CALICUT UNIVERSITY – FOUR-YEAR UNDER GRADUATE PROGRAMME (CU-FYUGP)

BSc PHYSICS HONOURS

Programme	**B.Sc. Physics Honours**				
Course Title	**PYTHON BASICS**				
Type of Course	**Vocational Minor (SET II: DATA ANALYSIS IN PHYSICS)**				
Semester	**I**				
Academic Level	**100 - 199**				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours
	4	3	-	2	75
Pre-requisites	Basic computer knowledge				
Course Summary	This course introduces Python programming for data analysis in Physics with the aid of machine learning. As the first step, Python language is introduced with emphasis on Numpy and matplotlib modules, for future use in machine learning.				

Course Outcomes (CO):

CO	CO Statement	Cognitive Level*	Knowledge Category#	Evaluation Tools used
CO1	Understand the significance of algorithm & flowchart in development of computer programs	U	F	Instructor-created exams
CO2	Understand and apply basic Python syntax	U, Ap	F, P	Instructor-created exams, Practical Assignment / Observation of Practical Skills
CO3	Understand and apply various conditional statements, as well as	U, Ap	F, P	Instructor-created exams, Practical Assignment /

	understand the modular nature of a program using functions in Python.			Observation of Practical Skills
CO4	Apply various modules for several tasks in Python	Ap	P	Instructor-created exams, Practical Assignment / Observation of Practical Skills/ Home Assignments
CO5	Understand in detail and apply the Numpy module in data analysis of physical data.	U, Ap	F, P	Instructor-created exams, Practical Assignment / Observation of Practical Skills
CO6	Understand and apply the matplotlib module for graphical representation of data in various pictorial formats.	U, Ap, C	F, P	Instructor-created exams, Practical Assignment / Observation of Practical Skills/ Home Assignments
* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C) # - Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)				

Detailed Syllabus:

Module	Unit	Content	Hrs (45 +30)	Marks (70)
I		**Introduction to Python**	**12**	**15**
	1	Use of algorithm and flowchart in computation.	2	
	2	Introduction to python, interactive and script mode, operators	2	
	3	Data types: numeric, string, list, tuple, set, dictionary (basics)	2	
	4	List operations, input() function, print() function, different formatted print statements, type() and eval() functions.	3	
	5	Files in Python & file operations: opening in different modes, read and write operations	3	

Chapter 2: p.31-33 (including Python's IDLE Graphics window), Chapter 3,4, Chapter 5: p.95-108 (upto and excluding Command Line Arguments), Chapter 17: p.441-452 (including with statement), from *Core Python Programming.*				
II		**Control statements, Functions and Modules**	**10**	**15**
	6	Conditional & control statements: if, if…else, if…elif else statements,	2	
	7	while and for loops, range() function. Nested loops. break & continue statements.	3	
	8	Functions: built-in functions & user defined functions,	3	
	9	Modules and Packages, lambda expressions. Calendar Module, Math Module, time module, date module, zip()	2	
Chapter 6: p.117-139, Chapter 9: p.237-270, Chapter 20: p.515-526 of Book 1				
III		**Numpy**	**15**	**25**
	10	Numpy Arrays: creating arrays using array(), linspace, logspace, arrange(), zeros() and ones() functions.	2	
	11	Mathematical operations on arrays.	2	
	12	Indexing and slicing arrays, dimension of array	1	
	13	Attributes of arrays: ndim, shape, size, itemsize, dtype, nbytes	1	
	14	reshape() and flatten() methods for arrays	1	
	15	Multi-dimensional arrays using array(), zeros() and ones() functions	2	
	16	Indexing and slicing multi-dimensional arrays.	2	
	17	Numpy matrix: creation, access, mathematical operations.	2	
	18	Matrix operations (eigenvalues, dot, determinant, transpose, inverse), random numbers, shape(), reshape() functions.	2	
Chapter 6 of Book 2				
IV		**Matplotlib module**	**8**	**15**
	19	Plotting, labelling, scale commands in matplotlib	2	
	20	subplot, axes, figure, commands in matplotlib	2	
	21	Plotting pie chart, histogram, line graph, scatter plot and bar graphs.	2	
	22	grid(), axhline(), axvline() commands.	2	
	Chapter 14 of Book 2			

