JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR
(Established by Govt. of A.P., ACT No.30 of 2008)
ANANTAPUR – 515 002 (A.P) INDIA

B.TECH. - CSE (ARTIFICIAL INTELLIGENCE & MACHINE LEARNING)
Course Structure (R20) – III Year

Semester–V						
S.No.	**Course Code**	**Course Name**	**L**	**T**	**P**	**Credits**
1.	20A30502a	Software Engineering for AI	3	0	0	3
2.	20A05602T	Machine Learning	3	0	0	3
3.	20A05703c	Deep Learning	3	0	0	3
4.	20A05504c 20A05501T 20A31501a	**Professional Elective Course – I** Big Data Technologies Computer Networks Robotic Process Automation	3	0	0	3
5.		**Open Elective Course – I**	3	0	0	3
6.	20A05602P	Machine Learning Lab	0	0	3	1.5
7.	20A31502	Deep Learning Lab	0	0	3	1.5
8.	20A30503	**Skill oriented course – III** Web Application Design	1	0	2	2
9.	20A33501	Evaluation of Community Service Project				1.5
Total						**21.5**

Open Elective-I

S.No	Course Code	Course Name	Offered by the Dept.
1	20A01505	Building Technology	CE
2	20A02505	Electric Vehicles	EEE
3	20A03505	3D Printing Technology	ME
4	20A04507	MATLAB Programming for Engineers	ECE/EEE
5	20A04508	Introduction to Control Systems	ECE/EEE
6	20A27505	Computer Applications in Food Processing	FT
7	20A54501	Optimization Techniques	Mathematics
8	20A56501	Materials Characterization Techniques	Physics
9	20A51501	Chemistry of Energy Materials	Chemistry

Note:
1. A student is permitted to register for Honours or a Minor in IV semester after the results of III Semester are declared and students may be allowed to take maximum two subjects per semester pertaining to their Minor from V Semester onwards.
2. A student shall not be permitted to take courses as Open Electives/Minor/Honours with content substantially equivalent to the courses pursued in the student's primary major.
3. A student is permitted to select a Minor program only if the institution is already offering a Major degree program in that discipline

Semester–VI						
S.No	**Course Code**	**Course Name**	**L**	**T**	**P**	**Credits**
1.	20A05702c	Natural Language Processing	3	0	0	3
2.	20A33601T	Advanced Machine Learning	3	0	0	3
3.	20A05701a	Cloud Computing	3	0	0	3
4.	 20A31601a 20A33602a 20A05604c	**Professional Elective Course– II** Robotics Automation of Model Building Computer Vision	3	0	0	3
5.		**Open Elective Course – II**	3	0	0	3
6.	20A30603	Natural Language ProcessingLab	0	0	3	1.5
7.	20A33601P	Advanced Machine Learning Lab	0	0	3	1.5
8.	20A12604	Cloud Computing Lab	0	0	3	1.5
9.	 20A52401	**Skill oriented course - IV** Soft Skills	1	0	2	2
10.	 20A99601	**Mandatory Non-credit Course** Intellectual Property Rights & Patents	2	0	0	0
Total						**21.5**
Industry Internship (Mandatory) for 6 - 8 weeks duration during summer vacation						

Open Elective-II

S.No	Course Code	Course Name	Offered by the Dept.
1	20A01704	Environmental Economics	CE
2	20A02605	Smart Electric Grid	EEE
3	20A04605	Signal Processing	ECE
4	20A04606	Basic VLSI Design	ECE
5	20A27605	Food Refrigeration and Cold Chain Management	FT
6	20A54701	Wavelet Transforms & its applications	Mathematics
7	20A56701	Physics Of Electronic Materials and Devices	Physics
8	20A51701	Chemistry of Polymers and its Applications	Chemistry

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B.Tech CSE (AI)– III-I Sem

L	T	P	C
3	0	0	3

(20A30502a) SOFTWARE ENGINEERING FOR AI

Course Objectives:

- Study the concepts of software engineering
- Understand the issues in development of AI software
- Explore the methods for AI software development
- Discuss the concepts of Machine learning and Expert systems
- Demonstrate the use of AI in Software development

Course Outcomes:

After completion of the course, students will be able to

- Understand the methods and issues in software engineering
- Apply the principles of Artificial Intelligence for Software engineering
- Design AI based software
- Apply the Algorithms of Machine learning in solving problems
- Design Expert systems

UNIT I **Introduction to Computer Software for AI, AI Problems and Conventional SE Problems, Software Engineering Methodology** Lecture Hrs 12

Computers and software systems, An introduction to Software engineering, Bridges and buildings versus software systems, The software crisis, A demand for more software power, Responsiveness to human users, Software systems in new types of domains, Responsiveness to dynamic usage environments, Software systems with self-maintenance capabilities, A need for Al systems

What is an AI problem, Ill-defined specifications, correct versus 'good enough' solutions, It's the HOW not the WHAT, the problem of dynamics, The quality of modular approximations, Context-free problems?

Specify and verify—the SAV methodology, the myth of complete specification, what is verifiable, Specify and test—the SAT methodology, testing for reliability, the strengths, the weaknesses, what are the requirements for testing, what's in a specification, Prototyping as a link

UNIT II **An Incremental and Exploratory Methodology, New Paradigms for System Engineering** Lecture Hrs 8

Classical methodology and AI problems, The RUDE cycle, how do we start, Malleable software, AI muscles on a conventional skeleton How do we proceed, how do we finish, The question of hacking, Conventional paradigms

Automatic programming, Transformational implementation, The "new paradigm" of Blazer, Cheatham and Green, Operational requirements of Kowalski, The POLITE methodology

UNIT III **Towards a Discipline of Exploratory Programming, Machine Learning: Much Promise, Many Problems** Lecture Hrs 8

Reverse engineering, Reusable software Design knowledge, Stepwise abstraction, The problem of decompiling, Controlled modification, Structured growth

Self-adaptive software, The promise of increased software power, The threat of increased software problems

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UNIT IV **Machine Learning and Expert Systems** Lecture Hrs 10

Practical machine learning examples, Multisession inductive programming, Expert Systems: The Success Story, Expert systems as Al software, Engineering expert systems, The lessons of expert systems for engineering Al software

UNIT V **AI into Practical Software** Lecture Hrs: 8

Support environments, Reduction of effective complexity,Moderately stupid assistance, An engineering toolbox, Self-reflective software, Overengineering software, Summary and What the Future Holds

Textbooks:

1) Derek Partridge, "Artificial Intelligence and Software Engineering", Glenlake Publishing Company, 1998.

Reference Books:

1) Charles Rich and Richard C. Waters, Readings in Artificial Intelligence and Sofrware Engineering, Morgan Kaufmann, 2014.

2) Farid Meziane &Sunil Vadera, "Artificial Intelligence Applications for Improved Software Engineering Development", Information Science Reference, 2009

Online Learning Resources:

1) Software Engineering: Software Engineering - Course (nptel.ac.in)

2) Software Engineering: Software Engineering Tutorial - javatpoint

3) Coursera: Saeed Aghabozorgi, IBM AI Engineering Professional Certificate course(s), https://www.coursera.org/professional-certificates/ai-engineer

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B.Tech CSE (AI)– III-I Sem **L T P C**

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(20A05602T) MACHINE LEARNING

Common to CSE, IT, CSD, CSE(AI),CSE(AI&ML),CSE(DS),AI&DS,CSE(IOT)

Course Objectives:

The course is introduced for students to

- Understand basic concepts of Machine Learning
- Study different learning algorithms
- Illustrate evaluation of learning algorithms

Course Outcomes (CO):

After completion of the course, students will be able to

- Identify machine learning techniques suitable for a given problem
- Solve the problems using various machine learning techniques
- Design application using machine learning techniques

UNIT – I **Introduction to Machine Learning &Preparing to Model** Lecture 9Hrs

Introduction: What is Human Learning? Types of Human Learning, what is Machine Learning?Types of Machine Learning, Problems Not to Be Solved Using Machine Learning, Applications of Machine Learning, State-of-The-Art Languages/Tools in Machine Learning, Issues in Machine Learning

Preparing to Model: Introduction, Machine Learning Activities, Basic Types of Data in Machine Learning, Exploring Structure of Data, Data Quality and Remediation, Data Pre-Processing

UNIT – II **Modelling and Evaluation &Basics of Feature Engineering** Lecture 9Hrs

Introduction, selecting a Model, training a Model (for Supervised Learning), Model Representation and Interpretability, Evaluating Performance of a Model, Improving Performance of a Model

Basics of Feature Engineering: Introduction, Feature Transformation, Feature Subset Selection

UNIT – III **Bayesian Concept Learning & Supervised Learning: Classification** Lecture 10Hrs

Introduction, Why Bayesian Methods are Important? Bayes' Theorem, Bayes' Theorem and Concept Learning, Bayesian Belief Network

Supervised Learning: Classification: Introduction**,** Example of Supervised Learning**,** Classification Model**,** Classification Learning Steps**,** Common Classification Algorithms-*k*-Nearest Neighbour(*k*NN), Decision tree, Random forest model, Support vector machines

UNIT – IV **Supervised Learning: Regression** Lecture 10Hrs

Introduction, Example of Regression, Common Regression Algorithms-Simple linear regression, Multiple linear regression, Assumptions in Regression Analysis, Main Problems in Regression Analysis, Improving Accuracy of the Linear Regression Model, Polynomial Regression Model, Logistic Regression, Maximum Likelihood Estimation.

