Shirpur Education Society's

R. C. Patel Institute of Technology, Shirpur

(An Autonomous Institute)

Course Structure and Syllabus

Third Year B. Tech

Artificial Intelligence and Machine Learning

With effect from Year 2024-25

Shahada Road, Near Nimzari Naka, Shirpur, Maharashtra 425405
Ph: 02563 259 802, Web: www.rcpit.ac.in

Third Year B. Tech Artificial Intelligence and Machine Learning Semester-V (w.e.f. 2024-25)

Sr	Course Category	Course Code	Course Title	Teaching Scheme			Evaluation Scheme					Total	Credit	
							Continuous Assessment (CA)							
							TA	Term Test 1 (TT1)	Term Test 2 (TT2)	Average of (TT1 & TT2)	ESE			
				L	T	P	[A]			[B]	[C]	[A+B+C]		
1	PC	22PCAI5010T	Digital Signal and Image Processing	3			25	10	10	10	65	100	3	4
	PC	22PCAI5010L	Digital Signal and Image Processing Laboratory			2	25				25	50	1	
2	PC	22PCAI5020T	Machine Learning	3			25	10	10	10	65	100	3	4
	PC	22PCAI5020L	Machine Learning Laboratory			2	25				25	50	1	
3	PC	22PCAI5030T	Natural Language Processing	3			25	10	10	10	65	100	3	4
	PC	22PCAI5030L	Natural Language Processing Laboratory			2	25				25	50	1	
4	PC	22PCAI5040L	Programming Laboratory-III (Full Stack Development Lab)			4	25				25	50	2	2
5@	PE	22PEAI5051T	Computer Network Security	3			25	10	10	10	65	100	3	4
		22PEAI5051L	Computer Network Security Laboratory			2	25				25	50	1	
		22PEAI5052T	Advanced Data Structures and Algorithms	3			25	10	10	10	65	100	3	
		22PEAI5052L	Advanced Data Structures and Algorithms Laboratory			2	25				25	50	1	
		22PEAI5053T	Recommendation Systems	3			25	10	10	10	65	100	3	
		22PEAI5053L	Recommendation Systems Laboratory			2	25				25	50	1	
6	MC	22MCAI5060T	Environmental Engineering	1								Audit Course		
7	PJ	22PJAI5070L	Semester Project-III			2	25				25	50	1	1
8	HM	22HMAI5080L	Employability Skill Development Program-II			2	50					50	1	1
			Total	13		16	300			40	410	750	20	

@Any 1 Professional Elective Course

Prepared by:
Ms. S. P. Salunkhe

Checked by:
Dr. P. S. Sanjekar

Prof. Dr. U. M. Patil
BOS Chairman

Prof. S. P. Shukla
C.O.E.

Prof. Dr. P. J. Deore
Dean Academics/Dy. Director

Prof. Dr. J. B. Patil
Director

Third Year B. Tech Artificial Intelligence and Machine Learning Semester-VI (w.e.f. 2024-25)

Sr	Course Category	Course Code	Course Title	Teaching Scheme			Evaluation Scheme					Total	Credit	
							Continuous Assessment (CA)							
							TA	Term Test 1 (TT1)	Term Test 2 (TT2)	Average of (TT1 & TT2)	ESE			
				L	T	P	[A]			[B]	[C]	[A+B+C]		
1	PC	22PCAI6010T	Computer Vision	3			25	10	10	10	65	100	3	4
	PC	22PCAI6010L	Computer Vision Laboratory			2	25				25	50	1	
2	PC	22PCAI6020T	Deep Learning	3			25	10	10	10	65	100	3	4
	PC	22PCAI6020L	Deep Learning Laboratory			2	25				25	50	1	
3	PC	22PCAI6030T	Dev Ops and ML Ops	3			25	10	10	10	65	100	3	4
	PC	22PCAI6030L	Dev Ops and ML Ops Laboratory			2	25				25	50	1	
4	PC	22PCAI6040L	Cloud Computing Laboratory			2	25				25	50	1	1
5@	PE	22PEAI6051T	IoT Foundations	3			25	10	10	10	65	100	3	4
		22PEAI6051L	IoT Foundations Laboratory			2	25				25	50	1	
		22PEAI6052T	Time Series Analysis	3			25	10	10	10	65	100	3	
		22PEAI6052L	Time Series Analysis Laboratory			2	25				25	50	1	
		22PEAI6053T	Human Machine Interaction	3			25	10	10	10	65	100	3	
		22PEAI6053L	Human Machine Interaction Laboratory			2	25				25	50	1	
6#	HM	22HMAI6060T	Professional and Business Communication Tutorial		2		25					25	2	2
7	PJ	22PJAI6070L	Project Stage-I			4	25				25	50	2	2
			Total	12	2	14	275			40	410	725	21	

@Any 1 Professional Elective Course
#2 hrs. of theory (class wise)

Prepared by:
Ms. S. P. Salunkhe

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Dean Academics/Dy. Director

Prof. Dr. J. B. Patil
Director

Semester - V

Digital Signal and Image Processing (22PCAI5010T)

Teaching Scheme
Lectures : 03 Hrs./week
Credits : 03

Examination Scheme
Term Test : 10 Marks
Teacher Assessment : 25 Marks
End Sem Exam : 65 Marks
Total Marks : 100 Marks

Prerequisite: Ability to deal with applied and abstract mathematical concepts.

Course Objectives:

1. To introduce students to the basic idea of signals and systems analysis with its characterization in time and frequency domain.
2. To implement algorithms that perform basic image processing- enhancement and filtering.
3. To implement algorithms for basic image segmentation.

CO	Course Outcomes	Blooms Level	Blooms Description
CO1	Classify signals and systems on the basis of their properties and analyze the implications in the context of practical signals and systems.	L4	Analyze
CO2	Represent signals in the time and frequency domain using multiple representations and analyze LTI systems using convolution in the frequency domain.	L2	Understand
CO3	Implement image enhancement techniques in spatial and frequency domain.	L5	Evaluate
CO4	Interpret and apply image segmentation and representation techniques for object recognition.	L3	Apply

Course Contents

Unit-I — 09 Hrs.

Discrete-Time Signal and Discrete-Time System: Introduction to Digital Signal Processing, Sampling and Reconstruction, Standard DT Signals, Concept of Digital Frequency, Representation of DT signal using Standard DT Signals, Signal Manipulations (shifting, reversal, scaling, addition, multiplication). Classification of Discrete-Time Signals, Classification of Discrete Systems. Linear Convolution formulation for 1-D signal (without mathematical proof), Circular Convolution (without mathematical proof), Linear convolution using Circular Convolution.

LTI system, Concept of Impulse Response and Step Response, Output of DT system using Time Domain Linear Convolution.

Unit-II — 10 Hrs.

Discrete Fourier Transform: Introduction to DTFT, Relation between DFT and DTFT, DFT of DT signal, Inverse DFT.

Properties of the DFT: Scaling and Linearity, Symmetry for real valued signal, Periodicity, Time Shift and Frequency Shift, Time Reversal, Convolution Property.

Fast Fourier Transform: Need of FFT, Radix-2 DIT-FFT algorithm. Flow graph for N=4 and 8 using Radix-2 DIT-FFT, Inverse FFT algorithm, Comparison of complex and real, multiplication and additions of DFT and FFT. Overlap Add Algorithm and Overlap Save Algorithm and implementation using FFT.

Unit-III — 02 Hrs.

Basics of Image Processing: Image acquisition, Sampling, Quantization, Image Types, and Image formats. Colour models RGB and CMYK models.

Unit-IV — 10 Hrs.

Image Enhancement in spatial domain: Point processing techniques, Neighborhood processing. Image Smoothing: Spatial Filters-Linear Filters-Averaging filter, Median filter, Sharpening Spatial Filters- The Laplacian, Unsharp Masking and High boost Filtering, Using First-Order Derivatives —The Gradient-Sobel, Prewitt and Roberts operator, Histogram processing (Stretching & Equalization)

Image Enhancement in Frequency domain: 2D-DFT, Properties of 2D-DFT, Low pass, High pass and Homomorphic filtering.)

Unit-V — 03 Hrs.

Image Restoration: Overview of Degradation models –Unconstrained and constrained restorations

Inverse Filtering, WienerFilter.

Unit-VI 05 Hrs.

Image Segmentation: Basic relationships between pixels -Neighbors, Connectivity, Detection of discontinuities- Point, Line, Edge detection, Region-based segmentation- Region Growing, Region Splitting and merging. Region Identification: chain code, simple geometric border representation, Boundary description using segment sequences. Edge Linking, Hough Transform.

Text Books:

1. Rafael C. Gonzalez, Richard E. Woods,"Digital Image Processing", Pearson, 4th Edition, 2018.
2. Tarun Rawat, "Signals and Systems", Oxford Higher Education, Paperback – 19 July 2010
3. V. Krishnaveni and A.Rajeshwari, "Signals and Systems", Wiley-India, 1st Edition, 2012.

Reference Books:

1. Simon Haykin and Barry Van Veen, "Signals and Sytems", John Wiley and Sons, 1st Edition, 2004.
2. Alan V. Oppenhiem, Alan S. Willsky and S. Hamid Nawab, "Signals and Systems", Prentice-Hall of India, 2nd Edition, 2002.
3. Anil K Jain, "Fundamentals of digital image processing", Paperback, PHI – 1 January 2015.
4. Willliam K Pratt, "Digital Image Processing", John Willey, 2002.
5. Malay K. Pakhira, "Digital Image Processing and Pattern Recognition", 1st Edition, PHI Learning Pvt. Ltd., 2011.

Evaluation Scheme:

Theory :

Continuous Assessment (A):

Subject teacher will declare Teacher Assessment criteria at the start of semester.

Continuous Assessment (B):

1. Two term tests of 10 marks each will be conducted during the semester.
2. Average of the marks scored in both the tests will be considered for final grading.

End Semester Examination (C):

1. Question paper based on the entire syllabus, summing up to 65 marks.
2. Total duration allotted for writing the paper is 2 hrs.

Digital Signal and Image Processing Laboratory (22PCAI5010L)

Practical Scheme
Practical : 02 Hrs./week
Credit : 01

Examination Scheme
Teacher Assessment : 25 Marks
End Sem Exam : 25 Marks
Total : 50 Marks

Course Objectives:

1. To become familiar with convolution, Sampling and Quantization on image quality.
2. To introduce Image Enhancement using different techniques.
3. To introduce homomorphic filter, image zooming and Image Segmentation operations.

CO	Course Outcomes	Blooms Level	Blooms Description
CO1	Implement linear and circular convolution with overlap and add method for computing the convolution.	L3	Apply
CO2	Classify effect of sampling and quantization on image quality.	L4	Analyze
CO3	Implement image enhancement using Spatial Domain and frequency domain.	L3	Apply
CO4	Construct image zooming and image Segmentation using different operators.	L3	Apply

List of Laboratory Experiments

Suggested Experiments:

1. Implementation of Linear and Circular Convolution of two discrete time sequences.
2. Implement Overlap and Add method for computing the convolution of two variable length sequences.
3. To understand the effect of Sampling and Quantization on image quality. Study image statistics. (Mean, Variance, Entropy)
4. To perform Spatial Domain Image Enhancement using different Point Processing techniques.
5. To perform Image steganography and retrieve the secret image from the stego image.
6. Implement homomorphic filter.
7. To perform frequency domain Image Enhancement techniques.
8. Perform image zooming.
9. To perform different Image Segmentation operations using different operators and Canny edge detection.

Minimum eight experiments from the above suggested list or any other experiment based on syllabus will be included, which would help the learner to apply the concept learnt.

Evaluation Scheme:

Laboratory:

Continuous Assessment (A):

Laboratory work will be based on 22PCAI5010T with minimum 08 experiments to be incorporated. The distribution of marks for term work shall be as follows:

1. Performance in Experiments: 05 Marks
2. Journal Submission: 05 Marks
3. Viva-voce: 05 Marks
4. Subject Specific Lab Assignment/Case Study: 10 Marks

The final certification and acceptance of term work will be subject to satisfactory performance of laboratory work and upon fulfilling minimum passing criteria in the term work.

End Semester Examination (C):

Oral/ Practical examination will be based on the entire syllabus including, the practicals performed during laboratory sessions.

Machine Learning (22PCAI5020T)

Teaching Scheme
Lectures : 03 Hrs./week
Credits : 03

Examination Scheme
Term Test : 10 Marks
Teacher Assessment : 25 Marks
End Sem Exam : 65 Marks
Total Marks : 100 Marks

Prerequisite: Knowledge of basic probability and statistics. Data Mining and Analytics concepts

Course Objectives:

1. To understand key machine learning concepts: hypothesis formation, bias-variance trade-off, and model evaluation metrics.
2. To master regression, classification, and clustering techniques.
3. To apply machine learning algorithms to real-world datasets effectively.

CO	Course Outcomes	Blooms Level	Blooms Description
CO1	Analyse model performance using evaluation metrics.	L4	Analyze
CO2	Implement and tune regression and classification algorithms.	L3	Apply
CO3	Apply knowledge of Bayesian learning principles.	L3	Apply
CO4	Apply clustering and dimensionality reduction techniques.	L3	Apply
CO5	Understand the fundamentals of Neural Networks.	L2	Understand

Course Contents

Unit-I — 05 Hrs.

Hypothesis and Inductive Bias, Bias-Variance Trade-off, Performance measures, Data Validation.

Evaluation & Selection: Metrics for Evaluating Classifier Performance, Holdout Method and Random Subsampling, Cross Validation, Bootstrap, Model Selection Using Statistical Tests of Significance, Comparing Classifiers Based on Cost–Benefit and ROC Curves.

Unit-II — 08 Hrs.

Regression: Linear Regression, Least Minimum Slope (LMS) algorithm, Gradient Descent, Lasso and Ridge Regression. Polynomial Regression. Logistic Regression, Maximum Likelihood Function.

Classification: Introduction to decision tree, Learning Decision tree using ID3 and Gini index; CART, Overfitting. Ensemble methods: Bagging (Random Forest) and Boosting (XG Boost).

Unit-III — 08 Hrs.

Bayesian Learning: Bayesian Learning, Naïve Bayes, Bayesian Network: Representation in Bayesian, Belief Network, Inference in Bayesian Network, Applications of Bayesian Network. Classification Model

Unit-IV — 05 Hrs.

Introduction to Support Vector Machine: Support Vectors, Kernels: Linear, Polynomial and Radial Basis Function (RBF) Kernel

Unit-V — 08 Hrs.

Clustering: Cluster Analysis and Requirements of Cluster Analysis Partitioning Methods: k-Means, k-Medoids Hierarchical Methods: Agglomerative, Divisive. Dimensionality Reduction: Dimensionality Reduction Techniques: Principal Component Analysis

Unit-VI — 05 Hrs.

Introduction to Neural Networks and Deep Learning: Deep Learning applications, Association of biological neuron with artificial network, activation functions, weights, bias, threshold, learning rate, momentum factor

McCulloch Pitts Neuron: Theory and architecture; linear separability; Hebb Network: Theory and algorithm, ANN architectures. Hyper parameter tuning and batch normalization, Machine Learning vs Deep Learning.

Text Books:

1. Peter Bruce, Andrew Bruce, Peter Gedeck, "Practical Statistics for Data Scientists", 2nd Edi-

tion, OReilly Publisher, 2020.

2. Howard J. Seltman,"Experimental Design and Analysis", July 11, 2018.

3. Tom Mittchell, "Machine Learning McGraw Hill, 2017.

Reference Books:

1. "Data Mining for Business Analytics, (An Indian Adaptation): Concepts, Techniques and Applications in Python", Cambridge University Press, ISBN NO. 978-1108727747, 2019.

2. Andreas C. Müller and Sarah Guido, "Introduction to Machine Learning with Python: A Guide for Data Scientists", O'reilly,2016

3. Stephen Marsland, "Machine Learning an Algorithmic Perspective", CRC Press, 2015

4. Han Kamber, "Data Mining Concepts & Techniques", Morgann Kaufmann Publishers, 2012.

5. Kevin P. Murphy, "Machine Learning — A Probabilistic Perspective", 2012.

Web Links:

1. https://onlinecourses.nptel.ac.in/noc21_cs06/preview

2. https://www.datacamp.com/tutorial/tableau-tutorial-for-beginners

3. https://www.kaggle.com/code/ekami66/detailed-exploratory-data-analysis-with python

Evaluation Scheme:

Theory :

Continuous Assessment (A):

Subject teacher will declare Teacher Assessment criteria at the start of semester.

