2. *Python for Advanced Data Analytics*: Data wrangling with Pandas; Visualization with Matplotlib and Seaborn
1. *R for Data Science*: Data transformation with dplyr; Visualization with ggplot2; Shiny apps for interactivity
2. *SQL and NoSQL Databases*: Advanced queries, joins, and aggregations; Working with MongoDB and Cassandra
3. *Jupyter Notebooks and RStudio*: Workflow automation and interactive programming environments
4. *Cloud Platforms*: Data analytics and storage on AWS, Google Colab, and Microsoft Azure
5. *Big Data Tools*: Introduction to Hadoop and Apache Spark for distributed computing
6. *Version Control and Collaboration*: Using Git and GitHub for managing code repositories
7. *Containerization with Docker*: Building, deploying, and managing analytics containers 10. *Data Visualization and Dashboarding*: Real-time dashboards with Tableau and Plotly

Recommended Textbooks:

1. McKinney, W. (2017). *Python for Data Analysis: Data Wrangling with Pandas, NumPy, and IPython* (2nd ed.). O'Reilly Media
2. Grolemund, G., & Wickham, H. (2016). *R for Data Science: Import, Tidy, Transform, Visualize, and Model Data*. O'Reilly Media
3. VanderPlas, J. (2016). *Python Data Science Handbook: Essential Tools for Working with Data*.
4. O'Reilly Media
5. Beaulieu, A. (2009). *Learning SQL: Master SQL Fundamentals* (2nd ed.). O'Reilly Media
6. White, T. (2015). *Hadoop: The Definitive Guide* (4th ed.). O'Reilly Media

Suggested Readings:

1. Han, J., Pei, J., & Kamber, M. (2011). *Data Mining: Concepts and Techniques* (3rd ed.).
2. Morgan Kaufmann
3. Wickham, H. (2014). *Advanced R*. CRC Press
4. Karim, M. R. (2022). *Apache Spark for Data Science Cookbook*. Packt Publishing
5. Turnbull, J. (2014). *The Docker Book: Containerization Is the New Virtualization*. James Turnbull
6. Friel, A. (2017). *SQL QuickStart Guide: The Simplified Beginner's Guide to SQL*. ClydeBank Media LLC

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DATA-5211: Survey Theory and Practice – 3(3+0)

Course Brief: This course introduces the principles and methods of survey sampling, which are crucial for data collection and analysis in various fields. The course covers both probability and non-probability sampling techniques, emphasizing practical applications and strategies to minimize errors and biases. Students will learn to design effective surveys, analyze complex sampling data, and use statistical software for data analysis. By the end of the course, students will be equipped to conduct reliable surveys and interpret results to inform data-driven decisions.

Course Learning Objectives:

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

1. Understand fundamental concepts and theories of survey sampling.
2. Differentiate between various sampling methods and select appropriate techniques for different scenarios.
3. Design and implement survey samples to minimize sampling and non-sampling errors.
4. Perform statistical analysis on survey data and interpret findings.
5. Use statistical software to manage and analyze survey data.
6. Evaluate the quality of survey data and address potential biases.
7. Communicate survey findings effectively through reports and presentations.

Course Contents:

1. Introduction to Survey Sampling: Overview of survey sampling; Key concepts such as population, sample, parameter, and statistic; Applications of sampling in data analytics.
2. Simple Random Sampling (SRS): Definition and techniques; Estimation of population mean and total; Variance and confidence interval estimation.
3. Systematic Sampling: Method and application; Advantages and limitations; Comparison with SRS.
4. Stratified Sampling: Purpose and benefits; Proportional and optimal allocation methods; Estimators for stratified samples; Practical examples.
5. Cluster Sampling: Single-stage and multi-stage sampling techniques; Estimating parameters and handling design complexities.
6. Complex Survey Designs: Design and analysis of multi-stage samples
7. Non-Probability Sampling Techniques: Convenience, quota, and snowball sampling; Differences from probability sampling; Application contexts and limitations.
8. Survey Errors and Biases: Sampling vs. non-sampling errors; non-response and measurement errors; Strategies to reduce errors.

Recommended Textbooks:

1. Cochran, W. G. (1977). *Sampling Techniques* (3rd ed.). Wiley.
2. Kish, L. (1995). *Survey Sampling*. Wiley.
3. Lohr, S. L. (2019). *Sampling: Design and Analysis* (3rd ed.). CRC Press.
4. Groves, R. M., et al. (2009). *Survey Methodology* (2nd ed.). Wiley.
5. Fowler, F. J. (2014). *Survey Research Methods* (5th ed.). Sage Publications.

Suggested Readings:

1. Thompson, S. K. (2012). *Sampling* (3rd ed.). Wiley.
2. Kalton, G. (1983). *Introduction to Survey Sampling*. Sage Publications.
3. Lumley, T. (2010). *Complex Surveys: A Guide to Analysis Using R*. Wiley.
4. Bethlehem, J. (2009). *Applied Survey Methods: A Statistical Perspective*. Wiley.
5. Dillman, D. A., Smyth, J. D., & Christian, L. M. (2014). *Internet, Phone, Mail, and Mixed-Mode Surveys: The Tailored Design Method* (4th ed.). Wiley.

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DATA-6201: Regression Modeling Strategies– 3(3+0)

Course Brief:

This course provides a comprehensive understanding of regression techniques used in data analytics and statistical modeling. It covers simple and multiple linear regression, diagnostics, model selection, and interpretation of results. Students will also explore non-linear regression, regularization techniques (e.g., Lasso and Ridge), and the use of regression in predictive modeling. Emphasis will be placed on the practical implementation of regression models using computing languages and statistical software. By the end of the course, students will be able to build, assess, and interpret regression models to derive insights from real-world data.

Course Learning Objectives:

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

1. Understand the principles of simple and multiple linear regression.
2. Perform model diagnostics and validate assumptions.
3. Use techniques such as stepwise regression and criteria (AIC, BIC) for model selection.
4. Explore regularization methods like Lasso and Ridge regression to prevent overfitting.
5. Implement logistic regression for binary outcome modeling.
6. Apply non-linear regression to handle complex relationships in data.
7. Use regression models for predictive analytics and decision-making.
8. Implement and evaluate regression models using computing languages and statistical software.

Course Contents:

1. *Introduction to Regression Analysis*: Overview and applications in data analytics
2. *Simple Linear Regression*: Fitting the model, assumptions, and interpretation
3. *Multiple Linear Regression*: Model building with multiple predictors; Interpretation of coefficients
4. *Model Diagnostics*: Residual analysis, multicollinearity, heteroscedasticity, and outliers
5. *Model Selection Techniques*: Stepwise selection; AIC and BIC criteria
6. *Regularization Techniques*: Lasso and Ridge regression; Introduction to Elastic Net
7. *Generalized Lineal Modeling*: Fitting and interpreting generalized linear models
8. *Applications in Predictive Analytics*: Forecasting and decision-making using regression
9. *Implementation Using Latest Software and Lanoguages*: Hands-on exercises with real-world datasets

Recommended Textbooks:

1. Montgomery, D. C., Peck, E. A., & Vining, G. G. (2015). *Introduction to Linear Regression Analysis* (5th ed.). Wiley
2. Draper, N. R., & Smith, H. (2014). *Applied Regression Analysis* (3rd ed.). Wiley
3. Kutner, M. H., Nachtsheim, C. J., & Neter, J. (2004). *Applied Linear Regression Models* (4th ed.). McGraw-Hill
4. Fox, J. (2015). *Applied Regression Analysis and Generalized Linear Models* (3rd ed.). Sage
5. Hastie, T., Tibshirani, R., & Friedman, J. (2009). *The Elements of Statistical Learning: Data Mining, Inference, and Prediction* (2nd ed.). Springer

Suggested Readings:

1. Seber, G. A. F., & Lee, A. J. (2012). *Linear Regression Analysis* (2nd ed.). Wiley
2. James, G., Witten, D., Hastie, T., & Tibshirani, R. (2021). *An Introduction to Statistical Learning with Applications in R* (2nd ed.). Springer
3. Weisberg, S. (2005). *Applied Linear Regression* (3rd ed.). Wiley
4. Fox, J., & Weisberg, S. (2018). *An R Companion to Applied Regression* (3rd ed.). Sage
5. Harrell, F. E. (2015). *Regression Modeling Strategies: With Applications to Linear Models, Logistic and Ordinal Regression, and Survival Analysis* (2nd ed.). Springer

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DATA-6202: Bayesian Analysis and Statistical Decision Making – 3(3+0)

Course Brief:
This course provides an in-depth introduction to Bayesian analysis and its applications in statistical decision-making. Students will explore fundamental Bayesian concepts such as prior, likelihood, posterior distributions, and Bayes' theorem. The course covers advanced topics including Markov Chain Monte Carlo (MCMC) methods, hierarchical models, and Bayesian model comparison. Emphasis is placed on practical decision-making scenarios, such as business forecasting and risk management, using probabilistic reasoning. Hands-on experience with computing languages and statistical software will enable students to implement Bayesian models and make informed decisions based on uncertainty and data.

Course Learning Objectives:
By the end of the course, students will be able to:

1. Understand the principles of Bayesian analysis and how they differ from frequentist methods.
2. Apply Bayes' theorem to update beliefs based on new information.
3. Use conjugate priors and posterior distributions for statistical inference.
4. Implement MCMC methods for sampling from complex posterior distributions.
5. Build hierarchical Bayesian models to analyze multi-level data.
6. Perform Bayesian model selection and comparison.
7. Make data-driven decisions using Bayesian decision theory.
8. Use computing languages and statistical software to implement Bayesian analysis for real-world applications.

Course Contents:

1. *Introduction to Bayesian Analysis*: Key concepts and differences between Bayesian and frequentist methods
2. *Bayes' Theorem and Prior Distributions*: Defining and selecting priors
3. *Posterior Distributions*: Updating beliefs and calculating posterior probabilities
4. *Conjugate Priors*: Common conjugate priors for analytical solutions
5. *Markov Chain Monte Carlo (MCMC)*: Metropolis-Hastings and Gibbs sampling algorithms
6. *Hierarchical Bayesian Models*: Modeling multi-level data
7. *Bayesian Model Comparison*: Model selection using Bayes factors and posterior predictive checks
8. *Bayesian Decision Theory*: Utility functions and decision-making under uncertainty
9. *Software Tools*: Implementing Bayesian models with Python, R, and Stan
10. *Applications in Business and Risk Management*: Forecasting, risk analysis, and real-world case studies

Recommended Textbooks:

1. Gelman, A., Carlin, J. B., Stern, H. S., Dunson, D. B., Vehtari, A., & Rubin, D. B. (2013). *Bayesian Data Analysis* (3rd ed.). CRC Press
2. McElreath, R. (2020). *Statistical Rethinking: A Bayesian Course with Examples in R and Stan* (2nd ed.). CRC Press
3. Bolstad, W. M., & Curran, J. M. (2016). *Introduction to Bayesian Statistics* (3rd ed.). Wiley
4. Kruschke, J. K. (2014). *Doing Bayesian Data Analysis: A Tutorial with R, JAGS, and Stan* (2nd ed.). Academic Press
5. Lee, P. M. (2012). *Bayesian Statistics: An Introduction* (4th ed.). Wiley

Suggested Readings:

1. Sivia, D. S., & Skilling, J. (2006). *Data Analysis: A Bayesian Tutorial* (2nd ed.). Oxford University Press
2. Bishop, C. M. (2006). *Pattern Recognition and Machine Learning*. Springer
3. Koller, D., & Friedman, N. (2009). *Probabilistic Graphical Models: Principles and Techniques*. MIT Press
4. Hoff, P. D. (2009). *A First Course in Bayesian Statistical Methods*. Springer
5. Berger, J. O. (1985). *Statistical Decision Theory and Bayesian Analysis* (2nd ed.). Springer

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STAT-6203: Design of Experiments – 3(3+0)

Course Brief:
This course introduces the principles and techniques of designing experiments, with a focus on statistical methods for planning, conducting, and analyzing experiments efficiently. It covers essential topics such as hypothesis testing, factorial designs, randomization, blocking, and ANOVA. The course emphasizes practical applications in data analytics and provides hands-on experience in designing experiments and analyzing results using Computing languages and statistical software. By the end of the course, students will be able to apply experimental design principles to real-world scenarios, ensuring robust data collection and insightful conclusions.

Course Learning Objectives:
By the end of the course, students will be able to:

1. Understand the role of experimental design in data analytics and decision-making.
2. Plan and design experiments to maximize information while minimizing costs.
3. Apply randomization, blocking, and replication techniques in experiments.
4. Use factorial designs to analyze interactions between multiple factors.
5. Implement ANOVA for comparing group means in experiments.
6. Perform statistical tests to validate experimental outcomes.
7. Use Computing languages and statistical software for data analysis in designed experiments.
8. Interpret results and draw actionable insights from experimental data.

Course Contents:

1. *Introduction to Experimental Design*: Importance of experiments in data analytics; Basic concepts
2. *Principles of Experimental Design*: Randomization, replication, and blocking
3. *Completely Randomized Design (CRD)*: Simple designs and analysis
4. *Randomized Block Design (RBD)*: Controlling variability through blocking
5. *Factorial Designs*: Full and fractional factorial experiments; Interactions between factors
6. *Analysis of Variance (ANOVA)*: Comparing multiple group means; One-way and two-way ANOVA
7. *Response Surface Methods*: Optimizing outcomes through experimental designs
8. *Statistical Testing in Experiments*: Hypothesis testing and confidence intervals
9. *Software Tools for Experimental Analysis*: Implementing designs in Computing languages and statistical software 10. *Applications of Experimental Design*: Case studies in business, healthcare, and manufacturing

Recommended Textbooks:

1. Montgomery, D. C. (2020). *Design and Analysis of Experiments* (10th ed.). Wiley
2. Box, G. E. P., Hunter, J. S., & Hunter, W. G. (2005). *Statistics for Experimenters: Design,*
3. *Innovation, and Discovery* (2nd ed.). Wiley
4. Dean, A., & Voss, D. (1999). *Design and Analysis of Experiments*. Springer
5. Wu, C. F. J., & Hamada, M. S. (2011). *Experiments: Planning, Analysis, and Optimization* (2nd ed.). Wiley
6. Lazic, S. E. (2016). *Experimental Design for Laboratory Biologists: Maximising Information and Improving Reproducibility*. Cambridge University Press

Suggested Readings:

1. Oehlert, G. W. (2010). *A First Course in Design and Analysis of Experiments*. W. H. Freeman
2. Bate, R., & Karp, N. A. (2016). *Experimental Design for the Life Sciences* (4th ed.). Oxford University Press
3. Mathews, P. G. (2005). *Design of Experiments with MINITAB*. ASQ Quality Press
4. Bisgaard, S. (2012). *Statistical Tools for Business and Industry*. Wiley
5. Lawson, J. (2014). *Design and Analysis of Experiments with R*. CRC Press

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STAT-6204: Applied Time Series Analysis – 3(3+0)

Course Brief:

This course introduces the fundamental concepts and techniques of time series analysis, focusing on the modeling and forecasting of sequential data. It covers key topics such as trend, seasonality, stationarity, autocorrelation, and advanced time series models like ARIMA, Exponential Smoothing, and GARCH. Students will gain hands-on experience working with real-world time series data using tools such as computing languages and statistical software. The course emphasizes practical applications of forecasting in finance, economics, business, and other industries, preparing students to make data-driven predictions and decisions using time series techniques.

