Course Code:	Course Title	Credit
ADLO6013	Image Processing and computer vision	3

Prerequisite: Engineering Mathematics, Algorithms	
Course Objectives:	
1	To introduce students to the basic concepts of image processing, file formats.
2	To acquire an in-depth understanding of image enhancement technqiues.
3	To gain knowledge of image segmentation and compression techniques.
4	To acquire fundamentals of image transform techniques.
Course Outcomes	
1	To gain fundamental knowledge of Image processing.
2	To apply image enhancement techniques.
3	To apply image segmentation and compression techniques.
4	To gain an in-depth understanding of image transforms.
5	To gain fundamental understanding of video processing.

Module		Content	Hrs
1		**Digital Image Fundamentals**	**04**
	1.1	Introduction to Digital Image, Digital Image Processing System, Sampling and Quantization,	
	1.2	Representation of Digital Image, Connectivity, Image File Formats : BMP, TIFF and JPEG.	
2		**Image Enhancement in Spatial Domain**	**08**
	2.1	**Image Enhancement** (point processing): Image Negative, Thresholding, Gray-level slicing with and without background, power law and log transform, Contrast Stretching, Histogram equalization and Histogram Specification	
	2.2	**Image Enhancement in Spatial Domain** (Neighbourhood processing): Low Pass and High Pass filtering for image enhancement, Basics of Spatial Filtering, Generating Spatial Filter Masks–Smoothing and Sharpening Spatial Filtering	
	2.3	**Image Transforms:** 1-D DFT, 2-D Discrete Fourier Transform and Its Inverse, Some Properties of 2D DFT, Walsh -Hadamard, Discrete Cosine Transform, Haar Transform, Slant Transform	
3		**Image Compression**	**06**
	3.1	Introduction, Redundancy, Fidelity Criteria	
	3.2	Lossless Compression Techniques : Run length Coding, ArithmeticCoding, Huffman Coding	

	3.3	Lossy Compression Techniques: Improved Gray Scale Quantization,Vector Quantization	
4	4.1	**Morphology:** Erosion and Dilation, Opening and Closing, The Hit or-Miss Transformation. Restoration: Noise models – Mean Filters – Order Statistics – Adaptive filters –wiener filter.	**08**
	4.2	**Corner and Interest Point detection:** The Harris Interest Point Operator: Corner Signals and shifts for various geometric configuration, Performance with crossing point and Junctions, Different forms of Harris Operator, Local Invariant Feature Detectors and Descriptors: Harris scale and Affine-Invariant Detectors and Descriptors, The SIFT operators, The SURF operators.	
5	5.1	**Point, Line, and Edge Detection:** Detection of Isolated Points, Line detection, edge models, basic and advance edge detection, Edge linking and boundary detection, Canny's edge detection algorithm **Thresholding:** Foundation, Role of illumination, Basic Global thresholding, Otsu's method Region Based segmentation: Region Growing, Region Splitting and merging, Relationships between pixels, Hough transform	**08**
	5.2	**Region Identification:** Chain code, simple geometric border representation, Fourier Transform of boundaries, Boundary description using segment sequences	
6	6.1	**Motion:** Optical Flow, Interpretation of Optical Fields, Using focus of expansion to avoid collision, Time to adjacency analysis, Basic difficulties with optical flow models, Stero from Motion	**05**
		Total	**39**

Textbooks:	
1	Rafael C. Gonzalez and Richard E. Woods, _Digital Image Processing', Pearson Education Asia, Third Edition, 2009
2	S. Jayaraman, E. Esakkirajan and T. Veerkumar, –Digital Image Processing TataMcGraw Hill Education Private Ltd, 2009
3	Anil K. Jain, —Fundamentals and Digital Image Processing, Prentice Hall of India Private Ltd, Third Edition
4	S. Sridhar, –Digital Image Processing, Oxford University Press, Second Edition, 2012.
5.	Alan C. Bovik, –The Essential Guide To Video Processing Academic Press,
6	Yao Wang, Jorn Ostermann, Ya-Qin Zang, –Video Processing and Communications, Prentice Hall, Signal Processing series.
	References Books
1.	S. Salivahanan, A. Vallavaraj, C. Gnanapriya, 'Digital Signal Processing', Tata McGraw Hill Publication 4th Edition, 2019.
2.	E. R. Davies, 'Computer and Machine Vision: Theory, Algorithms', Academic Press, 4th Edition, 2012.
3	David A. Forsyth, Jean Ponce, –Computer Vision: A Modern Approach, Pearson Education, Limited, 2011

