Programming for AI - Course Outline

<table>
<tr><td>Complete Title</td><td>Programming for Artificial Intelligence</td></tr>
<tr><td>Course Code</td><td>AI-804, AI-904</td></tr>
<tr><td>Instructor</td><td>Dr. Muhammad Adeel Nisar</td></tr>
<tr><td>Credit Hours</td><td>3
Theory/week:
Weight 2 Cr. hrs.
Lectures: 1, duration: 2 hours
Exercise/week:
Weight 1 Cr. hrs.
Lab: 1, duration: 3 hours</td></tr>
<tr><td>Prerequisite Course</td><td>None</td></tr>
<tr><td>Prerequisite Skill/Knowledge</td><td>o Student should know the basics of programming,
o Understanding the real spirit/cause of data driven programming.</td></tr>
<tr><td>Follow Up</td><td>None</td></tr>
<tr><td>Program Name</td><td>MPhil. / Ph.D. Artificial Intelligence</td></tr>
<tr><td>Aims and Objectives</td><td>o Introduction to Python programming language
o Introduction to the Python libraries and packages associated in developing Artificial Intelligence based applications.</td></tr>
<tr><td>Syllabus</td><td>Topics: Introduction to Python language, Variables, Data types, Control Structures, Procedures and Classes. Introduction to the Python libraries and packages: NumPy, Pandas, Matplotlib, Seaborn, Django, Sklearn, PyTorch, Tensorflow, Tensorboard, Tensorflow Lite with android applications, and Owlready2.</td></tr>
<tr><td>Text Book(s)</td><td>A. Staring out with Python by Tonny Gaddis</td></tr>
<tr><td>Reference Material</td><td>R1. https://docs.python.org/3/tutorial/
R2. https://www.w3schools.com/python/
R3. https://numpy.org/
R4. https://matplotlib.org/
R5. https://seaborn.pydata.org/
R6. https://pandas.pydata.org/
R7. https://www.djangoproject.com/
R8. https://scikit-learn.org/
R9. https://pytorch.org/tutorials/
R10. https://www.tensorflow.org/learn
R11. https://developer.android.com/training/basics/firstapp
R12. https://owlready2.readthedocs.io/en/v0.37/</td></tr>
<tr><td>Assessment Criteria</td><td>
<table>
<tr><td>Sessional ..... 25%</td><td></td><td>Mid ..... 35%</td><td>Final ..... 40%</td></tr>
<tr><td>Quizzes, Tests</td><td>6</td><td rowspan="3">Written Exam .....35</td><td rowspan="3">Written Exam .....40</td></tr>
<tr><td>Assignment</td><td>8</td></tr>
<tr><td>Project</td><td>10</td></tr>
<tr><td rowspan="2">Total</td><td>25</td><td>35</td><td>40</td></tr>
<tr><td colspan="3">100</td></tr>
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<tr><td colspan="2">Lecture Breakdown</td></tr>
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Week	Lecture	Topic	Source
1	1	Introduction to the course. Discussion on course outline with reasoning. Python Programming Language: Introduction, significance and comparison with other programming languages. Downloading and installation of Python, Running a Hello World program on console, Basic Constructs: data types (int, float, string, bool), variable, literals, constants, arithmetic operators and expressions, Basic Input and Output	R1, R2
	2	Control Structures: Decision making using if control structure, Relational and logical operators, Repetition using for and while loops, Break and continue statements.	R1, R2
2	3	Data structures: Lists, Tuples, Dictionaries, Arrays, Processing lists and arrays, Multidimensional arrays, Nesting and stacking control structures.	R1, R2
	4	Functions: Defining and calling functions, Passing arguments to the functions, Returning values, Default parameters, The pass statement, Recursion.	R1, R2
3	5	File handling: Open and close, Read and write, Create and delete.	R1, R2
	6	Object Oriented Programming: Class and object, The __init__() Function, Object properties and methods, Inheritence, Parent and child classes, super() function, Method overriding, Iterators.	R1, R2
4	7	Importing and using different libraries: datetime, math, statistics, itertools, numbers, os, sys, etc. Python Modules, Exception Handling.	R1, R2
	8	The use of PIP, Downloading python packages, Creating virtual environment, NumPy: Introduction and installation, NumPy arrays: creating, indexing, saving and loading	R1, R2, R3

5	9	NumPy arrays and matrices: slicing, iterating, reshaping, transposing, searching, sorting, broadcasting and flattening	R3
	10	NumPy random: normal, binomial, poisson, logistic distributions NumPy universal functions (ufuncs)	R3
6	11	Data Visualization: Matplotlib installation, plotting data, learning about pyplot, plotting, marker, line, label, grid, subplots, scatter, bars, histograms, boxplots, pie charts	R4
	12	Data Visualization: Seaborn Installation, visualizing statistical data using different types of charts	R5
7	13	Data Analysis and Manipulation with Pandas: Installation, Series, Dataframe, column selection, addition and deletion, indexing, multiIndexing and selection, transposing, interoperability with NumPy functions	R6
	14	Data Manipulation with Pandas: use of statistical functions, describe function, etc. Reindexing and aligning	R6
8	15	Data Manipulation with Pandas: IO tools, reading and writing CSV files, JSON files, excel files, text files, binary (HDF5, Pickle) files.	R6
	16	Review of the course for Mid Term Exam	
Mid Term Examination			
9	17	~~Web development using Python: Introduction and Installation of Django, Model View Template design pattern, creating a project, Django views, models and templates~~	R7
	18	~~Web development using Python: A complete example of website creation using Django~~	R7
10	19	Data Analysis with sklearn: Introduction and installation of sklearn module, statistical analysis of data	R8
	20	Working with sklearn functions *[on the topics related to AI and Mathematics for AI]*	R8
11	21	Data Science using PyTorch: Introduction and installation of PyTorch, tensors, operations on tensors, torch functions, indexing, Slicing, Joining, Mutating Ops, bridging with NumPy	R9
	22	Data Science using PyTorch: Datasets and data loaders, creating custom datasets, iterating and visualizing datasets, [Topics related to AI and MAI]	R9
12	23	Introduction and installation of Tensorflow, basic operations and data structures,	R10

	24	~~Tensorflow: writing applications [on the topics related to AI and MAI]~~	R10
13	25	~~Tensorflow.js for web: Introduction and installation of Tensorflow.js~~	R10
	26	~~Introduction to Tensorflow Lite for mobile and edge applications, performing basic operations~~	R10
14	27	~~Writing an android application~~	R11
	28	~~Using Tensorflow lite with android application~~	R10
15	29	~~Ontology oriented programming with Python: Installation and introduction to owlready2, creating ontologies in Protégé, connecting them with python applications~~	R12
	30	~~Ontology oriented programming with Python: operations on ontologies using python applications. Inference and reasoning~~	R12
16	31	Follow-up	Discussion/Seminar
	32	Overall Review of Course for Final Exam	
Final Term Examination			