Course Learning Objectives:

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

1. Understand the importance and applications of time series analysis in various fields.
2. Identify patterns such as trend, seasonality, and cycles in time series data.
3. Apply transformations to ensure stationarity in time series models.
4. Use autocorrelation and partial autocorrelation functions for model identification.
5. Implement ARIMA and Exponential Smoothing models for forecasting.
6. Apply advanced models such as GARCH for volatility forecasting.
7. Evaluate forecasting models using error metrics such as MAE, RMSE, and MAPE.
8. Develop forecasts using computing languages and statistical software for real-world applications.

Course Contents:

1. *Introduction to Time Series Analysis*: Overview, importance, and applications in finance, economics, and business
2. *Basic Components of Time Series*: Trend, seasonality, cyclic patterns, and irregular variations
3. *Stationarity in Time Series*: Differencing and transformations to achieve stationarity
4. *Autocorrelation and Partial Autocorrelation*: Identifying lags and model selection criteria
5. *ARIMA Models*: Model identification, estimation, and diagnostics
6. *Exponential Smoothing Methods*: Simple, Holt's, and Holt-Winters smoothing for forecasting
7. *Seasonal and Trend Decomposition*: Decomposing time series data to analyze individual components
8. *Volatility Models*: Introduction to GARCH models for volatility forecasting
9. *Model Evaluation*: Forecast accuracy metrics (MAE, RMSE, MAPE) and model validation 10. *Applications of Time Series Analysis*: Forecasting in finance, sales, and economics; Use cases in supply chain management.
10. *Practical Implementation*: Hands-on exercises and projects using computing languages and statistical software

Recommended Textbooks:

1. Hamilton, J. D. (1994). *Time Series Analysis*. Princeton University Press
2. Hyndman, R. J., & Athanasopoulos, G. (2018). *Forecasting: Principles and Practice* (2nd ed.). OTexts
3. Chatfield, C. (2003). *The Analysis of Time Series: An Introduction* (6th ed.). CRC Press
4. Shumway, R. H., & Stoffer, D. S. (2017). *Time Series Analysis and Its Applications: With R Examples* (4th ed.). Springer
5. Box, G. E. P., Jenkins, G. M., Reinsel, G. C., & Ljung, G. M. (2015). *Time Series Analysis: Forecasting and Control* (5th ed.). Wiley

Suggested Readings:

1. Brockwell, P. J., & Davis, R. A. (2016). *Introduction to Time Series and Forecasting* (3rd ed.). Springer
2. Fuller, W. A. (1996). *Introduction to Statistical Time Series* (2nd ed.). Wiley
3. Cryer, J. D., & Chan, K.-S. (2008). *Time Series Analysis: With Applications in R* (2nd ed.). Springer
4. Enders, W. (2014). *Applied Econometric Time Series* (4th ed.). Wiley
5. Wei, W. W. S. (2018). *Time Series Analysis: Univariate and Multivariate Methods* (2nd ed.). Pearson

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DATA-6205: Programming in R and Python – 3(3+0)

Course Brief:
This course introduces students to essential programming concepts and their applications in data analytics. Students will develop proficiency in programming languages such as computing languages and statistical software, focusing on data manipulation, analysis, and visualization. The course covers fundamental topics such as variables, loops, and functions, alongside advanced topics like data wrangling, file handling, and working with external APIs. Hands-on practice with real-world datasets will allow students to build automated workflows for data analysis and gain insights into how programming enhances analytical capabilities. By the end of the course, students will be able to write code to efficiently analyze data and create visualizations to support decision-making processes.

Course Learning Objectives:
By the end of the course, students will be able to:

1. Understand core programming concepts, including variables, data types, and control structures.
2. Write functions and modular code for reusable analytics workflows.
3. Perform data manipulation, transformation, and aggregation with computing languages and statistical software.
4. Handle structured and unstructured data from files, databases, and APIs.
5. Use programming libraries for data visualization, including Matplotlib, Seaborn, and ggplot2.
6. Build automated scripts for data cleaning, transformation, and analysis.
7. Develop proficiency in working with external data sources and web scraping.
8. Apply programming skills to solve real-world analytics problems.

Course Contents:

1. *Introduction to Programming for Data Analytics*: Role of programming in data analytics; Overview of computing languages and statistical software programming languages.
2. *Basic Programming Concepts*: Variables, data types, and operators; Control structures (if-else statements, loops); Functions and modular programming.
3. *Data Structures and Collections*: Lists, dictionaries, tuples, and sets in Python; Data frames and matrices in R.
4. *Data Handling and File Operations*: Reading from and writing to CSV, Excel, and JSON files; Working with SQL databases for data storage and retrieval.
5. *Data Wrangling and Transformation*: Cleaning and transforming data using Pandas (Python) and dplyr (R); Reshaping, merging, and aggregating datasets.
6. *Working with APIs and Web Scraping*: Accessing data from APIs; Web scraping with Beautiful Soup (Python).
7. *Data Visualization Techniques*: Creating visualizations with Matplotlib and Seaborn in Python; Visualizing data using ggplot2 in R; Interactive dashboards using Plotly and Dash.
8. *Automating Data Analysis Workflows*: Writing scripts for repetitive tasks; Scheduling analytics workflows with cron jobs or task schedulers.
9. *Introduction to Version Control Systems*: Basics of Git and GitHub for code management and collaboration.
10. *Case Studies and Real-World Applications*: Practical projects involving analytics programming in business, finance, or healthcare; Group projects: End-to-end data analysis using Python or R.

Recommended Textbooks:

1. McKinney, W. (2017). *Python for Data Analysis: Data Wrangling with Pandas, NumPy, and IPython* (2nd ed.). O'Reilly Media.
2. Grolemund, G., & Wickham, H. (2016). *R for Data Science: Import, Tidy, Transform, Visualize, and Model Data*. O'Reilly Media.
3. VanderPlas, J. (2016). *Python Data Science Handbook: Essential Tools for Working with Data*. O'Reilly Media.
4. Matloff, N. (2011). *The Art of R Programming: A Tour of Statistical Software Design*. No Starch Press.

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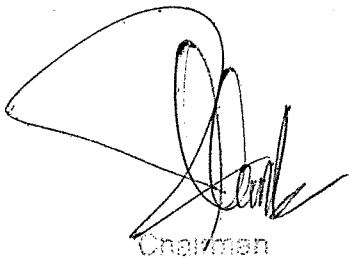
5. Lutz, M. (2013). *Learning Python* (5th ed.). O'Reilly Media.

Suggested Readings:

1. Albon, C. (2018). *Machine Learning with Python Cookbook: Practical Solutions from Preprocessing to Deep Learning*. O'Reilly Media.
2. Wickham, H. (2014). *Advanced R*. CRC Press.
3. Boschetti, A., & Massaron, L. (2015). *Python Data Science Essentials*. Packt Publishing.
4. Vohra, R. V. (2017). *Business Analytics: An Introduction*. Springer.
5. Han, J., Pei, J., & Kamber, M. (2011). *Data Mining: Concepts and Techniques* (3rd ed.). Morgan Kaufmann.



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DATA-6206: Multivariate Analysis – 3(3+0)

Course Brief:
This course provides a comprehensive introduction to multivariate analysis techniques used for analyzing datasets with multiple variables. It covers essential methods such as principal component analysis (PCA), factor analysis, cluster analysis, discriminant analysis, and canonical correlation. Emphasis is placed on understanding the relationships between variables and using multivariate techniques to reduce dimensionality, segment data, and classify observations. Students will gain hands-on experience using computing languages and statistical software to analyze multivariate datasets and interpret the results for practical applications in business, healthcare, and social sciences.

Course Learning Objectives:
By the end of the course, students will be able to:

1. Understand the role of multivariate analysis in data analytics and decision-making.
2. Apply principal component analysis (PCA) to reduce dimensionality.
3. Perform factor analysis to identify underlying factors influencing data.
4. Use cluster analysis for segmentation and pattern recognition.
5. Conduct discriminant analysis for classification tasks.
6. Implement canonical correlation to assess relationships between multiple sets of variables.
7. Analyze and interpret multivariate datasets using computing languages and statistical software.
8. Apply multivariate analysis techniques in real-world scenarios across various industries.

Course Contents:

1. *Introduction to Multivariate Analysis*: Overview, importance, and applications
2. *Data Preparation for Multivariate Analysis*: Handling missing values, scaling, and outlier detection
3. *Principal Component Analysis (PCA)*: Dimensionality reduction and visualization
4. *Factor Analysis*: Identifying latent variables influencing datasets
5. *Cluster Analysis*: K-means and hierarchical clustering for pattern recognition
6. *Discriminant Analysis*: Classification of observations based on multiple predictors
7. *Canonical Correlation Analysis*: Assessing relationships between two sets of variables
8. *Multivariate Analysis of Variance (MANOVA)*: Comparing group means across multiple variables
9. *Software Tools*: Implementing multivariate techniques using computing languages and statistical software
10. *Applications in Business and Healthcare*: Case studies and group projects with real-world data

Recommended Textbooks:

1. Johnson, R. A., & Wichern, D. W. (2018). *Applied Multivariate Statistical Analysis* (7th ed.). Pearson
2. Hair, J. F., Black, W. C., Babin, B. J., & Anderson, R. E. (2019). *Multivariate Data Analysis* (8th ed.). Cengage Learning
3. Everitt, B., & Hothorn, T. (2011). *An Introduction to Applied Multivariate Analysis with R*. Springer
4. Tabachnick, B. G., & Fidell, L. S. (2019). *Using Multivariate Statistics* (7th ed.). Pearson
5. Izenman, A. J. (2008). *Modern Multivariate Statistical Techniques: Regression, Classification, and Manifold Learning*. Springer

Suggested Readings:

1. Rencher, A. C., & Christensen, W. F. (2012). *Methods of Multivariate Analysis* (3rd ed.). Wiley 2. Jolliffe, I. T., & Cadima, J. (2016). *Principal Component Analysis: A Review and Recent*
2. *Developments*. Philosophical Transactions of the Royal Society A
3. Anderson, T. W. (2003). *An Introduction to Multivariate Statistical Analysis* (3rd ed.). Wiley
4. Hastie, T., Tibshirani, R., & Friedman, J. (2009). *The Elements of Statistical Learning: Data Mining, Inference, and Prediction* (2nd ed.). Springer
5. Abdi, H., & Williams, L. J. (2010). *Principal Component Analysis*. Wiley Interdisciplinary Reviews: Computational Statistics

DATA-6207: Introduction to Big Data Technologies – 3(3+0)

Course Brief:

This course provides a foundational understanding of big data technologies and their role in processing, managing, and analyzing large-scale datasets. It covers key concepts such as distributed computing, data storage, and big data frameworks like Hadoop and Apache Spark. Students will explore the architecture of big data ecosystems and gain hands-on experience with data management and processing using tools such as HDFS, Hive, and Kafka. The course also addresses cloud-based solutions for big data analytics, data privacy, and security challenges. By the end of the course, students will be able to use big data technologies to efficiently handle and analyze complex datasets.

Course Learning Objectives:

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

1. Understand the key concepts and challenges of big data technologies.
2. Explore the architecture and components of big data ecosystems.
3. Use Hadoop and HDFS for distributed data storage and management.
4. Implement data processing tasks using Apache Spark.
5. Query large datasets using Hive and perform batch processing.
6. Work with real-time data streams using Apache Kafka.
7. Understand data privacy, security, and governance challenges in big data environments.
8. Apply cloud-based platforms like AWS and Google Cloud for big data analytics.

Course Contents:

1. *Introduction to Big Data:* Definition, characteristics (volume, velocity, variety), and challenges
2. *Big Data Ecosystem and Architecture:* Components of big data systems (data storage, processing, and analysis)
3. *Hadoop Framework*: Overview of Hadoop; Distributed storage with HDFS
4. *Data Processing with Apache Spark*: Resilient Distributed Datasets (RDDs) and DataFrames; Parallel processing techniques
5. *Hive and SQL on Big Data*: Querying large datasets with Hive; Batch processing and data warehousing
6. *Real-Time Data Processing with Kafka*: Introduction to streaming data and event-driven systems
7. *NoSQL Databases*: Overview of Cassandra and MongoDB for handling unstructured data
8. *Cloud Platforms for Big Data*: Using AWS and Google Cloud for scalable data processing 9. *Data Privacy and Security*: Challenges and best practices for managing sensitive data in big data systems
9. *Big Data Use Cases*: Applications in finance, healthcare, and IoT analytics; Industry case studies and group projects

Recommended Textbooks:

1. White, T. (2015). *Hadoop: The Definitive Guide* (4th ed.). O'Reilly Media
2. Karau, H., & Warren, R. (2017). *High Performance Spark: Best Practices for Scaling and Optimizing Apache Spark*. O'Reilly Media
3. Guller, M. (2015). *Big Data Analytics with Spark: A Practitioner's Guide to Using Spark for Large-Scale Data Analysis*. Apress
4. Dean, J., & Ghemawat, S. (2008). *MapReduce: Simplified Data Processing on Large Clusters*. Communications of the ACM
5. Marr, B. (2016). *Big Data in Practice: How 45 Successful Companies Used Big Data Analytics to Deliver Extraordinary Results*. Wiley

Suggested Readings:

1. Hurwitz, J., Nugent, A., Halper, F., & Kaufman, M. (2013). *Big Data for Dummies*. Wiley 2. Laney, D. (2018). *Infonomics: How to Monetize, Manage, and Measure Information as an Asset for Competitive Advantage*. Gartner Press
2. Grover, V., & Kar, A. K. (2017). *Big Data Analytics: Methods and Applications*. Springer
3. Chambers, B., & Zaharia, M. (2018). *Spark: The Definitive Guide*. O'Reilly Media
4. Farhat, A. (2015). *Big Data Fundamentals: Concepts, Drivers & Techniques*. Pearson

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DATA-6208: Introduction to Machine Learning – 3(3+0)

Course Brief:

This course provides a comprehensive introduction to machine learning, focusing on the development of algorithms that enable computers to learn from data and make predictions. Students will explore supervised, unsupervised, and reinforcement learning techniques, as well as key models such as regression, decision trees, support vector machines, and neural networks. The course emphasizes hands-on implementation using Python and tools like Scikit-Learn, TensorFlow, and Keras. Students will also learn about model evaluation, hyperparameter tuning, and ethics in machine learning. By the end of the course, students will be able to develop, evaluate, and deploy machine learning models to solve real-world problems.

Course Learning Objectives:

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

1. Understand the principles and applications of machine learning in data analytics.
2. Implement supervised learning algorithms for classification and regression.
3. Apply unsupervised learning techniques for clustering and dimensionality reduction.
4. Develop deep learning models using neural networks.
5. Use reinforcement learning for dynamic decision-making tasks.
6. Evaluate machine learning models using appropriate performance metrics.
7. Optimize models through hyperparameter tuning and cross-validation.
8. Implement machine learning pipelines using Python libraries such as Scikit-Learn, TensorFlow, and Keras.

