



# **Indrashil University**

(Established by an Act under the Gujarat Private Universities Act, 2009)

*A Life Sciences University*

*Sustained Excellence with Relevance*

## **School of Engineering** **Post graduate diploma** **Proposed Course Curriculum** *w.e.f. Academic Year 2022-23*



# **Indrashil University**

(Established by an Act under the Gujarat Private Universities Act, 2009)

*A Life Sciences University*

*Sustained Excellence with Relevance*

## **School of Engineering**

### **PGD in AI & ML**

### **Proposed Course Curriculum**

### **w.e.f. Academic Year 2022-23**

**CURRICULUM FOR PGD in AI & ML (w.e.f. academic  
year 2022-23)**

Trimester: 1	Minimum Trimester Credit Required: 8 Cumulative Trimester Credit Required: 8		
Course Code	Subject Name	L-T-P	Credits
14101	Introduction to Python Programming	2-0-2	3
14102	Introduction to AI & ML	2-0-0	2
14103	Supervised Learning	2-0-2	3
	<b>Total</b>	<b>6-0-4</b>	<b>8</b>
Trimester: 2	Minimum Trimester Credit Required: 8 Cumulative Trimester Credit Required:16		
Course Code	Subject Name	L-T-P	Credits
14201	Advanced Machine Learning	3-0-0	3
14202	Marketing Analysis	2-0-0	2
14203	Unsupervised Learning	2-0-2	3
	<b>Total</b>	<b>7-0-2</b>	<b>8</b>

<b>Trimester: 3</b>	<b>Minimum Trimester Credit Required: 8 Cumulative Trimester Credit Required: 24</b>		
<b>Course Code</b>	<b>Subject Name</b>	<b>L-T-P</b>	<b>Credits</b>
14301	Natural Language Processing	2-0-2	3
14302	Introduction to Computer Vision and Image Processing	3-0-0	3
14303	Text Mining	2-0-0	2
14304	Project/ Research Paper	0-0-16	8
	*Choose 3 electives OR Live Project / Research Article in reputed Journal		
	<b>Total</b>	<b>7-0-2/0-0-16</b>	<b>8/8</b>



**Indrashil University**  
**School of Engineering**  
**First Trimester, 2022-23**

**Course Syllabus**

<b>Course Code:</b>	<b>14101</b>
<b>Course Title:</b>	<b>Introduction to Python Programming</b>
<b>Credit Structure (L-T-P-C):</b>	<b>2-0-2-3</b>
<b>Instructor in Charge:</b>	

## **Learning Outcome of the Course:**

After learning the course, the students should be able:

1. Understand basic principles of computers
2. Understand basics of binary computation
3. Understand the programming basics (operations, control structures, data types, etc.)
4. Readily use the Python programming language
5. Apply various data types and control structure
6. Understand class inheritance and polymorphism
7. Understand the object-oriented program design and development
8. Understand and begin to implement code

## **Syllabus:**

### **Introduction**

Relationship between computers and programs, Basic principles of computers, File systems, Using the Python interpreter, Introduction to binary computation, Input / Output

### **Data types and control structures**

Operators (unary, arithmetic, etc.), Data types, variables, expressions, and statements, Assignment statements, Strings and string operations, Control Structures: loops and decision

### **Modularization and Classes**

Standard modules, Packages, Defining Classes, Defining functions, Functions and arguments (signature)

### **Exceptions and data structures**

Data Structures (array, List, Dictionary), Error processing, Exception Raising and Handling

### **Object oriented design**

Programming types, Object Oriented Programming, Object Oriented Design, Inheritance and Polymorphism

**REFERENCE BOOKS:**

1. John V Guttag. "Introduction to Computation and Programming Using Python", Prentice Hall of India
2. R. Nageswara Rao, "Core Python Programming", dreamtech
3. Wesley J. Chun. "Core Python Programming - Second Edition", Prentice Hall
4. Michael T. Goodrich, Roberto Tamassia, Michael H. Goldwasser, "Data Structures and Algorithms in Python", Wiley
5. Kenneth A. Lambert, "Fundamentals of Python – First Programs", CENGAGE Publication
6. Luke Sneeringer, "Professional Python", Wrox

**Evaluation Scheme:**

Continuous evaluation process comprising of components like attendance, assignment, class tests, practical, Comprehensive examinations, etc.