Continuous Assessment (B):

1. Two term tests of 10 marks each will be conducted during the semester.

2. Average of the marks scored in both the tests will be considered for final grading.

End Semester Examination (C):

1. Question paper based on the entire syllabus, summing up to 65 marks.

2. Total duration allotted for writing the paper is 2 hrs.

Machine Learning Laboratory (22PCAI5020L)

Practical Scheme
Practical : 02 Hrs./week
Credit : 01

Examination Scheme
Teacher Assessment : 25 Marks
End Sem Exam : 25 Marks
Total : 50 Marks

Course Objectives:

1. Define the basics of Neural Network
2. Understand the key concept of ANN, CNN and RNN for Tensor Flow
3. Explain the concept of GAN generator or discriminator
4. Develop the Mini Project based on the Object Detection, Image or Text Classification etc.

CO	Course Outcomes	Blooms Level	Blooms Description
CO1	Implement Neural Network.	L3	Apply
CO2	Analyze ANN, CNN & RNN using Tensor Flow.	L4	Analyze
CO3	Evaluate GAN generator and discriminator.	L5	Evaluate
CO4	Build Mini Project based on Object Detection, Image or Text Classification etc.	L6	Create

List of Laboratory Experiments

Suggested Experiments:

1. Perform Linear Regression.
    - Perform data cleaning
    - EDA
    - Data transformation
    - Model Training
    - Performance evaluation
2. Perform Logistic Regression.
    - Perform data cleaning
    - EDA
    - Data transformation
    - Model Training
    - Performance evaluation
3. Perform Decision Tree using GINI.
    - Data cleaning
    - EDA
    - Data transformation
    - Model Training, Visualize Decision Tree
    - Performance evaluation
4. Perform CART decision tree algorithm.
    - Data cleaning
    - EDA
    - Data transformation
    - Model Training, Visualize Decision Tree
    - Performance evaluation
5. Perform Ensemble methods
    - Data cleaning
    - EDA

- Data transformation
- Model Training
- Performance evaluation

6. Perform Bayesian Classification
   - Data cleaning
   - EDA
   - Data transformation
   - Model Training
   - Performance evaluation
7. Compare performance of classification algorithms.
   - Model Training
   - Performance evaluation
   - Comparision of performance of different classification algorithms
8. Perform Support Vector Machine.
   - Data cleaning
   - EDA
   - Data transformation
   - Dimensionality reduction
9. Perform K-means/ K-Medoids clustering.
   - Data cleaning
   - EDA
   - Data transformation
   - Clustering
10. Study a machine learning patent.
11. Mini project based on any machine learning application.

Minimum eight experiments from the above suggested list or any other experiment based on syllabus will be included, which would help the learner to apply the concept learnt.

Evaluation Scheme:

Laboratory:

Continuous Assessment (A):

Laboratory work will be based on 22PCAI5020T with minimum 08 experiments to be incorporated.

The distribution of marks for term work shall be as follows:

1. Performance in Experiments: 05 Marks
2. Journal Submission: 05 Marks
3. Viva-voce: 05 Marks
4. Subject Specific Lab Assignment/Case Study: 10 Marks

The final certification and acceptance of term work will be subject to satisfactory performance of laboratory work and upon fulfilling minimum passing criteria in the term work.

End Semester Examination (C):

Oral/ Practical examination will be based on the entire syllabus including, the practicals performed during laboratory sessions.

Natural Language Processing (22PCAI5030T)

Teaching Scheme
Lectures : 03 Hrs./week
Credits : 03

Examination Scheme
Term Test : 10 Marks
Teacher Assessment : 25 Marks
End Sem Exam : 65 Marks
Total Marks : 100 Marks

Prerequisite: Python Programming

Course Objectives:

1. To introduce the fundamental concepts and techniques of Natural language Processing for analyzing words based on Morphology and CORPUS.
2. To examine the NLP models and interpret algorithms for classification of NLP sentences by using both the traditional, symbolic and the more recent statistical approach.
3. To get acquainted with the algorithmic description of the main language levels that includes morphology, syntax, semantics, and pragmatics for information retrieval and machine translation applications.

CO	Course Outcomes	Blooms Level	Blooms Description
CO1	Understand the Principles and Process of Natural Languages and real-world applications.	L2	Understand
CO2	Demonstrate understanding of state-of-the-art algorithms and techniques for text-based processing of natural language with respect to morphology.	L3	Apply
CO3	Perform POS tagging for a given natural language and select a suitable language modelling technique based on the structure of the language.	L6	Create
CO4	Check the syntactic and semantic correctness of sentences using grammars and labelling.	L5	Evaluate

Course Contents

Unit-I — 04 Hrs.

Introduction to Natural Language Processing: Origin & History of NLP, Stages in NLP, Ambiguities and its types in English and Indian Regional Languages; Applications of NLP- Machine Translation, Information Retrieval, Question Answering System, Sentiment Analysis, Text Categorization , Text Summarization, Named Entity Recognition.

Unit-II — 06 Hrs.

Computational tools for text analysis: Basic Terms: Tokenization, Stemming, Lemmatization, Natural Language Toolkit (NLTK): Corpora and other data resources, Uses of corpora: Lexicography, Grammar and syntax, Stylistics, Training and evaluation. Basic corpus analysis: Frequency distribution building and analyzing a corpus. Tokenization in the NLTK, Tokenizing text

Unit-III — 09 Hrs.

Word Level Analysis (statistical language model): Inflectional Morphology, Derivational Morphology, Regular expression with types, Morphological Models: finite state morphology, Morphological parsing with FST (Finite State Transducer), Lexicon free FST Porter Stemmer algorithm, Grams and its variation: Bigram, Trigram, Simple (Unsmoothed) N-grams; N-gram Sensitivity to the Training Corpus, Evaluating N-grams: Perplexity, smoothing: Laplace Smoothing, Good-Turing Discounting.

Unit-IV — 07 Hrs.

Syntax analysis: Part-Of-Speech tagging (POS), Tag set for English (Upenn Treebank), Difficulties /Challenges in POS tagging , Rule-based, Stochastic and Transformation-based tagging, Generative Model: Hidden Markov Model (HMM Viterbi) for POS tagging; Issues in HMM POS tagging, Discriminative Model: Maximum Entropy model, Conditional random Field (CRF), CYK.

Unit-V — 08 Hrs.

Semantic Analysis: Lexical Semantics; Corpus study; Study of Various language dictionaries like WorldNet, Babelnet. Attachment for fragment of English, Relations among lexemes & their senses –Homonymy, Polysemy, Synonymy, Hyponymy, Semantic Ambiguity, Word Sense Disambiguation (WSD), Knowledge based approach (Lesk's Algorithm), Supervised (Naïve Bayes, Decision List).

Unit-VI — 05 Hrs.

Pragmatic & Discourse Processing: Discourse: Reference Resolution, Reference Phenomena, Syntactic & Semantic constraint on coherence, Anaphora Resolution using Hobbs and Cantering Algorithm, Discourse segmentation, Coreference resolution.

Text Books:

1. Raymond S. T. Lee, "Natural Language Processing: A Textbook with Python Implementation", 1st Edition, 2023.

2. Lewis Tunstall, Leandro von Werra, Thomas Wolf, "Natural Language Processing with Transformers", O'Reilly , 2022.

3. Thushan Ganegedara, Andrei Lopatenko, "Natural Language Processing with TensorFlow: The definitive NLP book to implement the most sought-after machine learning models and tasks", 2nd Edition, 2022.

4. Daniel Jurafsky, James H. and Martin, "Speech and Language Processing An Introduction to Natural Language Processing, Computational Linguistics, and Speech Recognition", Pearson, 2014.

Reference Books:

1. Masato Hagiwara, "Real-World Natural Language Processing: Practical applications with deep learning", Mnaning, 2021.

2. Ashish Bansal, "Advanced Natural Language Processing with TensorFlow 2: Build effective real-world NLP applications using NER, RNNs, seq2seq models, Transformers, and more", Packt Publishing, 2021.

Useful Links:

1. Web Resources Blogs and Websites:

2. POS Tagging Hidden Markov Models (HMM) Viterbi algorithm in NLP maths — Data Science in your pocket (medium.com)

3. Text Generation Using N-Gram Model — by Oleg Borisov — Towards Data Science

4. How to Create Beautiful Word Clouds in Python — by Tia Plagata — Towards Data Science

5. Best NLP Algorithms to get Document Similarity — by Jair Neto — Analytics Vidhya — Medium

6. How to Chunk Text Data — A Comparative Analysis — by Solano Todeschini — Towards Data Science

7. Natural Language Processing. Title :- Morphological Analysis — by Raghvendra Zarkar — Medium

Online Courses and Tutorials:

1. NPTEL Course : Natural Language Processing - Course (nptel.ac.in)
2. Cousera: Natural Language Processing Specialization [4 courses] (DeepLearning.AI) — Coursera
3. Udemy: NLP - Natural Language Processing with Python — Udemy

Evaluation Scheme:

Theory :

Continuous Assessment (A):

Subject teacher will declare Teacher Assessment criteria at the start of semester.

Continuous Assessment (B):

1. Two term tests of 10 marks each will be conducted during the semester.
2. Average of the marks scored in both the tests will be considered for final grading.

End Semester Examination (C):

1. Question paper based on the entire syllabus, summing up to 65 marks.
2. Total duration allotted for writing the paper is 2 hrs.

Natural Language Processing Laboratory (22PCAI5030L)

Practical Scheme
Practical : 02 Hrs./week
Credit : 01

Examination Scheme
Teacher Assessment : 25 Marks
End Sem Exam : 25 Marks
Total : 50 Marks

Course Objectives:

1. To understand Preprocessing steps in NLP like Tokenization, stop word Removal, Lemmatization, stemming.
2. To provide the knowledge of operations involved in Natural Language Processing.
3. Implement complex applications like Information Retrieval System, Spelling Check, Spelling Correction, Auto complete, Text Summarization and Question Answering System.

CO	Course Outcomes	Blooms Level	Blooms Description
CO1	Use Natural Language Processing to solve language related tasks.	L3	Apply
CO2	Develop various applications based on natural language processing.	L6	Create

List of Laboratory Experiments

Suggested Experiments:

1. Preprocessing steps in NLP: Tokenization, stop word Removal, Lemmatization, stemming using NLTK and SPACY.
2. Implement Named Entity Recognition for any given text.
3. Perform morphological analysis and word generation for any given text.
4. Implement Chunking for the given input text.
5. Build a POS tagger using HMM.
6. Similarity Detection in NLP.
7. Implement N-Gram model for the given text input.
8. Generate word cloud using Python.
9. Any application of NLP: Spell Check, Autocorrect, plagiarism detection, sentiment analysis, sarcasm detection or text analytics in any domain.

Minimum eight experiments from the above suggested list or any other experiment based on syllabus will be included, which would help the learner to apply the concept learnt.

Evaluation Scheme:

Laboratory:

Continuous Assessment (A):

Laboratory work will be based on 22PCAI5030T with minimum 08 experiments to be incorporated. The distribution of marks for term work shall be as follows:

1. Performance in Experiments: 05 Marks
2. Journal Submission: 05 Marks
3. Viva-voce: 05 Marks
4. Subject Specific Lab Assignment/Case Study: 10 Marks

The final certification and acceptance of term work will be subject to satisfactory performance of laboratory work and upon fulfilling minimum passing criteria in the term work.

End Semester Examination (C):

Oral/ Practical examination will be based on the entire syllabus including, the practicals performed during laboratory sessions.

Programming Laboratory-III (Full Stack Development Laboratory)(22PCAI5040L)

Teaching Scheme
Practical : 04 Hrs./week
Credit : 02

Examination Scheme
Teacher Assessment : 25 Marks
End Sem Exam : 25 Marks
Total Marks : 50 Marks

Prerequisite: HTML5, CSS3, JavaScript, Database Management System

Course Objectives:

1. To orient students to Basics of REACT along with installation
2. To expose students to Advanced concepts in REACT
3. To orient students to Fundamentals of node.js
4. To expose students to node.js applications using express framework.
5. To gain expertise in a leading document-oriented NoSQL database, designed for speed, scalability, and developer agility using MongoDB

CO	Course Outcomes	Blooms Level	Blooms Description
CO1	Design front end application using basic React.	L6	Create
CO2	Design front end applications using functional components of React.	L3	Apply
CO3	Design back-end applications using Node.js.	L3	Apply
CO4	Construct web based Node.js applications using Express.	L3	Apply
CO5	Apply MongoDB for frontend and backend connectivity using REST API.	L3	Apply

Course Contents

Unit-I — 08 Hrs.

React Fundamental

Installation, Installing libraries, Folder and file structure, Components, Component lifecycle, State and Props, React Router and Single page applications, UI design, Forms, Events, Animations, Best practices, React vs Angular vs Vue.

Unit-II — 08 Hrs.

Advance React

Functional components- Refs, Use effects, Hooks, Flow architecture, Model View Controller (MVC) framework, Flux, Bundling the application. Web pack. Self-learning Topics: React Native

Unit-III — 10 Hrs.

Database Connectivity

Database Fundamentals, working with Database Schemas, Create-Read Update-Destroy (CRUD), Database Joins, Querying SQL databases, Serialization, how to model NoSQL data, Document Databases (MongoDB), Create-Read-Update-Destroy (CRUD), NoSQL Best Practices, Mongo Shell and command line use, installing MongoDB, Mapping relationships with MongoDB, using an object-data modelling library (Mongoose)

Unit-IV — 10 Hrs.

Node.js Node.js, Setup Development Environment: Installation of Node.js, Working in REPL, Node JS Console, working with an MVC framework, apply concepts like data types, objects, methods, object-oriented programming, and classes in the context of backend development, Server-Side JavaScript Using Node on the command line NPM JavaScript Build Processes, Event Loop and Emitters, File System Interaction, Modules, Native Node drivers.

Unit-V — 06 Hrs.

Express.js

Introduction, Installation, Express router, REST API, Generator, Authentication, sessions, Integrating with React, Commercial deployment.

Unit-VI — 10 Hrs.

Deployment and Building RESTful API

Understand hosting and deployment. Hosting static websites with GitHub Pages. Deploying server-based applications with Heroku. Deploying Databases with Mongo Atlas. Understand REST and

guiding principles behind API design. Learn to work with a MongoDB GUI Robo 3T Implementing GET, POST, PUT, PATCH and DELETE by creating a public API from scratch. Understand and use chained route handlers from Express.

List of Laboratory Experiments

1. Installation and Configuration of React.
2. Understanding JSX, Components, Props, State in React.
3. Implementing Forms, Events, Routers, Refs, Keys.
4. Implement CRUD operations in MongoDB.
5. Installation and Configuration of Node.js
6. Implementing Callbacks, Event loops in Node.js
7. Create an application to demonstrate use of React hooks and JS.
8. Create an application to demonstrate use of Conditional rendering in React JS.
9. Create an application to demonstrate various Node.js Events.
10. Create an application to demonstrate Node.js Functions
11. Create an application to demonstrate integration of Node JS and MongoDB.
12. Create an application to demonstrate integration of Node JS and React JS.
13. Create an Online Learning application using REST APIs.
14. Deploy the above developed application on any hosting platform of your choice

Minimum 10 experiments from the above suggested list or any other experiment based on syllabus will be included, which would help the learner to apply the concept learnt.

Text Books:

1. Adam Bretz and Colin J. Ihrig, "Full Stack JavaScript Development with MEAN", SitePoint Pty. Ltd., 2015 Edition.
2. Simon Holmes Clive Harber, "Getting MEAN with Mongo, Express, Angular, and Node", Manning Publications, 2015 Edition.
3. Venkat Subramaniam, "Rediscovering JavaScript, Master ES6, ES7, and ES8", The Pragmatic Bookshelf, 2018.
4. Alex Banks and Eve Porcello, "Learning React Functional Web Development with React and Redux", O Reilly, 1st Edition, 2017 Edition
5. Andrew Mead, "Learning Node.js Development", Packt Publishing, 2018 Edition.