Course Contents:

1. *Introduction to Machine Learning*: Overview, applications, and machine learning workflows
2. *Supervised Learning*: Linear and logistic regression, decision trees, random forests, naïve bayes and support vector machines
3. *Unsupervised Learning*: Clustering (K-means, hierarchical) and dimensionality reduction (PCA)
4. *Reinforcement Learning*: Basics of Q-learning and policy gradient methods
5. *Model Evaluation and Validation*: Accuracy, precision, recall, F1-score, confusion matrix, and ROC-AUC
6. *Overfitting and Regularization*: Lasso, Ridge regression, and dropout techniques
7. *Hyperparameter Tuning*: Grid search and random search for model optimization
8. *Machine Learning Pipelines*: Automating workflows with Scikit-Learn and TensorFlow

Recommended Textbooks:

1. Géron, A. (2019). *Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow* (2nd ed.). O'Reilly Media
2. Hastie, T., Tibshirani, R., & Friedman, J. (2009). *The Elements of Statistical Learning: Data*
3. *Mining, Inference, and Prediction* (2nd ed.). Springer
4. Goodfellow, I., Bengio, Y., & Courville, A. (2016). *Deep Learning*. MIT Press
5. Murphy, K. P. (2012). *Machine Learning: A Probabilistic Perspective*. MIT Press
6. Flach, P. (2012). *Machine Learning: The Art and Science of Algorithms That Make Sense of Data*. Cambridge University Press

Suggested Readings:

1. Nielsen, M. (2015). *Neural Networks and Deep Learning*. Determination Press
2. Sutton, R. S., & Barto, A. G. (2018). *Reinforcement Learning: An Introduction* (2nd ed.). MIT Press
3. Chollet, F. (2018). *Deep Learning with Python*. Manning Publications
4. Bishop, C. M. (2006). *Pattern Recognition and Machine Learning*. Springer
5. Albon, C. (2018). *Machine Learning with Python Cookbook: Practical Solutions from Preprocessing to Deep Learning*. O'Reilly Media

DATA-6209: Simulation Techniques for Data Analytics – 3(3+0)

Course Brief:
This course introduces the principles and applications of simulation techniques in data analytics, focusing on modeling real-world systems and evaluating outcomes through computer simulations. It covers various simulation methods, including Monte Carlo simulation, discrete event simulation, and agent-based modeling. Students will gain hands-on experience using computing languages and statistical software to implement simulation models for problem-solving and decision-making. The course emphasizes the role of simulation in risk analysis, forecasting, optimization, and scenario planning, equipping students with the skills to analyze complex systems and generate actionable insights.

Course Learning Objectives:
By the end of the course, students will be able to:

1. Understand the importance and applications of simulation techniques in data analytics.
2. Implement Monte Carlo simulations for risk analysis and forecasting.
3. Develop discrete event simulations to model system operations.
4. Use agent-based models to simulate complex interactions between entities.
5. Analyze and interpret simulation outputs to support decision-making.
6. Implement simulations in computing languages and statistical software for real-world scenarios.
7. Apply simulation techniques in business, healthcare, and finance analytics.
8. Evaluate the limitations and assumptions of simulation models.

Course Contents:

1. *Introduction to Simulation Techniques*: Overview and importance of simulations in data analytics
2. *Monte Carlo Simulation*: Random number generation and applications in risk analysis
3. *Discrete Event Simulation*: Modeling processes, queues, and system operations
4. *Agent-Based Modeling*: Simulating interactions between autonomous agents in dynamic systems
5. *Random Variate Generation*: Techniques for generating random samples from different distributions
6. *Scenario Planning and Forecasting*: Using simulations to evaluate possible outcomes
7. *Optimization through Simulation*: Applying simulations in optimization and decision-making problems
8. *Implementing Simulations*: Hands-on exercises with computing languages and statistical software
9. *Analyzing Simulation Results*: Statistical analysis and interpretation of outcomes
10. *Applications of Simulation*: Case studies in business operations, healthcare, and finance

Recommended Textbooks:

1. Law, A. M., & Kelton, W. D. (2014). *Simulation Modeling and Analysis* (5th ed.). McGraw-Hill
2. Banks, J., Carson, J. S., Nelson, B. L., & Nicol, D. M. (2010). *Discrete-Event System Simulation* (5th ed.). Pearson
3. Winston, W. L. (2021). *Operations Research: Applications and Algorithms* (5th ed.). Cengage Learning
4. Fishman, G. S. (2013). *Monte Carlo: Concepts, Algorithms, and Applications*. Springer
5. Heath, M. T. (2018). *Scientific Computing: An Introductory Survey* (2nd ed.). SIAM

Suggested Readings:

1. Ross, S. M. (2013). *Simulation* (5th ed.). Academic Press
2. Pidd, M. (2004). *Computer Simulation in Management Science* (5th ed.). Wiley
3. Altiok, T., & Melamed, B. (2007). *Simulation Modeling and Analysis with ARENA*. Academic Press
4. Gilbert, N., & Troitzsch, K. (2005). *Simulation for the Social Scientist* (2nd ed.). Open University Press
5. Metropolis, N., & Ulam, S. (1949). The Monte Carlo Method. *Journal of the American Statistical Association*

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DATA-6210: Business Analytics – 3(3+0)

Course Brief:

This course provides an introduction to the concepts, tools, and techniques of business analytics, focusing on how data-driven insights can enhance decision-making in organizations. It covers key areas such as descriptive, predictive, and prescriptive analytics, equipping students with the skills to analyze business data, identify trends, forecast outcomes, and make recommendations. Students will also explore real-world applications of business analytics across various industries and gain hands-on experience with analytics tools such as Python, R, Excel, and Tableau. The course emphasizes the importance of data visualization, performance metrics, and the use of analytics to support business strategies.

Course Learning Objectives:

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

1. Understand the role of business analytics in improving decision-making.
2. Perform descriptive analytics to summarize and interpret business data.
3. Apply predictive analytics techniques for forecasting outcomes.
4. Utilize prescriptive analytics to recommend optimal actions.
5. Use tools such as Python, R, Excel, and Tableau for business data analysis.
6. Interpret key performance indicators (KPIs) and metrics relevant to business contexts.
7. Visualize business data and insights using dashboards and reports.
8. Analyze real-world business problems and propose data-driven solutions.

Course Contents:

1. *Introduction to Business Analytics*: Importance of analytics in business decision-making; Overview of analytics frameworks
2. *Descriptive Analytics*: Summarizing business data; Using statistical measures for analysis
3. *Predictive Analytics*: Forecasting techniques (e.g., regression, time series models); Scenario analysis
4. *Prescriptive Analytics*: Optimization techniques; Decision models for business applications
5. *Business Metrics and KPIs*: Identifying and interpreting key metrics for performance management
6. *Tools for Business Analytics*: Data manipulation and analysis using Python, R, Excel, and Tableau
7. *Data Visualization for Business*: Creating dashboards and reports; Visual storytelling for business insights
8. *Applications of Business Analytics*: Case studies in finance, marketing, operations, and human resources
9. *Ethics and Privacy in Analytics*: Understanding the ethical implications of business analytics
10. *Group Project*: Analyzing a real-world business problem and presenting recommendations

Recommended Textbooks:

1. Evans, J. R. (2017). *Business Analytics: Methods, Models, and Decisions* (3rd ed.). Pearson
2. Albright, S. C., & Winston, W. L. (2019). *Business Analytics: Data Analysis & Decision Making* (7th ed.). Cengage Learning
3. Provost, F., & Fawcett, T. (2013). *Data Science for Business: What You Need to Know About*
4. *Data Mining and Data-Analytic Thinking*. O'Reilly Media
5. Vohra, R. V. (2017). *Business Analytics: An Introduction*. Springer
6. Davenport, T. H., & Kim, J. (2013). *Keeping Up with the Quants: Your Guide to Understanding and Using Analytics*. Harvard Business Review Press

Suggested Readings:

1. Camm, J. D., Cochran, J. J., Fry, M. J., & Ohlmann, J. W. (2019). *Essentials of Business Analytics* (2nd ed.). Cengage Learning
2. Laursen, G. H. N., & Thorlund, J. (2016). *Business Analytics for Managers: Taking Business*
3. *Intelligence Beyond Reporting* (2nd ed.). Wiley
4. Sharma, R. (2017). *Business Analytics: A Practitioner's Guide*. Sage Publications
5. Davenport, T. H. (2014). *Big Data at Work: Dispelling the Myths, Uncovering the Opportunities*. Harvard Business Review Press
6. Waller, M. A., & Fawcett, S. E. (2013). *Data Science, Predictive Analytics, and Big Data: A Revolution That Will Transform Supply Chain Design and Management*. Pearson

DATA-6211: Social Media Analytics – 3(3+0)

Course Brief:

This course introduces students to the field of social media analytics, focusing on how data from platforms like Twitter, Instagram, Facebook, and LinkedIn can be collected, analyzed, and used to derive insights. Students will learn to analyze user behavior, sentiment, and trends using advanced data analytics techniques. The course covers topics such as social network analysis, sentiment analysis, text mining, and the ethical use of social media data. Through hands-on projects using Python, R, and APIs, students will develop the skills required to extract, process, and visualize social media data to support marketing strategies, brand management, and public opinion analysis.

Course Learning Objectives:

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

1. Understand the role and applications of social media analytics in business and research.
2. Extract and analyze data from social media platforms using APIs.
3. Perform sentiment analysis to measure public opinion and brand perception.
4. Conduct social network analysis to understand relationships and influence within networks.
5. Use text mining techniques to extract insights from unstructured social media data.
6. Visualize social media trends and insights using Python, R, and Tableau.
7. Evaluate the ethical and privacy implications of social media data usage.
8. Develop data-driven strategies for marketing, brand management, and public policy.

Course Contents:

1. *Introduction to Social Media Analytics*: Overview, importance, and applications
2. *Social Media Data Collection*: Working with APIs (Twitter, Instagram, Facebook) and web scraping
3. *Sentiment Analysis*: Text preprocessing and sentiment classification using natural language processing (NLP)
4. *Social Network Analysis*: Identifying influencers and communities within social networks
5. *Text Mining*: Extracting insights from unstructured social media data
6. *Trend Analysis*: Identifying viral trends and monitoring brand perception
7. *Visualization of Social Media Data*: Creating dashboards and visual reports using Python, R, and Tableau
8. *Ethics and Privacy in Social Media Analytics*: Responsible use of data and compliance with platform policies
9. *Applications in Marketing and Brand Management*: Case studies in customer engagement and reputation management
10. *Practical Project*: Hands-on project analyzing a real-world social media dataset

Recommended Textbooks:

1. Fan, W., & Gordon, M. D. (2014). *The Power of Social Media Analytics*. Communications of the ACM
2. Pak, A., & Paroubek, P. (2010). *Twitter as a Corpus for Sentiment Analysis and Opinion Mining*. LREC
3. Russell, M. A. (2018). *Mining the Social Web: Data Mining Facebook, Twitter, LinkedIn, Instagram, GitHub, and More* (3rd ed.). O'Reilly Media
4. Zafarani, R., Abbasi, M. A., & Liu, H. (2014). *Social Media Mining: An Introduction*. Cambridge University Press
5. Aggarwal, C. C. (2011). *An Introduction to Social Network Data Analytics*. Springer

Suggested Readings:

1. Kavanaugh, A., & Yang, S. (2011). *Social Media Analytics for Disaster Management*. Communications of the ACM
2. Maynard, D., & Greenwood, M. A. (2014). *Who Cares about Sarcastic Tweets? Investigating the Impact of Sarcasm on Sentiment Analysis*. LREC
3. Zhao, X., & Rosson, M. B. (2009). *How and Why People Twitter: The Role that Microblogging Plays in Informal Communication at Work*. CHI
4. Gligorijevic, V., & Luck, J. (2012). *Social Media Analytics: Measuring the Impact of Social Media on Business Performance*. Springer
5. Cameron, G., & Lim, M. (2019). *Social Media Analytics and Practical Applications*. Palgrave Macmillan

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DATA- 6212: Data Driven Process Monitoring--3(3+0)

Course Brief:

This course provides a comprehensive introduction to data-driven process monitoring, enabling students to design, implement, and maintain effective process monitoring systems. This course provides an in-depth exploration of data-driven process monitoring, including the DMAIC Process, Statistical process control and Shewhart Philosophy for process monitoring. This will furnish basis to handle process data by advanced statistical software. Students will gain hands-on experience with data analysis, visualization, and interpretation, as well as learn how to establish process monitoring metrics, detect abnormal process conditions, and perform root cause analysis.

Course Learning Objectives:

Upon completing this course, students will be able to:

1. Define data-driven process monitoring and its importance in improving process efficiency and quality
2. Analyze and visualize process data to identify trends and patterns
3. Establish process monitoring metrics and detect abnormal process conditions
4. Perform root cause analysis and implement corrective actions
5. Make data-driven decisions to determine process improvements

Course Contents:

1. *Overview*: Process, Importance of process monitoring, Dimension of process quality, short run and long run processes, Specification of the process, Planning, Assurance and process control, Edwards Deming's process philosophy and Shewhart cycle, Data-driven process monitoring and Benefits of data-driven approach
2. *The DMAIC Process*: Importance of DMAIC, understanding process through Define, Measures, Analyze, Improve and Control
3. *Modeling Process variability*: Describing variation in the process, causes of variation, Assignable and chance causes, Root cause analysis, Estimation and inference of process variability by using statistical software
4. *Process Specification and tolerance*: Setting specification of the process, Adjustment of tolerance limits and estimation of tolerance limits of the process
5. *Statistical process control*: Magnificent seven, Basic principles, Rational subgrouping, Phase-I (training), Phase-II (testing), Analysis of trends and patterns, Pareto chart, cause and effect diagram by using statistical software
6. *Shewhart Philosophy for Process monitoring*: Use of Shewhart control charts, Utilization of Phase-I and Phase-II, Sensitizing rules and pattern recognition by using statistical software
7. *Process monitoring metrics*: Process capability indices, Cp, Cpk and their interval, Fraction non-confirming measures
8. *Process Alarm and Notification Systems*: Alarm types, Threshold, Rate-of-change, Pattern recognition by data driven control charts
9. *Page and Roberts Philosophy for Process monitoring*: Basic principles, EWMA, CUSUM, Design of EWMA and CUSUM by advanced statistical software
10. *Process Practices and Case Studies*: Industry-specific examples: manufacturing, healthcare, finance etc. by advanced statistical software

Recommended Textbooks:

1. Harrou, F., Sun, Y., Hering, A. S., & Madakyaru, M. (2020). *Statistical process monitoring using advanced data-driven and deep learning approaches: theory and practical applications*. Elsevier.
2. Qiu, P. (2013). *Introduction to statistical process control*. (1st ed.) CRC press.
3. Montgomery, D. C. (2012). *Statistical quality control,* (7th ed.). New York: Wiley.

Suggested Readings:

1. Peña-Rodríguez, M. E. (2018). *Process Monitoring and Improvement Handbook*. (2nd ed), ASQ Quality Press.
2. Stapenhurst, T. (2013). *Mastering statistical process control*. Routledge.
3. Vining, G. (Ed.). (2000). *Statistical process monitoring and optimization*. CRC Press.

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DATA-6213: Cloud Computing for Data Analytics – 3(3+0)

Course Brief:

This course introduces students to the principles and applications of cloud computing in the context of data analytics. It covers key cloud services and platforms such as Amazon Web Services (AWS), Microsoft Azure, and Google Cloud Platform (GCP) used for scalable data storage, processing, and analysis. The course includes foundational concepts in networking, emphasizing their relevance to cloud infrastructures, such as IP addressing, DNS, load balancing, and virtual private networks (VPNs). Students will gain hands-on experience with cloud-based data pipelines, serverless computing, and distributed frameworks like Apache Spark. The course emphasizes the importance of cloud infrastructure for big data analytics, exploring topics such as data security, cost optimization, and real-time analytics. By the end of the course, students will have the skills to build and deploy data analytics solutions on the cloud.

