|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| D:\UAAR\UIIT\courseOutlineCommittee\CourseContents_Final_V02\New folder\logo4.png | **PMAS Arid Agriculture University Rawalpindi**  **University Institute of Information Technology** | | | | C:\Users\Shahid\Downloads\IMG-20210824-WA0001.jpg |
| AI-401 Programming for Artificial Intelligence | | | | | | |
| **Credit Hours:** | | **3(2-3)** | **Prerequisites:** | **Artificial Intelligence (cs-632)** | | |
| **Teacher:** | | Ms.Noureen Zafar |  |  | | |

|  |
| --- |
| **Course Description:** |
| This course aims to introduce standard programming practices and to help develop programming skills necessary for designing and implementing Artificial Intelligence systems. The course introduces classical as well as modern state of the art programming language for Artificial Intelligence (Lisp, Prolog, Python, and R), and builds up the necessary programming background for the main courses like Machine Learning, Artificial Neural Networks & Deep Learning, Natural Language Processing, and Speech Processing. This course will help the students of Artificial Intelligence develop the programming acumen and style. The ultimate aim of this course is to help students in using the AI programming languages to solve problems of interest to them. |
| **Course Objective:** |
| The first objective of the course is to introduce and then build the proficiency of students in  Different AI programming languages. Second objective is given to writing production quality clean code in the programming language. |
| **Teaching Methodology:** |
| Lectures, Assignments, Presentations, etc. Major component of the course should be covered using conventional lectures. |
| **Courses Assessment:** |
| Exams, Assignments, Quizzes. Course will be assessed using a combination of written examinations. |
| **Reference Materials:** |
| 1. Russell, S. and Norvig, P. “Artificial Intelligence. A Modern Approach”, 3rd ed,  Prentice Hall, Inc., 2015.  2. Norvig, P., “Paradigms of Artificial Intelligence Programming: Case studies in  Common Lisp”, Morgan Kaufman Publishers, Inc., 1992.  3. Luger, G.F. and Stubblefield, W.A., “AI algorithms, data structures, and idioms in  Prolog, Lisp, and Java”, Pearson Addison-Wesley. 2009.  4. Severance, C.R., 2016. “Python for everybody: Exploring data using Python 3.”  CreateSpace Independent Publ Platform.  5. Miller, B.N., Ranum, D.L. and Anderson, J., 2019. “Python programming in  context.” Jones & Bartlett Pub.  6. McKinney, W., 2012. “Python for data analysis: Data wrangling with Pandas,  NumPy, and IPython.” O'Reilly Media, Inc.  7. Reference Book:  8. Joshi, P., 2017. “Artificial intelligence with python.” Packt Publishing Ltd.  9. Janert, P.K., 2010. “Data analysis with open source tools: a hands-on guide for  programmers and data scientists.” O'Reilly Media, Inc. |

|  |  |  |
| --- | --- | --- |
| **Course Learning Outcomes (CLOs):** |  |  |
| At the end of the course the students will be able to: | **Domain** | **BT Level\*** |
| 1. Understand the fundamental constructs of Lisp, Prolog,   and Python programming languages. | C | 2 |
| 1. Comprehend the fundamental constructs of programming   languages for data analysis and representation. | C | 2 |
| 1. Understand and apply the Object-oriented concepts in the   programming languages. | C | 2 |
| 1. Apply various libraries for plotting, interpreting and   analyzing data in Python. | C | 3 |
| \* BT= Bloom’s Taxonomy, C=Cognitive domain, P=Psychomotor domain, A= Affective doma | | |