6. Valentin Bojinov, "RESTful Web API Design with Node.js 10", Packt Publication, 2018 Edition.

Reference Books:

1. Ethan Brown, "Web Development with Node and Express", O'Reilly, 2019 Edition.

2. Shama Hoque, "Full-Stack React Projects: Learn MERN stack development by building modern web apps using MongoDB, Express, React, and Node.js", 2nd Edition, Packt Publication, 2020.

3. Brad Dayley, Brendan Dayley, Caleb Dayley, "Node.js, MongoDB and Angular Web Development: The definitive guide to using the MEAN stack to build web applications", 2nd Edition, Addison-Wesley Professional, 2017

Evaluation Scheme:

Laboratory:

Continuous Assessment (A):

Laboratory work will be based on 22PCAI5040L with minimum 10 experiments to be incorporated. The distribution of marks for term work shall be as follows:

1. Performance in Experiments: 05 Marks
2. Journal Submission: 05 Marks
3. Viva-voce: 05 Marks
4. Subject Specific Lab Assignment/Case Study: 10 Marks

The final certification and acceptance of term work will be subject to satisfactory performance of laboratory work and upon fulfilling minimum passing criteria in the term work.

End Semester Examination (C):

Oral / Practical examination will be based on the entire syllabus including, the practicals performed during laboratory sessions.

Computer Network Security (22PEAI5051T)

Teaching Scheme
Lectures : 03 Hrs./week
Credits : 03

Examination Scheme
Term Test : 10 Marks
Teacher Assessment : 25 Marks
End Sem Exam : 65 Marks
Total Marks : 100 Marks

Prerequisite: Knowledge of Basic Mathematics and Algorithms.

Course Objectives:

To get familiar with contemporary issues and challenges of various protocol designing in layered architecture and performance analysis of various protocols and security issues.

CO	Course Outcomes	Blooms Level	Blooms Description
CO1	Understand the concepts of data communication and functionalities of ISO - OSI model & TCP/IP model.	L2	Understand
CO2	Illustrate the functions of Data link layer and Network Layer.	L3	Apply
CO3	Demonstrate the working of transport and application layer protocols.	L3	Apply
CO4	Identify security vulnerabilities and explore various monitoring measures.	L1	Remember
CO5	Explore the fundamentals of security algorithms.	L4	Analyze

Course Contents

Unit-I — 04 Hrs.

Introduction to computer network, Network topology, Networking devices, Reference models: OSI, TCP/IP

Unit-II — 08 Hrs.

Physical and Data link Layer: Introduction, transmission medium, physical addressing, Error control (Hamming code, CRC), Flow control, Data-Link Layer Protocols: HDLC, Media Access Control: ALOHA, CSMA

Unit-III — 09 Hrs.

Network Layer: Unicast Routing Algorithms-(DVR, LSR), IPv4 Addressing (Classfull and Classless), Subnetting, Supernetting design problems, IPv4 Protocol, IPV6 protocol.

Unit-IV — 06 Hrs.

Transport & Application Layer: Services, sockets, Transport Layer Protocols - User Datagram Protocol (UDP), Transmission Control Protocol (TCP), Application layer protocols-HTTP, SMTP, DNS.

Unit-V — 04 Hrs.

Introduction to Security: Security Goals, Security threats and attacks, (Spoofing, Phishing, DOS, Virus, Worm, Trojans, Side-Channel Attack), Intrusion Prevention Systems Intrusion Detection System (IDS), Troubleshooting and monitoring tools, Wireshark, Kali Linux, Honeypot, Nmap, Kismet.

Unit-VI — 08 Hrs.

Fundamentals of security algorithms: Cryptography: Symmetric (Substitution Ciphers, Caesar Cipher, Playfair Cipher, Hill Cipher, Block Ciphers, DES and AES), Asymmetric (PKI, RSA, Digital Signature), Key exchange (Diffie-Hellman), Hashing (MD5, SHA)

Text Books:

1. Andrew S. Tanenbaum, "Computer Networks", 6th Edition, Pearson, 2022.
2. Behrouz A. Forouzan, "Data Communications and Networking", 5th Edition, TMH, 2017.
3. Atul Kahate, "Cryptography and Network Security" , 3rd Edition, Tata Mc Graw Hill, 2017.
4. William Stallings, "Computer Security Principles and Practice", 7th Edition, Pearson Education, 2017

5. Charles P. Pfleeger, "Security in Computing", 5th Edition, Pearson Education, 2015

6. Bernard Menezes, "Network Security and Cryptography", Cengage Learning, 2014.

7. Bible-Eric Cole, "Network Security", 2nd Edition, Wiley, 2011.

8. Deven Shah, "Mark Stamp's Information Security: Principles and Practice", Wiley, 2009.

Reference Books:

1. James F. Kurose, Keith W. Ross, "Computer Networking: A Top-Down Approach", 7th Edition, Pearson Education, 2017.

2. William Stallings, "Data and Computer Communications", 10th Edition, Pearson Education, 2013.

3. Nader F. Mir, "Computer and Communication Networks", 2nd Edition, Prentice Hall, 2014.

4. Ying-Dar Lin, Ren-Hung Hwang and Fred Baker, "Computer Networks: An Open-Source Approach", McGraw Hill Publisher, 2011.

5. Richard Steven, "UNIX Network Programming", Addison Wesley, 2003.

6. B. A. Forouzan, "TCP/IP Protocol Suite", 4th Edition, Tata Mc Graw Hill, 2017.

7. Larry L. Peterson, Bruce S. Davie, "Computer Networks: A Systems Approach", 5th Edition, Morgan Kaufmann Publishers Inc., 2012.

8. Bruce Schneier, "Applied Cryptography, Protocols Algorithms and Source Code in C", 2nd Edition / 20th Anniversary Edition, Wiley, 2015.

Web Links:

1. Nptel Course https://onlinecourses.nptel.ac.in/noc22_cs19/preview

2. Nptel Advanced course https://onlinecourses.nptel.ac.in/noc24_cs11/preview

3. Coursera Course https://www.coursera.org/learn/computer-networking

Evaluation Scheme:

Theory :

Continuous Assessment (A):

Subject teacher will declare Teacher Assessment criteria at the start of semester.

Continuous Assessment (B):

1. Two term tests of 10 marks each will be conducted during the semester.

2. Average of the marks scored in both the tests will be considered for final grading.

End Semester Examination (C):

1. Question paper based on the entire syllabus, summing up to 65 marks.

2. Total duration allotted for writing the paper is 2 hrs.

Computer Network Security Laboratory (22PEAI5051L)

Practical Scheme
Practical : 02 Hrs./week
Credit : 01

Examination Scheme
Teacher Assessment : 25 Marks
End Sem Exam : 25 Marks
Total : 50 Marks

Course Objectives:

1. To become familiar with network, protocol, security tools and network simulator like NS2/OPNET /Wireshark.
2. To introduce the concepts of Encryption and Decryption using various cipher techniques and attacks applied on it.

CO	Course Outcomes	Blooms Level	Blooms Description
CO1	Summarize the different topologies and use in Network Simulator.	L2	Understand
CO2	Implement an error detection code and distance vector routing algorithm.	L6	Create
CO3	Check the applications of TCP socket.	L5	Evaluate
CO4	Utilize the different open source tools for network security and analysis.	L3	Apply
CO5	Identify most common network attacks.	L4	Analyze
CO6	Demonstrate the data integrity using various cryptographic algorithms.	L3	Apply

List of Laboratory Experiments(At Least 08)

Suggested Experiments:

1. Installation & Configuration of Network Simulator (NS2) in Linux environment. -Study of different topologies and create duplex link in NS2.
2. Implementation of an error detection code using CRC.
3. Implementation of Distance Vector/ Link State Routing algorithm.
4. Study of Network simulator (NS) and performance evaluation of Routing protocols using Simulation tool.
5. Applications using TCP sockets like:
   - Echo client and echo server.
   - Chat
   - File Transfer
6. Demonstration of security tools.
7. Learn to use commands like tcpdump, netstat, ifconfig, nslookup and traceroute. Capture ping and trace route PDUs using a network protocol analyzer.
8. Design and Implement Caesar cipher cryptographic algorithm by considering letter [A... Z] and digits [0...9]. Apply Brute Force Attack to reveal secret.
9. Design and Implement Encryption and Decryption algorithm using Simple Columnar Transposition cipher technique. Study how dictionary attack can be applied on it.
10. Implement RSA Cryptosystem using RSA Algorithm / Implement Elliptical Curve Digital Signature Algorithm (ECDSA)
11. Demonstrate the data integrity using various cryptographic algorithms viz. MD-5, SHA-1 using VLAB, IIT Bombay.

C/C++/JAVA/Equivalent compiler.

Network Simulator like NS2/OPNET/Wireshark

Minimum eight experiments from the above suggested list or any other experiment based on syllabus will be included, which would help the learner to apply the concept learnt.

Evaluation Scheme:

Laboratory:

Continuous Assessment (A):

Laboratory work will be based on 22PEAI5051T with minimum 08 experiments to be incorporated.

The distribution of marks for term work shall be as follows:

1. Performance in Experiments: 05 Marks
2. Journal Submission: 05 Marks
3. Viva-voce: 05 Marks
4. Subject Specific Lab Assignment/Case Study: 10 Marks

The final certification and acceptance of term work will be subject to satisfactory performance of laboratory work and upon fulfilling minimum passing criteria in the term work.

End Semester Examination (C):

Oral / Practical examination will be based on the entire syllabus including the practicals performed during laboratory sessions.

Advanced Data Structures and Algorithm (22PEAI5052T)

Teaching Scheme
Lectures : 03 Hrs./week
Credits : 03

Examination Scheme
Term Test : 10 Marks
Teacher Assessment : 25 Marks
End Sem Exam : 65 Marks
Total Marks : 100 Marks

Prerequisite: Python Programming, Data Structures, Design & Analysis of Algorithms

Course Objectives:

1. To provide conceptual and practical knowledge of Advance Data Structures and Algorithms.
2. To Cultivate algorithmic thinking and problem-solving skills through practice and exposure to diverse problem domains.
3. Develop strategies for breaking down complex problems into manageable sub problems and applying suitable algorithms and data structures.
4. Develop skills to analyze problem complexity and choose appropriate data structures and algorithms for efficient solutions.

CO	Course Outcomes	Blooms Level	Blooms Description
CO1	Understand the concept of time complexity and its importance in analyzing algorithms and to Explore the complexity analysis of popular machine learning algorithms.	L2	Understand
CO2	Explore balanced search tree data structures and spatial data structures used in geometric and spatial applications.	L2	Understand
CO3	Apply graph algorithms to solve real-world problems related to network flows, matching, and optimization.	L3	Apply
CO4	Understand the complexity classes NP, P, NP-complete, and NP-hard and their significance in algorithm classification and to explore the computational geometry algorithms.	L2	Understand

Course Contents

Unit-I — 08 Hrs.

Analysis of Algorithm Based on Time:

i. Amortized Analysis: Aggregate Method, Accounting Method, Potential Method (for Stack data structure)

ii. Probabilistic and Randomized Algorithm: Probabilistic approach to algorithm and Randomized Analysis, Indicator Random Variable (IRV), Analysis of Hiring Problem

Complexity Analysis of Machine Learning Algorithms:

iii. Training Time Complexity and Testing Time Complexity

iv. Train/Test Complexity of Linear Regression

v. Train/Test Complexity of Naïve Bayes Classifier

Unit-II — 10 Hrs.

i. Balanced Search Trees: Red-Black Tree, Tango Tree, 2-3 Tree, B+ Tree, Splay Tree

Unit-III — 06 Hrs.

Advanced Data Structures:

i. Spatial Data Structure: KD Tree, R Tree

ii. Probabilistic Data Structure: Bloom filter, LogLog and HyperLogLog, Count Min sketch, MinHash with Machine Learning context (Vector Representation)

iii. Functional Data Structures: Binomial Tree, Binomial Heap

Unit-IV — 06 Hrs.

Graph Based Algorithms:

i. Flow Network Introduction: Residual Network, Augmenting Path, Ford-Fulkerson Method, Edmonds-Karp Method, Push-Relable Algorithm

ii. Bipartite Matching: Maximum Bipartite Matching

Unit-V — 07 Hrs.

Classification of Algorithms:

i. Algorithm Classes: P, NP, NP Hardness and NP Completeness

ii. Np Completeness Proofs: Satisfiability (3 sat), Reducibility, Cook's Theorem, Traveling Salesman Problem

iii. Approximation Algorithms: Vertex Cover Problem, Travelling Salesman problem

Unit-VI

02 Hrs.

Computational Algorithms – Computational Geometry:

Line Segment Properties, Convex Hull Graham's scan algorithm

Text Books:

1. Thomas H Cormen, Charles E. Leiserson, Ronald L Rivest, Clifford Stein, "Introduction to Algorithms", 3rd Edition, 2009.
2. S. Sridhar, "Design and analysis of algorithms", 1st Edition, Oxford , 2014.
3. Horowitz, Sahani and Rajsekaran, "Fundamentals of Computer Algorithms", 2nd Edition, Galgotia, 1998.
4. Harsh Bhasin, "Algorithms Design and Analysis", 1st Edition, Oxford, 2015.
5. Giuseppe Bonaccorso, "Machine Learning Algorithms", by Packt, 2019.

Reference Books:

1. Rajeev Motwani, Prabhakar Raghavan," Randomized Algorithm", Cambridge University, 2004.
2. Vijay V. Vajirani, "Approximation Algorithms", Springer, 2003.
3. "Computational Complexity", Stanford University, 2010.
4. Jason Brownlee, "Master Machine Learning Algorithms", Machine Learning Mastery, 2020.

Web Resources Blogs and Websites::

1. Train/Test Complexity and Space Complexity of Linear Regression — by Writuparna Banerjee — Level Up Coding (gitconnected.com)
2. Computational Complexity of ML Models — by Paritosh Kumar — Analytics Vidhya — Medium
3. Importance of Understanding the Complexity of a Machine Learning Algorithm — by Baran Köseoğlu — Towards Data Science
4. Probabilistic Data Structures Decoded: Enhancing Performance in Modern Computing — by Naman Agrawal — Towards Data Science
5. ML Security Pro Tips: Understanding MinHash in a Security Context — by Melanie Beck — AI/ML at Symantec — Medium.
6. Bloom Filters and when to use them — by Janko Krstic — The Little Bit Ninja — Medium
7. The Power of Bloom Filters: A Comprehensive Guide — by Chiranjeet Baruah — Medium

Evaluation Scheme:

Theory :

Continuous Assessment (A):

Subject teacher will declare Teacher Assessment criteria at the start of semester.

Continuous Assessment (B):

1. Two term tests of 10 marks each will be conducted during the semester.
2. Average of the marks scored in both the tests will be considered for final grading.

End Semester Examination (C):

1. Question paper based on the entire syllabus, summing up to 65 marks.
2. Total duration allotted for writing the paper is 2 hrs.

Advanced Data Structures and Algorithm Laboratory (22PEAI5052L)

Practical Scheme
Practical : 02 Hrs./week
Credit : 01

Examination Scheme
Teacher Assessment : 25 Marks
End Sem Exam : 25 Marks
Total : 50 Marks

Course Objectives:

1. To provide conceptual and practical knowledge of Advanced Data Structures and Algorithms.
2. To develop programmming skill through implemetation of various advanced data structures.
3. Develop strategies for breaking down complex problems into manageable sub problems and applying suitable algorithms and data structures.
4. Develop skills to analyze problem complexity and choose appropriate data structures and algorithms for efficient solutions.

CO	Course Outcomes	Blooms Level	Blooms Description
CO1	Understand the Working Principle of Red Black Tree as an Advanced Data Structure	L2	Understand
CO2	Implement KD Tree Data Structure.	L3	Apply
CO3	Apply graph algorithms to solve real-world problems.	L3	Apply
CO4	Experiment on Computational Geometry Algorithms.	L3	Apply

List of Laboratory Experiments

Suggested Experiments:

1. Experiment on Amortized Analysis.
2. To perform and implement Hiring Problem.
3. Experiment on Randomized Algorithms (Randomized Quick Sort)
4. To implement Red Black Tree creation.
5. To implement Red Black Tree deletion.
6. To implement KD Tree
7. To implement Ford Fulkerson Algorithm
8. To implement Approximation Algorithms (Vertex Cover)
9. Experiment on Computational Geometry Algorithms (Graham Scan)

Minimum eight experiments from the above suggested list or any other experiment based on syllabus will be included, which would help the learner to apply the concept learnt.