Course Learning Objectives:

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

1. Understand the role of cloud computing in modern data analytics.
2. Explore different cloud service models (IaaS, PaaS, SaaS) and their use cases.
3. Store, process, and analyze large datasets using cloud services.
4. Implement distributed data analytics with Apache Spark on the cloud.
5. Create data pipelines using serverless computing and cloud databases.
6. Apply cloud-based tools for real-time analytics and dashboarding.
7. Optimize cloud resource usage and manage costs effectively.
8. Address data security, privacy, and compliance challenges in the cloud.

Course Contents:

1. *Introduction to Cloud Computing*: Overview of cloud computing and its benefits for data analytics
2. *Networking Basics for the Cloud:* Key networking concepts, including IP addressing, DNS, virtual private networks (VPNs), and load balancing, as they apply to cloud architectures
3. *Cloud Service Models*: Understanding IaaS, PaaS, and SaaS platforms
4. *Data Storage in the Cloud*: Using Amazon S3, Google Cloud Storage, and Azure Data Lake
5. *Distributed Computing*: Implementing Spark and Hadoop clusters on the cloud
6. *Serverless Computing for Data Analytics*: AWS Lambda, Google Cloud Functions, and Azure Functions
7. *Data Pipelines and Workflow Automation*: Building ETL processes with Apache Airflow and cloud tools
8. *Real-Time Analytics*: Streaming data processing using Apache Kafka and cloud-native tools
9. *Visualization and Reporting*: Developing dashboards with cloud services like Power BI and Google Data Studio
10. *Cloud Security and Compliance*: Managing data privacy, encryption, and regulatory requirements
11. *Practical Project*: End-to-end deployment of a data analytics solution on a cloud platform

Recommended Textbooks:

1. Miller, M. (2021). *Cloud Computing: Web-Based Applications That Change the Way You Work and Collaborate Online* (2nd ed.). Que Publishing
2. Rittinghouse, J. W., & Ransome, J. F. (2017). *Cloud Computing: Implementation, Management, and Security*. CRC Press
3. Bahga, A., & Madisetti, V. (2014). *Cloud Computing: A Hands-On Approach*. CreateSpace Independent Publishing
4. Zikopoulos, P., & Eaton, C. (2011). *Understanding Big Data: Analytics for Enterprise Class*
5. *Hadoop and Streaming Data*. McGraw-Hill

Suggested Readings:

1. Barry, M. (2019). *Cloud Computing Basics: A Non-Technical Introduction*. Mercury Learning and Information
2. White, T. (2015). *Hadoop: The Definitive Guide* (4th ed.). O'Reilly Media
3. Zaharia, M., & Wen, A. (2021). *Learning Spark: Lightning-Fast Big Data Analytics* (2nd ed.). O'Reilly Media
4. Arora, I. (2021). *Serverless Architectures on AWS: With Examples Using AWS Lambda*. Apress

DATA-6214: Introduction to Deep Learning – 3(3+0)

Course Brief:

This course provides a comprehensive introduction to deep learning, focusing on neural networks and their applications in solving complex data problems. Students will explore the architecture and functioning of feedforward neural networks, convolutional neural networks (CNNs), recurrent neural networks (RNNs), and autoencoders. The course emphasizes hands-on practice using Python libraries such as TensorFlow, Keras, and PyTorch to develop and train models. Students will also learn about advanced topics, including transfer learning, generative adversarial networks (GANs), and hyperparameter tuning. By the end of the course, students will be able to design, train, and deploy deep learning models for real-world applications in areas such as image recognition, natural language processing, and time series forecasting.

Course Learning Objectives:

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

1. Understand the architecture and principles of neural networks and deep learning.
2. Implement feedforward neural networks for regression and classification tasks.
3. Develop convolutional neural networks (CNNs) for image processing.
4. Apply recurrent neural networks (RNNs) for time series forecasting and sequence modeling.
5. Use autoencoders for dimensionality reduction and anomaly detection.
6. Explore advanced topics such as GANs and transfer learning.
7. Train, evaluate, and optimize deep learning models using TensorFlow, Keras, and PyTorch.
8. Deploy deep learning models for real-world applications in business, healthcare, and research.

Course Contents:

1. *Introduction to Deep Learning*: Overview, history, and applications
2. *Feedforward Neural Networks*: Structure, activation functions, and backpropagation
3. *Convolutional Neural Networks (CNNs)*: Architecture, pooling, and applications in computer vision
4. *Recurrent Neural Networks (RNNs)*: LSTM and GRU networks for sequential data
5. *Autoencoders and Dimensionality Reduction*: Applications in anomaly detection and feature extraction
6. *Training Deep Neural Networks*: Optimizers, loss functions, and backpropagation
7. *Overfitting and Regularization*: Dropout, weight decay, and batch normalization
8. *Transfer Learning*: Using pre-trained models for new tasks
9. *Generative Models*: Introduction to GANs for image generation
10. *Deploying Deep Learning Models*: Using cloud platforms and APIs for deployment

Recommended Textbooks:

1. Goodfellow, I., Bengio, Y., & Courville, A. (2016). *Deep Learning*. MIT Press
2. Chollet, F. (2018). *Deep Learning with Python*. Manning Publications
3. Géron, A. (2019). *Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow* (2nd ed.). O'Reilly Media
4. Nielsen, M. (2015). *Neural Networks and Deep Learning*. Determination Press 5. Aggarwal, C. C. (2018). *Neural Networks and Deep Learning: A Textbook*. Springer

Suggested Readings:

1. Albon, C. (2018). *Machine Learning with Python Cookbook: Practical Solutions from Preprocessing to Deep Learning*. O'Reilly Media
2. Brownlee, J. (2019). *Deep Learning for Time Series Forecasting*. Machine Learning Mastery
3. Paszke, A., et al. (2019). *Deep Learning with PyTorch: A 60-Minute Blitz*. O'Reilly Media
4. Patterson, J., & Gibson, A. (2017). *Deep Learning: A Practitioner's Approach*. O'Reilly Media
5. LeCun, Y., Bengio, Y., & Hinton, G. (2015). *Deep Learning* in *Nature*

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DATA-6215: Healthcare Analytics – 3(3+0)

Course Brief:
This course provides an introduction to healthcare analytics, focusing on how data can be used to improve healthcare outcomes, optimize operations, and inform policy decisions. Students will explore key topics, including patient data management, predictive modeling, clinical decision support systems, and the use of electronic health records (EHR). The course emphasizes hands-on practice with Python, R, and healthcare datasets to analyze trends, forecast patient outcomes, and evaluate healthcare performance. Students will also explore ethical issues, data privacy regulations, and the challenges of working with healthcare data.

Course Learning Objectives:
By the end of the course, students will be able to:

1. Understand the role of data analytics in improving healthcare delivery and outcomes.
2. Work with healthcare datasets, including electronic health records (EHR) and public health data.
3. Apply predictive analytics to forecast patient outcomes and optimize resource allocation.
4. Use data visualization tools to communicate healthcare insights.
5. Develop clinical decision support models to assist healthcare providers.
6. Evaluate healthcare performance metrics, including cost, quality, and patient outcomes.
7. Explore ethical and privacy issues in healthcare data management.
8. Implement healthcare analytics projects using Python, R, and relevant tools.

Course Contents:

1. *Introduction to Healthcare Analytics*: Overview, importance, and applications in healthcare delivery
2. *Healthcare Data Sources*: Electronic health records (EHR), public health databases, and surveys
3. *Descriptive Analytics*: Identifying trends and summarizing patient data
4. *Predictive Modeling*: Building models to forecast patient outcomes (e.g., readmission risk)
5. *Clinical Decision Support Systems*: Using analytics to assist in clinical decision-making
6. *Resource Optimization in Healthcare*: Data-driven strategies for staff and equipment management
7. *Data Visualization in Healthcare*: Communicating insights through dashboards and reports
8. *Healthcare Performance Metrics*: Measuring cost, quality, and patient satisfaction
9. *Ethics and Privacy Regulations*: Data privacy laws (HIPAA, GDPR) and ethical considerations
10. *Practical Project*: Hands-on healthcare analytics project using real or synthetic datasets

Recommended Textbooks:

1. Reddy, C. K., & Aggarwal, C. C. (2015). *Healthcare Data Analytics*. CRC Press
2. Burton, T., & Weiner, B. (2019). *Applied Analytics: Transforming Healthcare*. Wiley
3. Harrison, J. P. (2016). *Essentials of Strategic Planning in Healthcare* (3rd ed.). Health Administration Press
4. Sharda, R., Delen, D., & Turban, E. (2020). *Analytics, Data Science, and Artificial Intelligence: Systems for Decision Support* (11th ed.). Pearson
5. McCormick, K., & Siegel, E. (2017). *Big Data in Healthcare: Statistical Tools and Data Mining Applications*. Wiley

Suggested Readings:

1. Koh, H. C., & Tan, G. (2011). *Data Mining Applications in Healthcare*. Journal of Healthcare Information Management
2. Kriegel, H., Borgwardt, K. M., & Krogan, N. J. (2020). *Analyzing Medical Data Using Data Science and Machine Learning*. Springer
3. Davenport, T., & Glaser, J. (2020). *Advanced Analytics in Healthcare: Healthcare Transformation through Data-Driven Decision Making*. Pearson
4. Collins, F. S., & Varmus, H. (2015). *A New Initiative on Precision Medicine*. New England Journal of Medicine
5. Blumenthal, D. (2017). *Data-Driven Healthcare: Reforming Healthcare Delivery through Analytics*. Harvard Business Review

DATA-6216: Geospatial Data Analytics – 3(3+0)

Course Brief:

This course introduces the fundamental concepts, tools, and techniques used in geospatial data analytics. It focuses on the collection, processing, visualization, and analysis of spatial data to uncover insights and solve real-world problems. Students will gain hands-on experience with Geographic Information Systems (GIS), spatial databases, and geospatial programming libraries such as GeoPandas and Folium in Python, as well as R and QGIS. The course also covers remote sensing, spatial statistics, and cloud-based platforms like Google Earth Engine for large-scale geospatial analysis. By the end of the course, students will be equipped to apply geospatial analytics in areas such as urban planning, environmental monitoring, and business intelligence.

Course Learning Objectives:

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

1. Understand the concepts and applications of geospatial data analytics.
2. Collect and preprocess spatial data from various sources, including APIs and open data portals.
3. Use GIS tools and geospatial libraries in computing languages and statistical software for spatial analysis.
4. Work with spatial databases such as PostGIS for efficient data storage and querying.
5. Visualize geospatial data using interactive maps and dashboards.
6. Apply remote sensing techniques for environmental and urban analysis.
7. Leverage spatial statistics to model spatial relationships and patterns.
8. Utilize cloud platforms like Google Earth Engine for large-scale geospatial data analysis.

Course Contents:

1. *Introduction to Geospatial Data Analytics*: Overview, importance, and real-world applications
2. *Spatial Data Collection and Preprocessing*: Handling spatial data formats (Shapefiles, GeoJSON, KML)
3. *Geographic Information Systems (GIS)*: Using QGIS and other GIS tools for spatial data analysis
4. *Geospatial Programming in computing languages and statistical software*: Working with GeoPandas, Folium, and Leaflet
5. *Spatial Databases*: Storing and querying spatial data using PostGIS
6. *Visualization of Geospatial Data*: Creating interactive maps and dashboards
7. *Remote Sensing and Satellite Imagery*: Extracting insights from satellite data
8. *Spatial Statistics*: Modeling spatial dependencies using spatial regression and Moran's I
9. *Cloud-Based Geospatial Platforms*: Introduction to Google Earth Engine for large-scale analysis.
10. *Applications of Geospatial Analytics*: Case studies in urban planning, environmental monitoring, and business

Recommended Textbooks:

1. De Smith, M. J., Goodchild, M. F., & Longley, P. (2018). *Geospatial Analysis: A Comprehensive Guide to Principles, Techniques, and Software Tools* (6th ed.). Troubador Publishing
2. Chang, K. T. (2016). *Introduction to Geographic Information Systems* (9th ed.). McGraw-Hill
3. Shekhar, S., Xiong, H., & Zhou, X. (2015). *Spatial Databases: A Tour* (2nd ed.). Springer
4. Sutton, T., Dassau, O., & Sutton, M. (2017). *QGIS Training Manual: Discover QGIS* (3rd ed.). Open Source Geospatial Foundation
6. Longley, P. A., Goodchild, M. F., Maguire, D. J., & Rhind, D. W. (2015). *Geographic Information Systems and Science* (4th ed.). Wiley

Suggested Readings:

1. Bivand, R., Pebesma, E., & Gómez-Rubio, V. (2013). *Applied Spatial Data Analysis with R* (2nd ed.). Springer
2. Hijmans, R. J. (2020). *Raster: Geographic Data Analysis and Modeling with R*. Chapman & Hall
3. Anselin, L. (2013). *Spatial Econometrics: Methods and Models*. Springer
4. Wood, C., & Gorsevski, P. V. (2015). *GIS Applications in the Environmental and Earth Sciences*. CRC Press
5. Kumar, M. (2019). *Learn QGIS: Your Step-by-Step Guide to the Fundamental Tools in QGIS* Packt Publishing

Course Outlines for Interdisciplinary Subjects

CSDE-5101: Introduction to Programming – 3(3+0)

Course Brief:
This course provides a foundational understanding of programming concepts and techniques, focusing on problem-solving and logical thinking. It introduces students to essential programming constructs such as variables, data types, control structures, functions, and loops. The course emphasizes hands-on learning through practical assignments and projects using computing languages, a widely used language in data analytics and software development. Students will gain experience in writing, testing, and debugging code, laying the groundwork for advanced programming and data analytics courses.

Course Learning Objectives:
By the end of the course, students will be able to:

1. Understand basic programming concepts such as variables, data types, and operators.
2. Implement control structures including conditional statements and loops.
3. Write and call functions to modularize code for reusability.
4. Handle basic input and output operations for data processing.
5. Use lists, dictionaries, and other collections for efficient data management.
6. Develop problem-solving skills through algorithm design and implementation.
7. Debug, test, and optimize code effectively.
8. Gain familiarity with different programming environments.

Course Contents:

1. *Introduction to Programming*: Importance of programming in analytics and software development
2. *Basic Concepts*: Variables, data types, and arithmetic operations
3. *Control Structures*: Conditional statements (if-else) and loops (for, while)
4. *Functions and Modular Programming*: Writing and using functions; Scope and recursion
5. *Data Structures*: Lists, tuples, dictionaries, and sets for data management
6. *File Handling*: Reading from and writing to files; Handling exceptions
7. *Input and Output*: Basic I/O operations for data processing and user interaction
8. *Error Handling and Debugging*: Identifying and fixing common programming errors
9. *Using Computing Languages for Problem Solving*: Algorithm development and code implementation

Recommended Textbooks:

1. Zelle, J. (2017). *Python Programming: An Introduction to Computer Science* (3rd ed.). Franklin, Beedle & Associates
2. Lutz, M. (2013). *Learning Python* (5th ed.). O'Reilly Media
3. Downey, A. B. (2015). *Think Python: How to Think Like a Computer Scientist* (2nd ed.). O'Reilly Media
4. Severance, C. (2016). *Python for Everybody: Exploring Data Using Python 3*. CreateSpace Independent Publishing
5. Miller, B. N., & Ranum, D. (2013). *Problem Solving with Algorithms and Data Structures Using Python* (2nd ed.). Franklin, Beedle & Associates

Suggested Readings:

1. Sweigart, A. (2019). *Automate the Boring Stuff with Python* (2nd ed.). No Starch Press
2. Shaw, Z. A. (2017). *Learn Python 3 the Hard Way: A Very Simple Introduction to the Terrifyingly Beautiful World of Computers*. Addison-Wesley
3. Hunt, A., & Thomas, D. (2000). *The Pragmatic Programmer: Your Journey to Mastery*. Addison-Wesley
4. Gries, P., Campbell, J., & Montojo, J. (2013). *Practical Programming: An Introduction to Computer Science Using Python 3* (2nd ed.). Pragmatic Bookshelf
5. Barry, P. (2016). *Head First Python: A Brain-Friendly Guide* (2nd ed.). O'Reilly Media

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CSDE-5102: Introduction to Artificial Intelligence– 3(3+0)

Course Brief:
This course introduces the fundamental concepts of artificial intelligence (AI) in an accessible and engaging way for beginners. Students will learn about essential AI techniques such as simple search algorithms, basic machine learning, introductory neural networks, and an overview of natural language processing (NLP). The course focuses on practical applications and equips students with hands-on experience using Python and basic AI libraries to build simple models and understand how AI can be applied to everyday problems. Additionally, the course addresses key topics such as ethical considerations in AI and the responsible use of AI technologies, providing a well-rounded understanding of AI's potential and limitations.