**Indrashil University**  
**School of Engineering**  
**First Trimester, 2022-23**

**Course Syllabus**

<b>Course Code:</b>	<b>14102</b>
<b>Course Title:</b>	<b>Introduction to AI &amp; ML</b>
<b>Credit Structure (L-T-P-C):</b>	<b>2-0-0-2</b>
<b>Instructor in Charge:</b>	



### **Learning Outcome of the Course:**

After learning the course, the students should be able to:

1. Understand the search technique procedures applied to real world problems
2. Understand and use various types of logic and knowledge representation schemes.
3. Understand various Game Playing techniques and apply them in programs.
4. Gain knowledge in AI Applications and advances in Artificial Intelligence & Machine Learning,

### **Syllabus:**

- Meaning, Scope, and Stages of Artificial Intelligence & Machine Learning,
- Three Stages of Artificial Intelligence & Machine Learning,
- Applications of Artificial Intelligence & Machine Learning,
- Effects of Artificial Intelligence & ML on Society,
- Solves Complex Social Problems, Benefits Multiple Industries,
- Key Takeaways

### **REFERENCE BOOKS:**

1. Artificial Intelligence: A Modern Approach, Stuart Russel, Peter Norvig, PHI
2. “PROLOG Programming For Artificial Intelligence” -By Ivan Bratko( Addison-Wesley)
3. “Programming with PROLOG” –By Klocks in and Mellish.
4. Introduction To Artificial Intelligence & Expert Systems, Patterson, PHI

### **Evaluation Scheme:**

Continuous evaluation process comprising of components like attendance, assignment, classtests, Practical, comprehensive examinations, etc.



**Indrashil University**  
**School of Engineering**  
**First Trimester, 2022-23**

**Course Syllabus**

<b>Course Code:</b>	<b>14103</b>
<b>Course Title:</b>	<b>Supervised Learning</b>
<b>Credit Structure (L-T-P-C):</b>	<b>2-0-0-2</b>
<b>Instructor in Charge:</b>	

## **Learning Outcome of the Course:**

After learning the course, the students should be able to:

1. Explore the fundamental issues and challenges in Machine Learning including data and model selection and complexity
2. Appreciate the underlying mathematical relationships within and across Machine Learning algorithms
3. Evaluate the various Supervised Learning algorithms using appropriate Dataset.
4. Understand the search technique procedures applied to real world problems

## **Syllabus:**

- Understand basic concepts of supervised learning,
- Apply k-nearest neighbor classification as an example of supervised learning,
- Understand over- and under-fitting and how to detect and prevent these.
- Be able to train and apply regression and classification objects (estimators) inscikit-learn,
- Understand and apply linear and logistic regression,
- linear and kernel supportvector machines,
- use model selection methods such as cross-validation to tune the choice ofmodel and key parameters.
- Understand and apply a wide variety of evaluation metrics to supervisedlearning scenarios.
- Be able to optimize a classifier for a variety of metrics,
- Learn how to apply a Naive Bayes classifier,
- Learn how to apply decision trees and advanced tree-based classifiers like gradient Boosted Decision Trees,
- Learn how to apply Neural Networks,
- Understand what data leakage is, why it's critical to avoid, and how to detect it.

## **REFERENCE BOOKS:**

1. Machine Learning, Saikat Dull, S. Chjandramouli, Das, Pearson
2. Machine Learning with Python for Everyone, Mark Fenner, Pearson
3. Machine Learning, Anuradha Srinivasaraghavan, Vincy Joseph, Wiley
4. Machine Learning with Python, U Dinesh Kumar Manaranjan Pradhan, Wiley
5. Python Machine Learning, Sebastian Raschka, Vahid Mirjalili, Packt PublishingArtificial Intelligence: A Modern Approach, Stuart Russel, Peter Norvig, PHI

## **Evaluation Scheme:**

Continuous evaluation process comprising of components like attendance, assignment, classtests, Practical, comprehensive examinations, etc.