Evaluation Scheme:

Laboratory:

Continuous Assessment (A):

Laboratory work will be based on 22PEAI5052T with minimum 08 experiments to be incorporated. The distribution of marks for term work shall be as follows:

1. Performance in Experiments: 05 Marks
2. Journal Submission: 05 Marks
3. Viva-voce: 05 Marks
4. Subject Specific Lab Assignment/Case Study: 10 Marks

The final certification and acceptance of term work will be subject to satisfactory performance of laboratory work and upon fulfilling minimum passing criteria in the term work.

End Semester Examination (C):

Oral/ Practical examination will be based on the entire syllabus including, the practicals performed during laboratory sessions.

Recommendation Systems (22PEAI5053T)

Teaching Scheme
Lectures : 03 Hrs./week
Credits : 03

Examination Scheme
Term Test : 10 Marks
Teacher Assessment : 25 Marks
End Sem Exam : 65 Marks
Total Marks : 100 Marks

Prerequisite: Knowledge of Machine Learning

Course Objectives:

1. To provide students with the basic concepts of Recommender Systems, design space, trade-offs and its application in various domain.
2. To have a broad understanding of the field of Recommendation Systems.

CO	Course Outcomes	Blooms Level	Blooms Description
CO1	Understanding the architecture and working of Collaborative Filtering, Content based recommendation systems.	L2	Understand
CO2	Understanding the architecture and basics of Knowledge based recommendation systems.	L2	Understand
CO3	Analyzing hybrid and ensembles recommendation systems.	L4	Analyze
CO4	Evaluation of recommendation systems by selecting right evaluation parameter.	L5	Evaluate

Course Contents

Unit-I — 06 Hrs.

Introduction to Recommender Systems

Introduction to Recommendation System, Framework of recommendation systems, Eliciting Ratings and other Feedback Contributions, Implicit and Implicit Ratings, Recommender system functions. Applications of recommendation systems, Issues with recommender system.

Unit-II — 08 Hrs.

Collaborative filtering-based Recommender System Architecture of Collaborative Filtering, User-based nearest- neighbour recommendation: Similarity Function, User-Based Algorithms, Item-based nearest neighbour recommendation: Similarity Function, Item-Based Algorithms, Comparing User-Based and Item-Based recommendations, data drift and concept drift.

Unit-III — 07 Hrs.

Content-based Recommender System:

Architecture of content-based systems, Content representation and content similarity, Item profiles, Discovering features of documents, Obtaining item features from tags, Representing item profiles, Methods for learning user profiles, Similarity based retrieval, The Role of User Generated Content in the Recommendation Process. Bayes classifier for recommendation, Regression based recommendation system. Advantages and drawbacks of content-based filtering.

Unit-IV — 06 Hrs.

Knowledge based recommendation

Knowledge representation and reasoning, Constraint based recommenders, Case based recommenders, Persistent Personalization in Knowledge-Based Systems, Conversational Recommendation. Search based recommendation, Navigation-based recommendation.

Unit-V — 06 Hrs.

Ensembled- Based and Hybrid Recommendation System

Opportunities for hybridization, Monolithic hybridization design: Feature combination, Feature augmentation, Parallelized hybridization design: Weighted, Switching, Mixed, Pipelined hybridization design: Cascade Meta level, Limitations of hybridization strategies. .

Unit-VI — 06 Hrs.

Evaluating Recommendation System:

Evaluation Paradigms, General Goals of Evaluation Design, Design Issues in Offline Recommender

Evaluation, Online Recommender evaluation techniques. Comparison between evaluation design of classification model and recommendation system, Error metrics, Decision-Support metrics, User Centered metrics. Comparative analysis between different types of recommendation systems.

Text Books:

1. C.C. Aggarwal, "Recommender Systems: The Textbook", Springer, 1st Edition, 2016.
2. Jannach D., Zanker M. and FelFering A., "Recommender Systems: An Introduction", Cambridge University Press, 1st Edition, 2011.
3. Ricci, F., Rokach, L., & Shapira, B., Introduction to Recommender Systems Handbook. Springer, Boston, MA 2011.

Reference Books:

1. M.D. Ekstrand, J.T. Riedl, J.A. Konstan, "Collaborative filtering recommender systems", Now publishers, 1st Edition, 2011.
2. J. Leskovec, A. Rajaraman and J. Ullman, "Mining of massive datasets", Cambridge, 2nd Edition, 2012.
3. Rounak Banik, "Hands-On Recommendation Systems with Python: Start building", Ingram short title, 2018.
4. P. Pavan Kumar, S. Vairachilai, Sirisha Potluri, "Recommender Systems: Algorithms and Applications", CRC Press, 1st Edition, 2021.
5. Kim Falk, "Practical Recommender Systems", Manning, 1st Edition, 2019
6. Rounak Banik, "Hands-On Recommendation Systems with Python: Start building powerful and personalized, recommendation engines with Python", 2018.

Web Links:

1. Udemy course on Recommender Systems and Deep Learning in Python: https://realpython.com/build-recommendation-engine-collaborative-filtering.
2. Coursera course on Recommender Systems Specialization: https://www.coursera.org/specializations/recommender-systems
3. http://www.iem.iitkgp.ac.in/eco/Recommender_Systems/
4. https://www.coursera.org/specializations/recommender-systems
5. https://www.udemy.com/course/recommender-systems/

6. https://www.analyticsvidhya.com/blog/2021/08/developing-acourse-recommendersystem- using-python

Evaluation Scheme:

Theory :

Continuous Assessment (A):

Subject teacher will declare Teacher Assessment criteria at the start of semester.

Continuous Assessment (B):

1. Two term tests of 10 marks each will be conducted during the semester.
2. Average of the marks scored in both the tests will be considered for final grading.

End Semester Examination (C):

1. Question paper based on the entire syllabus, summing up to 65 marks.
2. Total duration allotted for writing the paper is 2 hrs.

Recommendation Systems Laboratory (22PEAI5053L)

Practical Scheme
Practical : 02 Hrs./week
Credit : 01

Examination Scheme
Teacher Assessment : 25 Marks
End Sem Exam : 25 Marks
Total : 50 Marks

Course Objectives:

1. Design a recommender system for various problems.
2. Build different types of recommendation engines.
3. Build Recommenders using various algorithms.
4. Compare the performance of different recommender systems

CO	Course Outcomes	Blooms Level	Blooms Description
CO1	Build a Recommendation Engine and Recommender System.	L3	Apply
CO2	Implement Recommendation System.	L6	Create
CO3	Evaluate the Recommendation System.	L5	Evaluate
CO4	Compare the performance of different Recommender Systems.	L2	Understand

List of Laboratory Experiments

Suggested Experiments:

1. Build a Recommendation Engine with Item-Based Collaborative Filtering.
2. Build a Recommendation Engine with User-Based Collaborative Filtering.
3. Build Content-based recommendation engine on different datasets.
4. Build Recommender System using association rule mining.
5. Implement Recommendation System using K-Nearest Neighbors
6. Build Context-Aware Recommender Systems.
7. Build Constraint-based Recommenders.
8. Implement knowledge-based recommender system.
9. Implement a Monolithic hybridization design.
10. Evaluate the recommendation system with evaluation matrix.
11. Compare the performance of different recommender systems.
12. Mini Project.

Minimum eight experiments from the above suggested list or any other experiment based on syllabus will be included, which would help the learner to apply the concept learnt.

Evaluation Scheme:

Laboratory:

Continuous Assessment (A):

Laboratory work will be based on 22PEAI5053T with minimum 08 experiments to be incorporated. The distribution of marks for term work shall be as follows:

1. Performance in Experiments: 05 Marks
2. Journal Submission: 05 Marks
3. Viva-voce: 05 Marks
4. Subject Specific Lab Assignment/Case Study: 10 Marks

The final certification and acceptance of term work will be subject to satisfactory performance of laboratory work and upon fulfilling minimum passing criteria in the term work.

End Semester Examination (C):

Oral/ Practical examination will be based on the entire syllabus including, the practicals performed during laboratory sessions.

Environmental Engineering (22MCAI5060T)

Teaching Scheme
Lecture : 01 Hr./week

Audit Course

Prerequisite: Interest in Environment and its impact on Human.

Course Objectives:

1. Understand environmental issues such as depleting resources, pollution, ecological problems and the renewable energy scenario.
2. Familiarize environment related legislation.

CO	Course Outcomes	Blooms Level	Blooms Description
CO1	Understand how human activities affect environment.	L1	Remember
CO2	Understand the various technology options that can make a difference.	L1	Remember

Course Contents

Unit-I Social Issues and Environment 04 Hrs.

Ecological footprint and Carrying Capacity, Depleting nature of Environmental resources such as soil, water minerals and forests ,Carbon emissions and Global Warming.

Unit-II Technological growth for Sustainable Development 04 Hrs.

Social, Economical and Environmental aspects of Sustainable Development, Renewable Energy Harvesting ,Concept of Carbon credit, Green Building, Power and functions of Central Pollution Control Board and State Pollution Control Board.

Unit-III Green Technology 05 Hrs.

History, Agenda, and Challenges Ahead. Sustainable Cloud Computing, and Risk Management, Sustainable Software Design, Data Center Energy Efficiency, Thin-Client and Energy Efficiency.

Text Books:

1. R. Rajagopalan, "Environmental Studies From Crisis to Cure", 2012.
2. Textbook for Environmental Studies For Undergraduate Courses of all Branches of Higher Education, Erach Bharucha.
3. Mohammad Dastbaz, Colin Pattinson, Babak Akhgar, Morgan and Kaufman, "Green Information Technology A Sustainable Approach", Elsevier, 2015.

Reference Books:

1. Paulina Golinska, Marek Fortsch, Jorge Marx-Gómez, "Information Technologies in Environmental Engineering: New Trends and Challenges", Springer, 2011.

Evaluation Scheme:

1. Student should submit a report on the case study declared by teacher.
2. Audit point shall be awarded subject to submission of report of the case study declared by teacher.

Semester Project-III (22PJAI5070L)

Practical Scheme
Practical : 02 Hrs./week
Credit : 01

Examination Scheme
Teacher Assessment : 25 Marks
End Sem Exam : 25 Marks
Total : 50 Marks

Course Objectives:

Students are expected to design, simulate/implement a project based on the knowledge acquired from current semester subjects.

CO	Course Outcomes	Blooms Level	Blooms Description
CO1	Conduct a survey of several available literatures in the preferred field of study.	L4	Analyze
CO2	Demonstrate various/alternate approaches to complete a project.	L2	Understand
CO3	Ensure a collaborative project environment by interacting and dividing project work among team members.	L3	Apply
CO4	Present their project work in the form of a technical report / paper and thereby improve the technical communication skill.	L3	Apply
CO5	Demonstrate the ability to work in teams and manage the conduct of the research study.	L2	Understand

Semester Project:

The purpose of semester project is to provide exposure to students with a variety of projects based on the knowledge acquired from the semester subjects. This activity is supposed to enrich their academic experience and bring enough maturity in student while selecting the project. Students should take this as an opportunity to develop skills in implementation, presentation and discussion of technical ideas/topics. Therefore, proper attention shall be paid to the content of semester project report which is being submitted in partial fulfillment of the requirements of the Third Year and it is imperative that a standard format be prescribed for the report.

Each student shall work on project approved by departmental committee approved by the Head of Department, a group of 03 to 05 students (max allowed: 5 students in extraordinary cases, subject to the approval of the department committee and the Head of the department) shall be allotted for each Semester Project. Each group shall submit at least 3 topics for the Semester Project. The departmental committee shall finalize one topic for every group. Semester Project Title or Theme should be based on knowledge acquired during semester. The project work shall involve sufficient work so that students get acquainted with different aspects of knowledge acquired from semester subjects.

Student is expected to:

- Select appropriate project title based on acquired knowledge from current semester subjects.
- Maintain Log Book of weekly work done(Log Book Format will be as per Table 1).
- Report weekly to the project guide along with log book.

Assessment Criteria:

- At the end of the semester, after confirmation by the project guide, each project group will submit project completion report in prescribed format for assessment to the departmental committee (including project guide).
- Assessment of the project (at the end of the semester) will be done by the departmental committee (including project guide).

Prescribed project report guidelines:

Size of report shall be of minimum 25 pages. Project Report should include appropriate content for:

- Introduction
- Literature Survey
- Related Theory
- Implementation details

- Project Outcomes
- Conclusion
- References

Assessment criteria for the departmental committee (including project guide) for Continuous Assessment:

Guide will monitor weekly progress and marks allocation will be as per Table 2.

Assessment criteria for the departmental committee (including project guide) for End Semester Exam:

Departmental committee (including project guide) will evaluate project as per Table 3.

Each group shall present/publish a paper based on the semester project in reputed/peer reviewed Conference/Journal/TechFest/Magazine before end of the semester.

Table 1: Log Book Format

Sr	Week (Start Date:End Date)	Work Done	Sign of Guide	Sign of Coordinator
1				
2				

Table 2: Continuous Assessment Table

Sr	Exam Seat No	Name of Student	Student Attendance	Log Book Maintenance	Literature Review	Depth of Understanding	Report	Total
			5	5	5	5	5	25

Table 3: Evaluation Table

Sr	Exam Seat No	Name of Student	Project Selection	Design/ Simulation/ Logic	Hardware/ Programming	Result Verification	Presentation	Total
			5	5	5	5	5	25

Employability Skill Development Program-II (22HMAI5080L)

Practical Scheme
Practical : 02 Hrs./week
Credit : 01

Examination Scheme
Teacher Assessment : 50 Marks
Total : 50 Marks

Prerequisite: Basic Mathematics, Basic knowledge of C programming.

Course Objectives:

1. To enhance the problem solving skills with real life examples.
2. To enable the students to express their thoughts and knowledge on various platforms.
3. Able to describe the basic database management system.
4. Able to implement basic programming project using python.

CO	Course Outcomes	Blooms Level	Blooms Description
CO1	Analyze and solve the logical problem based on words, venn diagram etc.	L4	Analyze
CO2	Understand and solve the English comprehension, Sentence completion, Sentence Correction problems.	L2 and L4	Understand, Analyze
CO3	Understand and illustrate the concept of Exception Handling, Garbage collection.	L2 and L3	Understand, Apply
CO4	Understand and describe the fundamental of DBMS, NoSql, MongoDB.	L2	Understand

Course Contents

Unit-I 10Hrs

Reasoning : Data sufficiency, Logical Deductions, Logical Sequence of Words, Logical Venn Diagrams, Statement and Arguments, Statement and Assumptions, Statement and Conclusions Syllogism.
English: Reading Comprehension, Para Jumbles, Cloze Test, Tenses/ Voice/ Speech, Prepositions/ SVA/ Articles, Vocab /Verbal Analogy, Sentence completion, Sentence Correction.

Unit-II 10Hrs

Modules: Modules Introduction, Importance of Modularity programming, Import keyword, User defined modules creation, Function based modules, Classes based modules, Connecting modules, 'from' keyword.
Files Handling: Reading file char by character, Reading file line by line, Modes of files, Writing into file, Append data to a file, Reading CSV file, Pickling and Un pickling.
Garbage collection: Introduction, Importance of manual GC, Self-referenced objects, 'gc' module, Collect() method, Threshold function.

Unit-III 8Hrs

Collections Framework: Introduction to collection of data types, Importance of Data processing, DS algorithms introduction.
List: Create a list, Adding elements, Deleting elements, Pre-defined functionality of List, Nested List, Immutability and Mutability of List.
Set: The functionality of Set object, Frozen set, Dictionaries, Create a dictionary, Adding elements.
Dict: Pre-defined functions of Dict class, Programs using Collection types.

Unit-IV 8Hrs

Tkinter – GUI: Types of Layouts, Create Labels and Display images, Create Buttons, Create Events, StringVar class, Calculator program using GUI
Basic ML AI including Projects: Iterators, Nested functions, Generators, Closures, Decorators, Basic ML and AI, PIP, Visualization etc. . .
Project Domain(Per domain 1 or 2 project)

1. ML/AI Based Projects
2. Data Analysis Based projects
3. Test Summarization based projects
4. web scrapping and crawling

Unit-V 10Hrs

DBMS Using Python: Introduction to Mysql, Mysql – Python connectivity, DDL, DRL, DML, Transaction management examples (rollback and commit), GUI –Database connectivity.