Course Learning Objectives: By the end of the course, students will be able to:

1. Explain the fundamental concepts and significance of AI.
2. Use simple search algorithms to solve basic problems.
3. Build and evaluate simple machine learning models.
4. Understand the basics of neural networks and how they work.
5. Perform introductory text analysis using NLP techniques.
6. Recognize ethical concerns and responsible AI practices.
7. Write simple Python scripts using AI libraries like scikit-learn and TensorFlow.

Course Contents:

1. *Introduction to Artificial Intelligence:* Basic principles of AI, history, and real-world examples.
2. *Simple Problem Solving and Search Algorithms:* Introduction to simple search techniques like BFS and DFS.
3. *Basic Machine Learning Concepts:* Overview of supervised learning (e.g., linear regression, classification) and unsupervised learning (e.g., clustering).
4. *Introduction to Neural Networks:* Simple neural network models and basic understanding of how they work.
5. *Basic Natural Language Processing (NLP):* Text pre-processing and simple tasks like sentiment analysis.
6. *Introduction to AI Ethics:* Understanding fairness, privacy, and responsible use of AI.
7. *Hands-on Practice with Python:* Writing basic Python code for AI applications, using libraries like scikit-learn and simple TensorFlow models.

Recommended Textbooks:

1. Géron, A. (2019). *Hands-On Machine Learning with ScikitLearn, Keras, and TensorFlow* (2nd ed.). O'Reilly Media. (Chapters for beginners)
2. Russell, S., & Norvig, P. (2021). *Artificial Intelligence: A Modern Approach* (4th ed.). Pearson. (Basic sections)
3. Chollet, F. (2018). *Deep Learning with Python*. Manning Publications. (Introductory chapters)

Suggested Readings:

1. Nielsen, M. (2015). *Neural Networks and Deep Learning*. Determination Press. (Beginner-friendly sections) 2. Flach, P. (2012). *Machine Learning: The Art and Science of Algorithms That Make Sense of Data*. Cambridge University Press. (Introductory material)
2. Murphy, K. P. (2012). *Machine Learning: A Probabilistic Perspective*. MIT Press. (Simplified explanations)

CSDE-5103: Database Management Systems – 3(3+0)

Course Brief: This course provides a comprehensive introduction to database management systems (DBMS), covering the fundamental principles of designing, implementing, and managing databases. Students will explore relational database concepts, SQL (Structured Query Language), data modeling, normalization, and database administration. The course emphasizes practical skills in designing efficient databases, querying data, and ensuring data integrity. By the end of the course, students will be able to develop and manage robust database solutions and understand the role of databases in modern information systems.

Course Learning Objectives: By the end of the course, students will be able to:

1. Understand the core concepts and architecture of database management systems.
2. Design and implement relational database schemas using data modeling techniques.
3. Apply normalization principles to optimize database structures.
4. Construct and execute complex SQL queries for data retrieval and manipulation.
5. Ensure data integrity and consistency through database constraints and policies.
6. Administer and maintain databases, including backup and recovery operations.
7. Explore emerging trends in database technologies, such as NoSQL and cloud databases.

Course Contents:

1. *Introduction to Database Management Systems:* Overview of DBMS, data models, and the importance of databases.
2. *Data Modeling:* Entity-Relationship (ER) models, attributes, relationships, and converting ER models into relational schemas.
3. *Relational Database Design:* Concepts of primary and foreign keys, normalization (1NF, 2NF, 3NF, BCNF), and denormalization.
4. *Structured Query Language (SQL):* Basic to advanced SQL queries, data definition, data manipulation, and data control.
5. *Backup and Recovery:* Strategies for data backup, disaster recovery planning, and restoration techniques.
6. *Introduction to NoSQL Databases:* Overview of NoSQL databases, key-value stores, document databases, and graph databases.
7. *Emerging Trends in Databases:* Cloud databases, distributed databases, and advancements in big data technologies.

Recommended Textbooks:

1. Silberschatz, A., Korth, H. F., & Sudarshan, S. (2019). *Database System Concepts* (7th ed.). McGraw-Hill.
2. Elmasri, R., & Navathe, S. B. (2015). *Fundamentals of Database Systems* (7th ed.). Pearson.
3. Date, C. J. (2015). *An Introduction to Database Systems* (8th ed.). Addison-Wesley.
4. Ullman, J. D., & Widom, J. (2008). *A First Course in Database Systems* (3rd ed.). Pearson.
5. Ramakrishnan, R., & Gehrke, J. (2002). *Database Management Systems* (3rd ed.). McGraw-Hill.

Suggested Readings:

1. Garcia-Molina, H., Ullman, J. D., & Widom, J. (2009). *Database Systems: The Complete Book* (2nd ed.). Pearson.
2. Fowler, M. (2002). *Patterns of Enterprise Application Architecture*. Addison-Wesley.
3. O'Neil, P., & O'Neil, E. (2010). *Database: Principles, Programming, and Performance* (2nd ed.). Morgan Kaufmann.
4. Redmond, E., & Wilson, J. R. (2012). *Seven Databases in Seven Weeks: A Guide to Modern Databases and the NoSQL Movement*. Pragmatic Bookshelf.
5. Hoffer, J. A., Ramesh, V., & Topi, H. (2016). *Modern Database Management* (12th ed.). Pearson.

CSDE-5104: Data Structures and Algorithms – 3(3+0)

Course Brief

This course provides a comprehensive understanding of object-oriented programming (OOP) concepts alongside data structures and algorithms, emphasizing their practical application in data analytics. Students will learn to design, implement, and analyze algorithms to solve complex data problems efficiently. Topics covered include OOP principles, arrays, linked lists, stacks, queues, trees, graphs, hash tables, searching and sorting algorithms, and recursion. Through hands-on programming in computing languages, the course emphasizes both theoretical concepts and practical problem-solving skills essential for working with large datasets.

Course Learning Objectives:

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

1. Understand object-oriented programming concepts and their role in designing reusable and modular data structures and algorithms.
2. Grasp the significance of data structures and algorithms in solving computational and analytical problems.
3. Implement core data structures like arrays, linked lists, stacks, queues, trees, and graphs using OOP principles.
4. Evaluate algorithm performance using Big-O notation for time and space complexity.
5. Apply fundamental sorting and searching algorithms in practical scenarios.
6. Leverage hash tables for efficient data storage and retrieval.
7. Solve recursive problems using divide-and-conquer strategies.
8. Develop and implement graph traversal and shortest path algorithms.
9. Write efficient, optimized, and modular code for real-world data analytics challenges.

Course Contents:

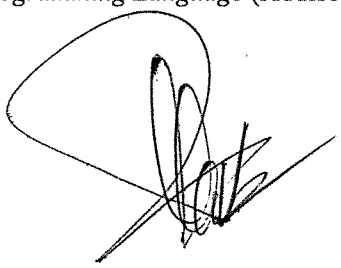
1. *Object-Oriented Programming Concepts* - Basics of OOP: Classes, objects, encapsulation, inheritance, polymorphism; Importance of OOP in designing reusable and modular data structures; Implementing data structures using OOP concepts
2. *Introduction to Data Structures and Algorithms* - Relevance to data analytics; Programming languages for algorithmic implementation
3. *Arrays and Linked Lists* - Operations on single and multidimensional arrays; Implementation of singly and doubly linked lists
4. *Stacks and Queues* - Stack operations: Push, pop; Queue types: FIFO, priority queues
5. *Recursion and Divide-and-Conquer* - Recursive problem-solving basics; Algorithms: Binary search, quicksort, mergesort
6. *Sorting and Searching Algorithms* - Sorting: Bubble sort, insertion sort, selection sort; Searching: Linear search, binary search
7. *Trees and Binary Search Trees (BST)* - Tree traversal: Inorder, preorder, postorder; Operations: Insertion, deletion, searching in BST
8. *Graphs and Graph Algorithms* - Representations: Adjacency matrix, adjacency list; Traversals: Depth-first search (DFS), breadth-first search (BFS); Shortest path algorithms: Dijkstra's, Bellman-Ford
9. *Hash Tables and Hashing Techniques* - Hash functions and collision resolution strategies; Practical applications
10. *Algorithm Complexity and Optimization* - Notations: Big-O, Big-Theta, Big-Omega; Space and time complexity analysis
11. *Applications in Data Analytics* - Using data structures for large-scale data processing; Efficient algorithms for analytics

Recommended Textbooks:

1. Cormen, T. H., Leiserson, C. E., Rivest, R. L., & Stein, C. - *Introduction to Algorithms* (MIT Press).
2. Goodrich, M. T., & Tamassia, R. - *Data Structures and Algorithms in Python* (Wiley).
3. Aho, A. V., Hopcroft, J. E., & Ullman, J. D. - *Data Structures and Algorithms* (Pearson).
4. Lafore, R. - *Data Structures and Algorithms in Java* (Pearson).
5. Tenenbaum, A. M. - *Data Structures Using C and C++* (Pearson).

Suggested Readings:

1. Dasgupta, S., Papadimitriou, C., & Vazirani, U. - *Algorithms* (McGraw-Hill).
2. Weiss, M. A. - *Data Structures and Algorithm Analysis in C++* (Pearson).
3. Narasimha Karumanchi - *Data Structures and Algorithms Made Easy* (Career Monk Publications).
4. Zed Shaw - *Learn Python 3 the Hard Way* (Addison-Wesley).
5. Miller, B., & Ranum, D. - *Problem Solving with Algorithms and Data Structures Using Python* (Franklin, Beedle & Associates).
6. Stroustrup, B. - *The C++ Programming Language* (Addison-Wesley).



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Course Outlines for General Education Subjects

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
   a) The Fables of Bidpai
   b) The Lion and the Bull
   c) The Ring-dove
   d) The Owls and the Crows
   e) Selected poem from Bang-i-Dara

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

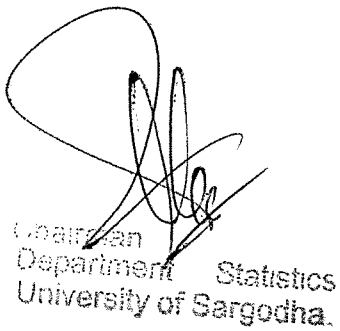
3. Epic
   a) THE SHĀHNĀMA OF FIRDAUSI

Recommended Books

1. John T. P. (1876). The Gulistan; or, Rose Garden of Shaikh Muslihu'd- DīnSa'dī of Shīrāz. London: Wm. II. Allen.
2. Chishti, Y.S. (1991). Sharaḥ-ibāng-idarā. Lāhaur: Maktaba-ita'mīr-iinsāniyat

Suggested Readings

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: MedinaPublishing, Limited.



URCG-5114 **Basic Science** 3(2-1)

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)

Course Contents

1. Life and Its Characteristics: Definition and properties of life, features of living organisms.
2. Natural Science: Overview, significance, interdisciplinary connections.
3. Biology and Its Branches: Study of living organisms, branches like botany, zoology, microbiology, genetics, and ecology.
4. Importance of Flora and Fauna in Biodiversity: Ecological balance, impact on stability and human well-being.
5. Importance of Natural Compounds: Use in medicine, healthcare, and daily living.
6. Latest Developments in Natural Sciences (Biotechnology): Genetic engineering, applications in various fields.
7. Ecosystem and Its Components: Definition, structure, producers, consumers, decomposers.
8. Environment and Its Components: Physical, chemical, biological components, human impact.
9. Pollutants and Their Effects: Types, environmental issues like greenhouse effect, global warming, acid rain, pollution, ozone depletion.
10. Introduction to Microorganisms: Overview, classification of bacteria, fungi, viruses, and their roles.

Practical

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

Recommended Books

1. 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:

1. 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 **Scienceof Society-I** **2 (2-0)**

Course Brief

Thiscoursewillintroducestudentswiththesubjectmatterofsocialscience,itsscope,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 onPakistani state and society, students will encounter theoretical concepts and methods from numeroussocial science disciplines, including sociology, politics, economics anthropology and psychology andmake them learn to think theoretically by drawing on examples and case studies from our own socialcontext. Students will be introduced to the works of prominent social theorists from both western andnon-westerncontexts.Instructionwillincludetheuseofwrittentexts,audio-visual aidsandfield visits.

Learning Outcomes

1. Introducestudentwiththenatureofhumansocialbehaviorandfoundationsofhumangrouplife
2. Analyze the reciprocal relationship between individuals and society.
3. Make students aware of the nature of societies existing in the modern world.
4. Familiarize students with the philosophy of knowledge in social sciences.
5. Introduce students to the works of prominent theorists explaining human group behavior.
6. Help students understand the foundations of society, including culture, socialization, politics, and economy.
7. Introduce students to various dimensions of social inequalities related to gender, race, ethnicity, and religion.
8. Make students aware of the themes related to social science in a local context.
9. Help them recognize the difference between the objective identification of empirical facts and the 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, post-industrial society
2. **Philosophy of Knowledge in Social Science and Social Inquiry**
   - Understanding social phenomena
   - Alternative ways of knowing
   - Science as a source to explore social reality
   - Objectivity and value-free research
   - Positivism vs. Interpretivism
   - Qualitative vs. Quantitative research
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, and heterogeneity

4. **Social Stratification and Social Inequality**
   - Dimensions of inequality, social class
   - Gender, race, religion, ethnicity, caste
   - Patterns of social stratification in Pakistan
   - Class and caste systems in agrarian society
   - Ascription vs. Achievement, meritocracy
   - Global stratification in the modern world, global patterns of inequality
5. **Personality, Self, and Socialization**
   - Concept of self, personality
   - Nature vs. Nurture, biological vs. social influences
   - 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's participation in politics, economy, and education
   - Toward a gender-sensitive society, gender mainstreaming
7. **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 ed.). 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., & Swedberg, R. *The Handbook of Economic Sociology*, Chapter 1: "Introducing Economic Sociology," Princeton University Press.
6. *Systems of Stratification* | Boundless Sociology. 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.
8. Zaidi, S. A. (2015). *Issues in Pakistan's Economy: A Political Economy Perspective*. Oxford University 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., & Swedberg, R. *The Handbook of Economic Sociology*, Chapter 1: "Introducing Economic Sociology," Princeton University Press.

