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| **Course Code** | **Course Title** | | | | | | | | |
| **2USI603** | **Applied Machine Learning using Tensor flow** | | | | | | | | |
|  | **TH** | | | | **P** | | **TUT** | | **Total** |
| **Teaching Scheme(Hrs.)** | **03** | | | | **--** | | **--** | | **03** |
| **Credits Assigned** | **02** | | | | **--** | | **--** | | **02** |
| **Examination Scheme** | **Marks** | | | | | | | | |
| **CA** | | | **ESE** | **TW** | **O** | **P** | **P&O** | **Total** |
| **ISE** | | **IA** |
| **30** | | **20** | **--** | **--** | **--** | **--** | **--** | **50** |

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| **Course prerequisites (if any):**  Data mining, machine learning concepts, neural networks & basic python programming.    **Course Objectives:**   1. Explain and demonstrate the basic concepts of Tensorflow, the main functions, operations and the execution pipeline. 2. To explore neural networks, understand deep learning frameworks; implement various machine learning algorithms using Tensorflow. 3. To give hands-on experience for building state-of-the-art image classifiers and other deep learning models. 4. To use various Tensorflow API’s to create, train, and evaluate an ML model. By the end of this course, students will get the necessary skills to start creating their own AI applications   **Course Outcomes**  **At the end of successful completion of the course the student will be able to**  CO1: Get a high-level overview of artificial intelligence and machine learning applications.  CO2: Deep dive into the inner workings of Tensorflow to learn about tensor operations, gradient-based optimization and graphs.  CO3: Learn how to build data pipelines & get data into Tensorflow from common sources, from CSV to text files.  CO4: Build Tensorflow model for image classification with convolutional neural networks and perform text processing, classification and analytics.  CO5: Use TF estimator API’s for various machine learning applications. |

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| **Module No.** | **Unit No.** | **Details** | **Hrs.** | **CO** |
| **1** | **Machine Learning & Deep learning Refresher** | | **06** | **CO1** |
| **1.1** | Steps in Machine Learning Process, Loss Functions in Machine Learning, Gradient Descent Variations, Model Selection and Evaluation. |  |  |
|  | **1.2** | Machine Learning Visualization, mathematical foundations of deep learning & neural network playground. |  |  |
| **2** | [**Introduction to Tensorflow & Data representation for Deep Learning**](https://colab.research.google.com/github/tfindiamooc/tfindiamooc.github.io/blob/master/colabs/MathematicalFoundationsOfDL.ipynb) | | **08** | **CO2** |
|  | 2.1 | Tensorflow 2.0 overview, features, basic mathematical operations. [Scalars (0D tensors), Vectors (1D tensors), Matrices (2D tensors), 3D Tensors, Tensor in MNIST datasets, Data Selection (Tensor Slicing), Selecting a single data point, Select multiple data points, Data Batches.](https://colab.research.google.com/github/tfindiamooc/tfindiamooc.github.io/blob/master/colabs/MathematicalFoundationsOfDL.ipynb) |  |  |
|  | 2.2 | [Vector dataTimeseries and sequence data](https://colab.research.google.com/github/tfindiamooc/tfindiamooc.github.io/blob/master/colabs/MathematicalFoundationsOfDL.ipynb) & video data, Key operations in Neural Networks,Tensor Graphs |  |  |
| 2.3 | Element-wise additions, broadcasting, tensor dot, reshaping, neural network training, gradient and momentum based optimization. |
| **3** | **Building Data Pipelines for Tensorflow** | | **05** | **CO3** |
| 3.1 | Data loading reading (load data from NumPy, CSV, Pandas, images & text files). |  |  |
| **4** | **Text Processing with Tensorflow** | | **05** | **CO3,CO4** |
| 4.1 | Data pipeline for text, handling unicode characters, tf.text library |  |  |
| **5** | **Building basic models with TF** | | **8** | **CO 3,CO4** |
| 5.1 | Classify images: explore data, preprocess, build model, train model, evaluate model & make predictions & save and restore model. |  |  |
| 5.2 | Classify Structured Data |
| 5.3 | Ttext classification |
| **6** | **Image models with TF** | | **08** | **CO3,CO4** |
| 6.1 | CNN, Transfer learning with Pre-trained CNN, transfer learning with TF hub |  |  |
| 6.2 | Image classification & visualization |  |  |
| **7** | **TF Estimator APIs** | | **05** | **CO5** |
| 7.1 | Estimator API, Logistic regression, boosted tree |  |  |
|  |  | **#Self learning :** Cloud ML Engine |  |  |
| **Total** | | | **45** |  |

**# Students should prepare all Self Learning topics on their own. Self-learning topics will enable students to gain extended knowledge of the topic. Assessment of these topics may be included in IA and Laboratory Experiments.**

**Recommended Books:**

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| **Sr. No.** | **Name/s of Author/s** | **Title of Book** | **Name of Publisher with country** | **Edition and Year of Publication** |
| 1. | Tom Mitchell | Machine Learning | Tata McGraw-Hill Education | 2013 |
| 2. | Peter Harrington | Machine Learning In Action | DreamTech Press | 2015 |
| 3. | Ian Goodfellow, Yoshua Bengio, Aaron Courville | Deep Learning | An MIT Press | 2016 |
| 4. |  | [TensorFlow 2.0 Documentation](https://www.tensorflow.org/beta) | <https://github.com/tensorflow/docs> |  |