UNIT – V **Unsupervised Learning**Lecture 9Hrs

Introduction, Unsupervised vs Supervised Learning, Application of Unsupervised Learning, Clustering – Clustering as a machine learning task, Different types of clustering techniques, Partitioning methods,

K-Medoids: a representative object-based technique, Hierarchical clustering, Density-based methods-DBSCAN

Finding Pattern using Association Rule- Definition of common terms, Association rule, Theapriori algorithm for association rule learning, Build the aprioriprinciplerules

Textbooks:

1. Machine Learning, SaikatDutt, Subramanian Chandramouli, Amit Kumar Das, Pearson, 2019.

Reference Books:

1. EthernAlpaydin, “Introduction to Machine Learning”, MIT Press, 2004.
2. Stephen Marsland, “Machine Learning -An Algorithmic Perspective”, Second Edition, Chapman and Hall/CRC Machine Learning and Pattern Recognition Series,2014.
1. Andreas C. Müller and Sarah Guido “Introduction to Machine Learning with Python: A Guide for Data Scientists”, Oreilly.

Online Learning Resources:

- Andrew Ng, “Machine Learning Yearning”
- https://www.deeplearning.ai/machine-learning- yearning/
- Shai Shalev-Shwartz , Shai Ben-David, “Understanding Machine Learning: From Theory to Algorithms” , Cambridge University Press https://www.cse.huji.ac.il/~shais/UnderstandingMachineLearning/index.html

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B.Tech CSE (AI)– III-I Sem

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(20A05703c) DEEP LEARNING

Course Objectives:

- Demonstrate the major technology trends driving Deep Learning
- Build, train, and apply fully connected deep neural networks
- Implement efficient (vectorized) neural networks
- Analyse the key parameters and hyper parameters in a neural network's architecture

Course Outcomes:

After completion of the course, students will be able to

- Demonstrate the mathematical foundation of neural network
- Describe the machine learning basics
- Differentiate architecture of deep neural network
- Build a convolutional neural network
- Build and train RNN and LSTMs

UNIT I **Lecture 8Hrs**

Linear Algebra: Scalars, Vectors, Matrices and Tensors, Matrix operations, types of matrices, Norms, Eigen decomposition, Singular Value Decomposition, Principal Components Analysis.
Probability and Information Theory: Random Variables, Probability Distributions, Marginal Probability, Conditional Probability, Expectation, Variance and Covariance, Bayes' Rule, Information Theory. Numerical Computation: Overflow and Underflow, Gradient-Based Optimization, Constrained Optimization, Linear Least Squares.

UNIT II **Lecture 9Hrs**

Machine Learning: Basics and Under fitting, Hyper parameters and Validation Sets, Estimators, Bias and Variance, Maximum Likelihood, Bayesian Statistics, Supervised and Unsupervised Learning, Stochastic Gradient Descent, Challenges Motivating Deep Learning. Deep Feed forward Networks: Learning XOR, Gradient-Based Learning, Hidden Units, Architecture Design, Back-Propagation and other Differentiation Algorithms.

UNIT III **Lecture 8Hrs**

Regularization for Deep Learning: Parameter Norm Penalties, Norm Penalties as Constrained Optimization, Regularization and Under-Constrained Problems, Dataset Augmentation, Noise Robustness, Semi-Supervised Learning, Multi-Task Learning, Early Stopping, Parameter Tying and Parameter Sharing, Sparse Representations, Bagging and Other Ensemble Methods, Dropout, Adversarial Training, Tangent Distance, Tangent Prop and Manifold Tangent Classifier. Optimization for Training Deep Models: Pure Optimization, Challenges in Neural Network Optimization, Basic Algorithms, Parameter Initialization Strategies, Algorithms with Adaptive Learning Rates, Approximate Second-Order Methods, Optimization Strategies and Meta-Algorithms.

UNIT IV **Lecture 9Hrs**

Convolutional Networks: The Convolution Operation, Pooling, Convolution, Basic Convolution Functions, Structured Outputs, Data Types, Efficient Convolution Algorithms, Random or Unsupervised Features, Basis for Convolutional Networks.

UNIT V **Lecture 8Hrs**

Sequence Modeling: Recurrent and Recursive Nets: Unfolding Computational Graphs, Recurrent Neural Networks, Bidirectional RNNs, Encoder-Decoder Sequence-to-Sequence Architectures, Deep Recurrent Networks, Recursive Neural Networks, Echo State Networks, LSTM, Gated RNNs, Optimization for Long-Term Dependencies, Auto encoders, Deep Generative Models.

Textbooks:

1. Ian Goodfellow, YoshuaBengio, Aaron Courville, "Deep Learning", MIT Press,2016.
2. Josh Patterson and Adam Gibson, "Deep learning: A practitioner's approach", O'Reilly Media, First Edition,2017.

Reference Books:

1. Fundamentals of Deep Learning, Designing next-generation machine intelligence algorithms, Nikhil Buduma, O'Reilly, Shroff Publishers,2019.
2. Deep learning Cook Book, Practical recipes to get started Quickly, DouweOsinga, O'Reilly, Shroff Publishers,2019.

Online Learning Resources:

- https://keras.io/datasets/
- http://deeplearning.net/tutorial/deeplearning.pdf
- https://arxiv.org/pdf/1404.7828v4.pdf
- https://www.cse.iitm.ac.in/~miteshk/CS7015.html
- https://www.deeplearningbook.org
- https://nptel.ac.in/courses/106105215

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B.Tech CSE (AI)– III-I Sem

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(20A05504c)BIG DATA TECHNOLOGIES

Common to CSE, IT, CSE(AI), CSE(AI&ML), AI&DS

(Professional Elective Course– I)

Course Objectives:

To learn the big data characteristics, study challenges and Hadoop framework to handle big data.

Course Outcomes:

After completion of the course, students will be able to

- Understand the elements of Big data
- Use different technologies to tame Big Data
- Process Given data using Map Reduce
- Develop applications using Hive, NoSQL.

UNIT I Lecture 8Hrs

Getting an Overview of Big Data: Introduction to Big Data, Structuring Big Data, Elements of Big Data, Big Data Analytics. Exploring the use of Big Data in Business Context Use of Big Data in Social Networking, Use of Big Data Preventing Fraudulent Activities, Use of Big Data in Retail Industry

UNIT II Lecture 9Hrs

Introducing Technologies for Handling Big Data Distributed and Parallel Computing for Big Data, Introducing Hadoop, Cloud Computing and Big Data, In-memory Computing Technology for Big Data.

Understanding Hadoop Ecosystem Hadoop Ecosystem, Hadoop Distributed File System, Map Reduce, Hadoop YARN, Introducing HBase, Combining HBase and HDFS, Hive, Pig and Pig Latin, Sqoop, ZooKeeper, Flume, Oozie.

UNIT III Lecture 9Hrs

Understanding Map Reduce Fundamentals and H Base The Map Reduce Framework, Techniques to Optimize Map Reduce Jobs, Uses of Map Reduce, Role of H Base in Big Data Processing. Processing Your Data with Map Reduce Recollecting he Concept of Map Reduce Framework, Developing Simple Map Reduce Application, Points to Consider while Designing Map Reduce.

UNIT IV Lecture 8Hrs

Customizing Map Reduce Execution and Implementing Map Reduce Program Controllong Map Reduce Execution with Input Format, Reading Data with Custom Record Reader, Organizing Output Data with Output Formats, Customizing Data with Record Writer, Customizing the Map Reduce Execution in Terms of YARN, Implementing a Map Reduce Program for Sorting Text Data.

Testing and Debugging Map Reduce Application Debugging Hadoop Map Reduce Locally, Performing Unit Testing for Map Reduce Applications.

UNIT V Lecture 8Hrs

Exploring Hive: Introducing Hive, Hive Service, Built-In Functions in Hive, Hive DDl, Data Manipulation in Hive, Data Retrieval Queries, Using JOINS in Hive.

NoSQL Data Management Introduction to NoSQL, Types of NoSQL Data Models, Schema-Less Databases, Materialized Views, Distribution Models, Sharding.

Textbooks:

1. Big Data Black Book, DT Editorial services, Dreamtech Press

Reference Books:

1. Data Science for Business by F. Provost and T. Fawcett, O'Reilly Media.
2. Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with Advanced
3. Hadoop: The Definitive Guide by Tom White, O'Reilly Media.
4. Big Data and Business Analytics by Jay Liebowitz, Auerbach Publications, CRC Press.