URCG-5118 **FunctionalEnglish** **3(3-0)**

Course Brief

The course aims to help students understand the goals of effective writing, focusing on creating clear, organized, and impactful content. It emphasizes the mastery of grammatical and academic writing skills. Students will learn argumentative writing techniques and how to support their arguments with facts, examples, and statistical evidence. The course will also teach students how to convey knowledge and ideas objectively and persuasively. Additionally, it will cover ethical considerations in academic writing, such as citation, plagiarism, formatting, and referencing, as well as the technical aspects of proper referencing.

Contents

1. Developing Analytical Skills
2. Transitional Devices (words, phrases, and expressions)
3. Development of Ideas in Writing
4. Reading Comprehension
5. Precis Writing
6. Developing Arguments
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 an 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 and Skills* (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). *Longman Grammar 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: Oxford University Press.

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URCG-5119 **ExpositoryWriting** **3 (3-0)**

Course Brief

This course equips undergraduates with the skills needed to become effective writers and readers of English. It focuses on developing fundamental language abilities, particularly writing, to help students communicate confidently in both oral and written English beyond the classroom. The course is structured into five units and utilizes a Project-Based Learning approach. Each unit emphasizes 21st-century skills, self-reflection, and active community engagement. By the end of the course, students will have developed communication skills as reflective and self-directed learners, engaged with various stages of the writing process, and enhanced their analytical and problem-solving skills to address community-specific challenges.

Contents

1. **Self-Reflection**
   - Introduction to the basics of the writing process
   - Steps of essay writing
   - Prewriting activities: Brainstorming, listing, clustering, and freewriting
   - Practicing essay outlining
2. **Personalized Learning**
   - Learning process, learning styles, goal setting, and creating a learning plan
3. **Oral Presentation**
   - Structure and significance, content selection, slide presentation, and peer review
4. **Critical Reading Skills**
   - Introduction to authentic reading (e.g., Dawn newspaper and non-specialist academic 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 and drafting research questions
   - Drafting interview/survey questions for community research (in English or L1)
   - Critical reading, presenting interview/survey information, fieldwork
   - Writing a Community Engagement Project
6. **Letter to the Editor**
   - Types, format, and purpose of letters to the editor
   - Steps involved in writing a letter to the editor

Recommended Books

1. Bailey, S. (2011). *Academic Writing: A Handbook for International Students* (3rd ed.). New York: Routledge.
2. Swales, J. M., & Feak, C. B. (2012). *Academic Writing for Graduate Students: Essential Tasks and 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.

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General Education Cluster: Quantitative Reasoning

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

This is an introductory-level undergraduate course that focuses on the fundamentals related to the quantitative concepts and analysis. The course is designed to familiarize students with the basic concepts of mathematics and statistics and to develop students' abilities to analyze and interpret quantitative information. Through a combination of theoretical concepts and practical exercises, this course will also enable students cultivate their quantitative literacy and problem solving skills while effectively expanding their academic horizon and breadth of knowledge of their specific major / field of study.

Course Learning Outcomes

By the end of this course, students shall have:

1. Fundamental numerical literacy to enable them work with numbers, understand their meaning and present data accurately;
2. Understanding of fundamental mathematical and statistical concepts;
3. Basic ability to interpret data presented in various formats including but not limited to tables, graphs, charts, and equations etc.

Contents

1. Numerical Literacy:
    i. Numbers system and basic arithmetic operations;
    ii. Units and their conversions, dimensions, area, perimeter and volume;
    iii. Rates, ratios, proportions and percentages;
    iv. Types and sources of data;
    v. Measurement scales;
    vi. Tabular and graphical presentation of data;
    vii. Quantitative reasoning exercises using number knowledge.

2. Fundamental mathematical concepts:
    i. Basics of geometry (lines, angles, circles, polygons etc.);
    ii. Sets and their operations;
    iii. Relations, functions, and their graphs;
    iv. Exponents, factoring and simplifying algebraic expressions;
    v. Algebraic and graphical solutions of linear and quadratic equations and inequalities;
    vi. Quantitative reasoning exercises using fundamental mathematical concepts.

3. Fundamental Statistical Concepts:
    i. Population and sample;
    ii. Measures of central tendency, dispersion and data interpretation;
    iii. Rules of counting (multiplicative, permutation and combination);
    iv. Basic probability theory;
    v. Introduction to random variables and their probability distributions;
    vi. Quantitative reasoning exercises using fundamental statistical concepts.

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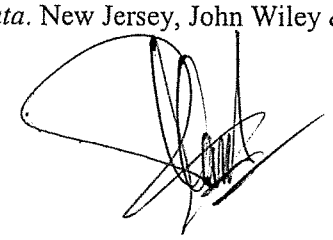
Recommended Texts

1. Sevilla, A., & Somers, K. (2012). *Quantitative reasoning: tools for today's informed citizen*. New Jersey, John Wiley & Sons.
2. Burzynski, D., & Ellis, W. (2008). *Fundamentals of mathematics*. USA, Saunders College Publishing.

Suggested Readings

1. Zaslow, E. (2020). *Quantitative reasoning: thinking in numbers*. Cambridge, Cambridge University Press.
2. de Mesquita, E. B., & Fowler, A. (2021). *Thinking clearly with data: A guide to quantitative reasoning and analysis*. New Jersey, Princeton University Press.
3. Bennett, J., & Briggs, W. (2019). *Using & understanding mathematics: a quantitative reasoning approach*. Pearson.
4. Rosen, K. H., & Krithivasan, K. (2012). *Discrete mathematics and its applications* (Vol. 6). New York: McGraw-Hill.
5. Chatfield, C. (2018). *Statistics for technology: a course in applied statistics*. Routledge.
6. Lock, R. H., Lock, P. F., Morgan, K. L., Lock, E. F., & Lock, D. F. (2020). *Statistics: Unlocking the power of data*. New Jersey, John Wiley & Sons.



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General Education Cluster: Quantitative Reasoning

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

This is a sequential undergraduate course that focuses on logical reasoning supported with mathematical and statistical concepts and modeling / analysis techniques to equip students with analytical skills and critical thinking abilities necessary to navigate the complexities of modern world. The course is designed to familiarize students with the quantitative concepts and techniques required to interpret and analyze numerical data and to inculcate ability in students the logical reasoning to construct and evaluate arguments, identify fallacies, and think systematically. Keeping the pre-requisite course of Quantitative reasoning (I) as its base, this course will enable students further their quantitative. Logical and critical reasoning abilities to complement their specific major field of study

Course Learning Outcomes

By the end of the course, student shall have:

1. Understanding of logic and logical reasoning:
2. Understanding the basic quantitative Modeling and Analyses.
3. Logical reasoning skills and abilities to apply them to solve quantitative problems and evaluate arguments;
4. Ability to critically evaluate quantitative information to make evidence based decisions through appropriate computational tools.

Contents

1. Logic, Logical and Critical Reasoning:
    i. Introduction and importance of logic,
    ii. Introductive, deductive and abductive approaches of reasoning,
    iii. Propositions, arguments (valid; invalid), logical connectives, truth tables and propositional equivalences,
    iv. Logical fallacies,
    v. Venn Diagrams,
    vi. Predicates and quantifiers,
    vii. Quantitative reasoning exercises using logical reasoning concepts and techniques.

2. Mathematical Modeling and Analyses:
    i. Introduction to deterministic models,
    ii. Use of linear function for modeling in real-world situations,
    iii. Modeling with the system of linear equation and linear solutions,
    iv. Elementary introduction to derivatives in mathematical modeling,
    v. Linear and exponential growth and decay models,
    vi. Quantitative reasoning exercises using mathematical modeling.

3. Statistical Modeling and Analyses:
    i. Introduction to probabilistic models,
    ii. Bivariate analysis, scatter plots,
    iii. Simple linear regression model and correlation analysis,
    iv. Basics of estimation and confidence interval,
    v. Testing of hypothesis (z-test; t-test),
    vi. Statistical inference in decision making,
    vii. Quantitative reasoning exercise using statistical modeling.

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Recommended Texts

1. Bennett, J., & Briggs, W. (2019). *Using & understanding mathematics: a quantitative reasoning approach*. Pearson.
2. Rosen, K. H., & Krithivasan, K. (2012). *Discrete mathematics and its applications* (Vol. 6). New York: McGraw-Hill.

Suggested Readings

1. Epp, S. S. (1990). *Discrete mathematics with applications*. Wadsworth Publ. Co..
2. Budnick, F. S., Quinn, S., Bowser, K., & Flaherty, E. H. (1993). *Applied mathematics for business, economics, and the social sciences*. New York: McGraw-Hill.
3. Bluman, A. (2014). *Elementary Statistics: A step by step approach 9e*. McGraw Hill.
4. Mann, P. S. (2007). *Introductory statistics*. John Wiley & Sons.
5. Babones, S. (2013). Applied statistical modeling. *(No Title)*.
6. Green, S. W., Wolf, I.k., Stewrat, B. W. (2022). SAT Study Guide Premium. Barrons

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URCG-5105 **Islamic Studies (Compulsory)** **2(2-0)**

Introductory/compulsory foundation course

Islamic Studies engages in the study of Islam as a textual tradition inscribed in the fundamental sources of Islam; Qur'aan and Hadith, history and particular cultural contexts. The area seeks to provide an introduction to and a specialization in Islam through a large variety of expressions (literary, poetic, social, and political) and through a variety of methods (literary criticism, hermeneutics, history, sociology, and anthropology). It offers opportunities to get fully introductory foundational basis of Islam in fields that include Qur'aanic studies, Hadith and Seerah of Prophet Muhammad (PBUH), Islamic philosophy, and Islamic law, culture and theology through the textual study of Qur'aan and Sunnah.

- To make students understand the relevance and pragmatic significance of Islam in theirlives.
- To make learners comprehend the true spirit of Islam with reference to modernworld.
- To generate a sense of Islamic principles as a code of living that guarantee the effective solutions to the current challenges ofbeing.
- To provide Basic information about IslamicStudies
- To enhance understanding of the students regarding IslamicCivilization
- To improve Students skill to perform prayers and otherworships
- To enhance the skill of the students for understanding the issues related to faith and religious life.

Contents

1.Introduction to Qur'aanic Studies تعارف قرآن مجید

1) Basic Concepts of Qur'aan قرآن مجید کا بنیادی تعارف

2) History of the compilation of Qur'aa تاریخ جمع وتدوین قرآن مجید

3) Uloom-ul-Qur'aan علوم القرآن

مطالعہ قرآن (تعارف قرآن مجید، منتخب آیات کا ترجمہ و تفسیر: سورۃ البقرہ آیات 1-5، 284-286؛ سورۃ الحجرات آیات 1-18؛ سورۃ الفرقان آیات 63-77؛ سورۃ المومنون آیات 1-11؛ سورۃ الاحزاب آیات 6، 21، 32- 33، 40، 56- 59؛ سورۃ الانعام آیات 151-153؛ سورۃ الصف آیات 1- 14؛ الحشر آیات 18- 20؛ آل عمران آیات 190- 192؛ النحل آیات 12-14؛ لقمن آیت 20، حم السجدہ آیت 53

2. Introduction to Hadith تعارف حدیث

1) Legal Status of Hadith حدیث کی قانونی حیثیت

2) History of the compilation of Hadith تاریخ جمع وتدوین حدیث

3) Classifications of Hadith حدیث کی اقسام

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متن، حدیث: 1 درج ذیل موضوعات پر احادیث کا مطالعہ

1۔اعمال کا اجر نیت پر منحصر ہے۔2۔بہترین انسان قرآن کا طالب علم اور اس کا معلم ہے۔3۔کتاب وسنت گمراہی سے بچنے کا ذریعہ ہیں 4۔ارکان اسلام 5۔اسلام، ایمان، احسان اور قیامت کی نشانیاں، 6۔بچوں کو نماز کی تلقین 7۔دین کا گہرا فہم اللہ کی خاص عنایت ہے 8۔حصول علم، تلاوتِ قرآن اور عمل کی اہمیت وفضیلت، 9۔روز محشر میں ہونے والا محاسبہ، 10۔حقوق اللہ کے ساتھ ساتھ حقوق العباد کا لحاظ رکھنا بھی لازم ہے 11۔حسن خلق کی عظمت اور فحش وبدگوئی کی مذمت 12۔دنیا وآخرت کی بھلائی کی ضامن چار چیزیں، 13۔ہلاک کر دینے والی سات چیزیں، 14۔بے عمل مبلغ کا عبرت ناک انجام 15۔ہر شخص نگران ہے اور ہر شخص مسئول

3. Sirah of the Prophet (PBUH)	سیرت النبی ﷺ
1. Significance of Seerah Studies	مطالعہ سیرت کی ضرورت واہمیت
2. Prophetic principles of Character building	تعمیر سیرت وشخصیت کا نبوی منہاج

اقامت دین کا نبوی طریق کار، اقامتِ دین بعہدِ خلافت راشدہ، میثاق مدینہ، خطبہ حجۃ الوداع، اخلاقی تعلیمات، تشکیل اجتماعیت اور اسوہ حسنہ، قرآن مجید میں سیرت سرور عالم کا بیان، غزواتِ نبوی ﷺ کے مقاصد وحکمتیں

4. Islamic Culture & Civilization	اسلامی تہذیب وتمدن
1) Basic Concepts of Islamic Civilization	اسلامی تہذیب کا مفہوم
2) Historical evaluation of Islamic Civilization	اسلامی تہذیب کا تاریخی ارتقاء
3) Salient feature of Islamic Civilization	اسلامی تہذیب کی نمایاں خصوصیات
4) Islamic Civilization and ContemporaryIssues	اسلامی تہذیب وتمدن اور معاصر مسائل

اسلامی تہذیب کے عوامل وعناصر، اسلامی تہذیب کے علمی، معاشرتی اور سماجی اثرات، تہذیبوں کے تصادم کے نظریے کا تنقیدی جائزہ، تہذیبی تصادم کے اثرات و نتائج، طبعی، حیاتیاتی اور معاشرتی علوم میں مسلمانوں کا کردار، نامور مسلمان سائنسدان

Pre-Requisite: Nil

Recommended Books

1) Hameed ullahMuhammad, —Emergence ofIslam ,IRI,Islamabad
2) Hameed ullah Muhammad, —Muslim Conduct ofState
3) Hameed ullah Muhammad, _Introduction toIslam
4) Ahmad Hasan, —Principles of Islamic Jurisprudence, Islamic Research Institute, International Islamic University, Islamabad (1993)
5) Dr.Muhammad Zia-ul-Haq,—Introduction to Al Sharia Al Islamia, Allama Iqbal Open University, Islamabad(2001)
6) Dr. Muhammad Shahbaz Manj, Teleeemat-e- Islam

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

Contents

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

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University of Sargodha

URCG-5128:Pakistan Studies-2(2-0)

Course Description:
This course is designed to provide students with a comprehensive exploration of Pakistan's identity, encompassing its geographical, historical, and cultural dimensions. It delves into the diverse landscapes, ancient civilizations, and rich cultural heritage that define Pakistan. Additionally, it examines the country's democratic transitions, military interventions, and socio-economic developments. The aim is to develop a nuanced understanding of Pakistan's past, present, and potential future trajectories while enabling students to critically evaluate the complex dynamics shaping the nation's development.

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

1. Gain enhanced knowledge of the geographical, historical, and political aspects of Pakistan.
2. Understand the societal and cultural diversity of Pakistan.
3. Analyze and explain Pakistan's socio-economic developments.
4. Explore contemporary issues and challenges faced by Pakistan and their implications for its future.