V	**PRACTICALS**		**30**	
	Conduct any 5 experiments from the given list and 1 additional experiment, decided by the teacher-in-charge, related to the content of the course. The 6th experiment may also be selected from the given list.			
	1	Developing Algorithms for Formatted Printing - Printing of triangle or inverted triangle (Pyramid form), Binomial coefficients in Pyramid form, fibonacci series.		
	2	Create and print a 3×3 matrix using nested loop.		
	3	Solution of simultaneous equations using Numpy.		
	4	Generate calendar using Calendar module.		
	5	Plot trigonometric functions - sin, cos, tan, x^2, exp(x).		
	6	Write a program for the ATM Pin verification process		
	7	Diagonalize a 3x3 matrix and verify that by evaluating the eigenvalues. Also evaluate the eigenvectors for the matrix.		
Relevant sections from Book 1 & Book 2				
Books and References: 1. Core Python Programming 2nd edition or higher, Dr. R. Nageswara Rao, Dreamtech press, 2020 (Book 1) 2. Machine Learning in Data Science using Python, Dr. R. Nageswara Rao, Dreamtech press, 2022 (Book 2)				

Mapping of COs with PSOs and POs :

	PSO 1	PSO 2	PSO 3	PSO 4	PSO5	PSO6	PO1	PO2	PO3	PO4	PO5	PO 6	PO 7
CO 1	0	0	0	0	1	0	1	0	0	1	0	0	0
CO 2	0	0	0	0	1	0	1	0	0	1	0	0	0
CO 3	0	0	0	0	1	0	1	0	0	1	1	0	0
CO 4	0	0	0	0	1	0	1	0	0	2	1	0	0
CO 5	0	1	0	0	2	1	1	0	0	2	2	0	0
CO 6	0	1	0	0	2	1	1	0	0	2	1	0	0

Correlation Levels:

Level	Correlation
0	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Assessment Rubrics:

- Quiz / Assignment/ Quiz/ Discussion / Seminar
- Midterm Exam
- Programming Assignments (20%)
- Final Exam (70%)

Mapping of COs to Assessment Rubrics :

	Internal Exam	Assignment	Project Evaluation	End Semester Examinations
CO 1	✓			✓
CO 2	✓			✓
CO 3	✓			✓
CO 4		✓		✓
CO 5		✓		✓
CO 6			✓	

CALICUT UNIVERSITY – FOUR-YEAR UNDER GRADUATE PROGRAMME (CU-FYUGP)

BSc PHYSICS HONOURS

Programme	**B.Sc. Physics Honours**				
Course Title	**DATA ANALYSIS IN PHYSICS USING PYTHON**				
Type of Course	**Vocational Minor (SET II: DATA ANALYSIS IN PHYSICS)**				
Semester	**II**				
Academic Level	**100 - 199**				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours
	4	3	-	2	75
Pre-requisites	PHY1VN102- Python Basics				
Course Summary	This paper continues from the previous paper for data analysis. More data analysis tools are introduced to be used in machine learning, as well as in physical data analysis. In addition, essential statistics required for data analysis is also introduced.				

Course Outcomes (CO):

CO	CO Statement	Cognitive Level*	Knowledge Category#	Evaluation Tools used
CO1	Become familiar with data format & programs used in data analysis	U	F	Practical Assignment / Observation of Practical Skills
CO2	Understand & apply Pandas module for data analysis	U, Ap	P	Instructor-created exams, Practical Assignment / Observation of Practical Skills

CO3	Understand & apply Seaborn module for data visualization	U, Ap	P	Instructor-created exams, Practical Assignment / Observation of Practical Skills
CO4	Understand the significance of statistical analyses as well as error analysis in physical measurements.	U	F	Instructor-created exams
CO5	Understand the significance of few distributions commonly found in physical measurements.	U	F	Instructor-created exams/ Home Assignments
CO6	Apply statistical methods to physical measurements	U, E	P	Home Assignments
* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C) # - Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)				

Detailed Syllabus:

Module	Unit	Content	Hrs (45 +30)	Marks (70)
I		**Data file formats**	**8**	**10**
	1	Introducing different data file formats: csv, xls, tab, dat formats.	2	
	2	Jupyter Notebooks using Anaconda and Google Colab: introduction.	2	
	3	Familiarization with Google Colab	1	
	4	Familiarization with Anaconda	2	
	5	Reading data files in Jupyter Notebooks.	1	
Basic overview to be given about data formats and software used.				
II		**Using Pandas for Data Analysis**	**12**	**20**
	6	Data Analysis Using Pandas: Series and dataframe, creating data frame from an excel spreadsheet - creating dataframe from .csv files.	3	