NoSql Using Python: Installation and Configuration, MongoDB Tools, Collection and Documents, CRUD and the MongoDB Shell, Introduction to CRUD, Introduction to the MongoDB API, Creating a Database, Collection and Documents.

Data Modelling and Schema Design: MongoDB Database References Model Tree Structures, MongoDB Analysing Queries, Atomic Operations, Map Reduce, Text Search, Regular Expression, Capped Collections.

Administration: MongoDB Deployment and Cluster setup, MongoDB GridFS, Trident Spout, Working with Replica Sets, MongoDB Sharding.

Reference Books:

1. Dr. R S Aggarwal, "Quantitative Aptitude for Competitive Examinations", S. Chand Publication.
2. M. G. Venkateshmurthy, "Programming Techniques through C", Pearson Publication.
3. Behrouz Forouzan, "A Computer Science Structure Programming Approaches using C", Cengage Learning.
4. YashwantKanetkar, "Let Us C", BPB Publication.

Evaluation Scheme:

Teacher Assessment(TA):

Teacher's Assessment (TA) will carry weightage of 50 marks. The components of TA are

1. MCQ Test based on Aptitude: 20 Marks
2. MCQ Test based on Programming skills: 30 Marks
3. Total Marks: 50 Marks

Any other component recommended by BOS and approved by Dean Academics.

The final certification and acceptance of term work will be subject to satisfactory performance of laboratory work and upon fulfilling minimum passing criteria in the term work.

Semester - VI

Computer Vision (22PCAI6010T)

Teaching Scheme
Lectures : 03 Hrs./week
Credits : 03

Examination Scheme
Term Test : 10 Marks
Teacher Assessment : 25 Marks
End Sem Exam : 65 Marks
Total Marks : 100 Marks

Prerequisite: Linear Algebra, Digital Signal Processing, Digital Image Processing

Course Objectives:

1. To develop a comprehensive understanding of computer vision and its real-world applications.
2. To apply image feature detection and noise reduction methods to improve image quality, to extract features and perform model fitting methods to analyze and process images.
3. To implement segmentation and object detection algorithms to identify and locate objects in images.
4. To implement pattern recognition methods to classify and analyze data and motion analysis and action detection methods to track and recognize dynamic objects in videos.

CO	Course Outcomes	Blooms Level	Blooms Description
CO1	Explain the fundamentals of computer vision, including imaging geometry, transformations, and image formation, and analyze low-level image processing techniques for feature detection and noise modelling.	L2	Understand
CO2	Apply advanced feature extraction techniques such as Canny, SIFT, SURF, and HOG, and evaluate model fitting methods like RANSAC and Hough Transform for object recognition and image analysis.	L3	Apply
CO3	Demonstrate object segmentation and detection using techniques such as region growing, graph-cut, and semantic segmentation, and develop solutions for clustering and texture analysis in computer vision applications.	L3	Apply
CO4	Utilize supervised, unsupervised, and deep learning models such as CNNs, RNNs, and YOLO to design and implement vision-based pattern recognition and transfer learning systems.	L6	Create
CO5	Analyse 3D data representation, stereo vision, and 3D reconstruction methods, and construct solutions for shape inference using photometric stereo, optical flow, and other shape-from-X techniques.	L4	Analyse

Course Contents

Unit-I — 03 Hrs.

Overview of Computer Vision and its Applications:

Geometries and basic transformation: Imaging geometry, radiometry, digitization, cameras and Projections, rigid and affine transformation. Image Formation and Representation.

Unit-II — 04 Hrs.

Image Features and Noise: Low level processing: Segmentation, Points, corners, edges, pyramid, Scale and orientation

Types of Image Noise, Modeling image noise, Convolution, image smoothing.

Unit-III — 08 Hrs.

Feature Extraction and Model Fitting: Edges - Canny, LOG, DOG, Line detectors (Hough Transform), Corners - Harris and Hessian Affine, Orientation Histogram, SIFT, SURF, HOG, GLOH, Deformation, RANSAC, Scale-Space Analysis-Image Pyramids and Gaussian derivative filters, Gabor Filters and DWT.

Unit-IV — 09 Hrs.

Object Segmentation and Detection: Region Growing, Edge Based approaches to segmentation, Graph-Cut, Mean-Shift, MRFs, Texture Segmentation, Semantic segmentation, Scene Parsing, Clustering method for segmentation, Distance metrics, Linkage.

Unit-V — 07 Hrs.

Pattern Recognition: Use of Supervised, unsupervised and semi supervised learning in Computer Vision; Deep Learning Models for Computer Vision: CNNs, RNNs, R-CNNs; Transfer Learning; YOLO; Attention Mechanism in Computer Vision.

Unit-VI — 08 Hrs.

3-D Computer Vision: Sources of 3D Data sets, Slicing, Arbitrary section planes, Color display, Volumetric display, Stereo Viewing, Ray tracing, Reflection, Surfaces, Multiple connected surfaces, Image processing and Measurements in 3D.

Multiple Image: Stereo, Epipolar Geometry, Stereo Essential and Fundamental Matrices, Multiview stereo, Triangulation, Correspondence, Rectification, 3D Reconstruction.

Shape from X: Reflectance map, Shape from shading, Photometric stereo, Shape from optical flow, Rotating camera, Silhouettes.

Text Books:

1. Richard Szeliski, "Computer Vision: Algorithms and Applications", 2nd Edition, Springer-Verlag London Limited, 2022.
2. Rajeev Ratan, "Hands-On Computer Vision with OpenCV, Keras, and TensorFlow", 1st Edition, Packt Publishing, 2021.
3. E. R. Davies, "Computer Vision: Principles, Algorithms, Applications, Learning", 5th Edition, Academic Press Publisher, 2018.

Reference Books:

1. Hafsa Asad, Vishwesh Shrimali, Nikhil Singh, "The Computer Vision Workshop", 1st Edition, Packt Publishing, 2022.
2. Katsushi Ikeuchi, "Computer Vision: A Reference Guide", 2nd Edition, Springer Publishing, 2021.
3. David Forsyth, Jean Ponce, "Computer Vision: A Modern Approach", 2nd Edition, Pearson Education, 2015.
4. Scott Krig, "Computer Vision Metrics: Survey, Taxonomy, and Analysis", 1st Edition, Apress, Publisher, 2014.

Useful Links:

1. Advances in Computer Vision: 6.869 Course Materials (mit.edu)
2. Machine Vision | Electrical Engineering and Computer Science | MIT OpenCourseWare
3. vision.stanford.edu
4. Computer Vision Notes (Faisal Z. Qureshi at Ontario Tech University) (uoit.ca)
5. Deep Learning for Computer Vision - Course (nptel.ac.in)
6. Computer Vision Basics | Coursera
7. Introduction to Computer Vision and Image Processing | Coursera

Evaluation Scheme:

Theory :

Continuous Assessment (A):

Subject teacher will declare Teacher Assessment criteria at the start of semester.

Continuous Assessment (B):

1. Two term tests of 10 marks each will be conducted during the semester.

2. Average of the marks scored in both the tests will be considered for final grading.

End Semester Examination (C):

1. Question paper based on the entire syllabus, summing up to 65 marks.

2. Total duration allotted for writing the paper is 2 hrs.

Computer Vision Laboratory (22PCAI6010L)

Practical Scheme
Practical : 02 Hrs./week
Credit : 01

Examination Scheme
Teacher Assessment : 25 Marks
End Sem Exam : 25 Marks
Total : 50 Marks

Course Objectives:

1. To become familiar with image transformation and image enhancement techniques.
2. To understand and apply image processing fundamentals.
3. To explore feature detection techniques.
4. To implement object detection and tracking.

CO	Course Outcomes	Blooms Level	Blooms Description
CO1	Implement Image Transformation Techniques.	L3	Apply
CO2	Demonstrate Feature Detection using OpenCV.	L4	Analyze
CO3	Apply Image Denoising and Enhancement Techniques.	L3	Apply
CO4	Design and Implement Object Detection Models.	L6	Create

List of Laboratory Experiments

Suggested Experiments:

1. Image assessment with NumPy and OpenCV.
2. Image Transformation in OpenCV
3. Feature Detection using OpenCV- Corner, Edge, Pyramid
4. Image Denoising and enhancement techniques
5. Object Detection
6. Basic Video Processing in OpenCV
7. Object Tracking
8. Pattern Recognition
9. Face Recognition
10. Optical Flow computation algorithm
11. 3D Image Reconstruction
12. Project Based Learning
13. Research Article Review

A minimum of 08 experiments from the above suggested list or any other experiment based on syllabus will be included, which would help the learner to apply the concept learnt.

Evaluation Scheme:

Laboratory:

Continuous Assessment (A):

Laboratory work will be based on 22PCAI6010T with minimum 08 experiments to be incorporated. The distribution of marks for term work shall be as follows:

1. Performance in Experiments: 05 Marks
2. Journal Submission: 05 Marks
3. Viva-voce: 05 Marks
4. Subject Specific Lab Assignment/Case Study: 10 Marks

The final certification and acceptance of term work will be subject to satisfactory performance of laboratory work and upon fulfilling minimum passing criteria in the term work.

End Semester Examination (C):

Oral/ Practical examination will be based on the entire syllabus including, the practicals performed during laboratory sessions.

Deep Learning (22PCAI6020T)

Teaching Scheme
Lectures : 03 Hrs./week
Credits : 03

Examination Scheme
Term Test : 10 Marks
Teacher Assessment : 25 Marks
End Sem Exam : 65 Marks
Total Marks : 100 Marks

Prerequisite: Linear Algebra, Calculus, Probability, Statistics and Machine Learning Basics.

Course Objectives:

1. To introduce fundamental concepts of artificial neural network and different learning algorithms: supervised and unsupervised neural networks.
2. Develop in-depth understanding of the key techniques in designing Deep Network and GAN.
3. To expose Deep Network based methods to solve real world complex problems.
4. To explore applications and challenges in deep learning.

Course Outcomes:

CO	Course Outcomes	Blooms Level	Blooms Description
CO1	Understand the fundamentals of deep neural networks and their training mechanisms.	L2	Understand
CO2	Apply optimization and regularization techniques to improve model performance.	L3	Apply
CO3	Design and implement CNN models for supervised learning tasks.	L3	Apply
CO4	Develop solutions for sequence learning applications using recurrent networks.	L3	Apply
CO5	Analyze unsupervised learning techniques for dimensionality reduction and data reconstruction.	L4	Analyze
CO6	Evaluate recent trends in adversarial networks and generative models.	L5	Evaluate

Course Contents

Unit-I — 07 Hrs.

Supervised Learning Networks Feedforward DNN:

Perceptron: Representational power of Perceptron, The Perceptron Training Rule, Multilayer perceptron: Delta training rule; Multilayer Networks: A differentiable Threshold Unit (Sigmoid Neurons), Representational Power of Feedforward Networks; Activation functions: Tanh, Logistic, Linear, Softmax, ReLU, Leaky ReLU, Loss functions: Squared Error loss, Cross Entropy, Choosing output function and loss function

Unit-II — 07 Hrs.

Optimization: Learning with backpropagation: EBPTA, Learning Parameters: Gradient Descent (GD), Stochastic and Mini Batch GD, Momentum Based GD, Nesterov Accelerated GD, AdaGrad, Adam, RMSProp, Convergence and local minima, stopping criteria.

Regularization: Regularization for Deep Learning: Parameter Norm Penalties, Dataset Augmentation, Noise Robustness, Early Stooping, Sparse Representation, Dropout.

Unit-III — 06 Hrs.

Convolutional Neural Networks: Convolution operation, Padding, Stride, Relation between input, output and filter size, CNN architecture: Convolution layer, Pooling Layer, Weight Sharing in CNN, Fully Connected NN vs CNN, Variants of basic Convolution function, 2D Convolution.

ConvNet Architectures: LeNet: Architecture, AlexNET: Architecture, ResNet : Architecture, ConvNeXt, EfficientNET,

Applications: object detection and recognition tasks, medical image analysis, image classification

Unit-IV — 06 Hrs.

Sequence Modelling: Sequence Learning Problem, Unfolding Computational graphs, Recurrent Neural Network, Bidirectional RNN, Backpropagation Through Time (BTT), Limitation of "vanilla RNN", Vanishing and Exploding Gradients, The Long Short-Term Memory, GRU, Deep recurrent Networks.

Applications: Sentiment analysis, stock prices or market trends

Unit-V — 07 Hrs.

Unsupervised Learning Networks: Kohonen Self-Organizing Feature Maps – architecture, training algorithm

Autoencoders: Introduction, comparison with PCA, Linear Autoencoder, Undercomplete Autoencoder, Overcomplete Autoencoders, Regularization in Autoencoders, Denoising Autoencoders, Sparse

Autoencoders, Contractive Autoencoders, Variational Autoencoders (VAEs)

Applications: image compression, feature extraction, risk assessment and fraud detection

Unit-VI 06 Hrs.

Adversarial Networks: Generative Vs Discriminative Modeling, Generative Adversarial Networks (GAN) Architecture, GAN challenges: Oscillation Loss, Mode Collapse, Uninformative Loss, Hyperparameters, Tackling GAN challenges, Wasserstein GAN, Cycle GAN, Neural Style Transfer, Diffusion Models: Introduction, Comparison with GANs. Applications: image synthesis or style transfer, Data Augmentation.

Text Books:

1. Asaton Zhang, Zhacary Lipton, Mu Li and Alex Smola, "Dive into Deep Learning", December 2023.
2. Simon Prince, "Understanding Deep Learning", MIT Press, December 2023.
3. Simon Haykin, "Neural Networks and Learning Machines", Pearson Prentice Hall, 3rd Edition, 2010.
4. S. N. Sivanandam and S. N. Deepa, "Introduction to Soft Computing", Wiley India Publications, 3rd Edition, 2018.
5. M. J. Kochenderfer, Tim A. Wheeler, "Algorithms for Optimization", IT Press.
6. David Foster, "Generative Deep Learning", O'Reilly Media, 2019.
7. Denis Rothman, "Hands-On Explainable AI (XAI) with python", Packt, 2020.

Reference Books:

1. Ian Goodfellow and Yoshua Bengio and Aaron Courville, "Deep Learning", An MIT Press, 2016.
2. François Chollet, "Deep Learning with Python", Manning Publication, 2017.
3. Josh Patterson, Adam Gibson, "Deep Learning: A Practitioner's Approach", O'Reilly Publication, 2017.
4. Andrew W. Trask, Grokking, "Deep Learning", Manning Publication, 2019.
5. John D. Kelleher, "Deep Learning", MIT Press Essential Knowledge series, 2019.
6. Douwe Osinga, "Deep Learning Cookbook", O'REILLY, SPD Publishers, Delhi.

Web Resources:

1. Deep Learning: https://vlab.spit.ac.in/ai/#/experiments
2. Deep learning book: https://www.deeplearningbook.org/
3. Deep learning all videos: https://www.cse.iitm.ac.in/ miteshk/CS6910.html
4. Deep Learning Specialization: https://www.coursera.org/specializations/deep-learning

Online Resources:

1. Deep Learning, IIT Ropar NPTEL course by Prof. Sudarshan Iyengar, Dr. Padmavati https://nptel.ac.in/courses/106106184

Evaluation Scheme:

Theory:

Continuous Assessment (A):

Subject teacher will declare Teacher Assessment criteria at the start of semester.

Continuous Assessment (B):

1. Two term tests of 10 marks each will be conducted during the semester.
2. Average of the marks scored in both the tests will be considered for final grading.

End Semester Examination (C):

1. Question paper based on the entire syllabus, summing up to 65 marks.
2. Total duration allotted for writing the paper is 2 hrs.

Deep Learning Laboratory (22PCAI6020L)

Practical Scheme
Practical : 02 Hrs./week
Credit : 01

Examination Scheme
Teacher Assessment : 25 Marks
End Sem Exam : 25 Marks
Total : 50 Marks

Course Objectives:

1. Monitor and evaluate the deep learning models using different techniques.
2. Building CNN, RNN and explainable AI with real world data.