Course Outline:

1. **Introduction to Pakistan**
   - Geographical location and significance.
   - Historical background: Ancient civilizations in the region.
   - Factors leading to the creation of Pakistan.
2. **Political History of Pakistan**
   - Formative phase of Pakistan.
   - Military interventions and democratic transitions.
3. **Geography of Pakistan**
   - Physiography: Mountains, plains, plateaus, deserts, valleys, and coastal areas.
   - River systems: Indus River and its tributaries.
   - Climatic regions of Pakistan.
4. **Society and Culture of Pakistan**
   - Socio-cultural diversity.
   - Languages and literature of Pakistan.
5. **Economic Development of Pakistan**
   - Agriculture and industrial sectors.
   - Economic challenges and prospects.
6. **Contemporary Issues**
   - Foreign relations of Pakistan.
   - Security challenges: Terrorism, extremism, and regional conflicts.
   - Environmental problems and sustainable development (SDGs).
   - Media and social change.

Recommended Readings

1. *Jinnah of Pakistan* by Stanley Wolpert
2. *The Sole Spokesman: Jinnah, the Muslim League, and the Demand for Pakistan* by Ayesha

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3. *The Struggle for Pakistan* by Ishtiaq Hussain Qureshi
4. *Pakistan: The Formative Phase, 1857–1947* by Khalid B. Sayeed
5. *Pakistan Studies: A Book of Readings* by Sikandar Hayat
6. *Constitutional and Political History of Pakistan* by Hamid Khan
7. *Trek to Pakistan* by Ahmad Saeed and Kh. Mansur Sarwar
8. *Pakistan: A Modern History* by Ian Talbot
9. *Politics in Pakistan: The Nature and Direction of Change* by Khalid B. Sayeed
10. *Physical Geography of Pakistan* by Umar Jahangir
11. *A Geography of Pakistan: Environment, People, and Economy* by Fazle Karim Khan
12. *Pakistan's Foreign Policy: A Historical Analysis* by S.M. Burke
13. *Separatism in East Pakistan* by Rizwan Ullah Kokab
14. *Being Pakistani: Society, Culture and the Arts* by Raza Rumi
15. *Pakistan's Cultural Heritage: Socio-Economic and Technological Aspects* edited by Abdul Jabbar Khan
16. *Language and Politics in Pakistan* by Tariq Rahman
17. *Sociology* by Horton and Hunt
18. *Pakistan in the Twentieth Century: A Political History* by Lawrence Ziring
19. *Economic Development of Pakistan* by Ishrat Husain
20. *Issues in Pakistan's Economy* by S. Akbar Zaidi

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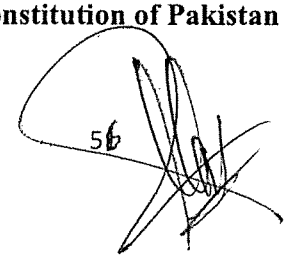
URCG-5122 **Ideology and Constitution of Pakistan** 2(2-0)

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

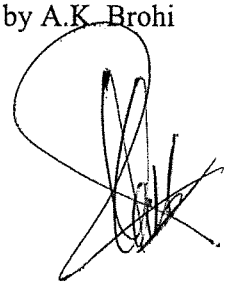
Contents

1. **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.
2. **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
3. **Fundamental rights**
4. **Principles of policy**
5. **Federation of Pakistan**
    - President
    - Parliament
    - The Federal Government
6. **Provinces**
    - Governors
    - Provincial Assemblies T
    - he Provincial Government
7. **The Judicature**
    - Supreme Court
    - High Courts
    - Federal Shariat Courts
    - Supreme Judicial Council
    - Administrative Courts and tribunals
8. **Islamic Provisions in Constitution**
9. **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 revised edition). 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 Publications, 1975.
4. Rizvi, Syed Shabbar Raza. *Constitutional Law of Pakistan: Text, Case Law and Analytical Commentary* (2nd revised edition). 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

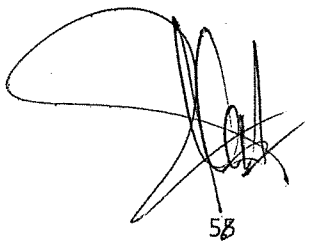
7. Introduction, Overview of Information Technology.
8. Hardware: Computer Systems & Components, Storage Devices.
9. Software: Operating Systems, Programming and Application Software.
10. Databases and Information Systems Networks.
11. File Processing Versus Database Management Systems.
12. Data Communication and Networks.
13. Physical Transmission Media & Wireless Transmission Media.
14. Applications of smart phone and usage.
15. The Internet, Browsers and Search Engines.
16. Websites and their types.
17. Email Collaborative Computing and Social Networking.
18. E-Commerce.
19. IT Security and other issues.
20. Cyber Laws and Ethics of using social media.
21. Use of Microsoft Office tools (Word, Power Point, Excel) or other similar tools depending on the operating system.
22. 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.



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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

1. To enhance the 'entrepreneurial intentions' of the students by improving their natural willingness to start a business.
2. 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.
3. 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.

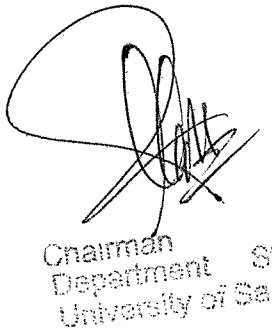
9. **Building a Powerful Marketing Plan**: Building a Guerrilla Marketing Plan, Pinpointing the Target Market, Determining Customer Needs and Wants Through Market Research. Plotting a Guerrilla Marketing Strategy: How to Build a Competitive Edge, Feed Back & Suggestions on Student Project, Islamic Ethics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

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



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

Course Brief

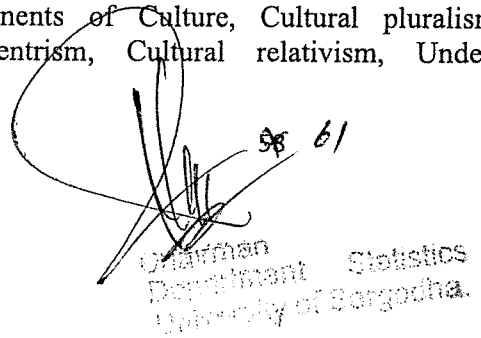
The Civics and Community Engagement course is designed to provide students with an understanding of the importance of civic participation, culture and cultural diversity, basic foundations of citizenship, group identities and the role of individuals in creating positive change within their communities.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

Course Learning outcomes

1. After completing this course, students will be able to
2. Understand the concepts of civic engagement, community development, and social responsibility.
3. Understand rights and responsibilities of citizenship
4. Understand cultural diversity in local and global context
5. Analyze the significance of civic participation in promoting social justice, equity, and
6. democracy.
7. Examine the historical and contemporary examples of successful civic and community engagement initiatives.
8. Identify and assess community needs, assets, and challenges to develop effective strategies for community improvement.
9. Explore the ethical implications and dilemmas associated with civic and community engagement.
10. Develop practical skills for effective community organizing, advocacy, and leadership.
11. Foster intercultural competence and respect for diversity in community engagement efforts.
12. Collaborate with community organizations, stakeholders, and fellow students to design and implement community-based projects.
13. Reflect on personal growth and learning through self-assessment and critical analysis of community engagement experiences.

Course Contents

1. **Introduction to Civics & Community Engagement**
   a. Overview of the course: Civics & Community Engagement
   b. Definition and importance of civics
   c. Key concepts in civics: citizenship, democracy, governance, and the rule of law
   d. Rights and responsibilities of citizens
2. **Citizenship and Community Engagement**
   a. Introduction to Active Citizenship: Overview of the Ideas, Concepts, Philosophy and Skills
   b. Approaches and Methodology for Active Citizenship
3. **Identity, Culture, and Social Harmony**
   a. Concept and Development of Identity, Group identities
   b. Components of Culture, Cultural pluralism, Multiculturalism, Cultural Ethnocentrism, Cultural relativism, Understanding cultural diversity,



Globalization and Culture, Social Harmony,

c. Religious Diversity (Understanding and affirmation of similarities & differences)
d. Understanding Socio-Political Polarization
e. Minorities, Social Inclusion, Affirmative actions

4. **Multi-cultural society and inter-cultural dialogue**
   a. Inter-cultural dialogue (bridging the differences, promoting harmony)
   b. Promoting intergroup contact/ Dialogue
   c. Significance of diversity and its impact
   d. Importance and domains of Inter-cultural dialogue
5. **Active Citizen: Locally Active, Globally Connected**
   a. Importance of active citizenship at national and global level
   b. Understanding community
   c. Identification of resources (human, natural and others)
   d. Utilization of resources for development (community participation)
   e. Strategic planning, for development (community linkages and mobilization)
6. **Human rights, constitutionalism and citizens' responsibilities**
   a. Introduction to Human Rights
   b. Human rights in constitution of Pakistan
   c. Public duties and responsibilities
   d. Constitutionalism and democratic process
7. **Social Institutions, Social Groups, Formal Organizations and Bureaucracy**
   a. Types of Groups, Group identities, Organizations
   b. Bureaucracy, Weber's model of Bureaucracy
   c. Role of political parties, interest groups, and non-governmental organizations
8. **Civic Engagement Strategies**
   a. Grassroots organizing and community mobilization
   b. Advocacy and lobbying for policy change
   c. Volunteerism and service-learning opportunities
9. **Social issues/Problems of Pakistan**
   a. Overview of major social issues of Pakistani society
10. **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. 1. Glencoe McGraw-Hill. (n.d.). Civics Today: Citizenship, Economics, and Youth.
2. 2. Magleby, D. B., Light, P. C., &Nemacheck, C. L. (2020). Government by the People (16th ed.). Pearson.
3. 3. Sirianni, C., & Friedland, L. (2005). The Civic Renewal Movement: Community-Building and Democracy in the United States. Kettering Foundation Press.

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4. 4. Bloemraad, I. (2006). Becoming a Citizen: Incorporating Immigrants and Refugees in the United States and Canada. University of California Press.
5. 5. Kuyek, J. (2007). Community Organizing: Theory and Practice. Fernwood Publishing.
6. 6. DeKieffer, D. E. (2010). The Citizen's Guide to Lobbying Congress. TheCapitol.Net.
7. 7. Rybacki, K. C., & Rybacki, D. J. (2021). Advocacy and Opposition: An Introduction to Argumentation (8th ed.). Routledge.
8. 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. 9. Patterson, T. E. (2005). Engaging the Public: How Government and the Media Can Reinvigorate American Democracy. Oxford University Press.
10. 10. Love, N. S., & Mattern, M. (2005). Doing Democracy: Activist Art and Cultural Politics. SUNY

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Model Course Outline
for the Course Understanding of Quran – I

Course Title: Understanding of Quran – I Course Code: URCG-5129
Course Book: Muallim ul Quran (Volume 1, 2 & 3) by Dr Ubaid ur Rahman
Credit Hours: 1 (0-1)
Contact Hours: 3 per week
Weeks: 15-16 (45-48 hours)

Course Learning Outcomes:

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

1. Develop the ability to understand basic words of the Quran, phrases and sentences that do not contain verbs (unit 1 to 5 of Muallim ul Quran Book) and then sentences having present tense (first half of unit 6 of Muallim ul Quran Book).
2. Acquire a strong foundation for understanding long verses of the Quran with clarity.
3. Comprehend Quranic vocabulary, particles (operative & non operative particles) , compounds (Adjective & Possessive compound), pronouns (singular & plural) and types of plural through hundreds of Quranic sentences.
4. Recognize and understand different styles of Quranic sentences, including nominal sentence, emphatic sentence, double emphatic sentence, negative sentence, interrogative sentence, oath –based sentences.
5. Strengthen understanding of fundamental Quranic linguistic styles, expressions and idioms.
6. Understand at least 30 to 40 % of each page of the holy Quran.

Provision of material, content and books:

- **Paper book**: All volumes are available in printed book form.
- **Tutorial videos:** Teaching video of each lesson available on YouTube.
- **Confirmation Videos:** A complete series of confirmation videos of all lessons is available in which the student can confirm his answers.
- **A flipbook:** A flipbook edition is also accessible.
- **Helping material:** Helping material for the teachers like quizzes, question papers and images is available on website.

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Course Outline:

Weeks	Lectures (1.5 hrs)	Units	Lessons	Assignments/Home Task	Linguistic Rules
1.	1.	1	1-6	Writing the meaning of Quranic words Lesson 1-8	Proper Noun Masculine & Feminine
	2.	1	9-14	Writing the meaning of Quranic words 9-14	Two kinds of plural Concept of (و) "And" Common Noun
2.	1.	1	15-17	Writing the meaning of Quranic words, phrases & translation of Sentences 15-17	Demonstrative Noun (This & That for Masculine (هذا- هذه) Demonstrative Noun (This & That for Feminine) (ذلك- تلك)
	2.	1	18-19 & Revision (Unit 1)	Writing the meaning of Quranic words , phrases & translation of Sentences 17-19 Quiz	Laam for emphasis (لام التأكيد) Superlative Degree like أكبر Revision of all Quranic Sentences
3.	1.	Unit 2	1-3	Writing the meaning of Quranic words, phrases & translation of Sentences 1-3	Emphatic Particle إن Preposition "For" (اللام) Preposition (في)
	2.	2	4-6	Writing the meaning of Quranic words, phrases & translation of Sentences 4-6	Preposition (على- من- إلى)
4.	1.	2	7- 9	Writing the meaning of Quranic words & translation of Sentences 7-9	Preposition (الباء) Absolute Negation Particle Exceptive Particle (لا النافية للجنس)(ما النافية) (إلا)
	2.	2	10-13 & Revision (Unit 2)	Writing the meaning of Quranic words, phrases & translation of Sentences 10-13 Quiz	Subordinating Conjunction(أن), Was (كان), Vocative Particle(حرف النداء)

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5.	1.	Unit 3	1-2	Writing the meaning of Quranic phrases 1-2	Quranic Adjective Compounds (صفة وموصوف)
	2.	3	3-5	Writing the meaning of Quranic phrases & translation of sentences 3-5	Quranic Possessive Construction (مضاف ومضاف إليه)
6.	1.	3	6 -7	Writing the meaning of Quranic phrase translation of sentences 6-7	Quranic Possessive Construction (مضاف ومضاف إليه)
	2.	3	8-10 & Revision (Unit 3)	Writing the meaning of Quranic phrase & translation of sentences 8-10 Quiz	Active Participle (اسم الفاعل), Passive Participle (اسم المفعول), Dual (مثنى)
7.	1.	Unit 4	1-2	Writing the meaning of Quranic phrase & translation of sentences 1-2	Personal Pronoun He(هو المنفصل) Possessive Pronoun His ـه المتصل)
	2.	4	3-4	Writing the meaning of Quranic phrase & translation of sentences 3 -4	Possessive Pronoun with prepositions like في بيته Pronoun "His" with prepositions like فيه، منه، له
8.	1.	4	5-8	Writing the meaning of Quranic sentences 5-8	Personal Pronoun You(أنت المنفصل) Possessive Pronoun Your ك المتصل) Possessive Pronoun with prepositions like في بيتك Pronoun "your" with prepositions like فيك، منك، لك
	2.	Mid Term			