	7	Creating data frame from a python dictionary - creating dataframe from python list of tuples - viewing data frame using loc() and iloc().	3	
	8	Operations on data frames series object - creating series from a dataframe - creating dataframe from series - creating series from numpy array.	2	
	9	Converting series into numpy array - creating series from a dictionary - accessing elements of a series.	2	
	10	Joining data frames - how to join when there is no common column - concatenation of tables - where() method - groupby() method - aggregate functions on data frames.	2	
Chapters 12,13 (SQL & Regular expressions not required) of Book 1				
III	**Data Visualization using Seaborn**		**10**	**20**
	10	Loading datasets in Seaborn, Distribution plot	1	
	11	Count plot, box plot, scatter plot, joint plot.	2	
	12	Line Plot, displaying scatter plot with regression line	2	
	13	Creating subplots	1	
	14	Heat map - cat plot	2	
	15	Violin plot - pair plot.	2	
Chapter 15 of Book 1				
IV	**Basic Statistics & Error Analysis**		**15**	**20**
	16	Preliminaries of Error Analysis: errors as uncertainties, inevitability of uncertainty,	2	
	17	Importance of knowing the uncertainties.	2	
	18	Statistical analysis of random uncertainties: random and systematic errors, the mean and standard deviation.	2	
	19	Standard deviation as the uncertainty in a single measurement, the standard deviation of the mean, systematic errors.	2	
	20	The Normal Distribution: Histograms and distributions, limiting distributions, the normal distribution.	3	
	21	The Standard deviation as 68% confidence limit, justification of the mean as best estimate.	2	
	22	The Poisson Distribution: Definition of the Poisson Distribution, Properties of the Poisson Distribution.	2	

Sections 1.1-1.3; 4.1-4.6; 5.1-5.5; and 11.1-11.3 of Book 2				
V	**PRACTICALS**		**30**	
	Conduct any 6 experiments from the given list and 1 additional experiment, decided by the teacher-in-charge, related to the content of the course. The 7th experiment may also be selected from the given list.			
		1. Familiarising Jupyter notebook using Colab/Anaconda and basic coding 2. Read data from different output format (csv, xls, tab, dat, txt) and save it in a specific format (csv, dat) 3. Heat map, Box plot, scatter plot 4. Violin plot, Pair plot 5. Basic statistics - plots including error bars 6. Grouping example using colab 7. Create series from a dataframe and dataframe from series using numpy array.		
Books and References: 1. Machine Learning in Data Science using Python, Dr. R. Nageswara Rao, Dreamtech press, 2022 (Book 1) 2. An Introduction to Error Analysis, John R. Taylor 2nd edition, University Science Books, 1996 (Book 2)				

Mapping of COs with PSOs and POs :

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO 1	0	0	0	0	1	0	1	0	0	2	1	0	0
CO 2	0	0	0	0	2	0	1	0	0	2	1	0	0
CO 3	0	0	0	0	2	0	1	0	0	2	1	0	0
CO 4	0	1	2	0	1	1	1	0	0	1	2	0	0
CO 5	0	1	1	0	1	1	1	0	0	1	2	0	0
CO 6	0	1	1	0	1	1	1	0	0	1	2	0	0

Correlation Levels:

Level	Correlation
0	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Assessment Rubrics:

- Quiz / Assignment/ Quiz/ Discussion / Seminar
- Midterm Exam
- Programming Assignments (20%)
- Final Exam (70%)

Mapping of COs to Assessment Rubrics :

	Internal Exam	Assignment	Project Evaluation	End Semester Examinations
CO 1	✓			✓
CO 2	✓			✓
CO 3	✓			✓
CO 4		✓		✓
CO 5		✓		✓
CO 6			✓	

CALICUT UNIVERSITY – FOUR-YEAR UNDER GRADUATE PROGRAMME (CU-FYUGP)

BSc PHYSICS HONOURS

Programme	**B.Sc. Physics Honours**				
Course Title	**DATA ANALYSIS IN PHYSICS USING MACHINE LEARNING**				
Type of Course	**Vocational Minor (SET II: DATA ANALYSIS IN PHYSICS)**				
Semester	**III**				
Academic Level	**200 - 299**				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours
	4	3	-	2	75
Pre-requisites	1. Fundamentals of Programming Concepts 2. PHY1VN102- Python Basics 3. PHY2VN102- Data Analysis in Physics Using Python				
Course Summary	This course explores Machine Learning fundamentals: types, challenges, and model training techniques like Linear Regression, Gradient Descent, KNN, and clustering. Analyze data using Scikit-learn, handle classification problems with performance evaluation measures on real datasets.				

