Institute of Business And Economic Research (IBER)

United International **University**

Institute of Business and Economic Research

UNITED INTERNATIONAL UNIVERSITY

Course outline for

PGD in Data Science (DS)



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TERM – I (3 COURSES)

Course Code & Title: PGDDS 101_ Programming on Core Python

COURSE OUTLINE

Weeks	Topics
1	An Introduction to Python
2	Basic Python Syntax
3	Language Components & Loop
4	List, Tuple, Set & Dictionary
5	Functions
6	Data Analysis using NumPy
7	Data Analysis using Pandas
8	Project with Pandas
9	Classes, Objects & Methods, Inheritance, Overloading, Encapsulation
10	Data Visualization using Matplotlib
11	Data Visualization using Pandas
12	Problem Solving and Reviews

Course Code & Title: PGDDS 102_ Machine Learning using Python

COURSE OUTLINE

Weeks	Topics
1	Introduction to Machine Learning
2	Feature Scaling, Principal Component Analysis (PCA)
3	Label Encoding, Ordinal Encoding, One Hot Encoding, Outlier Removing
4	Simple Linear Regression, Multiple Linear Regression
5	Logistic Regression (Theory, Algorithm, Hands-on Model)
6	K Nearest Neighbors (Algorithm, Exercise, Model)
7	Naive Bayes Classification (Theory, Hands-on)
8	Decision Tree (Theory, Hands-on, Google Colab Introduction)
9	Random Forests (Splitting, Entropy, IG, Bootstrap, Bagging)
10	Support Vector Machines (Save & Load Trained Model)
11	K Means Clustering (Theory, Hands-on Model)
12	Natural Language Processing (NLP)

Course Code & Title: PGDDS 103_ Data Analysis & Data Visualizations

COURSE OUTLINE

The course will be completed over 12 weeks, with both the Mid-Term and Final Examinations scheduled within these 12 classes.	
Module	**Topics**
01	**Introduction to Data Analysis and Visualization** 1. Understanding the importance of data analysis and visualization 2. Different types of data and data sources 3. Overview of data analysis and visualization tools and software
02	**Importing Datasets** 1. Understanding the Data 2. Python Packages for Data Science 3. Importing and Exporting Data in Python 4. Accessing Databases with Python
03	**Data Wrangling** 1. Pre-processing Data in Python 2. Dealing with Missing Values in Python 3. Data Formatting in Python 4. Data Normalization in Python 5. Binning in Python 6. Turning categorical variables into quantitative variables in Python
04	**Exploratory Data Analysis** 1. Descriptive Statistics 2. GroupBy in Python 3. Correlation 4. Correlation – Statistics 5. Association between two categorical variables: Chi- Square
05	**Data Visualization Fundamentals** 1. Principles of effective data visualization 2. Choosing the right chart types (bar charts, line charts, pie charts)
06	**Advanced Data Visualization** 1. Interactive visualizations (e.g., using Plotly, Seaborn) 2. Geospatial visualization 3. Data Visualization & reporting using Power BI

TERM – II (3 COURSES)

Course Code & Title: PGDDS 201_ SQL Database Design and Development

COURSE OUTLINE

Weeks	Topics
01	Introduction & Installations: RDBMS , Normalization, NoSQL
02	SQL Commands & Keys - DDL, DML, DCL, TCL - Keys & Constraints, Nested Queries - Joins, Views, Stored Procedures, Triggers
03	Constraints & Identity - Primary, Not Null, Unique, Check, Default, Foreign Key
04	Select Statements - Delete vs Truncate - Where Clause, Multiple Conditions - Order By, Distinct, TOP, LIKE
05	Operators & Group By - Arithmetic, Comparison, Logical Operators - Group By, Having
06	Joins - Inner, Left, Right, Full, Cross, Self - Merge, Pivot
07	Union, Case, ISNULL & Coalesce - Union, Intersect, Except - Case Statement & Execution Plan
08	Functions & Casting - String Functions (LEFT, RIGHT, SUBSTRING) - Date Functions , CAST, CONVERT
09	Temp Tables & Subqueries - Temporary Tables - Subqueries, Correlated Subqueries - Table Variables , CTE & Views
10	Conditions & Loops - BETWEEN, Aliases, NULLIF - IF ELSE, WHILE Loop - SELECT INTO, INSERT INTO SELECT
11	Stored Procedures - Parameters, Variables, Output Parameters - Advantages of Stored Procedures
12	Indexing & Transactions - Clustered vs Non-Clustered Indexes - Transaction Management