9.	1.	4	9-12	Writing the meaning of Quranic phrases & sentences 9-12	Personal Pronoun She(هي المنفصل) Possessive Pronoun Her ها المتصل) Possessive Pronoun with prepositions like في بيتها Pronoun "Her" with prepositions like لها،
	2.	4	13-16	Writing the meaning of Quranic phrases & sentences 13-16	Personal Pronoun I (انا المنفصل) Possessive Pronoun Her ي المتصل) Possessive Pronoun with prepositions like في بيتيPronoun "My" with prepositions like لي
10.	1	4	17 & Revision Unit 4	Revision of all Quranic sentences of Unit 4 Quiz	Adverb (حال)
	2.	Unit 5	1-2	Writing the meaning of Quranic phrases & sentences 1-2	Masculine Plural جمع المذكر السالم و جمع المذكر السالم المسبوق بحرف الجر
11.	1.	5	3-4	Writing the meaning of Quranic phrases & sentences 3-4	Possessive Construction with Plurals جمع المذكر السالم المسبوق بالإضافة
	2.	5	5-6	Writing the meaning of Quranic phrases, sentences & verses 5-6	Personal Pronoun They (هم المنفصل) Possessive Pronoun Their هم المتصل)
12.	1.	5	7-8	Writing the meaning of Quranic phrases, sentences & verses 7-8	Possessive Pronoun with prepositions like في بيتهمPronoun "Their" with prepositions like لهم
	2.	5	9-11	Writing the meaning of Quranic phrases, sentences & verses 9-11	Personal Pronoun You (أنتم المنفصل) Possessive Pronoun Your كم المتصل) Possessive Pronoun with prepositions

					في بيتكم like
13.	1.	5	12-14	Writing the meaning of Quranic phrases & sentences & verses 12-14	Pronoun "Your" with prepositions like لكم Personal Pronoun We (نحن المنفصل) Possessive Pronoun Our نا المتصل)
	2.	5	15-16	Writing the meaning of Quranic sentences & verses 15-16	Possessive Pronoun with prepositions like في بيتنا Pronoun "Our" with prepositions like لنا
14.	1.	5	17-18	Writing the meaning of Quranic sentences & Verses 17-18	Demonstrative Pronoun These, Those (هؤلاء- أولئك)
	2.	5	19-23	Writing the meaning of Quranic sentences & Verses 19-23	(ما / إلا، إن / إلا، إنما، ليس، ما ، أ/أم، أن، بل، كأن) (ألا، أليس، اليوم، يومئذ، سبحان، مابينهما، قل، إذن، بئس، نعم، كلا، ما أدراك، حسب، أعلم ب، مصير ، مرجع، دينا(تمييز)
15.	1.	5	Revision Unit 5	Quiz	
	2.	5	1-3 (till Page 16)	Writing the meaning of Quranic Verbs &Translation of Quranic Sentences & Verses (1-3)	Introduction of Present Tense(فعل مضارع) & Verbal Sentence (جملة فعلية) Present Tense الفعل المضارع صيغة المفرد يعلم
16.	1.	6	3 (From Page 17) & 4 -5	Translation of Quranic Sentences & Verses 3-5	Present Tense الفعل المضارع صيغة المفرد يعلم
	2.	6	6	Translation of Quranic Sentences & Verses	Present Tense الفعل المضارع صيغة الجمع يعلمون

Model Course Outline
for the Course Understanding of Quran – II

Course Title: Understanding of Quran – II Course Code: URCG-5130
Course Book: Muallim ul Quran (Volume 3, 4 & 5) by Dr Ubaid ur Rahman
Credit Hours: 1 (0-1)
Contact Hours: 3 per week
Weeks: 15-16 (45-48 hours)

Course Learning Outcomes:

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

1. Directly comprehend hundreds of Quranic sentences & verses.
2. Understand at least 80 to 85 % of each page of the holy Quran.
3. Understand common verses across different Quranic topics.
4. Achieve proficiency in the basic and advance linguistic aspects of the Arabic language.
5. Understand the difference between Quranic verbs in various forms, such as present, past and imperative.
6. Develop the ability to understand long verses of the holy Quran independently and then comprehend their interpretation.

Provision of material, content and books:

- **Paper book**: All volumes are available in printed book form.
- **Tutorial videos:** Teaching video of each lesson available on YouTube.
- **Confirmation Videos:** A complete series of confirmation videos of all lessons is available in which the student can confirm his answers.
- **A flipbook:** A flipbook edition is also accessible.
- **Helping material:** Helping material for the teachers like quizzes, question papers and images is available on website.

Course Outline:

Weeks	Lectures	Units	Lessons	Assignments/Home Task	
1.	1.	6	6	Understanding & Translation of Verses	Present Tense صیغۃ جمع مذکر غائب مثل یعبدون
	2.	6	7-8	Understanding & Translation of Verses	Present Tense صیغۃ جمع مذکر غائب مثل یعبدون
2.	1.	6	9-10	Understanding & Translation of Verses	Present Tense صیغۃ مفرد مذکر مخاطب (تعبد) وجمع مذکر مخاطب (تعبدون)
	2.	6	11-12	Understanding & Translation of Verses	Present Tense صیغۃ جمع مذکر مخاطب (تعبدون)

					صيغة المتكلم (أعبد)
3.	1.	6	13	Understanding & Translation of Verses	Present Tense صيغة جمع المتكلم (نعبد)
	2.	6	14-15	Understanding & Translation of Verses	Negative Imperative صيغة المفرد وصيغة الجمع , لا تعبدْ، لا تعبدوا
4.	1.	6	16-17	Understanding & Translation of Verses	Conditional Sentences & masdar moawal (مصدر موؤل)
	2.	6	18-19	Understanding & Translation of Verses	Laam uttaleel (لام التعليل) & Laam ul jhood(لام الجحود)
5.	1.	6	20-21	Understanding & Translation of Verses	Present with object pronouns & Passive Voice
	2.	6	Revision (Unit 6)	Quiz	
6.	1.	Unit 7	1 (sec 1-3)	Understanding & Translation of Verses	Past Tense صيغة المفرد الغائب
	2.	6	1 (Sec 4-5)	Understanding & Translation of Verses	Past Tense صيغة المفرد للغائب
7.	1.	6	1 (Sec 5-6)	Understanding & Translation of Verses	Past Tense صيغة المفرد للغائب
	2.	6	1 (Sec 7-9)	Understanding & Translation of Verses	Past Tense صيغة المفرد للغائب
8.	1.	7	Revision	Understanding & Translation of Verses QUIZ	Past Tense صيغة المفرد للغائب
	2.	MID TERM			
9.	1.	7	2 (sec 1-2)	Understanding & Translation of Verses	Past Tense صيغة الجمع للغائب عبدوا
	2.	7	2 (sec 3)	Understanding & Translation of Verses	Past Tense صيغة الجمع للغائب عبدوا
10.	1.	7	2 (sec 4-5)	Understanding & Translation of Verses	Past Tense صيغة الجمع للغائب عبدوا
	2.	7	2 (sec 6-7)	Understanding & Translation of Verses	Past Tense صيغة الجمع للغائب عبدوا
11.	1.	7	3 (sec 1-2)	Understanding & Translation of Verses	Past Tense صيغة الجمع للمتكلم عبدنا

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	2.	7	3 (sec 2-3)	Understanding & Translation of Verses	Past Tense صیغۃ الجمع للمتکلم عبدنا
12.	1.	7	3 (sec 3-4)	Understanding & Translation of Verses	Past Tense صیغۃ الجمع للمتکلم عبدنا
	2.	7	3 (sec 4-5)	Understanding & Translation of Verses	Past Tense صیغۃ الجمع للمتکلم عبدنا
13.	1.	7	4 (sec 1-2-3)	Understanding & Translation of Verses	Past Tense صیغۃ الجمع للمخاطب عبدتم
	2.	7	4 (sec 4-5)	Understanding & Translation of Verses	Past Tense صیغۃ الجمع للمخاطب عبدتم
14.	1.	7	5-6	Understanding & Translation of Verses Quiz	Past Tense صیغۃ المتکلم والمخاطب عبدتُ ، عبدت
	2.	7	7	Understanding & Translation of Verses	Past Tense صیغۃ المؤنث للغائب عبدَتْ
15.	1.	7	8	Understanding & Translation of Verses	Passive Voice (Past Tense) فعل مجھول للمفرد
	2.	7	9	Understanding & Translation of Verses	Passive Voice (Past Tense) فعل مجھول الجمع
16.	1.	8	1-4	Understanding & Translation of Verses	Imperative Verb for singular فعل الأمر للمفرد
	2.	7	5-8	Understanding & Translation of Verses	Imperative Verb for plural فعل الأمر للجمع

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

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 کروانا کہ 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 حالات زندگی	۱۔ حضور صلی اللہ علیہ وسلم کا خاندانی حسب ونسب ۲۔ پیدائش اور ابتدائی تربیت ۳۔ لڑکپن اور جوانی کے حالات 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 ومعلم
7	خصائص النبیؐ	بحیثیت تاجر
8	خصائص النبیؐ	بحیثیت سربراہ ریاست
9	خصائص النبیؐ	ذاتی محاسن اور عالمگیر اثرات

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

نصابی کتب

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

حوالہ جاتی کتب

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

Ethics-I URCG-5131 1 (0-1)

1-Course Description

The Ethics-I course is designed to provide students with a comprehensive understanding of ethical principles, practices, and theories in various societal contexts. Throughout this degree program, students will explore the complexities of ethical theories of semitic and non-semitic religions along with decision-making and develop critical thinking skills to navigate moral dilemmas. This course will also enable the students to interact with others religious identities with humanistic, inclusive and holistic approach

2- Learning Objectives

This course aims to:

1. Introduce students to the fundamental concepts, scope, and importance of ethics.
2. Explore the relationship between law, morality, and social values.
3. Develop a clear understanding of virtuous and immoral ethics and their impact on individual and collective life.
4. Study the role of major religious figures in the moral development of human society and enable students to apply ethical principles for personal development, conflict resolution, and social harmony.

3- Learning Outcomes

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

1. Students will be able to identify and analyze major ethical theories, values, and their scope in social and individual life.
2. Differentiate between law and ethics, and analyze their interrelationship.
3. Identify types of virtuous and immoral ethics and assess their social impacts.
4. Examine the ethical teachings of major religions and their relevance in contemporary society.
5. Apply ethical principles to address modern challenges in personal and professional life.

4-Course Structure

1. Interactive lectures, Group discussions and debates
2. Reflection papers and presentations
3. Assignments and Quiz

Course Contents

Unit 1: Introduction and Fundamentals of Ethics

1. Literal and terminological definition of ethics
2. Literal and terminological definition of values
3. Relationship between law and ethics
4. Need, importance, and scope of ethics

Unit 2: Types of Ethics and Their Impact on Society

- Virtuous ethics: concept, types, benefits, and outcomes
- Immoral ethics: concept, types, and harms
- Role of ethics in social refinement and establishment of peace

Unit 3: Virtuous Ethics (Akhlaq-e-Hasanah)

- Concept, need, and importance of virtuous ethics
- Scope of virtuous ethics in the light of religions
- Major virtues in revealed and non-revealed religions
- Impact of virtuous ethics on individual and collective life

Unit 4: Immoral Ethics (Akhlaq-e-Razilah)

- Concept of immoral ethics
- Social problems caused by immoral ethics
- Practical consequences of immoral ethics
- Major vices in revealed and non-revealed religions

Unit 5: Role of World Religious Figures in Moral Development

- Prophet Moses (AS): introduction, miracles, and role in moral refinement
- Prophet Jesus (AS): introduction, miracles, and role in moral refinement
- Prophet Muhammad (ﷺ): introduction, miracles, and role in moral refinement

Textbook

1. Izutsu, T. (2002). *Ethico-Religious Concepts in the Qur'an*. McGill-Queen's University Press.

Suggested Readings

1. Gert, B. (2005). *Morality: Its Nature and Justification*. Oxford University Press.
2. MacIntyre, A. (2007). *After Virtue: A Study in Moral Theory*. University of Notre Dame Press.
3. Al-Ghazali, Abu Hamid (2001). *The Alchemy of Happiness*. Islamic Texts Society.
4. Nasr, S. H. (1994). *The Heart of Islam: Enduring Values for Humanity*. Harper One.
5. Beauchamp, T. L., & Childress, J. F. (2019). *Principles of Biomedical Ethics*. Oxford University Press.
6. Hasan, Z. (2010). *Ethics in Islam: Key Concepts and Contemporary Challenges*. Islamic Research Institute.

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Ethics-II URCG-5132 1 (0-1)

1-Course Description

The course *Ethics-II* is designed to provide students with a deeper understanding of ethical principles and practices from both Semitic and non-Semitic religions, as well as their application in professional and social contexts. Students will engage with Jewish, Christian, Islamic, Hindu, Buddhist, Sikh, Confucian, and Jain ethical traditions. The course emphasizes moral reasoning, decision-making, tolerance, and peacebuilding. It aims to cultivate an inclusive, humanistic, and holistic approach towards ethical living and interfaith engagement.

2- Learning Objectives

The course objectives are to:

1. Understand the fundamental principles and theories of ethics.
2. Introduce the ethical and moral teachings of Judaism, Christianity, Islam, and Hinduism.
3. Explore the ethical teachings of non-Semitic religions such as Buddhism, Sikhism, Confucianism, and Jainism.
4. Develop critical thinking skills to evaluate ethical arguments and theories.
5. Promote ethical leadership and interfaith harmony.

3- Learning Outcomes

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

1. Identify and analyze major ethical theories and teachings from world religions.
2. Understand the role of religions in improving moral values and social behavior.
3. Demonstrate ethical decision-making in various personal and professional contexts.
4. Recognize the impact of ethical decisions on individuals, communities, and society.
5. Apply skills of ethical leadership, including communication, conflict resolution, and inclusive engagement.

4-Course Structure

1. Interactive lectures, Group discussions and debates
2. Reflection papers and presentations
3. Assignments and Quiz

Course Contents

Unit 1: Ethical Teachings of Semitic Religions

- Judaism and its ethical teachings
- Christianity and its ethical teachings
- Islam and its ethical teachings

Unit 2: Ethical Teachings of Non-Semitic Religions

- Hinduism and its ethical teachings
- Sikhism and Buddhism: ethical values and practices
- Confucian and Jain ethical traditions

Unit 3: Professional Ethics

- Ethics for students and teachers
- Ethics in doctor–patient relationships
- Ethics in trader–customer interactions

Unit 4: Concept and Significance of Tolerance

- Definition, need, and importance of tolerance
- Teachings of Semitic religions on tolerance and their contemporary relevance
- Teachings of non-Semitic religions on tolerance and their contemporary relevance

Unit 5: Foundational Values and Ethics for Peacebuilding in Society

- Respect for sacred scriptures, personalities, places of worship, and religious symbols
- Promotion of tolerance and broadmindedness
- Encouragement of dialogue and harmony
- Benevolence towards humanity
- Establishment of justice and fairness
- Patience, forbearance, and forgiveness

Textbook

- Kidder, R. M. (2009). *How Good People Make Tough Choices: Resolving the Dilemmas of Ethical Living*. Harper.

Suggested Readings

1. Barash, D. P., & Webel, C. P. (2014). *Peace and Conflict Studies*. Sage.
2. Smart, N. (1998). *The World's Religions*. Cambridge University Press.
3. Nasr, S. H. (2003). *The Heart of Islam: Enduring Values for Humanity*. HarperOne.
4. Sharma, A. (2006). *Hindu Ethics: Purity, Abortion, and Euthanasia*. SUNY Press.
5. Harvey, P. (2000). *An Introduction to Buddhist Ethics: Foundations, Values and Issues*. Cambridge University Press.
6. Coward, H., & Perkinson, J. (2013). *A Cross-Cultural Dialogue on Ethical Leadership*. Wilfrid Laurier University Press.
7. Confucius. (1998). *The Analects*. Oxford University Press.

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