CO	Course Outcomes	Blooms Level	Blooms Description
CO1	Illustrate performance of deep learning models using different techniques.	L3	Apply
CO2	Analyze and evaluate deep network-based methods to design innovative solutions for real-world complex problems.	L4	Analyze
CO3	Build solution using appropriate neural network models.	L6	Create

List of Laboratory Experiments

Suggested Experiments:

1. Implement Boolean gates using perceptron.
2. Implement representation power of perceptron.
3. Implement backpropagation algorithm from scratch.
4. Train CNN Models for Image Classification Tasks.
5. Evaluate the Effect of Optimizers (SGD, Adam) on Model Performance.
6. Compare the Performance of PCA and Autoencoders on Dimensionality Reduction Tasks.
7. Sequence Classification Using RNN or GRU (e.g., Sentiment Analysis or Activity Recognition).
8. Anomaly detection using Self-Organizing Network.
9. Compare the performance of PCA and Autoencoders on a given dataset.
10. Train Variational Autoencoders (VAEs) for Image Reconstruction.
11. Build Generative adversarial model for fake (news/image/audio/video) prediction.
12. Generate Synthetic Data Using Diffusion Models and Evaluate Results.
13. Mini Project

A minimum of 08 experiments and mini project from the above suggested list or any other experiment based on syllabus will be included, which would help the learner to apply the concept learnt.

Evaluation Scheme:

Laboratory:

Continuous Assessment (A):

Laboratory work will be based on 22PCAI6020T with minimum 08 experiments to be incorporated. The distribution of marks for term work shall be as follows:

1. Performance in Experiments: 05 Marks
2. Journal Submission: 05 Marks
3. Viva-voce: 05 Marks
4. Subject Specific Lab Assignment/Case Study: 10 Marks

The final certification and acceptance of term work will be subject to satisfactory performance of laboratory work and upon fulfilling minimum passing criteria in the term work.

End Semester Examination (C):

Oral/ Practical examination will be based on the entire syllabus including, the practicals performed during laboratory sessions.

Dev Ops and ML Ops (22PCAI6030T)

Teaching Scheme
Lectures : 03 Hrs./week
Credits : 03

Examination Scheme
Term Test : 10 Marks
Teacher Assessment : 25 Marks
End Sem Exam : 65 Marks
Total Marks : 100 Marks

Prerequisite: Machine Learning.

Course Objectives:

1. To understand the need for DevOps as a software engineering practice.
2. To know and understand the concept of Continuous Integration Continuous Delivery (CICD).
3. To learn the concept of continuous deployment and monitoring strategies.
4. To learn various tools used in DevOps.
5. To comprehend the concepts in MLOps.
6. To learn deployment strategies in MLOps.

CO	Course Outcomes	Blooms Level	Blooms Description
CO1	Understand the fundamental concepts of DevOps.	L2	Understand
CO2	Comprehend the concept of continuous integration and continuous delivery.	L2	Understand
CO3	Compare various stages of continuous deployment and monitoring strategies.	L4	Analyze
CO4	Explore various tools to implement concepts in DevOps.	L4	Analyze
CO5	Describe the concepts used in the automation of Machine Learning life cycle phases.	L2	Understand
CO6	Elaborate deployment strategies in MLOps.	L4	Analyze

Course Contents

Unit-I — 06 Hrs.

Introduction to DevOps and the Culture: Definition, History of Devops, Objectives, Role of DevOps Engineer, Developer responsibility, Continuous Integration & Deployment, Containers and Virtual Development, Configuration Management Tools, Introduction to DevOps pipeline phases, Defining the Development Pipeline, Centralizing the Building Server, Monitoring Best Practices and Best Practices for Operations.

Unit-II — 06 Hrs.

Source Code Management: Version Control: GIT Features, 3-Tree Architecture, GIT – Clone /Commit / Push, GIT Hub Projects, GIT Hub Management, GIT Rebase & Merge, GIT Stash, Reset, Checkout, GIT Clone, Fetch, Pull, Membership GITHUB.

Continuous Integration and Continuous Delivery: Implementing Continuous Integration-Version control, automated build, Continuous Integration Practices using Continuous Integration Software (Jenkins as an example tool), Jenkins Architecture, Integrating Source code management, Continuous delivery to a staging environment or the pre-production, environment, Self-healing systems.

Unit-III — 06 Hrs.

Continuous Deployment and Continuous Monitoring: Implementing a testing Strategy: Types of Tests, Integration testing, managing defect backlogs,

Continuous Deployment: Trade-offs in the deployment pipeline, Basic Deployment pipeline, Deployment pipeline practices & Commit stage, Automated Acceptance Test Gate,

Factors involved in monitoring systems: white-box and black-box monitoring, building a monitoring system, monitoring infrastructure and applications, collecting data, logging, creating the dashboard, behaviour-driven monitoring, Site reliability engineering, SRE and DevOps, roles, and responsibilities of SRE, common tools used by SREs.

Unit-IV — 07 Hrs.

Configuration Management: The Process of Configuration in Devops.

Configuration Management Tools Containerization: Docker introduction, Docker Image, working with Docker Containers, Docker Engine, Creating Containers with an Image, working with Images, Docker Hub, Docker Trusted Registry, Docker File & Commands. Devops Monitoring Tool: Introduction to Nagios, Architecture

Virtualization and Containerization: Virtualization, Virtualization vs Containerization, Micro-services and Containerization, orchestration, Difference between orchestration and automation.

Unit-V

07 Hrs.

Introduction to MLOps: MLOps Motivation, Solutions and Future Trends, MLOps Components, Different Roles involved in MLOps (ML Engineering + Operations), Machine Learning Life Cycle, MLOps Vs DevOps, Tools to create ML pipelines.

Unit-VI

07 Hrs.

ML Model Deployment: MLOps Maturity Model Levels, MLOps - Stages Of CI / CD, Creating and deploying ML/AI models, ML Pipelines, automation of ML through Pipelines, Tools to create ML pipelines, Monitoring and Logging, Data Quality and Integrity, Model Retraining and Model replacement, Model Versioning, MLOps: Infrastructure, MLOps: Testing, Monitoring and Maintenance.

Text Books:

1. Karl Matthias & Sean P. Kane, "Docker: Up and Running", O'Reilly Publication, 2nd Edition, 2018.
2. PierluigiRiti, "Pro DevOps with Google Cloud Platform", Apress, ISBN: 978-1-4842-3896-7.
3. Gene Kim, Kevin Behr, George Spafford, "The Phoenix Project: A Novel About IT, DevOps, and Helping Your Business", It Revolution Press publication, 2018.
4. Gene Kim, Patrick Debois, John Willis, Jez Humble, "The DevOps Handbook: How to Create World-Class Agility, Reliability, and Security in Technology Organizations", IT Revolution Press, 2021.
5. Noah Gift, "Practical MLOps: A Guide to Building Real-World Machine Learning Systems", O'Reilly, 1st Edition, September 2021.

Reference Books:

1. Viktor Farcic, "The DevOps 2.0 Toolkit: Automating the Continuous Deployment Pipeline with Containerized Microservices".
2. Jennifer Davis and Katherine Daniels, "Effective DevOps: Building a Culture of Collaboration, Anity, and Tooling at Scale", O'Reilly Media, Inc., ISBN: 978-1-491-92630-7.
3. Sanjeev Sharma and Bernie Coyne, "DevOps for Dummies", John Wiley & Sons, Inc., 2nd IBM Limited Edition, ISBN: 978-1-119-04705-6.
4. Sridhar Alla, Suman Kalyan Adari, "Beginning MLOps with MLFlow: Deploy Models in AWS SageMaker, Google Cloud, and Microsoft Azure".
5. Mark Treveil, Nicolas Omont, "Introducing MLOps: How to Scale Machine Learning in the Enterprise", O'Reilly Media, 1st Edition, January 5, 2021.

6. Chris Fregly, Antje Barth, "Data Science on AWS: Implementing End-to-End Continuous Machine Learning Pipelines", O'Reilly, 1st Edition, 9 May 2021.

Web Links:

1. https://www.redhat.com/en/resources/cloud-native-container-design-whitepaper
2. https://www.redhat.com/en/topics/cloud-native-apps/what-is-serverless
3. https://www.redhat.com/en/topics/automation/what-is-orchestration
4. https://www.atlassian.com/continuous-delivery/continuous-integration
5. https://www.flagship.io/glossary/site-reliability-engineer/
6. https://docs.microsoft.com/en-us/learn/paths/intro-to-vc-git/
7. https://www.javatpoint.com/kubernetes
8. https://www.javatpoint.com/docker-tutorial
9. https://www.javatpoint.com/jenkins
10. 1https://www.javatpoint.com/jenkinss
11. https://www.javatpoint.com/ansible
12. https://www.javatpoint.com/selenium-tutorial
13. https://prometheus.io/docs/introduction/overview/
14. https://www.javatpoint.com/jira-tutorial
15. https://www.geeksforgeeks.org/what-is-elastic-stack-and-elasticsearch/
16. Coursera: Machine Learning Engineering for Production (MLOps) Specialization by Andrew Ng
17. Coursera: "Machine Learning Engineering for Production (MLOps)" by deeplearning.ai.
18. Udacity: "Machine Learning Deployment" by Google Cloud.

Evaluation Scheme:

Theory :

Continuous Assessment (A):

Subject teacher will declare Teacher Assessment criteria at the start of semester.

Continuous Assessment (B):

1. Two term tests of 10 marks each will be conducted during the semester.

2. Average of the marks scored in both the tests will be considered for final grading.

End Semester Examination (C):

1. Question paper based on the entire syllabus, summing up to 65 marks.

2. Total duration allotted for writing the paper is 2 hrs.

Dev Ops and ML Ops Laboratory (22PCAI6030L)

Practical Scheme
Practical : 02 Hrs./week
Credit : 01

Examination Scheme
Teacher Assessment : 25 Marks
End Sem Exam : 25 Marks
Total : 50 Marks

Course Objectives:

1. Understand DevOps Principles, and Practices.
2. Perform various GIT operations on local and remote repositories using GIT.
3. Setup and Run Selenium Tests in Jenkins Using Maven.
4. Install and Configure Pull based Software Configuration Management and provisioning tools Using Puppet.

CO	Course Outcomes	Blooms Level	Blooms Description
CO1	Create program using DevOp's Practices and Priciples.	L6	Create
CO2	Apply various GIT operations.	L3	Apply
CO3	Understand Docker Architecture and Container Life Cycle.	L2	Understand
CO4	Learn Software Configuration Management and provisioning using Puppet Blocks.	L2	Understand

List of Laboratory Experiments

Suggested Experiments:

1. Write code for a simple user registration form for an event. To Study DevOps: Principles, Practices, and DevOps Engineer Role and Responsibilities
2. To carry out 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. 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 Setup and Run Selenium Tests in Jenkins Using Maven.
7. To study Docker Architecture and Container Life Cycle, install Docker and execute docker commands to manage images and interact with containers.
8. To study Dockerfile instructions, build an image for a sample web application using Dockerfile.
9. To install and Configure Pull based Software Configuration Management and provisioning tools using Puppet.
10. To perform Software Configuration Management and provisioning using Puppet Blocks (Manifest, Modules, Classes, Function).
11. Setting up a Version Control System (VCS) for ML Projects:
    - Experiment with popular VCS tools like Git and create a repository for ML projects.
    - Learn to track code changes, collaborate with team members, and manage different branches.
12. Creating a Continuous Integration (CI) Pipeline:
    - Build a CI pipeline using tools like Jenkins, Travis CI, or GitLab CI.
    - Automate the process of building, testing, and validating ML models with each code commit.
13. Containerization with Docker:
    - Containerize ML models and their dependencies using Docker.
    - Experiment with Docker images, containers, and Dockerfile configurations.

14. Orchestrating ML Workflows with Kubernetes:

    - Deploy ML models as scalable and resilient services using Kubernetes.
    - Experiment with deploying, managing, and scaling ML workloads in Kubernetes clusters.

15. Experiment Tracking and Management:

    - Use tools like MLflow or Neptune.ai to track experiments, log metrics, and manage model versions.
    - Explore features like hyperparameter tuning, model registry, and experiment reproducibility.

A minimum of 08 experiments from the above suggested list or any other experiment based on syllabus will be included, which would help the learner to apply the concept learnt.

Evaluation Scheme:

Laboratory:

Continuous Assessment (A):

Laboratory work will be based on 22PCAI6030T with minimum 08 experiments to be incorporated. The distribution of marks for term work shall be as follows:

1. Performance in Experiments: 05 Marks
2. Journal Submission: 05 Marks
3. Viva-voce: 05 Marks
4. Subject Specific Lab Assignment/Case Study: 10 Marks

The final certification and acceptance of term work will be subject to satisfactory performance of laboratory work and upon fulfilling minimum passing criteria in the term work.

End Semester Examination (C):

Oral/ Practical examination will be based on the entire syllabus including, the practicals performed during laboratory sessions.

Cloud Computing Laboratory (22PCAI6040L)

Practical Scheme
Practical : 02 Hrs./week
Credit : 01

Examination Scheme
Teacher Assessment : 25 Marks
End Sem Exam : 25 Marks
Total : 50 Marks

Course Objectives:

1. To familiarize with cloud computing terminologies and industry standards.
2. To gain Hands-on experience in virtualizing resources in a cloud environment.
3. To introduce the best practices for securing cloud services and managing user access.
4. To Introduce distributed database design principles and techniques.

CO	Course Outcomes	Blooms Level	Blooms Description
CO1	Understand the fundamental concepts and principles of cloud computing.	L2	Understand
CO2	Use virtualization technologies and tools.	L2	Understand
CO3	Understand the concept of identity and access management in cloud computing.	L3	Apply
CO4	Utilize big data processing frameworks such as Hadoop, Spark, and Flink to process and analyze large datasets.	L3	Apply

Course Contents

Unit-I — 04 Hrs.

Introduction to Cloud Computing: Overview of cloud computing, Fundamentals of cloud computing ecosystem, cloud computing characteristics, Components of cloud computing, peer-to-peer, client-server, grid computing, Cloud Architecture, Introduction to distributed computing, need of distributed computing, Introduction to Parallel computing, Parallel computing platforms.

Unit-II — 08 Hrs.

Cloud Services and Deployment Models: Infrastructure as a service (IaaS), Platform as a service (PaaS), Software as a service (SaaS), NIST Model for cloud, Public cloud, Private cloud, Hybrid cloud, Community cloud. Computing services, Storage services, Networking services, Database services.

Virtualization: Full Virtualization, Para-Virtualization, Hardware/ Memory Virtualization, KVM architecture.

Cloud Infrastructure mechanism: Logical network perimeter, virtual server, cloud storage devices, cloud usage monitor, resource replication, readymade environment.

Unit-III — 07 Hrs.

Cloud Programming: Programming Support for Amazon EC2: Amazon S3, EBS and Simple DB Programming Support for Google Apps engine: GFS, Big 4 Tables, Googles NO SQL System, Chubby, Google Distributed Lock Service

Unit-IV — 08 Hrs.

Cloud Security: Securing the Cloud, The security boundary, Security service boundary, Security mapping.

Host security for SaaS, 4 PaaS and IaaS,

Data Security: Data Security Concerns, Data Confidentiality and Encryption, Data Availability, Data Integrity, Cloud Storage Gateways, Cloud Firewall

Establishing Identity and Presence: Identity and Access Management (IAM)

Unit-V — 06 Hrs.

Serverless Computing: overview of serverless computing, serverless architecture and design patterns, Microservices and event-driven architectures, Functions and triggers.

Serverless Platforms and Providers: Overview of serverless platforms and providers (AWS Lambda, Google Cloud Functions, Azure Functions, etc.) Features and capabilities of serverless platforms, Overview of serverless security and governance

Unit-VI

06 Hrs.

Cloud Applications: MapReduce: Paradigm, Programming Model, Applications, Scheduling, Fault-Tolerance, Implementation Overview, Examples Introduction to Spark: Resilient Distributed Datasets (RDDs), RDD Operations, Spark applications: Page Rank Algorithm, GraphX, GraphX API, GraphX working.

Introduction to Kafka: Kafka, Use cases for Kafka, Data model, Architecture, Types of messaging systems, Importance of brokers, Kafka Stream processing.