4	Malay K. Pakhira, –Digital Image Processing and Pattern Recognition, Prentice Hall of India Private Ltd, Third Edition

Internal Assessment:
Assessment consists of one Mid Term Test of 20 marks and Continuous Assessment of 20 marks. Mid Term test is to be conducted when approx. 50% syllabus is completed Duration of the midterm test shall be one hour.

Continuous Assessment:-
Continuous Assessment **is of 20 marks.** The rubrics for assessment will be considered on approval by the subject teachers. The rubrics can be any 2 or max 4 of the following:-

Sr.no	Rubrics	Marks
1.	*Certificate course for 4 weeks or more:- NPTEL/ Coursera/ Udemy/any MOOC	10 marks
2.	Content beyond syllabus presentation	10 marks
3.	Creating Proof of concept	10 marks
4.	Mini Project / Extra Experiments/ Virtual Lab / Competitive programming-based event / Group Discussion	10 marks
5.	Multiple Choice Questions (Quiz)	5 marks
6.	GATE Based Assignment /Tutorials etc	10 marks

For sr.no.1, the date of certification exam should be within the term and in case a student is unable to complete the certification , the grading has to be done accordingly.

End Semester Theory Examination:

1	Question paper will be of 60 marks
2	Question paper will have a total of five questions
3	All questions have equal weightage and carry 20 marks each
4	Any three questions out of five needs to be solved.

Useful Links

1	https://swayam.gov.in
2	https://nptel.ac.in/courses
3	https://www.coursera.org

Lab Code	Lab Name	Credit
ADL601	Data Analytics and Visualization Lab	1

Prerequisite: Basic Python	
Lab Objectives:	
1	To effectively use libraries for data analytics.
2	To understand the use of regression Techniques in data analytics applications.
3	To use time series models for prediction.
4	To introduce the concept of text analytics and its applications.
5	To apply suitable visualization techniques using R and Python.
Lab Outcomes: **At the end of the course, students will be able to —-**	
1	Explore various data analytics Libraries in R and Python.
2	Implement various Regression techniques for prediction.
3	Build various time series models on a given data set.
4	Design Text Analytics Application on a given data set.
5	Implement visualization techniques to given data sets using R .
6	Implement visualization techniques to given data sets using Python.

Suggested Experiments: Students are required to complete at least 08 experiments Preferably using **R Programming Language/Python**

Sr. No.	Name of the Experiment
1	Getting introduced to data analytics libraries in Python and R.
2	Simple Linear Regression in Python.
3	Multiple Linear Regression in Python
4	Time Series Analysis in Python
5	Implementation of ARIMA model in python
6	Implementation of Time series Decomposition and ACF and PACF
7,8	Set Up a D3.js Environment, Select Elements in D3, Modify Elements in D3,Data Loading in D3,Create a World Map with d3.js, Event Handling with D3.js
9,10	Two visualization experiments in python using different Libraries.

Useful Links:	
1	https://www.geeksforgeeks.org/data-visualization-with-python
2	https://www.coursera.org/specializations/data-science-python
3	https://www.geeksforgeeks.org/data-visualization-in-r/
5	https://towardsdatascience.com/introduction-to-arima-for-time-series-forecasting-

References:	
1	Data Analytics using R, Bharati Motwani, Wiley Publications
2	Python for Data Analysis: 3rd Edition, WesMcKinney, Publisher(s): O'Reilly Media, Inc.