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(20A05501T) COMPUTER NETWORKS
Common to CSE, IT, CSD, CSE(AI), CSE(AI&ML), AI&DS, CSE(IOT)
PROFESSIONAL ELCTIVE COURSE - I

Course Objectives:

The course is designed to

- Understand the basic concepts of Computer Networks.
- Introduce the layered approach for design of computer networks
- Expose the network protocols used in Internet environment
- Explain the format of headers of IP, TCP and UDP
- Familiarize with the applications of Internet
- Elucidate the design issues for a computer network

Course Outcomes (CO):

After completion of the course, students will be able to

- Identify the software and hardware components of a computer network
- Design software for a computer network
- Develop new routing, and congestion control algorithms
- Assess critically the existing routing protocols
- Explain the functionality of each layer of a computer network
- Choose the appropriate transport protocol based on the application requirements

UNIT I **Computer Networks and the Internet** Lecture 8Hrs

What Is the Internet? The Network Edge, The Network Core, Delay, Loss, and Throughput in Packet-Switched Networks(Textbook 2), Reference Models, Example Networks, Guided Transmission Media, Wireless Transmission(Textbook 1)

UNIT II **The Data Link Layer, Access Networks, and LANs** Lecture 10Hrs

Data Link Layer Design Issues, Error Detection and Correction, Elementary Data Link Protocols, Sliding Window Protocols (Textbook 1) Introduction to the Link Layer, Error-Detection and - Correction Techniques, Multiple Access Links and Protocols, Switched Local Area Networks

Link Virtualization: A Network as a Link Layer, Data Center Networking, Retrospective: A Day in the Life of a Web Page Request (Textbook 2)

UNIT III **The Network Layer** Lecture 8Hrs

Routing Algorithms, Internetworking, The Network Layer in The Internet (Textbook 1)

UNIT IV **The Transport Layer** Lecture 9Hrs

Connectionless Transport: UDP (Textbook 2), The Internet Transport Protocols: TCP, Congestion Control (Textbook 1)

UNIT V **Principles of Network Applications** Lecture 8Hrs

Principles of Network Applications, The Web and HTTP, Electronic Mail in the Internet, DNS—The Internet's Directory Service, Peer-to-Peer Applications Video Streaming and Content Distribution Networks (Textbook 2)

Textbooks:

1. Andrew S.Tanenbaum, David j.wetherall, Computer Networks, 5th Edition, PEARSON.
2. James F. Kurose, Keith W. Ross, "Computer Networking: A Top-Down Approach", 6th edition, Pearson, 2019.

Reference Books:

1. Forouzan, Datacommunications and Networking, 5th Edition, McGraw Hill Publication.
2. Youlu Zheng, Shakil Akthar, "Networks for Computer Scientists and Engineers", Oxford Publishers, 2016.

Online Learning Resources:

https://nptel.ac.in/courses/106105183/25
http://www.nptelvideos.in/2012/11/computer-networks.html
https://nptel.ac.in/courses/106105183/3

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B.Tech CSE (AI)– III-I Sem **L T P C**

3 0 0 3

(20A31501a) ROBOTICS PROCESS AUTOMATION

Professional Elective Course– I

Course Objectives:

- Describe Intelligent Automation and its impact on the transformation of business
- Study the technologies and best practices used to enable process automation
- Identify areas where Intelligent Automation is applicable and formulate its value (quantify and qualify).

Course Outcomes (CO):

After completion of the course, students will be able to

- Outline the benefits of RPA and various platforms available on the market.
- Describe RPA, where it can be applied and how it's implemented.
- Identify and understand different types of variables, Image, Text and Data Tables Automation.
- Understand the Deployment of the Robot and to maintain the connection.
- Describe how to handle the User Events and various types of Exceptions and strategies.

UNIT I RPA Foundations& RPA Skills Lecture 8Hrs

What Is RPA? Flavors of RPA History of RPA, The Benefits of RPA, The Downsides of RPA, RPA Compared to BPO, BPM, and BPA, Consumer Willingness for Automation, The Workforce of the Future.

RPA Skills: On-Premise Vs. the Cloud, Web Technology, Programming Languages and Low Code, OCR (Optical Character Recognition),Databases,

APIs (Application Programming Interfaces), AI (Artificial Intelligence), Cognitive Automation, Agile, Scrum, Kanban, and Waterfall, DevOps, Flowcharts

UNIT II Process Methodologies & Planning Lecture 9Hrs

Lean, Six Sigma, How to Implement Six Sigma, Six Sigma Roles and Levels, Lean Six Sigma, Finding the Right Balance, Applying Lean and Six Sigma to RPA.

Planning: The Preliminaries, Use a Consulting Firm?

RPA Consulting: Some Case Studies, What to Automate? ROI for RPA, RPA Use Cases, The Plan

UNIT III RPA Vendor Evaluation & Center of Excellence (CoE) Lecture 8Hrs

Be Realistic, Check Out Third Parties, Minimum Capabilities, Who Is the User?, Funding, Ecosystem, Costs, Training and Education, Support, Best-of-Breed vs. End-to-End, Thought Leadership and Vision, Industry Expertise, Security, Monitoring, and Deployment, What Type of RPA?, The Design, Next-Generation Technologies

Center of Excellence (CoE): What Is the CoE? Why Have a CoE? Forming the Team, Business Analyst, Developer, RPA Solution Architect, RPA Supervisor, What Should a CoE Do? Communication, Change Management, CoE Case Study: Intuit

UNIT IV Bot Development, Deployment and Monitoring & Data Preparation Lecture 10Hrs
Preliminaries, Installation of UiPath, Getting Started, Activities, Flowcharts and Sequences, Log Message, Variables, Loops and Conditionals, For Each Loop, Do While Loop and While Loop, IF/THEN/ELSE Conditionals, Switch, Debug, Common UiPath Functions, The UiPath Orchestrator, Best Practices for Bot Development
Deployment and Monitoring: Testing, Going into Production, Monitoring, Security, Scaling
Data Preparation: Types of Data, Big Data, The Issues with Big Data, The Data Process, Types of Algorithms, The Perils of the Moonshot, Bias

UNIT V Open Source RPA, Process Mining & Future of RPA Lecture 9 Hrs
What Is Open Source Software?, The Business Model of Open Source?, The Pros and Cons of Open Source Software, Open RPA, UI. Vision, Robot Framework, Robocorp, Orchestra, TagUI
Process Mining: Old Way Vs. Process Mining, Backgrounder on Process Mining, How Process Mining Works, Celonis, ProM, Signavio, Fluxicon, ABBYY, The Future of Process Mining
Future of RPA: Consolidation and IPOs, Microsoft, Attended Automation, Vertical-Specific Companies, Hype Factor, Software-as-a-Service (SaaS) and Open Source, Chatbots, Artificial Intelligence, Privacy and Ethics.

Textbooks:
1. Tom Taulli, "The Robotic Process Automation Handbook", Apress, 2020
Reference Books:
1. Alok Mani Tripathi, "Learning Robotic Process Automation", March 2018
2. Robotic process and Cognitive Automation by, Mary C Lacity& Leslie P Willcocks, 2018.
Online Learning Resources:
1. https://www.uipath.com/rpa/robotic-process-automation
2. https://www.academy.uipath.com

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B.Tech CSE (AI)– III-I Sem

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0	0	3	1.5

(20A05602P) MACHINE LEARNING LAB
Common to CSE, CSD,CSE(AI),CSE(AI&ML),CSE(DS),AI&DS

Course Objectives:
- Make use of Data sets in implementing the machine learning algorithms
- Implement the machine learning concepts and algorithms in any suitable language of choice.

Course Outcomes (CO):
After completion of the course, students will be able to
- Understand the Mathematical and statistical prospectives of machine learning algorithms through python programming
- Appreciate the importance of visualization in the data analytics solution.
- Derive insights using Machine learning algorithms

List of Experiments:

Note:
a. The programs can be implemented in either JAVA or Python.
b. For Problems 1 to 6 and 10, programs are to be developed without using the built-in classes or APIs of Java/Python.
c. Data sets can be taken from standard repositories (https://archive.ics.uci.edu/ml/datasets.html) or constructed by the students.

1. Implement and demonstrate the FIND-S algorithm for finding the most specific hypothesis based on a given set of training data samples. Read the training data from a .CSV file.
2. For a given set of training data examples stored in a .CSV file, implement and demonstrate the Candidate-Elimination algorithm to output a description of the set of all hypotheses consistent with the training examples.
3. Write a program to demonstrate the working of the decision tree based ID3 algorithm. Use an appropriate data set for building the decision tree and apply this knowledge to classify a new sample.
4. Build an Artificial Neural Network by implementing the Back-propagation algorithm and test the same using appropriate data sets.
5. Write a program to implement the naïve Bayesian classifier for a sample training data set stored as a .CSV file. Compute the accuracy of the classifier, considering few test data sets.
6. Assuming a set of documents that need to be classified, use the naïve Bayesian Classifier model to perform this task. Built-in Java classes/API can be used to write the program. Calculate the accuracy, precision, and recall for your data set.
7. Write a program to construct a Bayesian network considering medical data. Use this model to demonstrate the diagnosis of heart patients using standard Heart Disease Data Set. You can use Java/Python ML library classes/API.
8. Apply EM algorithm to cluster a set of data stored in a .CSV file. Use the same data set for clustering using k-Means algorithm. Compare the results of these two algorithms and comment on the quality of clustering. You can add Java/Python ML library classes/API in the program.
9. Write a program to implement k-Nearest Neighbour algorithm to classify the iris data set. Print both correct and wrong predictions. Java/Python ML library classes can be used for this problem.
10. Implement the non-parametric Locally Weighted Regression algorithm in order to fit data points. Select appropriate data set for your experiment and draw graphs.