Course Outcomes (CO):

CO	CO Statement	Cognitive Level*	Knowledge Category#	Evaluation Tools used
CO1	Grasp the concepts and importance of Machine Learning, its types, and	U	C	Instructor-created exams / Quiz

	real-world problem-solving applications.			
CO2	Understand linear regression, model evaluation metrics, and various types of regression. They will apply this knowledge practically using examples.	Ap	P	Practical Assignment / Observation of Practical Skills
CO3	Master in K-Nearest Neighbor classification, decision trees, entropy, Gini index, and K-means clustering, demonstrated through practical applications with sample datasets.	Ap	P	Seminar Presentation / Group Tutorial Work
CO4	Apply classification algorithms to MNIST data, including binary classifiers and multilabel classification, and interpret performance measures like confusion matrix, precision, recall, and ROC curve	U	C	Instructor-created exams / Home Assignments
CO5	Learn to implement and construct a ML model for one of the problems mentioned.	Ap	P	One Minute Reflection Writing assignments/ Vice Voce
* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C) # - Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)				

Detailed Syllabus:

Module	Unit	Content	Hrs (45 +30)	Marks (70)
I	**Foundations of Machine Learning**		**11**	**15**
	1	Introduction to Machine Learning - Need for Machine Learning - Machine Learning model	1	
	2	Challenges in ML - Applications of ML	1	
	3	Types of ML algorithms - Supervised ML Algorithms - Classification - Regression -	1	

	4	Exploring Unsupervised Learning, Reinforcement Learning -	2	
	5	Preparing Data - Steps involved in data cleaning - Data Standardization - Data Scaling, Binarization - Data Labeling,	3	
	6	Feature Selection Techniques - Detecting Outliers - Z score - Optimization Algorithm - Gradient Descent - SGD	3	
	Sections from 9.1 - 9.9 of Chapter 9 of Book 2			
II	**Regression Analysis: Techniques, Evaluation, and Practical Applications**		**11**	**18**
	7	Overview of how Regression works - Model evaluation metrics - Types of Regression	2	
	8	Understanding Linear Regression, Simple Linear regression - Variables - Linear Regression - Linear equation - The r-squared value	3	
	9	Practical use of Simple Linear regression - An example problem using sample data (home prices)	3	
	10	Make the data - identify the features - Training and Testing - another example problem for linear regression (Salary data)	1	
	11	Multiple linear regression - Example problem using sample data	2	
	1. Section 10.1 - 10.4 of Chapter 10 of Book 2 2. Chapter 19 page no. 382 - 400 of Book 3 3. Chapter 20 page no. 401 - 408 of Book 3			
III	**ML Classification & Clustering Essentials**		**14**	**25**
	12	Classification Algorithms - K-Nearest Neighbour classifier - How to select K value	2	
	13	Calculate the distance metric between two points - Example problem to construct the classifier - use breast cancer data set	3	
	14	Decision Trees - Entropy - How to calculate total entropy for a dataset	3	
	15	Gini Index	1	
	16	Comparison between Gini index and entropy- Example problem using a given data set	2	
	17	Clustering Algorithms - K- means clustering	1	
	18	Rules to generate clusters - Elbow method - Sample problem using a standard data set	2	
	1. Sections and references from Chapters 29 page no. 572 - 585 of Book 3			