**Indrashil University**  
**School of Engineering**  
**Second Trimester, 2022-23**

**Course Syllabus**

<b>Course Code:</b>	<b>14201</b>
<b>Course Title:</b>	<b>Advanced Machine Learning</b>
<b>Credit Structure (L-T-P-C):</b>	<b>3-0-0-3</b>
<b>Instructor in Charge:</b>	

## **Learning Outcome of the Course:**

After learning the course, the students should be able to:

1. Explore the fundamental issues and challenges in Machine Learning including data and model selection and complexity
2. Appreciate the underlying mathematical relationships within and across Machine Learning algorithms
3. Evaluate the various Supervised Learning algorithms using appropriate Dataset.
4. Understand the search technique procedures applied to real world problems

## **Syllabus:**

- Backpropagation, Tensorflow and Keras
- Convolutional Neural Networks
- Recurrent Neural Networks
- Timeseries Processing
- Transformer Networks
- Semantic Segmentation
- Generative Models
- Generative Adversarial Networks
- Model Interpretation

## **REFERENCE BOOKS:**

1. Machine Learning, Saikat Dull, S. Chjandramouli, Das, Pearson
2. Machine Learning with Python for Everyone, Mark Fenner, Pearson
3. Machine Learning, Anuradha Srinivasaraghavan, Vincy Joseph, Wiley
4. Machine Learning with Python, U Dinesh Kumar Manaranjan Pradhan, Wiley
5. Python Machine Learning, Sebastian Raschka, Vahid Mirjalili, Packt Publishing
6. Artificial Intelligence: A Modern Approach, Stuart Russel, Peter Norvig, PHI

## **Evaluation Scheme:**

Continuous evaluation process comprising of components like attendance, assignment, classtests, Practical, comprehensive examinations, etc.



**Indrashil University**  
**School of Engineering**  
**Second Trimester, 2022-23**

**Course Syllabus**

<b>Course Code:</b>	<b>14202</b>
<b>Course Title:</b>	<b>Marketing Analysis</b>
<b>Credit Structure (L-T-P-C):</b>	<b>2-0-0-2</b>
<b>Instructor in Charge:</b>	

## **Learning Outcome of the Course:**

After learning the course, the students should be able to:

1. Build and define a brand architecture and how to measure the impact of marketing efforts on brand value over time
2. Design basic experiments so that you can assess your marketing efforts and invest your marketing dollars most effectively.
3. Set up regressions, interpret outputs, explore confounding effects and biases, and distinguish between economic and statistical significance.

## **Syllabus:**

- Introduction: Marketing decisions as interventions,
- Predictive modeling with marketing data: Penalized regression,
- Targeting marketing interventions,
- Experiments for customer acquisition and product innovation Guest: ZachWinston,
- Recommendation and personalization,
- Marketplace analytics,
- A Tableau for Business Analytics and Marketing
- Analytics in B2B marketing and startups

## **REFERENCE BOOKS:**

1. Data-Driven Marketing: The 15 Metrics Everyone in Marketing Should Know
2. Marketing Analytics: A Practical Guide to Improving Consumer Insights Using Data Techniques
3. Marketing Analytics: Strategic Models and Metrics
4. Data Science for Marketing Analytics: Achieve Your Marketing Goal With the Data Analytics with Python
5. Hands-on Data Science for Marketing: Improve Your Marketing Strategies With Machine Learning with Python

## **Evaluation Scheme:**

Continuous evaluation process comprising of components like attendance, assignment, classtests, Practical, comprehensive examinations, etc.