Projects

1. Predicting the Sale price of a house using Linear regression
2. Spam classification using Naïve Bayes algorithm
3. Predict car sale prices using Artificial Neural Networks
4. Predict Stock market trends using LSTM
5. Detecting faces from images

References:

1. Python Machine Learning Workbook for beginners, AI Publishing, 2020.

Online Learning Resources/Virtual Labs:

1) Machine Learning A-Z (Python & R in Data Science Course) | Udemy
2) Machine Learning | Coursera

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B.Tech CSE (AI)– III-I Sem

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(20A31502) DEEP LEARNING LAB

Course Objectives:

- Understand the context of Neural networks and deep learning.
- Introduce major Deep learning algorithms, the problem settings, and their applications to solve real world problems

Course Outcomes (CO):

After completion of the course, students will be able to

- Identify the Deep learning algorithms which are more appropriate for various types of learning tasks in various domains
- Implementing Deep learning algorithms and solve real-world problems.

List of Experiments:

1. Introduction of Keras.
2. Installing Keras and packages in Keras.
3. Train the model to add two numbers and report the result.
4. Train the model to multiply two matrices and report the result using keras.
5. Train the model to print the prime numbers using Keras
6. Recurrent Neural Network
   a. Numpy implement of a simple recurrent neural network
   b. Create a recurrent layer in keras
   c. Prepare IMDB data for movie review classification problem.
   d. Train the model with embedding and simple RNN layers.
   e. Plot the Results
7. Consider temperature-forecast as one the example for recurrent neural network and implement the following.
   a. Inspect the data of the weather dataset
   b. Parsing the data
   c. Plotting the temperature timeseries
   d. Plotting the first 10 days of the temperature timeseries
8. Long short-term memory network
   a. Implement LSTM using LSTM layer in keras
   b. Train and evaluate using reversed sequences for IMDB data
   c. Train and evaluate a bidirectional LSTM for IMDB data

   Train and evaluate a Gated Recurrent Unit based model
   a. By using GRU layer
   b. By adding dropout and recurrent dropout to GRU layer.
   c. Train a bidirectional GRU for temperature prediction data

   Convolutional Neural Networks
   a. Preparing the IMDB data
   b. Train and evaluate a simple 1D convent on IMDB Data
   c. Train and evaluate a simple 1D convent on temperature prediction data

   Develop a traditional LSTM for sequence classification problem.

PROJECTS:

1)Write a program for Multilabel Movie Poster Classification.

2)Write a program for Predicting Bike-Sharing patterns

References:

1) Ian Goodfellow, YoshuaBengio, Aaraon Courville, “Deep Learning (Adaptive Computation and Machine Learning series)”, MIT Press, 2016.

Online Learning Resources/Virtual Labs:

1) Introduction to Deep Learning Course | Introduction to Deep Learning Course (rses-dl-course.github.io)

2) Deep Learning | Introduction to Long Short Term Memory - GeeksforGeeks

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

B.Tech CSE (AI)– III-I Sem

L	T	P	C
1	0	2	2

(20A30503) WEB APPLICATION DESIGN
Skill Oriented Course - III

Course Objectives:

- Explore the programming aspects of Web
- Teach concepts related to client side and server-side programming
- Understand Full Stack Development

Course Outcomes (CO):

After completion of the course, students will be able to

- Develop Client-side applications
- Develop Server-side applications
- Connect to Databases
- Design comprehensive web applications

Activities:

Module 1:

Introduction, MERN Components: React, Node.js, Express, MongoDB, Tools and Libraries, Why MERN? JavaScript Everywhere, JSON Everywhere , Node.js Performance, The npm Ecosystem Isomorphic, It's Not a Framework!

Hello World: Server-Less Hello World, Server Setup, Build-Time JSX Compilation

Task: Create a simple Hello world web page using node.js and express.

Module 2:

React Components, Issue Tracker, React Classes, Composing Components, Passing Data Using Properties, Passing Data Using Children, Dynamic Composition.

React State, Async State Initialization, Event Handling, communicating from child to parent, Stateless Components, Designing Components: State vs. Props, Component Hierarchy, Communication, Stateless Components.

Task: Create the Issue Tracker Application: -

1. The user should be able to view a list of issues, with an ability to filter the list by various parameters.
2. The user should be able to add new issues, by supplying the initial values of the issue's fields.
3. The user should be able to edit and update an issue by changing its field values.
4. The user should be able delete an issue.
5. An issue should have following attributes: A title that summarizes the issue (freeform long text),An owner to whom the issue is assigned (freeform short text), A status indicator (a list of possible status values),Creation date (a date, automatically assigned),Effort required to address the issue (number of days, a number),Estimated completion date or due date (a date, optional)

Module 3:

Express REST APIs, REST: Resource Based, HTTP Methods as Actions, JSON ,Express: Routing, Handler Function, Middleware, The List API: Automatic Server Restart ,Testing. The Create API , Using the List API, Using the Create API, Error Handling.

Task : Create a Issues API to

1. Show the list of Issues which are sorted according to creation date.
2. To create the new Issue.
3. To delete the existing Issue title.
4. To update the existing Issue.

Module 4:
MongoDB Basics: Documents, Collections, Databases, Query Language, Installation, The mongo Shell, Shell Scripting, Schema Initialization, MongoDB Node.js Driver, Reading from MongoDB, Writing to MongoDB.

Task : Develop the Student Management API to store the student data into Database :-
1. To add the new students.
2. To remove the existing student.
3. To update the existing student details.
4. To list all the students.
5. To list all the students based on Roll Number or any unique ID or Age.
6. The student should have the following attributes:- Name , Date of Birth , Branch , Year of Study , Address , Roll Number or any unique ID.

Module 5:
Modularization and Webpack: Server-Side Modules, Introduction to Webpack, Using Webpack Manually, Transform and Bundle, Libraries Bundle, Hot Module Replacement, HMR using Middleware, Debugging, Server-Side ES2015, ESLint.
Routing with React Router : Routing Techniques, Simple Routing, Route Parameters, Route Query String, Programmatic Navigation, Nested Routes, Browser History.

Forms: More Filters in the List API, Filter Form, The Get API, Edit Page, UI Components: Number Input , Data Input, Update API , Using the Update API, Delete API, Using the Delete API.
React-Bootstrap: Bootstrap Installation, Navigation, Table and Panel, Forms: Grid-Based Forms, Inline Forms, Horizontal Forms, Alerts: Validations, Results , Modals.

Task: Develop the Student Management System website for the College.

1. The admins should be able to Sign In, Sign out from the website.
2. The admin should be able to see the Dashboard after successful sign in.
3. The Dashboard should contain the Add Student, Delete Student, Update Student, List Student.
4. The admin should able filter the students based on branch or Roll Number or Date of Birth.

Task: Develop the Bookstore Library Website:
1. It should contain the 2 interfaces: User and Admin Interface.
2. User should be able do the following:
   - browse books from the library
   - filter them based on category, author, publications etc.
   - Rent them for a specific duration
   - Like/Review them
3. Admin should be able do the following:
   - List/manage books
   - Track rented books and their availability
4. Deploy the application in Netlify.

References:
1. VasanSubramanian , Pro MERN Stack: Full Stack Web App Development with Mongo, Express, React, and Node, APress, 2nd Edition, 2019.

Online Learning Resources/Virtual Labs:
1. https://nodejs.org/en/
2. https://expressjs.com/
3. https://www.mongodb.com/
4. https://reactjs.org/
5. https://www.netlify.com/

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

B.Tech CSE (AI)– III-II Sem

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3	0	0	3

(20A05702c) NATURAL LANGUAGE PROCESSING

Course Objectives:

- Explain and apply fundamental algorithms and techniques in the area of natural language processing (NLP)
- Understand approaches to syntax and semantics in NLP.
- Understand current methods for statistical approaches to machine translation.
- Understand language modeling.
- Understand machine learning techniques used in NLP.

Course Outcomes (CO):

After completion of the course, students will be able to

- Understand the logic behind Natural languages
- Understand the significance of syntax and semantics of natural languages
- Process the Natural languages
- Verify the syntax and semantics of languages
- Design new natural languages

UNIT – I Introduction to Natural language Lecture 8Hrs

The Study of Language, Applications of NLP, Evaluating Language Understanding Systems, Different Levels of Language Analysis, Representations and Understanding, Organization of Natural language Understanding Systems, Linguistic Background: An outline of English Syntax.