3	Better Data Visualizations A Guide for Scholars, Researchers, and Wonks, Jonathan Schwabish, Columbia University Press

Term Work:	
1	Term work should consist of 8(min) to 12(max) experiments.
2	The final certification and acceptance of term work ensures satisfactory performance of laboratory work and minimum passing marks in term work.
3	Total 25 Marks based on evaluation of Experiments
Evaluation Exam	
	Practical Exam based on lab syllabus of ADL601

Lab Code	Lab Name	Credit
ADL602	Cryptographic and system security Lab	1

Prerequisite: Operating System, Basics of Java and Python Programming.	
Lab Objectives:	
1	To be able to apply the knowledge of symmetric cryptography to implement simple ciphers
2	To be able to analyze and implement public key algorithms like RSA and El Gamal
3	To analyze and evaluate performance of hashing algorithms
4	To explore the different network reconnaissance tools to gather information about networks .
Lab Outcomes:	
1	Apply the knowledge of symmetric cryptography to implement simple ciphers
2	Analyze and implement public key algorithms like RSA and El Gamal
3	Analyze and evaluate performance of hashing algorithms
4	Explore the different network reconnaissance tools to gather information about networks
5	Use tools like sniffers, port scanners and other related tools for analyzing packets in a network.
6	Apply and set up firewalls and intrusion detection systems using open source technologies and to explore email security.

Suggested Experiments: Students are required to complete at least 10 experiments.	
Star (*) marked experiments are compulsory.	
Sr. No.	**Name of the Experiment**
1*	Design and Implementation of a product cipher using Substitution and Transposition ciphers.
2*	Implementation and analysis of RSA cryptosystem and Digital signature scheme using RSA/El Gamal.
3*	Implementation of Diffie Hellman Key exchange algorithm
4	For varying message sizes, test integrity of message using MD-5, SHA-1, and analyse the performance of the two protocols. Use crypt APIs.
5*	Exploring wireless security tools like Kismet, NetStumbler etc.
6*	Study the use of network reconnaissance tools like WHOIS, dig,traceroute, nslookup to gather information about networks and domain registrars.
7	Study of packet sniffer tools wireshark, :- 1. Observer performance in promiscuous as well as non-promiscuous mode. 2. Show the packets can be traced based on different filters.
8*	Download and install nmap. Use it with different options to scan open ports, perform OS fingerprinting, do a ping scan, tcp port scan, udp port scan, etc. .
9*	Detect ARP spoofing using nmap and/or open source tool ARPWATCH and wireshark
10	Use the NESSUS/ISO Kaali Linux tool to scan the network for vulnerabilities

11	Set up IPSEC under LINUX. b) Set up Snort and study the logs. c) Explore the GPG tool of linux to implement email security.

Useful Links:	
1	www.leetcode.com
2	www.hackerrank.com
3	www.cs.usfca.edu/
4	www.codechef.com

Term Work:	
1	Term work should consist of 8(min) to 12(max) experiments.
2	The final certification and acceptance of term work ensures satisfactory performance of laboratory work and minimum passing marks in term work.
3	Total 25 Marks based on evaluation of Experiments

Lab Code	Lab Name	Credit
ADL603	Software Engineering and Project Management Lab	1

Prerequisite: Knowledge of Linux Operating system, installation and configuration of services and command line basics, Basics of Computer Networks and Software Development Life cycle.	
Lab Objectives:	
1	To understand DevOps practices which aims to simplify Software Development Life Cycle.
2	To be aware of different Version Control tools like GIT, CVS or Mercurial
3	To Integrate and deploy tools like Jenkins and Maven, which is used to build, test and deploy applications in DevOps environment
4	To understand the importance of Jenkins to Build and deploy Software Applications on server environment
5	To use Docker to Build, ship and manage applications using containerization
6	To understand the concept of Infrastructure as a code and install and configure Ansible tool
Lab Outcomes:	
1	To understand the fundamentals of DevOps engineering and be fully proficient with DevOps terminologies, concepts, benefits, and deployment options to meet your business requirements
2	To obtain complete knowledge of the –version control system to effectively track changes augmented with Git and GitHub
3	Understand the importance of Selenium and Jenkins to test Software Applications
4	To understand the importance of Jenkins to Build and deploy Software Applications on server environment
5	To understand concept of containerization and Analyze the Containerization of OS images and deployment of applications over Dockerk.
6	To Synthesize software configuration and provisioning using Ansible.