**Indrashil University**  
**School of Engineering**  
**Second Trimester, 2022-23**

**Course Syllabus**

<b>Course Code:</b>	<b>14203</b>
<b>Course Title:</b>	<b>Unsupervised Learning</b>
<b>Credit Structure (L-T-P-C):</b>	<b>2-0-2-3</b>
<b>Instructor in Charge:</b>	



## Learning Outcome of the Course:

After learning the course, the students should be able to:

1. Correctly apply and interpret results from clustering methods in scikit-learn, including k-means, agglomerative clustering, hierarchical clustering, and DBSCAN.
2. Understand the use of topic modeling (Latent Dirichlet Allocation and Non-Negative Matrix Factorization forms) and best practices for its application.
3. Correctly apply and interpret results from manifold learning methods, including multidimensional scaling (MDS) and t-SNE.
4. Understand how to evaluate clustering results using a variety of metrics.
5. Understand the tradeoffs and assumptions inherent in different clustering techniques.
6. Understand how unsupervised learning can be used to improve supervised prediction.

## Syllabus:

- Apply PCA to a dataset: create and interpret biplot.
- Understand the Singular Value Decomposition.
- Apply MDS and t-SNE to a dataset, interpret results.
- Learn how normalization should be applied to input, and how key parameters can affect output.
- Perform density estimation on a single variable using different kernel choices/parameters.
- Apply k-means clustering to a given dataset.
- Learn about issues with applying some clustering methods in practice, such as local minima and restarts.
- Create a dendrogram from hierarchical data to answer questions about the dataset.
- Use DBSCAN to find groups and detect outliers.
- Compare different clusters in terms of selected quality metrics.
- Apply unsupervised learning techniques to a real-world dataset, including the methods.
- Use unsupervised methods to find features for a supervised learning problem.
- Learn how unsupervised learning can be used for data imputation.
- Learn about related methods: self-supervised learning and semi-supervised learning.

## REFERENCE BOOKS:

1. The Elements of Statistical Learning (Second Ed.) by Trevor Hastie, Robert Tibshirani, and Jerome Friedman, published by Springer.  
The entire textbook is free and available on <https://hastie.su.domains/ElemStatLearn/>
2. Introduction to Machine Learning with Python, by Andreas C. Müller and Sarah Guido (O'Reilly Media)

## Evaluation Scheme:

Continuous evaluation process comprising of components like attendance, assignment, classtests, Practical, comprehensive examinations, etc.



**Indrashil University**  
**School of Engineering**  
**Third Trimester, 2022-23**

**Course Syllabus**

<b>Course Code:</b>	<b>14301</b>
<b>Course Title:</b>	<b>Natural Language Processing</b>
<b>Credit Structure (L-T-P-C):</b>	<b>2-0-2-3</b>
<b>Instructor in Charge:</b>	

## **Learning Outcome of the Course:**

After learning the course, the students should be able to:

1. Understand comprehend the key concepts of NLP and identify the NLP challenges and issues.
2. Develop Language Modeling for various text corpora across the different languages.
3. Illustrate computational methods to understand language phenomena of word sense disambiguation
4. Design and develop applications for text or information extraction/summarization/classification.
5. Apply different Machine translation techniques for translating a source to target language(s)

## **Syllabus:**

### **Introduction to NLP:**

What is NLP? Why NLP is Difficult? History of NLP, Advantages of NLP, Disadvantages of NLP, Components of NLP, Applications of NLP, How to build an NLP pipeline? Phases of NLP, NLP APIs, NLP Libraries

### **Language Modeling and Part of Speech Tagging:**

Unigram Language Model, Bigram, Trigram, N-gram, Advanced smoothing for language modeling, Empirical Comparison of Smoothing Techniques, Applications of Language Modeling, Natural Language Generation, Parts of Speech Tagging, Morphology, Named Entity Recognition

### **Words and Word Forms:**

Bag of words, skip-gram, Continuous Bag-Of-Words, Embedding representations for words Lexical Semantics, Word Sense Disambiguation, Knowledge Based and Supervised Word Sense Disambiguation

### **Text Analysis, Summarization and Extraction:**

Sentiment Mining, Text Classification, Text Summarization, Information Extraction, Named Entity Recognition, Relation Extraction, Question Answering in Multilingual Setting; NLP in Information Retrieval, Cross-Lingual IR

### **REFERENCE BOOKS:**

1. Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics and Speech Recognition Jurafsky, David, and James H. Martin, PEARSON
2. Foundations of Statistical Natural Language Processing, Manning, Christopher D., and Hinrich Schutze, Cambridge, MA: MIT Press
3. Natural Language Understanding, James Allen. The Benjamin/Cummings Publishing Company Inc..
4. Natural Language Processing with Python – Analyzing Text with the Natural Language Tool kit

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**Evaluation Scheme:**

Continuous evaluation process comprising of components like attendance, assignment, classtests, Practical, comprehensive examinations, etc.