UNIT - II Grammars and Parsing Lecture 8Hrs

Grammars and Parsing- Top- Down and Bottom-Up Parsers, Transition Network Grammars, Feature Systems and Augmented Grammars, Morphological Analysis and the Lexicon, Parsing with Features, Augmented Transition Networks, Bayes Rule, Shannon game, Entropy and Cross Entropy.

UNIT - III Grammars for Natural Language Lecture 9Hrs

Grammars for Natural Language, Movement Phenomenon in Language, Handling questions in Context Free Grammars, Hold Mechanisms in ATNs, Gap Threading, Human Preferences in Parsing, Shift Reduce Parsers, Deterministic Parsers.

UNIT - IV Interpretation and Modelling Lecture 9Hrs

Semantic Interpretation-Semantic & Logical form, Word senses & ambiguity, the basic logical form language, encoding ambiguity in the logical Form, Verbs & States in logical form, Thematic roles, Speech acts &embedded sentences, Defining semantics structure model theory.

Language Modelling-Introduction, n-Gram Models, Language model Evaluation, Parameter Estimation, Language Model Adaption, Types of Language Models, Language-Specific Modelling Problems, Multilingual and Cross lingual Language Modelling.

UNIT - V Machine Translation and Multilingual Information Lecture9 Hrs

Machine Translation Survey: Introduction, Problems of Machine Translation, Is Machine Translation Possible, Brief History, Possible Approaches, Current Status. Anusaraka or Language Accessor: Background, Cutting the Gordian Knot, The Problem, Structure of Anusaraka System, User Interface, Linguistic Area, Giving up Agreement in Anusaraka Output, Language Bridges.

Multilingual Information Retrieval - Introduction, Document Pre-processing, Monolingual Information Retrieval, CLIR, MLIR, Evaluation in Information Retrieval, Tools, Software and Resources.

Multilingual Automatic Summarization - Introduction, Approaches to Summarization, Evaluation, How to Build a Summarizer, Competitions and Datasets.

Textbooks:

1. James Allen, Natural Language Understanding, 2nd Edition, 2003, Pearson Education.
2. Multilingual Natural Language Processing Applications: From Theory to Practice-Daniel M.Bikel and ImedZitouni, Pearson Publications.
3. Natural Language Processing, A paninian perspective, Akshar Bharathi, Vineet Chaitanya, Prentice –Hall of India.

Reference Books:

1. Charniack, Eugene, Statistical Language Learning, MIT Press, 1993.
2. Jurafsky, Dan and Martin, James, Speech and Language Processing, 2nd Edition, Prentice Hall, 2008.
3. Manning, Christopher and Henrich, Schutze, Foundations of Statistical Natural Language Processing, MIT Press, 1999.

Online Learning Resources:
http://peterindia.net/AILinks.html

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B.Tech CSE (AI)– III-II Sem

L	T	P	C
3	0	0	3

(20A33601T) ADVANCED MACHINE LEARNING

Course Objectives:

The course is introduced for students to

- Study different advanced machine learning algorithms
- Discuss about evaluation of learning algorithms
- Explore Python concepts related to machine learning

Course Outcomes (CO):

After completion of the course, students will be able to

- Use Deep belief networks and CNN
- Identify machine learning techniques suitable for a given problem
- Solve the problems using various machine learning techniques
- Apply Feature Engineering
- Design application using machine learning techniques

UNIT - I Unsupervised Machine Learning & Deep Belief Networks Lecture 8 Hrs

Principal component analysis, Introducing K-means clustering, self-organizing maps. Deep Belief Networks: Neural networks – a primer, composition of a neural network, network topologies, Restricted Boltzmann Machine, Introducing the RBM, Applications of the RBM, Further applications of the RBM, Deep belief Networks-Training a DBN, Applying the DBN, Validating the DBN

UNIT –IIStacked Denoising Autoencoders & Convolutional Neural Networks Lecture 9 Hrs

Autoencoders, Introducing the autoencoder, Topology, Training, Denoising autoencoders, ApplyingadA, Stacked Denoising Autoencoders, Applying the SdA, Assessing SdA performance

Convolutional Neural Networks: Introduction to CNN, Understanding the convnet topology, understanding convent layers and pooling layers, training a convent, Applying a CNN

UNIT - III Semi-Supervised Learning & Text Feature Engineering Lecture 9 Hrs

Introduction, understanding semi-supervised learning, Semi-supervised algorithms in action, Self-training, implementing self-training, Finessing your self-training implementation, Contrastive Pessimistic Likelihood Estimation

Text Feature Engineering: Introduction, Text feature engineering, Cleaning text data, Text cleaning with Beautiful Soup, managing punctuation and tokenizing, Tagging and categorizing words, creating features from text data, stemming, Bagging and random forests, Testing our prepared data

UNIT - IV Feature Engineering Lecture 9 Hrs

Introduction, creating a feature set, Engineering features for ML applications, using rescaling techniques to improve the learnability of features, creating effective derived variables, reinterpreting non-numeric features, using feature selection techniques, Performing feature selection, Feature engineering in practice, Acquiring data via RESTful APIs, Testing the performance of our model, Twitter, Deriving and selecting variables using feature engineering techniques

UNIT –VEnsemble Methods & Additional Python Machine Learning ToolsLecture 8 Hrs

Introducing ensembles, understanding averaging ensembles, using bagging algorithms, using random forests, applying boosting methods, Using XGBoost, Using stacking ensembles, Applying ensembles in practice, Using models in dynamic applications, Understanding model robustness, Identifying modeling risk factors, Strategies to managing model robustness

Additional Python Machine Learning Tools: Alternative development tools, Introduction to Lasagne, getting to know Lasagne, Introduction to Tensor flow, knowing when to use these libraries

Textbooks:

1. John Hearty, Advanced Machine Learning with Python, Packt Publishing Ltd, 2016.

Reference Books:

1. T.M. Mitchell, “Machine Learning”, McGraw-Hill,1997.
2. Machine Learning, SaikatDutt, Subramanian Chandramouli, Amit Kumar Das, Pearson, 2019.

Online Learning Resources:www.packtpub.com

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B.Tech CSE (AI)– III-II Sem

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3	0	0	3

(20A05701a) CLOUD COMPUTING
Common to CSE,IT, CSD, CSE(AI), CSE(AI&ML), CSE(DS), AI&DS

Course Objectives:
- To explain the evolving computer model called cloud computing.
- To introduce the various levels of services that can be achieved by cloud.
- To describe the security aspects in cloud.

Course Outcomes (CO):

After completion of the course, students will be able to
- Ability to create cloud computing environment
- Ability to design applications for Cloud environment
- Design & develop backup strategies for cloud data based on features.
- Use and Examine different cloud computing services.
- Apply different cloud programming model as per need.

UNIT - I **Basics of Cloud computing** Lecture 8Hrs

Introduction to cloud computing: Introduction, Characteristics of cloud computing, Cloud Models, Cloud Services Examples, Cloud Based services and applications

Cloud concepts and Technologies: Virtualization, Load balancing, Scalability and Elasticity, Deployment, Replication, Monitoring, Software defined, Network function virtualization, Map Reduce, Identity and Access Management, services level Agreements, Billing.

Cloud Services and Platforms: Compute Services, Storage Services, Database Services, Application services, Content delivery services, Analytics Services, Deployment and Management Services, Identity and Access Management services, Open Source Private Cloud software.

UNIT - II **Hadoop and Python** Lecture 9Hrs

Hadoop MapReduce: Apache Hadoop, Hadoop Map Reduce Job Execution, Hadoop Schedulers, Hadoop Cluster setup.

Cloud Application Design: Reference Architecture for Cloud Applications, Cloud Application Design Methodologies, Data Storage Approaches.

Python Basics: Introduction, Installing Python, Python data Types & Data Structures, Control flow, Function, Modules, Packages, File handling, Date/Time Operations, Classes.

UNIT - III **Python for Cloud computing** Lecture 8Hrs

Python for Cloud: Python for Amazon web services, Python for Google Cloud Platform, Python for windows Azure, Python for MapReduce, Python packages of Interest, Python web Application Frame work, Designing a RESTful web API.

Cloud Application Development in Python: Design Approaches, Image Processing APP, Document Storage App, MapReduce App, Social Media Analytics App.

UNIT - IV **Big data, multimedia and Tuning** Lecture 8Hrs

Big Data Analytics: Introduction, Clustering Big Data, Classification of Big data Recommendation of Systems.

Multimedia Cloud: Introduction, Case Study: Live video Streaming App, Streaming Protocols, case Study: Video Transcoding App.

Cloud Application Benchmarking and Tuning: Introduction, Workload Characteristics, Application Performance Metrics, Design Considerations for a Benchmarking Methodology, Benchmarking Tools, Deployment Prototyping, Load Testing & Bottleneck Detection case Study, Hadoop benchmarking case Study.

UNIT - V **Applications and Issues in Cloud** Lecture 9 Hrs

Cloud Security: Introduction, CSA Cloud Security Architecture, Authentication, Authorization, Identity Access Management, Data Security, Key Management, Auditing.