Suggested Experiments: Students are required to complete at least 10 experiments from the list given below.	
Star (*) marked experiments are compulsory.	
Sr. No.	**Name of the Experiment**
1	To understand DevOps: Principles, Practices, and DevOps Engineer Role and Responsibilities
2	To understand Version Control System / Source Code Management, install git and create a GitHub account
3	To Perform various GIT operations on local and Remote repositories using GIT Cheat-Sheet
4	To understand Continuous Integration, install and configure Jenkins with

	Maven/Ant/Gradle to setup a build Job
5	To Build the pipeline of jobs using Maven / Gradle / Ant in Jenkins, create a pipeline script to Test and deploy an application over the tomcat server.
6	To understand Jenkins Master-Slave Architecture and scale your Jenkins standalone implementation by implementing slave nodes.
7	To Setup and Run Selenium Tests in Jenkins Using Maven.
8	To understand Docker Architecture and Container Life Cycle, install Docker and execute docker commands to manage images and interact with containers
9	To learn Docker file instructions, build an image for a sample web application using Docker file.
10	To install and Configure Pull based Software Configuration Management and provisioning tools using Puppet
11	To learn Software Configuration Management and provisioning using Puppet Blocks(Manifest, Modules, Classes, Function)
12	To provision a LAMP/MEAN Stack using Puppet Manifest.

Useful Links:	
1	https://nptel.ac.in/courses/128106012
2	https://www.edureka.co/devops-certification-training
3	https://www.coursera.org/professional-certificates/devops-and-software-engineering

Term Work:	
1	Term work should consist of 8(min) to 12(max) experiments.
2	The final certification and acceptance of term work ensures satisfactory performance of laboratory work and minimum passing marks in term work.
3	Total 25 Marks based on evaluation of Experiments
Evaluation Exam	
	Practical Exam based on lab syllabus of ADL603

Lab Code	Lab Name	Credit
ADL604	Machine Learning Lab	1

Prerequisite: C Programming Language.	
Lab Objectives:	
1	To introduce platforms such as Anaconda, COLAB suitable to Machine learning
2	To implement various Regression techniques
3	To develop Neural Network based learning models
4	To implement Clustering techniques
Lab Outcomes: **After successful completion of the course students will be able to:**	
1	Implement various Machine learning models
2	Apply suitable Machine learning models for a given problem
3	Implement Neural Network based models
4	Apply Dimensionality Reduction techniques

Suggested Experiments: Students are required to complete at least 10 experiments.	
Sr. No.	**Name of the Experiment**
1	Introduction to platforms such as Anaconda, COLAB
2	Study of Machine Learning Libraries and tools (Python library, tensorflow, keras,...)
	Implementation of following algorithms for a given example data set-
3	Linear Regression.
4	Logistic Regression.
5	Support Vector Machines
6	Hebbian Learning
7	Expectation -Maximization algorithm
8	McCulloch Pitts Model.
9	Single Layer Perceptron Learning algorithm
10	Error Backpropagation Perceptron Training Algorithm
11	Principal Component Analysis
12	Applications of above algorithms as a case study (E.g. Hand Writing Recognition using MNIST data set, classification using IRIS data set, etc)

Useful Links:	
1	https://www.learndatasci.com/out/edx-columbia-machine-learning/
2	https://www.learndatasci.com/out/oreilly-hands-machine-learning-scikit-learn-keras-and-tensorflow-2nd-edition/
3	https://www.learndatasci.com/out/google-machine-learning-crash-course/

4	https://www.learndatasci.com/out/edx-columbia-machine-learning/

Term Work:	
1	Term work should consist of 8(min) to 12(max) experiments.
2	The final certification and acceptance of term work ensures satisfactory performance of laboratory work and minimum passing marks in term work.
3	Total 25 Marks based on evaluation of Experiments
Evaluation Exam	
	Practical Exam based on lab syllabus of ADL604

Course Code	Course Name	Credits
ADL601	Skill based Lab: R Programming / Tableau	02

Prerequisite:	
Lab Objectives:	
1	To understand and identify the problem
2	To apply basic engineering fundamentals and attempt to find solutions to the problems.
3	Identify, analyze, formulate and handle programming projects with a comprehensive and systematic approach
Lab Outcomes: **At the end of the course, students will be able to —-**	
1	Identify Methodology for solving above problem and apply engineering knowledge and skills to solve it
2	Analyze and evaluate the impact of solution/product/research/innovation /entrepreneurship towards societal/environmental/sustainable development
3	Identify Methodology for solving above problem and apply engineering knowledge and skills to solve it