Suggested List of Experiments:

1. Virtualization: Hosted Virtualization and Bare Metal Virtualization.
2. Creating a virtual machine on a public cloud platform: how to create a virtual machine on a public cloud platform like Amazon Web Services (AWS) or Microsoft Azure and configure it to run a basic application.
3. Host a Static Website on cloud.
4. Configure Identity and Access Management (IAM) for secure access.
5. Create and migrate relational database on cloud.
6. Study different Infrastructure as a service (IaaS), Platform as a service (PaaS), Software as a service (SaaS) application.
7. Install Google App Engine. Create simple web applications using python/java
8. Building a simple web application on the cloud: how to build a simple web page using the cloud infrastructure mechanism, including a virtual server, cloud storage, and networking services.
9. Automate Infrastructure Development using IaaS.
10. Implement serverless architecture and configure notification services.
11. Cloud case studies and future trends.
    Case studies of successful cloud deployments in AI/ML.
    Emerging cloud technologies and trends.
    Ethical and legal considerations in cloud computing.

A minimum of 08 experiments from the above suggested list or any other experiment based on syllabus will be included, which would help the learner to apply the concept learnt.

Text Books:

1. Barrie Sosinsky, "Cloud Computing Bible", 2018.
2. Mehul Mahrishi Kamal Kant Hiran, Ruchi Doshi, Dr. Fagbola Temitayo, "Cloud Computing", 2019.
3. Lizhe Wang, Rajiv Ranjan, Jinjun Chen, and Boualem Benatallah, "Cloud Computing: Methodology, Systems, and Applications", released by CRC Press, 2017.
4. Arshdeep Bahga and Vijay Madisetti, "Cloud Computing: A Hands-On Approach", 2014.

Reference Books:

1. Judith Hurwitz ,"Cloud Computing for Dummies" , Wiley Publication, 2020.
2. Tim Mather, Subra Kumaraswamy, Shahed Latif, "Cloud Security and Privacy: An Enterprise Perspective on Risk and Compliance", 2019.
3. Thomas Erl Ricardo Puttini, Zaigham Mahmood, "Cloud Computing: Concepts, Technology & Architecture", 2013.
4. Joe Weinman, "Cloudonomics: The Business Value of Cloud Computing", 2012.

Useful Links:

1. https://www.coursera.org/learn/introduction-to-cloud
2. https://www.coursera.org/projects/googlecloud-introduction-to-cloud-dataproc- hadoop-and-spark-on-google-clou-j3jfl
3. https://www.coursera.org/learn/ibm-cloud-essentials
4. https://www.coursera.org/learn/microsoft-azure-cloud-services

Evaluation Scheme:

Laboratory:

Continuous Assessment (A):

Laboratory work will be based on 22PCAI6040L with minimum 08 experiments to be incorporated. The distribution of marks for term work shall be as follows:

1. Performance in Experiments: 05 Marks
2. Journal Submission: 05 Marks
3. Viva-voce: 05 Marks
4. Subject Specific Lab Assignment/Case Study: 10 Marks

The final certification and acceptance of term work will be subject to satisfactory performance of laboratory work and upon fulfilling minimum passing criteria in the term work.

End Semester Examination (C):

Oral/ Practical examination will be based on the entire syllabus including, the practicals performed during laboratory sessions.

IoT Foundations (22PEAI6051T)

Teaching Scheme
Lectures : 03 Hrs./week
Credits : 03

Examination Scheme
Term Test : 10 Marks
Teacher Assessment : 25 Marks
End Sem Exam : 65 Marks
Total Marks : 100 Marks

Course Objectives:

1. To introduce basic architecture and organization of processor and controller.
2. To introduce optimizing techniques for machine learning.
3. To introduce different architectures used for connected smart devices.
4. To study integration of AI with IoT and various protocols used in the IoT environment.

CO	Course Outcomes	Blooms Level	Blooms Description
CO1	Understand the basic architecture and organization of processor and controller.	L2	Understand
CO2	Discover embedded systems design principles and concepts.	L2	Understand
CO3	Appraise the role of IoT protocols for efficient network communication.	L5	Evaluate
CO4	Illustrate different sensor technologies for sensing real world entities and identify the applications of IoT in Industry.	L3	Apply

Course Contents

Unit-I — 08 Hrs.

Introduction to Microprocessor and Microcontroller: Architecture of Microprocessor 8086- Internal registers, CPU, ALU, Types of System Bus, Bus Structure- address and data bus, Instruction Register, Timing and Control, Interrupts and Serial I/O.

Microcontroller: CPU architecture, memory organization, and I/O ports, Embedded peripherals (timers, counters, ADC, DAC), Interrupt handling and real-time programming.

Unit-II — 04 Hrs.

Embedded systems design principles and concepts: Design Principles for Embedded Systems, Techniques for optimizing ML algorithms for low-power devices, Quantization, pruning, and model compression, Model selection and trade-offs in resource-constrained environments.

Unit-III — 08 Hrs.

Introduction to IoT: Definition, Characteristics, Physical and 8 Logical Designs, IoT Protocols, IoT Communications Models and API, IoT Enabling Technologies, IoT Levels and Deployment Templates, IoT Examples, M2M, Industrial IoT (IIoT) and architecture. RFID Technology – Working of RFID, Components of an RFID system, RFID Transponder (tag) classes, System architecture, Localization and Handover Management, Technology considerations, Performance Evaluation, Applications.

Unit-IV — 06 Hrs.

IoT Data Collection and Preprocessing : Sensor networks and data acquisition techniques - Data Preprocessing for AI and machine learning, Edge Computing for Machine Learning - Deploying machine learning models on edge devices - Edge analytic and decision-making algorithms.

Unit-V — 08 Hrs.

IoT and AI Integration: AI –Graphic Processing Unit, Tensor Processing Unit, FPGA-based acceleration for machine learning, case study on Google's TPU and the Edge TPU. TensorFlow Lite, ONNX Runtime, and Edge TPU for deployment of AI models.

Unit-VI — 05 Hrs.

IoT applications: IoT for Entertainment and wearables, IoT for Manufacturing, IoT for Employee safety, IoT for healthcare, IoT for Logistics & Supply chain, Retail Supply chain control, NFC Payment, Intelligent shopping application, Smart product management. Case studies on Smart cities, Smart Home, Smart Environment, Smart Agriculture.

Text Books:

1. Design Principles for Embedded Systems, KCS Murti, Springer Singapore ISBN-978-981-16-3295-2, 22 September 2022.
2. Peter Waher, "Mastering Internet of Things: Design and create your own IoT applications using Raspberry Pi 3", 1st Edition, Packt Publishing, 2018.
3. Srinivasa K G, "Internet of Things", CENGAGE Leaning India, 2017.
4. Hakima Chaouchi, "Internet of Things: Connecting Objects to the Web", 1st Edition, Wiley, 2013.

Reference Books:

1. Intelligent Connectivity: AI, IoT, and 5G (IEEE Press), Abdulrahman Yarali Wiley-IEEE Press, 2021.
2. Jonathan W. Valvano, "Embedded Microcomputer Systems-Real Time Interfacing", Publisher Cengage Learning, 3rd Edition, 2012
3. Vijay Madisetti, Arshdeep Bahga, "Internet of Things (A Hands-on-Approach)", 2015.

Web Links:

1. NPTEL :: Computer Science and Engineering - Microprocessors and Microcontrollers
2. Embedded Systems Academy- https://www.embedded-sys.com/plus/
3. Embedded Systems Basics by Tutorials point-
   https://www.tutorialspoint.com/embedded_systems/index.htm

Evaluation Scheme:

Theory :

Continuous Assessment (A):

Subject teacher will declare Teacher Assessment criteria at the start of semester.

Continuous Assessment (B):

1. Two term tests of 10 marks each will be conducted during the semester.
2. Average of the marks scored in both the tests will be considered for final grading.

End Semester Examination (C):

1. Question paper based on the entire syllabus, summing up to 65 marks.
2. Total duration allotted for writing the paper is 2 hrs.

IoT Foundations Laboratory (22PEAI6051L)

Practical Scheme
Practical : 02 Hrs./week
Credit : 01

Examination Scheme
Teacher Assessment : 25 Marks
End Sem Exam : 25 Marks
Total : 50 Marks

Course Objectives:

1. Define the basics of processor and controller.
2. Understand the key concept of MQTT protocol.
3. To interface IoT sensors and actuators for data collection and control operations.
4. Understand the Client Server Configuration.

CO	Course Outcomes	Blooms Level	Blooms Description
CO1	Apply IoT concepts using Arduino, sensors, actuators, and the MQTT protocol.	L3	Apply
CO2	Analyze MQTT communication with NodeMCU and display messages on an I2C LCD.	L4	Analyze
CO3	Design IoT systems for data collection, processing, and actuator control.	L6	Create
CO4	Develop interactive applications like 3D Pong and simulate client-server setups.	L6	Create

List of Laboratory Experiments

Suggested Experiments:

1. Setting Up and Programming the Arduino.
2. Implement basic operations for the MQTT protocol: publish and subscribe.
3. Use the NodeMCU to subscribe to messages that published by MQTT client, then display. these messages on a 1602 I2C LCD display.
4. To study and implement interfacing of different IoT sensors with Raspberry Pi pico/Arduino/ModeMCU.
5. To study and implement interfacing of actuators based on the data collected using IoT sensors. (like led switch ON/OFF, stepper motor)
6. To study and implement IoT Data processing using Pandas.
7. 3D Pong Game With Arduino and vPython.
8. Understanding and Creating a Simple Client Server Configuration.

Evaluation Scheme:

Laboratory:

Continuous Assessment (A):

Laboratory work will be based on 22PEAI6051T. The distribution of marks for term work shall be as follows:

1. Performance in Experiments: 05 Marks
2. Journal Submission: 05 Marks
3. Viva-voce: 05 Marks
4. Subject Specific Lab Assignment/Case Study: 10 Marks

The final certification and acceptance of term work will be subject to satisfactory performance of laboratory work and upon fulfilling minimum passing criteria in the term work.

End Semester Examination (C):

Oral/ Practical examination will be based on the entire syllabus including, the practicals performed during laboratory sessions.

Time Series Analysis (22PEAI6052T)

Teaching Scheme
Lectures : 03 Hrs./week
Credits : 03

Examination Scheme
Term Test : 10 Marks
Teacher Assessment : 25 Marks
End Sem Exam : 65 Marks
Total Marks : 100 Marks

Course Objectives:

1. Learn basic analysis of time series data.
2. Auto regressive and model averaging models.
3. Learn basic concepts of forecasting.
4. To understand the detection of outliers in time series data.

CO	Course Outcomes	Blooms Level	Blooms Description
CO1	To understand the basics of Time series Analysis.	L2	Understand
CO2	To apply statistical smoothening methods for the time series data.	L3	Apply
CO3	To forecast the time series data using traditional methods.	L4	Analyze
CO4	To analyze and explore the deep learning techniques for forecasting the time series data.	L4	Analyze

Course Contents

Unit-I — 05 Hrs.

Introduction to Time series: Taxonomy of time series forecasting methods. Time series Decomposition. Real-life examples of time series, types of variation in time series, tests of randomness, tests for trend, seasonality.

Unit-II — 08 Hrs.

Exploratory Data Analysis & Visualizations for Time Series Analysis: Handling time series data: working with Date and Time, Handling Missing values: Understanding missing data, performing data quality checks, handling missing data with univariate imputation using pandas and scikit-learn, Plotting Time series data with interactive Visualizations using hvPlot, Decomposing Time series data.

Unit-III — 08 Hrs.

Smoothening Methods: Naïve method, Seasonal Naïve method, Average method, Moving Average Smoothing, Time series analysis using Linear Regression, Autocorrelation, Auto Regression, stationary data, differentiation, Seasonal differentiation, moving average of error, ARIMA Model, SARIMA, . . . Machine Learning methods- windowing, Neural Network Auto Regressive

Unit-IV — 06 Hrs.

Forecasting: Forecasting in time series models, forecasting for autoregressive processes, One-step ahead predictors based on the finite past: Durbin-Levinson algorithm.

Unit-V — 06 Hrs.

Deep Learning for Time Series Forecasting: Understanding Artificial Neural Networks, forecasting with an RNN using keras, forecasting with LSTM with keras, forecasting with a GRU using keras , forecasting with an RNN using PyTorch, Forecasting with an LSTM using PyTorch, Forecasting with GRU using PyTorch.

Unit-VI — 06 Hrs.

Outlier Detection in Time series Data: Detecting Outliers using Statistical methods: Visualizations, Tukey method, z-score and modified z- score.

Detecting Outliers using Unsupervised Machine Learning Techniques: KNN, LOF, iForest, One-class Support Vector Machine (OCSVM). Detecting outliers using COPOD and PyCaret.

Text Books:

1. Tarek A. Atwan, "Time Series Analysis with Python Cookbook: Practical recipes for exploratory

data analysis, data preparation, forecasting, and model evaluation", Packt Publishing Limited, 2022.

2. James D. Hamilton, "TIME SERIES ANALYSIS", Levant Books, 2012.

3. B. V. Vishwas and Ashish Patel, "Hands-on Time Series Analysis with Python," 1st Edition, Apress, 2020.

4. Ted Dunning and Ellen Friedman, "Time Series Databases: New Ways to Store and Access Data", 1st Edition, O'Reilly, 2019.

Reference Books:

1. Vijay Kotu , Bala Deshpande , "Data Science: Concepts and Practice", 2nd Edition, Morgan Kaufmann, 2018.

2. Robert H. Shumway and David S. Stoffer, "Time Series Analysis and Its Applications : With R Examples," 4th Edition, Springer, 2017.

Web Links:

1. Energy consumption time series forecasting with python and LSTM deep learning model | by Eligijus Bujokas | Towards Data Science

2. Autoregression Models for Time Series Forecasting With Python - MachineLearningMastery.com

3. Python | ARIMA Model for Time Series Forecasting - GeeksforGeeks

4. Weekly Rainfall and Temperature Forecasting | Kaggle

5. Air Passenger Forecast : ARIMA - SARIMA | Kaggle

6. Stock Price prediction by simple RNN and LSTM | Kaggle

7. LSTM for Time Series Prediction in PyTorch - MachineLearningMastery.com

8. Gated Recurrent Unit (GRU) With PyTorch (floydhub.com)

Evaluation Scheme:

Theory :

Continuous Assessment (A):

Subject teacher will declare Teacher Assessment criteria at the start of semester.

Continuous Assessment (B):

1. Two term tests of 10 marks each will be conducted during the semester.

2. Average of the marks scored in both the tests will be considered for final grading.

End Semester Examination (C):

1. Question paper based on the entire syllabus, summing up to 65 marks.

2. Total duration allotted for writing the paper is 2 hrs.

Time Series Analysis Laboratory (22PEAI6052L)

Practical Scheme
Practical : 02 Hrs./week
Credit : 01

Examination Scheme
Teacher Assessment : 25 Marks
End Sem Exam : 25 Marks
Total : 50 Marks

Course Objectives:

1. Learn basic analysis of time series data.
2. Auto regressive and model averaging models.
3. Learn basic concepts of forecasting.
4. To understand the detection of outliers in time series data.

CO	Course Outcomes	Blooms Level	Blooms Description
CO1	To preprocess and visualize the time series dataset.	L3	Apply
CO2	To apply statistical smoothening methods for the time series data.	L3	Apply
CO3	To forecast the time series data using traditional methods.	L4	Analyze
CO4	To analyze and explore the deep learning techniques for forecasting the time series data.	L4	Analyze

List of Laboratory Experiments

Suggested Experiments:

1. Data Preprocessing: Clean and preprocess a given time series dataset, handling missing values.
2. Data Exploration: Use Pandas to explore and visualize various time series datasets.
3. Autoregression Models for Time Series Forecasting with Python.
4. Apply ARIMA - SARIMA models to predict / forecast the number of passengers travelling using aeroplanes based on time series data.
5. Implementing Basic RNN: Develop an RNN model for stock price prediction using historical data.
6. Time Series Prediction with LSTM Recurrent Neural Networks in Python with Keras.
7. Gated Recurrent Unit (GRU) With PyTorch.
8. Outlier Detection using statistical methods.
9. Outlier Detection using Unsupervised Machine Learning Techniques.
10. Compare and contrast on Statistical methods and Deep Learning methods by forecasting the Weekly Rainfall and Temperature.

A minimum of 08 experiments from the above suggested list or any other experiment based on syllabus will be included, which would help the learner to apply the concept learnt.