Cloud for Industry, Healthcare &Education: Cloud Computing for Healthcare, Cloud computing for Energy Systems, Cloud Computing for Transportation Systems, Cloud Computing

for Manufacturing Industry, Cloud computing for Education.

Migrating into a Cloud: Introduction, Broad Approaches to migrating into the cloud, the seven–step model of migration into a cloud.

Organizational readiness and Change Management in The Cloud Age: Introduction, Basic concepts of Organizational Readiness, Drivers for changes: A frame work to comprehend the competitive environment, common change management models, change management maturity models, Organizational readiness self – assessment.

Legal Issues in Cloud Computing: Introduction, Data Privacy and security Issues, cloud contracting models, Jurisdictional issues raised by virtualization and data location, commercial and business considerations, Special Topics.

Textbooks:

1. Cloud computing A hands-on Approach‖ By ArshdeepBahga, Vijay Madisetti, Universities Press, 2016
2. Cloud Computing Principles and Paradigms: By Raj Kumar Buyya, James Broberg, Andrzej Goscinski, Wiley, 2016

Reference Books:

1. Mastering Cloud Computing by Rajkumar Buyya, Christian Vecchiola, SThamaraiSelvi, TMH
2. Cloud computing A Hands-On Approach by ArshdeepBahga and Vijay Madisetti.
3. Cloud Computing: A Practical Approach, Anthony T. Velte, Toby J. Velte, Robert Elsenpeter, Tata McGraw Hill, rp2011.
4. Enterprise Cloud Computing, Gautam Shroff, Cambridge University Press, 2010.
5. Cloud Application Architectures: Building Applications and Infrastructure in the Cloud, George Reese, O ‘Reilly, SPD, rp2011.
6. Essentials of Cloud Computing by K. Chandrasekaran. CRC Press.

Online Learning Resources:

Cloud computing - Course (nptel.ac.in)

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

B.Tech CSE (AI)– III-II Sem

L	T	P	C
3	0	0	3

(20A31601a) ROBOTICS
(Professional Elective Course– II)

Course Objectives:

- Discuss the basics of Robotics
- Understand the working of Robots
- Demonstrate the building of Robots

Course Outcomes:

- Ability to process end effectors and robotic controls.
- Analyze Robot Transformations and Sensors
- Able to understand Robot cell design and applications

UNIT I **Introduction** Lecture 9 Hrs

Robot anatomy-Definition, law of robotics, History and Terminology of Robotics-Accuracy and repeatability of Robotics-Simple problems Specifications of Robot-Speed of Robot-Robot joints and links-Robot Classifications-Architecture of robotic systems

UNIT II **End Effectors and Robot Controls** Lecture 9 Hrs

Mechanical grippers-Slider crank mechanism, Screw type, Rotary actuators, cam type-Magnetic grippers-Vacuum grippers-Air operated grippers-Gripper force analysitims-Gripper design-Simple problems- Robot controls-Point to point control, Continuous path control, Intelligent robot Control system for robot joint-Control actions-Feedback devices-Encoder, Resolver, LVDTMotion Interpolations-Adaptive control.

UNIT III **Robot Transformations and Sensors** Lecture 9 Hrs

Robot Transformations and Sensors: Robot Kinematics-Types- 2D, 3D Transformation-Scaling, Rotation, Translation- Homogeneouscoordinates, multiple transformation-Simple problems. Sensors in robot – Touch Sensors-Tactile sensor – Proximity and range sensors – Robotic vision sensor-Force Sensor-Light sensors, Pressure sensors.

UNIT IV **Robot Cell Design and Applications** Lecture 8 Hrs

Robot work cell design and control-Sequence control, Operator interface, Safety monitoring devices in Robot-Mobile robot working principle, actuation using MATLAB, NXT Software Introductions-Robot applications Material handling, Machine loading and unloading, assembly, Inspection, Welding, Spray painting and undersea robot**.**

UNIT V **Micro/Nano Robotics System** Lecture 9 Hrs

Micro/Nanorobotics system overview-Scaling Effect-Top down and bottom up approach Actuators of Micro/Nano robotics system-Nano robot communication techniques-Fabrication of micro/nano grippers-Wall climbing micro robot working principles-Biomimetic robot-Swarm robot-Nano robot in targeted drug delivery system

Textbooks:

1.S.R. Deb, Robotics Technology and flexible automation, Tata McGraw-Hill Education.,2009

2. Mikell P Groover & Nicholas G Odrey, Mitchel Weiss, Roger N Nagel, Ashish Dutta, Industrial Robotics, Technology programming and Applications, McGraw Hill, 2012.

Reference Books:

1.Carl D. Crane and Joseph Duffy, Kinematic Analysis of Robot manipulators, Cambridge University press, 2008.

2. Fu. K. S., Gonzalez. R. C. & Lee C.S.G., "Robotics control, sensing, vision and intelligence", McGraw Hill Book co, 1987

3. Craig. J. J. "Introduction to Robotics mechanics and control", Addison- Wesley, 1999.

4. Ray Asfahl. C., "Robots and Manufacturing Automation", John Wiley & Sons Inc., 1985**.**

Online Learning Resources:

1. Robotics | Coursera
2. Introduction to robotics - Course (nptel.ac.in)

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B.Tech CSE (AI)– III-II Sem

L	T	P	C
3	0	0	3

(20A33602a) AUTOMATION OF MODEL BUILDING
(Professional Elective Course-II

Course Objectives:

To train students with in-depth and advanced knowledge to become professional and capable of identifying, analyzing and solving complex problems in the areas of Automation Engineering.

Course Outcomes (CO):

After completion of the course, students will be able to

- Acquire, demonstrate and apply advanced knowledge in the area of Automation engineering.
- Identify problems in the field of Automation engineering, formulate them and solve by using advanced techniques.
- Apply engineering and scientific principles for the effective management of Automation systems.

UNIT I **Lecture 8Hrs**

Introduction to AutoML: Scope of machine learning, what is AutoML? Why use AutoML and how does it help? When do you automate ML? What will you learn? Core components of AutoML system, Building prototype subsystems for each component. Putting it all together as end & end AutoML System Overview of AutoML libraries.

UNIT - II **Lecture 9Hrs**

Introduction to Machine Learning Using Python: Technical requirements, Machine learning, Linear regression, What is linear regression? important evaluation metrics regression algorithms, Logistic regression, Important evaluation metrics, classification algorithms, Decision trees, Support Vector Machines, k-Nearest Neighbours, Ensemble methods, Comparing the results of classifiers, Cross-validation: Clustering**.**

UNIT - III **Lecture 9Hrs**

Data Preprocessing: Technical requirements, Data transformation, Numerical data transformation, Categorical data transformation, Text Preprocessing, Feature selection, Feature generation.

Automated Algorithm Selection: Technical requirements, Computational complexity, Differences in training and scoring time, Linearity versus non-linearity, Necessary feature transformations, supervised ML, Unsupervised AutoML.

UNIT - IV **Lecture 8Hrs**

Hyperparameter Optimization: Technical requirements, Hyperparameters, Warm start, Bayesian- based hyperparameter tuning, An example system

Creating AutoML Pipelines: Technical requirements, An introduction to machine learning pipelines, A simple pipeline, Function Transformer, A complex pipeline.

UNIT - V **Lecture 8Hrs**

Dive into Deep Learning: Technical requirements, Overview of neural networks, Neuron, Activation functions, A feed-forward neural network using Keras: Autoencoders, Convolutional Neural Networks. Critical Aspects of ML and Data Science Projects: Machine learning as a search, Trade-offs in machine learning, Engagement model for a typical data science project, The phases of an engagement model.

Textbooks:

1. Sibanjan Das, UmitMertCakmak "Hands-On Automated Machine Learning" Packt Publishing, 2018.

Reference Books:

1. EthernAlpaydin, "Introduction to Machine Learning", MIT Press,2004.
2. Stephen Marsland, "Machine Learning -An Algorithmic Perspective", Second Edition, Chapman and Hall/CRC Machine Learning and Pattern Recognition Series,2014.

Online Learning Resources:

Machine Learning for Construction Automation – NPTEL+

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B.Tech CSE (AI)– III-II Sem

L	T	P	C
3	0	0	3

(20A05604c) COMPUTER VISION

Common to CSE, IT,CSD, CSE(AI), CSE(AI&ML)AI&DS

(Professional Elective Course– II)

Course Objectives:

The objective of this course is to understand the basic issues in computer vision and major approaches to address the methods to learn the Linear Filters, segmentation by clustering, Edge detection, Texture.

Course Outcomes:

After completing the course, you will be able to:

- Identify basic concepts, terminology, theories, models and methods in the field of computer vision,
- Describe known principles of human visual system,
- Describe basic methods of computer vision related to multi-scale representation, edge detection and detection of other primitives, stereo, motion and object recognition,
- Suggest a design of a computer vision system for a specific problem

UNIT I LINEAR FILTERS Lecture 8Hrs

Introduction to Computer Vision, Linear Filters and Convolution, Shift Invariant Linear Systems, Spatial Frequency and Fourier Transforms, Sampling and Aliasing Filters as Templates, Technique: Normalized Correlation and Finding Patterns, Technique: Scale and Image Pyramids.