Course Code & Title: PGDDS 202_ Deep Learning

COURSE OUTLINE

Week	Topics	Resources	Remarks
Week 01	Orientation and Course Overview; Basic Concepts of Data Science, Artificial Intelligence, Artificial Neural Networks, Deep Learning, and Their Applications. **ANN (Single-Layer Perceptron):** Concept, Algorithm, Mathematical Example, Project on ANN	PPT + Lecture Notes	
Week 02	**ANN (Multi-Layer Perceptron):** Concept, Algorithm, Mathematical Example, Project on ANN	PPT + Lecture Notes	
Week 03	**Convolutional Neural Network (CNN):** Concept, Algorithm, Mathematical Example, Project on CNN	PPT + Lecture Notes	
Week 04	**Self-Organizing Map (SOM):** Concept, Algorithm, Mathematical Example, Project on SOM	PPT + Lecture Notes	
Week 05	**Restricted Boltzmann Machine (RBM):** Concept, Algorithm, Mathematical Example, Project on RBM	PPT + Lecture Notes	
Week 06	**Autoencoder:** Concept, Algorithm, Mathematical Example, Project on Autoencoder	PPT + Lecture Notes	
Week 07	**Deep Belief Network (DBN):** Concept, Algorithm, Mathematical Example, Project on DBN	PPT + Lecture Notes	
Week 08	Midterm Examination and Two Class Tests	—	Assessment
Week 09	**Recurrent Neural Network (RNN):** Concept, Algorithm, Mathematical Example, Project on RNN	PPT + Lecture Notes	
Week 10	**Long Short-Term Memory (LSTM):** Concept, Algorithm, Mathematical Example, Project on LSTM	PPT + Lecture Notes	
Week 11	**Generative Adversarial Network (GAN):** Concept, Algorithm, Mathematical Example, Project on GAN; Review Class	PPT + Lecture Notes	
Week 12	Final Examination		Final Assessment

Course Code & Title: PGDDS 203_ Data Science Project

COURSE OUTLINE

Week	Topics	Resources	Remarks
Week 01	Orientation and Course Overview; Basic concepts of project and project management; Steps of project development; Writing project reports and presentations	PPT + Lecture Notes	
Week 02	Introduction to Python: Input, control statements, functions, file handling; Working with Python libraries for project development (NumPy, Pandas, Sklearn, etc.)	PPT + Lecture Notes	
Week 03	Data Preprocessing: Reading CSV/Excel files, data cleaning, handling missing values, data encoding, labeling, feature extraction, dimensionality reduction	PPT + Lecture Notes	
Week 04	**Project 1**: Development using Decision Tree, Support Vector Machine, and Naïve Bayes with real data	PPT + Lecture Notes	
Week 05	**Project 2**: Development using K-Nearest Neighbor, K-Means Clustering, and Regression with real data	PPT + Lecture Notes	
Week 06	**Project 3**: Development using Voting, Boosting, Bagging, and Random Forest with real data	PPT + Lecture Notes	
Week 07	Real-Life Project: Stock Price Prediction (LSTM Neural Network) and Online Payment Fraud Detection	PPT + Lecture Notes	
Week 08	Report and Presentation Review		Checking Session
Week 09	Real-Life Project: Future Sales Prediction and Waiter Tips Analysis & Prediction	PPT + Lecture Notes	
Week 10	Real-Life Project: Flipkart/Twitter Review Sentiment Analysis	PPT + Lecture Notes	
Week 11	Real-Life Project: Article Recommendation System; Final Project Submission and Presentation	PPT + Lecture Notes	
Week 12	Final Project Submission and Presentation		Final Assessment