Evaluation Scheme:

Laboratory:

Continuous Assessment (A):

Laboratory work will be based on 22PEAI6052T with minimum 08 experiments to be incorporated. The distribution of marks for term work shall be as follows:

1. Performance in Experiments: 05 Marks
2. Journal Submission: 05 Marks
3. Viva-voce: 05 Marks
4. Subject Specific Lab Assignment/Case Study: 10 Marks

The final certification and acceptance of term work will be subject to satisfactory performance of laboratory work and upon fulfilling minimum passing criteria in the term work.

End Semester Examination (C):

Oral/ Practical examination will be based on the entire syllabus including, the practicals performed during laboratory sessions.

Human Machine Interaction (22PEAI6053T)

Teaching Scheme
Lectures : 03 Hrs./week
Credits : 03

Examination Scheme
Term Test : 10 Marks
Teacher Assessment : 25 Marks
End Sem Exam : 65 Marks
Total Marks : 100 Marks

Course Objectives:

1. This course provides an opportunity to learn and apply the design principles of Human Machine Interaction.
2. Learners will learn the basic human psychology of everyday actions and will be able to design an UI prototype of an application.
3. This course covers the discussion on various interaction design concepts.
4. The laboratory experiments are designed to practice the concepts and to adopt the systematic approach for interface design using various UX tools.

CO	Course Outcomes	Blooms Level	Blooms Description
CO1	Identify the various design principles used for interacting between human and machine.	L1	Remember
CO2	Apply human psychology of everyday actions and UI design processes for real world applications.	L3	Apply
CO3	Implement mobile, windows, and web-based application.	L3	Apply
CO4	Evaluate and justify UI design and Create an application for a social and technical task.	L5	Evaluate

Course Contents

Unit-I — 07 Hrs.

Introduction: Introduction to Human Machine Interface, Hardware, software and operating environment to use HMI in various fields. The psychopathology of everyday things – complexity of modern devices; human-centered design; fundamental principles of interaction; Psychology of everyday actions- how people do things; the seven stages of action and three levels of processing; human error.

Unit-II — 06 Hrs.

Graphical User Interface and Web Interface: The Graphical User Interface: Popularity of graphics, the concept of direct manipulation, characteristics of GUI, Web user Interface: Interface popularity, characteristics. Principles of user interface design.

Unit-III — 07 Hrs.

Understanding Goal-Directed Design: Goal-directed design; Implementation models and mental models; Beginners, experts, and intermediates – designing for different experience levels. Understanding users; Modeling users – personas and goals.

Unit-IV — 07 Hrs.

Design Guidelines: perception, Gestalt principles, visual structure, reading is unnatural, color, vision, memory, six behavioral patterns, recognition and recall, learning, factors affecting learning, and time.

Unit-V — 07 Hrs.

Interaction Styles and Communication:

Interaction Styles: Menus, Windows, Device-based and Screen-based Controls.

Communication: Text messages, Feedback, and Guidance, Icons, Multimedia, and colors.

Unit-VI — 05 Hrs.

UX tools: Figma, Just In Mind, and any open-source tool for prototype designing. Mobile Ecosystem: Platforms, Application frameworks: Types of Mobile Applications: Widgets, Applications.

Text Books:

1. Kalbande, Kanade, Iyer, "Galitz's Human Machine Interaction", 1st Edition, Wiley Publications, 2015.
2. Alan Dix, J. E. Finlay, G. D. Abowd, R. Beale, "Human Computer Interaction", Peason, Pren-

tice Hall, 3rd Edition, 2003

3. Wilbert O. Galitz, "The Essential Guide to User Interface Design", 3rd Edition, Wiley publication, 2007.

4. Donald A. Normann, "Design of everyday things", 2nd Edition, Basic Books, 2013.

Reference Books:

1. Rogers Sharp Preece, "Interaction Design: Beyond Human Computer Interaction", 5th Edition, Wiley publications.

2. Brian Fling, "Mobile Design and Development", 1st Edition, O'Reilly Media Inc., 2009.

Web links:

1. Nielsen's Heuristics: 10 Usability Principles To Improve UI Design - Aela School

2. 12 UX Designer Tools You Should Be Using (From Beginner to Pro) | Columbia Engineering Boot Camps

Evaluation Scheme:

Theory :

Continuous Assessment (A):

Subject teacher will declare Teacher Assessment criteria at the start of semester.

Continuous Assessment (B):

1. Two term tests of 10 marks each will be conducted during the semester.

2. Average of the marks scored in both the tests will be considered for final grading.

End Semester Examination (C):

1. Question paper based on the entire syllabus, summing up to 65 marks.

2. Total duration allotted for writing the paper is 2 hrs.

Human Machine Interaction Laboratory (22PEAI6053L)

Practical Scheme
Practical : 02 Hrs./week
Credit : 01

Examination Scheme
Teacher Assessment : 25 Marks
End Sem Exam : 25 Marks
Total : 50 Marks

Course Objectives:

1. To introduce students with different UX tools.
2. To understand principles of good UI design.
3. To design the interface using various UX tool.

CO	Course Outcomes	Blooms Level	Blooms Description
CO1	Understand the different open source UX tools.	L2	Understand
CO2	Analyze the Graphical user interface and Web interface.	L4	Analyze
CO3	Implement the real world applications.	L3	Apply
CO4	Design UI prototype for given problem statement.	L6	Create

List of Laboratory Experiments

Suggested Experiments:

1. To Study of open-source UX tools (Justinmind Prototype, Pidoco, Marvel ,Figma Prototype) and create a simple design for a given problem definition.
2. Know your client.
   - Design an app that can teach mathematics to children of 4-5 years age in schools in Rural Sector.
   - Design an app that can teach mathematics to children of 4-5 years age in schools in Urban Sector.
   - Design a site that can help people to sell their handmade products in metro cities.
   - Design a site that can connect housewives and keep them engaged.
     Note : Students should be able to do the following for any given problem statement.
   - Analysis of user's/client's behavior eg their preferences, interests etc
   - What kind of interfaces will they like and why?
   - Existing apps - analyze and rate them.
   - What will be your choice of screen elements?
   - How will your app/web design be better than the existing one?
3. Goal-oriented design - Design an experience for passengers whose flight /train is delayed.
4. Design Principles - Understand principles of good UI design by heuristic evaluation. Design UI for a given problem statement.
5. Menus & Navigation – Redesign of a user interface (Suggest and implement changes in Existing User Interface) for a given problem statement.
6. - Windows & Screen controls – Design UI for a given problem statement. Design a navigator for a student new in your Institute.
   - Design a navigator for a person new in tourist city/ village.
   - Motor paralysis for differently able people.
   - Vaccination App design with localization.
7. Icons - Design appropriate icons pertaining to a given domain. (Eg. Greeting cards, Travelling, restaurants, Education, Medical, security at Airport, Malls etc)
8. Colors – Design a personal website for any socio-technical problem. Use color guidelines with statistical graphics for better visualization.

9. Design a Map-based UI(Web User) for the given problem statement. Example: Mumbai Dabbawallas with localization feature. Pet Care New Visitors to Hospital.

10. To calculate the screen complexity of the existing Graphical User Interface and redesign the interface to minimize the screen complexity.

A minimum of 08 experiments from the above suggested list or any other experiment based on syllabus will be included, which would help the learner to apply the concept learnt.

Evaluation Scheme:

Laboratory:

Continuous Assessment (A):

Laboratory work will be based on 22PEAI6053T with minimum 08 experiments to be incorporated. The distribution of marks for term work shall be as follows:

1. Performance in Experiments: 05 Marks
2. Journal Submission: 05 Marks
3. Viva-voce: 05 Marks
4. Subject Specific Lab Assignment/Case Study: 10 Marks

The final certification and acceptance of term work will be subject to satisfactory performance of laboratory work and upon fulfilling minimum passing criteria in the term work.

End Semester Examination (C):

Oral/ Practical examination will be based on the entire syllabus including, the practicals performed during laboratory sessions.

Professional and Business Communication Tutorial (22HMAI6060T)

Teaching Scheme	Examination Scheme
Tutorial : 02 Hrs./week	Teacher Assessment : 25 Marks
Credit : 02	Total : 25 Marks

Prerequisite: Basic course in Effective Communication Skills

Course Objectives:

1. To inculcate professional and ethical attitude at the workplace.
2. To enhance communication and interpersonal skills.
3. To develop effective presentation skills.
4. To hone written skills for technical documentation.

CO	Course Outcomes	Blooms Level	Blooms Description
CO1	Prepare technical documents using appropriate style, format, and language.	L3	Apply
CO2	Use employability skills to optimize career opportunities.	L3	Apply
CO3	Employ storytelling techniques in corporate situations.	L3	Apply
CO4	Conduct effective meetings and document the process.	L3	Apply
CO5	Demonstrate interpersonal skills in professional and personal situations.	L3	Apply
CO6	Describe cultural differences, etiquettes, and the concept of professional ethics.	L2	Understand

Course Contents

Unit-I Technical Writing — 06 Hrs.

Report Writing: Types of reports, Basic structure of a report, collection of data through questionnaires, survey analysis, language and style in reports

Business Proposal Writing Types of business proposals, format of proposal, language and style, presentation of proposal

Plagiarism: Types of plagiarism, consequences of plagiarism

Unit-II Employment Skills — 08 Hrs.

Group Discussion: Purpose of a GD, types of GD, criteria for evaluating GD, Dos and Don'ts of GD

Resume Writing: Types of resumes, structure, content and formatting of resume.

Interview Skills: Types and modes of interview, Preparation for interview, Dos and Don'ts of interview, frequently asked questions during interview.

Presentation Skills: Presentation strategies, overcoming stage fear, techniques to prepare effective PowerPoint presentation.

Unit-III Corporate Story Telling — 03 Hrs.

Basics of storytelling: Setting, characters, plot, crisis, climax, resolution, Benefits of storytelling

Types of stories: Elevator pitch, product stories, event stories, stories in presentations, story telling in SOP's and interviews, story telling to manage conflict or to motivate.

Storytelling techniques: Narration using verbal and non-verbal communication, Analysis of story telling strategies of corporate master story tellers.

Unit-IV Meetings and Documentation — 02 Hrs.

Planning and preparation for meetings: Planning layout of meetings, arranging logistics, defining roles and responsibilities

Strategies for conducting effective meetings: Follow the agenda, record discussion, observe

meeting decorum

Documentation: Draft notice, agenda and minutes of meeting.

Business meeting etiquettes: Verbal and non-verbal aspects of etiquettes.

Unit-V Introduction to Interpersonal Skills 05 Hrs.

Emotional Intelligence: Definition, difference between IQ and EQ, how to develop EQ

Leadership: Types of leadership, leadership styles, case studies.

Team Building: Difference between group and team, importance of teamwork, strategies to be a good team player

Time Management: Importance of time management, cultural views of time, 80/20 rule, time wasters, setting priorities and goals,

Conflict Management: Types of conflicts, strategies to manage conflict, case studies

Unit-VI Cross-cultural communication and Professional ethics

02 Hrs.

Communication across cultures: Understanding cultures and developing sensitivity towards cultural differences

Corporate etiquettes: Telephone, dining, cubicle etiquette, etc.

Professional ethics: Effective work habits, accountability, integrity and excellence

Text Books:

1. Fred Luthans, "Organizational Behavior", McGraw Hill Edition.
2. Lesiker and Petit, "Report Writing for Business", McGraw Hill Edition.
3. Huckin and Olsen, "Technical Writing and Professional Communication", McGraw Hill.
4. Wallace and Masters, "Personal Development for Life and Work", 12th Edition, Thomson Learning.

Reference Books:

1. Heta Murphy, "Effective Business Communication", Mc Graw Hill Edition
2. Sharma R.C. and Krishna Mohan, "Business Correspondence and Report Writing", Tata McGraw-Hill Education.

3. Ghosh, B. N., "Managing Soft Skills for Personality Development", Tata McGraw Hill, Lehman.

4. Bell, Smith, "Management Communication", 3rd Edition, Wiley India Edition.

5. Dr. Alex, K., "Soft Skills", S. Chand and Company.

6. Subramaniam, R., "Professional Ethics", Oxford University Press.

7. Sandeep Das, "How Business Story Telling Works: Increase Your Influence and Impact", Penguin Random House India Pvt. Ltd.

Evaluation Scheme:

Continuous Assessment (A):

The term work will be calculated based on Tutorials (10m), Business Proposal (10m) and Group Discussion (05m).

The distribution of marks will be as follows:

1. Tutorials: 10 Marks
2. Business Proposal : 10 Marks
3. Group Discussion : 05 Marks

Total : 25 Marks

Project Stage-I (22PJAI6070L)

Practical Scheme
Practical : 04 Hrs./week
Credits : 02

Examination Scheme
Teacher Assessment : 25 Marks
End Sem Exam : 25 Marks
Total : 50 Marks

Course Objectives:

- To implement the solution as per the problem statement.
- To develop the team building, writing, logical reasoning and management skills.
- To provide the connections between the designs and concepts across different disciplinary boundaries.
- To encourage students to become independent personnel, critical thinkers and lifelong learners.

Course Outcomes:

CO	Course Outcomes	Blooms Level	Blooms Description
CO1	Apply engineering knowledge to produce solution of a problem considering cultural, social, environmental, and economic factors using appropriate tool and method. .	L4	Analyze
CO2	Demonstrate project based learning that allows students to transfer existing ideas into new applications.	L2	Understand
CO3	Develop an ability to work in teams and manage the conduct of the research study.	L3	Apply
CO4	Integrate different perspectives from relevant disciplines which help them to get internships, jobs and admission for higher studies.	L3	Apply
CO5	Present the research in the form of technical writing, understand what constitutes to plagiarism and how to use proper referencing styles.	L2	Understand

Syllabus:

Domain knowledge (any beyond) needed from the areas of Computer Science & Engineering(Data Science)for the effective implementation of the project.

The areas can be updated based on the technological innovations and development needed for specific project.

Guidelines:

The main purpose of this activity is to improve the students' technical skills, communication skills by integrating writing, presentation and teamwork opportunities.

- Each group will be reviewed twice in a semester and marks will be allotted based on the various points mentioned in the evaluation scheme.
- In the first review of this semester, each group is expected to complete 30 percent of project.
- In the second review of this semester, each group is expected to complete 50 percent of project.
- Interaction with alumni mentor will also be appreciated for the improvement of project.

Student is expected to:

- Maintain Log Book of weekly work done(Log Book Format will be as per Table 4).
- Report weekly to the project guide along with log book.

Table 4: Log Book Format

Sr	Week (Start Date:End Date)	Work Done	Sign of Guide	Sign of Coordinator
1				
2				

Assessment Criteria:

- At the end of the semester, after confirmation by the project guide, each project group will submit project completion report in prescribed format for assessment to the departmental committee (including project guide).
- Assessment of the project stage I (at the end of the semester) will be done by the departmental committee (including project guide).
- Oral examination should be conducted by Internal and External examiners. Students have to give presentation and demonstration based on their project.

Prescribed project report guidelines:

Size of report shall be of minimum 25 pages. Project Report should include appropriate content for:

- Introduction
- Literature Survey
- Related Theory
- Implementation details
- Project Stage-I Outcomes
- Conclusion
- References

Assessment criteria for the departmental committee (including project guide) for Continuous Assessment:

Guide will monitor weekly progress and marks allocation will be as per Table 5.

Assessment criteria for the departmental committee (including project guide) for End Semester Exam:

Each group will be reviewed twice in a semester by faculty guide and faculty coordinator based on the following criteria:

- Project progress
- Documentation/Technical paper writing
- Key findings
- Validation of results

Table 5: Continuous Assessment Table

Sr	Exam Seat No	Name of Student	Student Attendance	Log Book Maintain	Literature Review	Depth of Understanding	Report	Total
			5	5	5	5	5	25

Each review consists of 25 marks. Average of the marks scored in both the two reviews will be considered for final grading. The final certification and acceptance of TA ensures the satisfactory performance on the above aspects.

Departmental committee (including project guide) will evaluate project as per Table 6.

Table 6: Evaluation Table

Sr	Exam Seat No	Name of Student	Project Selection	Design/ Methodology	Fabrication/ Modeling/ Simulation	Result Verification	Presentation	Total
			5	5	5	5	5	25