UNIT II EDGE DETECTION Lecture 9Hrs

Noise- Additive Stationary Gaussian Noise, Why Finite Differences Respond to Noise, Estimating Derivatives - Derivative of Gaussian Filters, Why Smoothing Helps, Choosing a Smoothing Filter, Why Smooth with a Gaussian? Detecting Edges-Using the Laplacian to Detect Edges, Gradient-Based Edge Detectors, Technique: Orientation Representations and Corners.

UNIT III TEXTURE Lecture 9Hrs

Representing Texture –Extracting Image Structure with Filter Banks, Representing Texture using the Statistics of Filter Outputs, Analysis (and Synthesis) Using Oriented Pyramids – The Laplacian Pyramid, Filters in the Spatial Frequency Domain, Oriented Pyramids, Application: Synthesizing Textures for Rendering, Homogeneity, Synthesis by Sampling Local Models, Shape from Texture, Shape from Texture for Planes,

UNIT IV SEGMENTATION BY CLUSTERING Lecture 8Hrs

What is Segmentation, Human Vision: Grouping and Gestalt, Applications: Shot Boundary Detection and Background Subtraction. Image Segmentation by Clustering Pixels, Segmentation by Graph-Theoretic Clustering. The Hough Transform, Fitting Lines, Fitting Curves

UNIT V RECOGNIZATIONBYRELATIONSBETWEENTEMPLATES Lecture 8Hrs

Finding Objects by Voting on Relations between Templates, Relational Reasoning Using Probabilistic Models and Search, Using Classifiers to Prune Search, Hidden Markov Models, Application: HMM and Sign Language Understanding, Finding People with HMM.

Textbooks:
David A. Forsyth, Jean Ponce, Computer Vision – A modern Approach, PHI, 2003.

Reference Books:
1. Geometric Computing with Clifford Algebras: Theoretical Foundations and Applications in Computer Vision and Robotics, Springer;1 edition,2001bySommer.
2. Digital Image Processing and Computer Vision,1/e,bySonka.
3. Computer Vision and Applications: Concise Edition (WithCD) by Jack Academy Press, 2000.

Online Learning Resources:
https://nptel.ac.in/courses/106105216
https://nptel.ac.in/courses/108103174

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B.Tech CSE (AI&ML)– III-II Sem

L	T	P	C
0	0	3	1.5

(20A30603) NATURAL LANGUAGE PROCESSING LAB

Course Objectives:

- To introduce the students with the basics of NLP which will empower them for developing advanced NLP tools and solving practical problems in the field.

Course Outcomes (CO):

After completion of the course, students will be able to

- Understand approaches to syntax and semantics in NLP.
- Analyse grammar formalism and context free grammars
- Apply the statistical estimation and statistical alignment models
- Apply Rule based Techniques, Statistical Machine translation (SMT), word alignment, phrase-based translation
- Have the skills (experience) of solving specific NLP tasks, which may involve programming in Python, as well as running experiments on textual data.

List of Experiments:

1. Word Analysis
2. Word Generation
3. Morphology
4. N-Grams
5. N-Grams Smoothing
6. POS Tagging: Hidden Markov Model
7. POS Tagging: Viterbi Decoding
8. Building POS Tagger
9. Chunking
10. Building Chunker

Refer: https://nlp-iiith.vlabs.ac.in/List%20of%20experiments.html

References:

1. James Allen, Natural Language Understanding, 2nd Edition, 2003, Pearson Education.
2.Natural Language Processing, A paninian perspective, Akshar Bharathi, Vineet Chaitanya, Prentice –Hall of India.

Online Learning Resources/Virtual Labs:

1. Natural Language Processing in TensorFlow | Coursera

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B.Tech CSE (AI)– III-II Sem

L	T	P	C
0	0	3	1.5

(20A33601P) ADAVNCED MAHINE LEARNING LAB

Course Objectives:

- Study various learning algorithms
- Make use of Data sets in implementing the machine learning algorithms
- Implement the machine learning concepts and algorithms in any suitable language of choice
- Learn about feature engineering
- To develop skills of using recent machine learning packages for solving practical problems

Course Outcomes (CO):

At the end of the course students will be able to:

- Familiarize with Python
- Able to generate, analyze and interpret data using Python.
- Use Python to design and implement classifiers for machine learning applications.
- Implement an end to end Machine Learning System

List of Experiments:

1. The probability that it is Friday and that a student is absent is 3 %. Since there are 5 school days in a week, the probability that it is Friday is 20 %. What is the probability that a student is absent given that today is Friday? Apply Baye's rule in python to get the result.
2. Create a K-Means Clustering Algorithm from Scratch in Python?
3. Implement k-nearest neighbours classification using python
4. Given the following data, which specify classifications for nine combinations of VAR1 and VAR2 predict a classification for a case where VAR1=0.906 and VAR2=0.606, using the result of k-means clustering with 3 means (i.e., 3 centroids) VAR1 VAR2 CLASS 1.713 1.586 0 0.180 1.786 1 0.353 1.240 1 0.940 1.566 0 1.486 0.759 1 1.266 1.106 0 1.540 0.419 1 0.459 1.799 1 0.773 0.186 1
5. The following training examples map descriptions of individuals onto high, medium and low credit-worthiness.

Income	Recreation	Job	Status	Age group	Home-owner	Risk
Medium	skiing	design	single	twenties	no	High risk
High	golf	trading	married	forties	yes	Low risk
Low	speedway	transport	married	thirties	yes	Med risk
Medium	football	banking	single	thirties	yes	Low risk
High	flying	media	married	fifties	yes	High risk
Low	football	security	single	twenties	no	Med risk
Medium	golf	media	single	thirties	yes	Med risk
Medium	golf	transport	married	forties	yes	Low risk
High	skiing	banking	single	thirties	yes	High risk
Low	golf	unemployed	married	forties	yes	High risk

Input attributes are (from left to right) income, recreation, job, status, age group, home-owner. Find the unconditional probability of `golf' and the conditional probability of `single' given `med Risk' in the dataset?

6. Implement linear regression using python.
7. Build an Artificial Neural Network by implementing the Back-propagation algorithm and test the same using appropriate data sets.
8. Implement Naïve Bayes' theorem to classify the English text
9. Use the appropriate dataset for implementing feature engineering for machine learning to find

- Missing data imputation
- Categorical encoding
- Outliers
- Feature scaling
- Mixed variables

10. Design an Optical Character Recognizer
11. Design Heart Attack risk predictor using Auto ML
12. Design Petrol price forecasting using Auto Keras
13. Design Cricket score prediction using TPOT (Auto ML)

References:

1. Advanced Machine Learning with python: by john hearty, 2016
2. Hands-On Machine Learning with Scikit-Learn and Tensor Flow (2nd Edition) by Aurelian Ger, 2020
3. Y. S. Abu-Mostafa, M. Magdon-Ismail, H.-T. Lin. Learning from Data: A Short Course. First Edition, 2012
4. C. M. Bishop. Pattern Recognition and Machine Learning. First Edition. Springer, 2006. (Second Indian Reprint, 2015).
5. S. J. Russell, P. Norvig. Artificial Intelligence: A Modern Approach. Third Edition, Prentice-Hall, 2010.

Online Learning Resources/Virtual Labs:

https://github.com/jiadaizhao/Advanced-Machine-Learning-Specialization

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

B.Tech (AI & DS)– III-II Sem

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(20A121604) CLOUD COMPUTING LAB
Common to IT, CSE(AI), CSE(AI&ML), CSE(DS), AI&DS

Course Objectives:
- Demonstrate application development using Cloud
- Explain features of Hadoop

Course Outcomes (CO):

On completion of this course, the students will be able to:
- Configure various virtualization tools such as Virtual Box, VMware workstation.
- Design and deploy a web application in a PaaS environment.
- Learn how to simulate a cloud environment to implement new schedulers.
- Install and use a generic cloud environment that can be used as a private cloud.
- Manipulate large data sets in a parallel environment.