	2. Sections and references from Chapters 30 page no. 591 - 607 of Book 3 3. Chapter 11 Section 11.3 - 11.4			
IV	**Classification: Metrics & Multilabel Analysis**		**9**	**12**
	19	Classification problem using MNIST data	2	
	20	Training a binary classifier	2	
	21	Performance Measures - Confusion Matrix - Precision and Recall - ROC curve	3	
	22	Multilabel Classification, multi output classification	2	
	1. Sections from Chapter 3 page no. 85 - 108 of Book 1			
V	**Hands-on Data Structures:** **Practical/Project Applications, Case Study and Course Project**		**30**	
	1	Implement the following: **1. Classification of iris data using KNN:** Data: Read from Scikit-learn **2. Classification of iris data using K-means Cluster:** Data: Read from Scikit-learn **3. Draw the confusion matrix of iris dat:** Data: Use the classification results from experiments 1 & 2 **4. Design ML Classifier:** To classify RR Lyrae stars using KNN.		
	1. https://scikit-learn.org/stable/auto_examples/neighbors/plot_classification.html#sphx-glr-auto-examples-neighbors-plot-classification-py 2. https://www.geeksforgeeks.org/analyzing-decision-tree-and-k-means-clustering-using-iris-dataset/ 3. https://www.kaggle.com/code/ankumagawa/knn-confusion-matrix-iris-flower-digits-data 4. https://sigmoidal.ai/en/k-nearest-neighbors-k-nn-for-classifying-rr-lyrae-stars/			

Books and References:

1. Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow: Concepts, Tools, and Techniques to Build Intelligent Systems, Third Edition by Aurélien Géron. (Book 1)
2. Data Science and Machine Learning using Python by Reema Thereja (Book 2)
3. Machine Learning in Data Science using Python by R Nageswara Rao (Book 3)

Mapping of COs with PSOs and POs :

	PSO 1	PSO 2	PSO 3	PSO4	PS O5	PS O6	PO1	PO2	PO3	PO4	PO5	PO 6	PO 7
CO 1	0	0	1	0	1	0	2	0	0	2	1	0	0
CO 2	0	1	2	0	1	0	2	0	0	2	1	0	0
CO 3	0	1	2	0	1	0	2	0	0	2	1	0	0
CO 4	0	1	2	0	1	0	2	0	0	2	2	0	0
CO 5	0	2	1	1	1	0	2	0	1	2	1	0	0
CO 6	0	0	1	0	1	0	2	0	0	2	1	0	0

Correlation Levels:

Level	Correlation
0	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Assessment Rubrics:

- Quiz / Assignment/ Quiz/ Discussion / Seminar
- Midterm Exam
- Programming Assignments (20%)
- Final Exam (70%)

Mapping of COs to Assessment Rubrics :

	Internal Exam	Assignment	Project Evaluation	End Semester Examinations
CO 1	✓			✓
CO 2	✓			✓
CO 3	✓			✓
CO 4		✓		✓
CO 5		✓		✓
CO 6			✓	

CALICUT UNIVERSITY – FOUR-YEAR UNDER GRADUATE PROGRAMME (CU-FYUGP)

BSc PHYSICS HONOURS

Programme	**B.Sc. Physics Honours**				
Course Title	**APPLICATIONS OF ADVANCED MACHINE LEARNING & ARTIFICIAL INTELLIGENCE IN PHYSICS**				
Type of Course	**Vocational Minor (SET II: DATA ANALYSIS IN PHYSICS)**				
Semester	**VIII**				
Academic Level	**300 - 399**				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours
	4	4	-	-	60
Pre-requisites	1. PHY1VN102- Python Basics 2. PHY2VN102- Data Analysis in Physics Using Python 3. PHY3VN202- Data Analysis in Physics Using Machine Learning				
Course Summary	This course explores the fundamentals of Artificial Intelligence: Basic idea about AI. It also explains the advanced concepts of Machine Learning Techniques. Deep Learning and CNNs are introduced.				

Course Outcomes (CO):

CO	CO Statement	Cognitive Level*	Knowledge Category#	Evaluation Tools used
CO1	Acquire expertise in DBSCAN for spatial clustering and neural networks for comprehensive data analysis and pattern recognition proficiency.	Ap	P	Practical Assignment / Observation of Practical Skills

CO2	Grasp the significance of SVM, apply it using Python, adjust parameters, evaluate pros/cons, and employ it across varied applications.	U	C	Instructor-created exams / Quiz
CO3	Understand the Deep Learning concepts, utilise the TensorFlow/Keras framework, grasp neural network variants, and understand various neural network architectures.	U	C	Seminar Presentation / Group Tutorial Work
CO4	Develop machine learning models for practical applications, enhancing skills in classification, feature selection, and model evaluation techniques.	Ap	P	Instructor-created exams / Home Assignments
CO5	Grasp the concepts and importance of Artificial Intelligence, historical context and how the brain processes information.	U	C	One Minute Reflection Writing assignments

* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C)

- Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)

Detailed Syllabus:

Module	Unit	Content	Hrs (48 +12)	Marks (70)
I		**Neural Networks and Clustering Techniques in ML**	**13**	**18**
	1	Density Based Spatial Clustering of Applications with Noise (DBSCAN) - Understand how DBSCAN works	2	
	2	Algorithmic steps for DBSCAN clustering - parameter estimation	1	
	3	Python implementation of DBSCAN using Scikit-learn - example using random sample generation	3	
	4	Neural Network - Working of a neural network - model - Pros and Cons	3	

	5	Applications of neural networks - Activation Function - Steps involved in neural network methodology - Example using scikit-learn (not for examination)	4	
	Sections 11.5 - 11.5.5 and 11.7 - 11.7.6 of Chapter 11 of Book 1			
II	**Support Vector Machine**		**11**	**16**
	6	Support Vector Machine (SVM) - Need of SVM	2	
	7	Important terms in SVM - Hyperplane - Margin - Tuning Parameters	2	
	8	Working of SVM - Advantages and Disadvantages of SVM	2	
	9	Applications of SVM	2	
	10	Tuning hyperparameters - Python implementation of SVM - Example data using breast cancer (Not for examination)	3	
	Section 11.8 - 11.8.6 of Chapter 11 of Book 1			
III	**Advanced Machine Learning Techniques**		**13**	**20**
	11	Deep Learning - Working of DL Model - Comparison between ML and DL	2	
	12	Applications of Deep Learning - Libraries for implementing DL - TensorFlow and Keras	3	
	13	Types of Neural Networks - ANN - MLP - CNN - RNN	3	
	14	Architecture of Keras - Model - Layer	2	
	15	Loss - Optimizer - Metrics	1	
	16	Training the model - With ionosphere data to identify any structure is present in a radar data using Keras (Not for examination)	2	
	Section 12.1 - 12.4 of Chapter 12 of Book 1			
IV	**Foundations of Artificial Intelligence**		**11**	**16**
	17	What is Artificial Intelligence - Turing Test - Cognitive modeling approach	2	
	18	Foundations of AI - Philosophy	2	
	19	How do brain process information - How can we build an efficient computer	1	
	20	History of AI - The birth - Early Enthusiasm - Availability of large data sets	2	
	21	Knowledge-based systems - AI adopts the scientific method	2	

	22	Intelligent agents -The State of art	2	
	Section 1.1 - 1.4 of Chapter 1 of Book 2			
V	**OPEN ENDED MODULE**		**12**	
	Implement one of the following tasks or any other relevant project: **1. Photometric Redshift Estimation using the data:** Data: Read from Scikit-learn 2. **Develop a neural network for the detection of exoplanet:** Data: Repository given in the reference section 3. **Develop a SVM model for the detection of exoplanet:** Data:Repository given in the reference section			
	1. https://ogrisel.github.io/scikit-learn.org/sklearn-tutorial/tutorial/astronomy/regression.html 2. https://github.com/gabrielgarza/exoplanet-deep-learning/tree/master			

Books of Study:

1. Data Science and Machine Learning using Python by Reema Thereja
2. Artificial Intelligence – A Modern Approach Third Edition by Stuart Russel and Peter Norvig.

Reference:

1. Machine Learning in Data Science using Python by R Nageswara Rao

Mapping of COs with PSOs and POs :

	PSO 1	PSO 2	PSO 3	PSO4	PS O5	PS O6	PO1	PO2	PO3	PO4	PO5	PO 6	PO 7
CO 1	2	1	1	2	1	1	1	1	2	2	2	1	1
CO 2	1	2	2	1	1	1	1	1	2	2	2	1	1
CO 3	1	1	3	1	2	1	1	1	2	3	3	1	1
CO 4	1	2	3	3	1	1	1	1	3	3	3	1	1
CO 5	1	1	1	1	3	1	2	1	1	2	1	1	1
CO 6	2	1	1	2	1	1	1	1	2	2	2	1	1

Correlation Levels:

Level	Correlation
0	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Assessment Rubrics:

- Quiz / Assignment/ Quiz/ Discussion / Seminar
- Midterm Exam
- Programming Assignments (20%)
- Final Exam (70%)

Mapping of COs to Assessment Rubrics :

	Internal Exam	Assignment	Project Evaluation	End Semester Examinations
CO 1	✓			✓
CO 2	✓			✓
CO 3	✓			✓
CO 4		✓		✓
CO 5		✓		✓
CO 6			✓	

GENERAL FOUNDATION COURSES