|  |  |  |  |
| --- | --- | --- | --- |
| **Week/Lecture #** | | **Theory** | **Practical** |
| Week 1 | Lect-I | Introduction to python language , **Variables, expressions, and statements** |  |
| Lect-II | Values and types ,Variables , Variable names and keywords , Statements , Operators and operands , Expressions , Order of operations , Modulus operator , String operations . |  |
|  | Lect-III |  | Asking the user for input , Comments , Choosing mnemonic variable names ,Debugging |
| Week 2 | Lect-I | **Conditional execution** |  |
| Lect-II | Boolean expressions , Logical operators , Conditional execution ,  Alternative execution ,  Chained conditionals. |  |
|  | Lect-III |  | Nested conditionals , Catching exceptions using try and except , Short-circuit evaluation of logical expressions , Debugging |
| Week 3 | Lect-I | **Functions** |  |
| Lect-II | Function calls , Built-in functions , Type conversion functions , Math functions , Random numbers , Adding new functions ,Definitions and uses | Hands on practice |
|  | Lect-III |  | Flow of execution , Parameters and arguments , Fruitful functions and void functions , Why functions? , Debugging |
| Week 4 | Lect-I | **Iteration** |  |
| Lect-II | Updating variables , The while statement , Infinite loops, Finishing iterations with continue , Definite loops using for |  |
|  | Lect-III |  | Loop patterns , Counting and summing loops, Maximum and minimum loops , Debugging |
| Week 5 | Lect-I | **Strings** |  |
| Lect-II | A string is a sequence ,Getting the length of a string using len , Traversal through a string with a loop . ,String slices ,Strings are immutable ,Looping and counting |  |
|  | Lect-III |  | The in operator ,String comparison , String methods ,Parsing strings , Format operator , Debugging . |
| Week 6 | Lect-I | Introduction to pandas Data Structures, Series,  DataFrame,  Index Objects |  |
| Lect-II | Essential Functionality | Reindexing  Dropping entries from an axis  Indexing, selection, and filtering  Arithmetic and data alignment  Function application and mapping  Sorting and ranking  Axis indexes with duplicate values |
|  | Lect-III | Summarizing and Computing Descriptive Statistics | Correlation and Covariance  Unique Values, Value Counts, and Membership |
| Week 7 | Lect-I | Handling Missing Data,  Filtering Out Missing Data ,  Filling in Missing Data |  |
| Lect-II | Hierarchical Indexing |  |
|  | Lect-III |  | Reordering and Sorting Levels  Summary Statistics by Level  Using a DataFrame’s Columns |
| Week 8 | Lect-I | Essential Functionality ,  Reindexing ,Dropping entries from an axis ,  Function application and mapping , |  |
| Lect-II | Sorting and ranking ,Axis indexes with duplicate values |  |
|  | Lect-III |  | Indexing, selection, filtering  Arithmetic and data alignment, |
| Mid Term Exam | | |  |
| Week 9 | Lect-I | Data Wrangling: Clean, Transform, Merge, Reshape |  |
| Lect-II |  | Combining and Merging Data Sets,  Database-style DataFrame Merges ,Merging on Index ,  Concatenating Along an Axis ,Combining Data with Overlap,Reshaping |
|  | Lect-III |  | Pivoting ,Reshaping with Hierarchical Indexing ,  Pivoting “long” to “wide” Format |
| Week 10 | Lect-I | Data Transformation ,  Removing Duplicates ,  Transforming Data Using a Function or Mapping , |  |
| Lect-II |  | Replacing Values ,  Renaming Axis Indexes ,  Discretization and Binning ,  Detecting and Filtering Outliers |
|  | Lect-III |  | Permutation and Random Sampling ,  Computing Indicator/Dummy Variables |
| Week 11 | Lect-I | Plotting and Visualization(A Brief matplotlib API Primer) |  |
| Lect-II |  | Plotting Functions in pandas,  Line Plots,Bar Plots, |
|  | Lect-III |  | Histograms and Density Plots ,Scatter Plots |
| Week 12 | Lect-I | Data Aggregation and Group Operations |  |
| Lect-II |  | GroupBy Mechanics ,  Iterating Over Groups,  Selecting a Column or Subset of Columns ,  Grouping with Dicts and Series ,Grouping with Functions,Grouping by Index Levels |
|  | Lect-III |  | Data Aggregation ,  Column-wise and Multiple Function Application ,  Returning Aggregated Data in “unindexed” Form |
| Week 13 | Lect-I | Group-wise Operations and Transformations ,  Apply: General split-apply-combine ,  Quantile and Bucket Analysis , |  |
| Lect-II |  | Example: Filling Missing Values with Group-specific Values ,  Example: Random Sampling and Permutation |
|  | Lect-III |  | Example: Group Weighted Average and Correlation ,  Example: Group-wise Linear Regression |
| Week 14 | Lect-I | Time Series(Time Series Basics, Time Zone Handling) |  |
| Lect-II | Periods and Period Arithmetic, Resampling and Frequency Conversion |  |
|  | Lect-III |  | Debugging of Periods and Period Arithmetic, Resampling and Frequency Conversion |
| Week 15 | Lect-I | Time Series Plotting , |  |
| Lect-II | Moving Window Functions |  |
|  | Lect-III |  | Time series dataset case study practice |
| Week 16 | Lect-I | Presentations/demo |  |
| Lect-II | Presentations/demo |  |
|  | Lect-III | Presentations/demo |  |
| **Final Term Exam** | | |  |

|  |  |  |  |
| --- | --- | --- | --- |
| **Sr. No** | **Course Learning Outcomes** |  |  |
|  | **Course Learning Outcomes** | **PLOs** | **BT Level\*** |
| CLO-1 | Understand the fundamental constructs of Lisp, Prolog, and Python programming languages. | 5 | 2 |
| CLO-2 | Comprehend the fundamental constructs of programming languages for data analysis and representation. | 1 | 2 |
| CLO-3 | Understand and apply the Object-oriented concepts in the programming languages. | 3 | 2 |
| CLO-4 | Apply various libraries for plotting, interpreting and analyzing data in Python. | 3 | 3 |
|  | \* BT= Bloom’s Taxonomy, C=Cognitive domain, P=Psychomotor domain, A= Affective doma | | |