List of Experiments:
1. Install VirtualBox/VMware Workstation with different flavours of Linux or windows OS on top of windows operating systems.
2. Install a C compiler in the virtual machine created using virtual box and execute Simple Programs
3. Install Google App Engine. Create hello world app and other simple web applications using python/java.
4. Use GAE launcher to launch the web applications.
5. Simulate a cloud scenario using CloudSim and run a scheduling algorithm that is not present in CloudSim.
6. Find a procedure to transfer the files from one virtual machine to another virtual machine.
7. Find a procedure to launch virtual machine using try stack (Online Open stack Demo Version)
8. Install Hadoop single node cluster and run simple applications like wordcount
9. Establish an AWS account. Use the AWS Management Console to launch an EC2 instance and connect to it.
10. Develop a Guestbook Application using Google App Engine
11. Develop a Serverless Web App using AWS
12. Design a Content Recommendation system using AWS
13. Design a Cloud based smart traffic management system
14. Design Cloud based attendance management system
15. Design E-learning cloud-based system
16. Using Amazon Lex build a Chatbot

References:
1. https://www.vmware.com/products/workstation-pro/workstation-pro-evaluation.html.
2. http://code.google.com/appengine/downloads.html
3. http://code.google.com/appengine/downloads.html

Online Learning Resources/Virtual Labs:
1. Google Cloud Computing Foundations Course - Course (nptel.ac.in)

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

B.Tech CSE (AI)– III-II Sem

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(20A52401) SOFT SKILLS
(Skill Oriented course – IV)

Course Objectives:

- To encourage all round development of the students by focusing on soft skills
- To make the students aware of critical thinking and problem-solving skills
- To develop leadership skills and organizational skills through group activities
- To function effectively with heterogeneous teams

Course Outcomes (CO):

By the end of the program students should be able to

- Memorize various elements of effective communicative skills
- Interpret people at the emotional level through emotional intelligence
- apply critical thinking skills in problem solving
- analyse the needs of an organization for team building
- Judge the situation and take necessary decisions as a leader
- Develop social and work-life skills as well as personal and emotional well-being

UNIT I **Soft Skills & Communication Skills** **10 Hrs**

Introduction, meaning, significance of soft skills – definition, significance, types of communication skills - Intrapersonal & Inter-personal skills - Verbal and Non-verbal Communication

Activities:

Intrapersonal Skills- Narration about self- strengths and weaknesses- clarity of thought – self- expression – articulating with felicity

(The facilitator can guide the participants before the activity citing examples from the lives of the great, anecdotes and literary sources)

Interpersonal Skills- Group Discussion – Debate – Team Tasks - Book and film Reviews by groups - Group leader presenting views (non- controversial and secular) on contemporary issues or on a given topic.

Verbal Communication- Oral Presentations- Extempore- brief addresses and speeches- convincing- negotiating- agreeing and disagreeing with professional grace.

Non-verbal communication – Public speaking – Mock interviews – presentations with an objective to identify non- verbal clues and remedy the lapses on observation

UNIT II **Critical Thinking** **10 Hrs**

Active Listening – Observation – Curiosity – Introspection – Analytical Thinking – Open-mindedness – Creative Thinking

Activities:

Gathering information and statistics on a topic - sequencing – assorting – reasoning – critiquing issues – placing the problem – finding the root cause - seeking viable solution – judging with rationale – evaluating the views of others - Case Study, Story Analysis

UNIT III **Problem Solving & Decision Making** **10 Hrs**

Meaning & features of Problem Solving – Managing Conflict – Conflict resolution –
Methods of decision making – Effective decision making in teams – Methods & Styles

Activities:

Placing a problem which involves conflict of interests, choice and views – formulating the problem – exploring solutions by proper reasoning – Discussion on important professional, career and organizational decisions and initiate debate on the appropriateness of the decision.

Case Study & Group Discussion

UNIT IV Emotional Intelligence & Stress Management 10 Hrs

Managing Emotions – Thinking before Reacting – Empathy for Others – Self-awareness – Self-Regulation – Stress factors – Controlling Stress – Tips

Activities:

Providing situations for the participants to express emotions such as happiness, enthusiasm, gratitude, sympathy, and confidence, compassion in the form of written or oral presentations.

Providing opportunities for the participants to narrate certain crisis and stress –ridden situations caused by failure, anger, jealousy, resentment and frustration in the form of written and oral presentation, Organizing Debates

UNIT V Leadership Skills 10 Hrs

Team-Building – Decision-Making – Accountability – Planning – Public Speaking – Motivation – Risk-Taking - Team Building - Time Management

Activities:

Forming group with a consensus among the participants- choosing a leader- encouraging the group members to express views on leadership- democratic attitude- sense of sacrifice – sense of adjustment – vision – accommodating nature- eliciting views on successes and failures of leadership using the past knowledge and experience of the participants, Public Speaking, Activities on Time Management, Motivation, Decision Making, Group discussion etc.

NOTE-:

1. The facilitator can guide the participants before the activity citing examples from the lives of the great, anecdotes, epics, scriptures, autobiographies and literary sources which bear true relevance to the prescribed skill.
2. Case studies may be given wherever feasible for example for Decision Making- The decision of King Lear or for good Leadership – Mahendar Singh Dhoni etc.

Textbooks:

1. Personality Development and Soft Skills (English, Paperback, Mitra BarunK.)Publisher: Oxford University Press; Pap/Cdr edition (July 22, 2012)
2. Personality Development and Soft Skills: Preparing for Tomorrow, Dr Shikha KapoorPublisher : I K International Publishing House; 0 edition (February 28, 2018)

Reference Books:

1. Soft skills: personality development for life success by Prashant Sharma, BPB publications 2018.
2. Soft Skills By Alex K. Published by S.Chand
3. Soft Skills: An Integrated Approach to Maximise Personality Gajendra Singh Chauhan, Sangeetha Sharma Published by Wiley.
4. Communication Skills and Soft Skills (Hardcover, A. Sharma) Publisher: Yking books
5. SOFT SKILLS for a BIG IMPACT (English, Paperback, RenuShorey) Publisher: Notion Press
6. Life Skills Paperback English Dr. Rajiv Kumar Jain, Dr. Usha Jain Publisher: Vayu Education of India

Online Learning Resources:

1. https://youtu.be/DUlsNJtg2L8?list=PLLy_2iUCG87CQhELCytvXh0E_y-bOO1_q
2. https://youtu.be/xBaLgJZ0t6A?list=PLzf4HHlsQFwJZel_j2PUy0pwjVUgj7KlJ
3. https://youtu.be/-Y-R9hDl7lU
4. https://youtu.be/gkLsn4ddmTs
5. https://youtu.be/2bf9K2rRWwo
6. https://youtu.be/FchfE3c2jzc

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

B.Tech CSE (AI)– III-II Sem **L T P C**

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(20A99601) INTELLECTUAL PROPERTY RIGHTS AND PATENTS
(Mandatory Non-Credit Course)

Course Objectives:

This course introduces the student to the basics of Intellectual Property Rights, Copy Right Laws, Cyber Laws, Trade Marks and Issues related to Patents. The overall idea of the course is to help and encourage the student for startups and innovations

Course Outcomes:

- Understand IPR law & Cyber law
- Discuss registration process, maintenance and litigations associated with trademarks
- Illustrate the copy right law
- Enumerate the trade secret law.

UNIT I

Introduction to Intellectual Property Law – Evolutionary past – Intellectual Property Law Basics – Types of Intellectual Property – Innovations and Inventions of Trade related Intellectual Property Rights – Agencies Responsible for Intellectual Property Registration – Infringement – Regulatory – Overuse or Misuse of Intellectual Property Rights – Compliance and Liability Issues.

UNIT II

Introduction to Copyrights – Principles of Copyright – Subject Matters of Copyright – Rights Afforded by Copyright Law –Copyright Ownership – Transfer and Duration – Right to Prepare Derivative Works –Rights of Distribution – Rights of performers – Copyright Formalities and Registration – Limitations – Infringement of Copyright – International Copyright Law-Semiconductor Chip Protection Act.

UNIT III

Introduction to Patent Law – Rights and Limitations – Rights under Patent Law – Patent Requirements – Ownership and Transfer – Patent Application Process and Granting of Patent – Patent Infringement and Litigation – International Patent Law – Double Patenting – Patent Searching – Patent Cooperation Treaty – New developments in Patent Law- Invention Developers and Promoters.

UNIT IV

Introduction to Trade Mark – Trade Mark Registration Process – Post registration procedures – Trade Mark maintenance – Transfer of rights – Inter parties Proceedings – Infringement – Dilution of Ownership of Trade Mark – Likelihood of confusion – Trade Mark claims – Trade Marks Litigation – International Trade Mark Law.

UNIT V

Introduction to Trade Secrets – Maintaining Trade Secret – Physical Security – Employee Access Limitation – Employee Confidentiality Agreement – Trade Secret Law – Unfair Competition – Trade Secret Litigation – Breach of Contract – Applying State Law. Introduction to Cyber Law – Information Technology Act – Cyber Crime and E-commerce – Data Security – Confidentiality – Privacy – International aspects of Computer and Online Crime.

Textbooks:

1. Deborah E.Bouchoux: “Intellectual Property”. Cengage learning, New Delhi
2. Kompal Bansal &Parishit Bansal “Fundamentals of IPR for Engineers”, BS Publications (Press)
3. Cyber Law. Texts & Cases, South-Western’s Special Topics Collections

References:

1. Prabhuddha Ganguli: ‘ Intellectual Property Rights” Tata Mc-Graw – Hill, New Delhi
2. Richard Stim: “Intellectual Property”, Cengage Learning, New Delhi.
3. R. Radha Krishnan, S. Balasubramanian: “Intellectual Property Rights”, Excel Books. New Delhi.
4. M. Ashok Kumar and Mohd. Iqbal Ali: “Intellectual Property Right” Serials Pub.