R Programming	
1	Introduction: Installing R on personal machines. installing R and RStudio. • The basic functionality of R will be demonstrated, Variable types in R. Numeric variables, strings and factors. • Accessing the help system. Retrieving R packages. • Basic data types and operations: numbers, characters and composites. • Data entry and exporting data
2	Data structures: vectors, matrices, lists and data frames.
3	R as a programming language:Grouping, loops and conditional execution, Functions Exploratory data analysis Range, summary, mean, variance, median, standard deviation, histogram, box plot, scatterplot
4	Graphics in R • Graphics and tables • Working with larger datasets • Building tables with aggregate • Introduction to ggplot2 graphics
5	Regression and correlation • Simple regression and correlation Multiple regression • Tabular data and analysis of Categorical Data
6	R for Data Science (Mini Project) Implementing a mini project using any data mining or big data analytics algorithm in R • Extracting data from a large Dataset • Exploratory analysis • Using Mining algorithm • Visualizations and interpretation of Results

Tableau	
1	**Tableau Basic** :Connecting to Excel Files Connecting to Text Files , Connect to Microsoft SQL Server , Connecting to Microsoft Analysis Services ,Creating and Removing Hierarchies , Bins , Joining Tables , Data Blending
2	**Learn Tableau Basic Reports** : Parameters , Grouping Example 1 , Grouping Example 2 ,Edit Groups , Set , Combined Sets • Creating a First Report , Data Labels • Create Folders , Sorting Data , Add Totals, Sub Totals and Grand Totals to Report
3	**Learn Tableau Charts** : Area Chart ,Bar Chart , Box Plot , Bubble Chart , Bump Chart , Bullet Graph , Circle Views , Dual Combination Chart , Dual Lines Chart , Funnel Chart , Traditional Funnel Charts , Gantt Chart , Grouped Bar or Side by Side Bars Chart , Heat map , Highlight Table , Histogram , Cumulative Histogram • Line Chart
4	**Learn Tableau Calculations & Filters** : Calculated Fields ,Basic Approach to Calculate Rank , Advanced Approach to Calculate Rank , Calculating Running Total, Filters Introduction , Quick Filters , Filters on Dimensions , Conditional Filters ,Top and Bottom Filters , Filters on Measures , Context Filters , Slicing Filters , Data Source Filters , Extract Filters
5	**Learn Tableau Dashboards** : Create a Dashboard , Format Dashboard Layout , Create a Device preview of dashboard. Create Filters on Dashboard , Dashboard Objects , Create a Story

Term Work:	
1	Term work should consist of 5 Experiment.
2	The final certification and acceptance of term work ensures satisfactory performance of laboratory work and minimum passing marks in term work.
3	Total 50 Marks (Experiments: 50 Marks)

Course Code	Course Name	Credits
ADS602	Skill based Lab: AWS Essentials / Azure for data engineering	02

Prerequisite:	
Lab Objectives:	
1	To understand and identify the problem
2	To apply basic engineering fundamentals and attempt to find solutions to the problems.
3	Identify, analyze, formulate and handle programming projects with a comprehensive and systematic approach
Lab Outcomes: **At the end of the course, students will be able to —-**	
1	Identify Methodology for solving above problem and apply engineering knowledge and skills t solve it
2	Analyze and evaluate the impact of solution/product/research/innovation /entrepreneurship towards societal/environmental/sustainable development
3	Identify Methodology for solving above problem and apply engineering knowledge and skills to solve it

AWS Essentials	
1	Introduction to Amazon Web Services
2	Compute in the Cloud
3	Global Infrastructure and Reliability
4	Networking storage and database
5	Monitoring and Analytics

Data Engineering on Microsoft Azure	
1	Introduction to data engineering on Azure
2	Introduction to Azure Data Lake Storage Gen2
3	Introduction to Azure Synapse Analytics
4	Use Azure Synapse serverless SQL pool to query files in a data lake
5	Use Azure Synapse serverless SQL pools to transform data in a data lake

Term Work:	
1	Term work should consist of 5 Experiment.
2	The final certification and acceptance of term work ensures satisfactory performance of laboratory work and minimum passing marks in term work.
3	Total 50 Marks (Experiments: 50 Marks)