**Indrashil University**  
**School of Engineering**  
**Third Trimester, 2022-23**

**Course Syllabus**

<b>Course Code:</b>	<b>14302</b>
<b>Course Title:</b>	<b>Introduction to Computer Vision and Image Processing</b>
<b>Credit Structure (L-T-P-C):</b>	<b>3-0-0-3</b>
<b>Instructor in Charge:</b>	

## **Learning Outcome of the Course:**

After learning the course, the students should be able to:

1. Use the Vertex AI Feature Store
2. Understand how to move from raw data to features
3. Understand Feature Engineering in BigQuery ML and Keras
4. Identify and apply Preprocess features using Apache Beam and Cloud DataFlow

## **Syllabus:**

- Introduction to Computer Vision
- Image Processing with OpenCV and Pillow
- Machine Learning Image Classification
- Neural Networks and Deep Learning for Image Classification
- Object Detection
- Project Case: In the final week of this course, you will build a computer vision app that you will deploy on the cloud through Code Engine. For the project, you will create a custom classifier, train it and test it on your own image

## **REFERENCE BOOKS:**

1. Digital Image Processing - R.C.Gonzalez & P.Wintz
2. Robot Vision - B.K.P.Horn
3. Computer Vision - D.H.Ballard & C.M.Brown
4. Syntactic Pattern Recognition : An introduction -R.C.Gonzalez and M.G.Thomason
5. Pattern Recognition - A Statistical Approach - P.A. Devijver and J. Kittler
6. Digital Image Processing - W. K. Pratt
7. Fundamentals of Digital Image Processing - A.K. Jain

## **Evaluation Scheme:**

Continuous evaluation process comprising of components like attendance, assignment, classtests, Practical, comprehensive examinations, etc.



**Indrashil University**  
**School of Engineering**  
**Third Trimester, 2022-23**

**Course Syllabus**

**Course Code:** 14303

**Course Title:** Text Mining

**Credit Structure (L-T-P-C):** 2-0-0-2

**Instructor in Charge:**

## **Learning Outcome of the Course:**

After learning the course, the students should be able to:

1. Use the Vertex AI Feature Store
2. Understand how to move from raw data to features
3. Understand Feature Engineering in BigQuery ML and Keras
4. Identify and apply Preprocess features using Apache Beam and Cloud DataFlow

## **Syllabus:**

- Introduction
- Natural language processing
- Document representation
- Text categorization
- Text clustering
- Topic modeling
- Document summarization
- Social media and network analysis
- Sentiment analysis
- Text visualization
- Final project

## **REFERENCE BOOKS:**

1. Feature Engineering and Selection: A Practical Approach for Predictive Models, Max Kuhn CRC Press, 2019.
2. Feature Engineering for Machine Learning: Principles and Techniques for Data Scientists, Alice Zheng and Amanda Casari, O Reilly, 2018.

## **Evaluation Scheme:**

Continuous evaluation process comprising of components like attendance, assignment, classtests, Practical, comprehensive examinations, etc.





**Indrashil University**  
**School of Engineering**  
**Third Trimester, 2022-23**

**Course Syllabus**

<b>Course Code:</b>	<b>14304</b>
<b>Course Title:</b>	<b>INDUSTRY PROJECT/ MAJOR PROJECT</b>
<b>Credit Structure (L-T-P-C):</b>	<b>0-0-16-8</b>
<b>Instructor in Charge:</b>	

**Evaluation Scheme:**

1. Continuous evaluation components- 50%
  - Classroom participation and attendance
  - Presentation, role play, Quiz etc
  - Assignments, case study analysis.
2. Mid-Trimester exam- 20%
3. External examination- 30%
4. Project work –
  - Mid Presentation: 40%
  - Final presentation cum viva-voce: 60% (it includes thesis evaluation)

