Chhattisgarh Swami Vivekananda Technical University, Bhilai (C.G.)

Program / Semester: **B.Tech (VII Sem)**	Branch: **Artificial Intelligence and Machine Learning**
Subject: **Deep Learning and Applications**	Course Code: **D109711(022)**
Total / Minimum-Pass Marks (End Semester Exam): 100 / 35	**L: 2 T: 1 P: 0** Credits: **3**
Class Tests & Assignments to be conducted: **2 each**	**Duration (End Semester Exam): 03 Hours**

Course Objectives:

- Introduce the student to the latest algorithms which have made everything from Self driving cars to Google's Alpha Go possible.
- Deep Learning is at the core of modern-day Artificial Intelligence and Machine Learning applications.
- Student will be introduced to the theoretical background required to fully understand the ongoing research in the field.

UNIT-I: Feed forward Deep Networks: Review of Machine Learning Basics, Vanilla MLP, Estimating conditional Statistics, Flow Graphs and Back propagation, Universal Approximation Properties and Depth, Feature representation, Piecewise Linear Hidden UNITs.

UNIT-II: Regularization of Deep Models: Regularization from Bayesian Perspective, Parameter Norm Penalty, Regularization as Constrained Optimization, Under-Constrained Problems, Classical Regularization as Noise Robustness, Dropout, Multi-Task training, Adversarial Training.

UNIT-III: Optimization for Training Deep Models: Optimization for Model Training, Challenges in Optimization, Basic Algorithms, Adaptive learning rates, Second order methods, Natural gradient methods, Global Optimization.

UNIT-IV: Convolutional Networks: The Convolution Operation, Pooling, Convolution Modules, Efficient Convolution Algorithms, Random or Unsupervised features, Applications in Computer Vision

UNIT-V: Recurrent and Recursive Nets: Unfolding Flow graphs and parameter sharing, Recurrent Neural Networks, Bidirectional RNNs, Deep Recurrent Architecture, Auto- Regressive Networks.

Text Book:

1. Deep Learning, Ian Good fellow, Yoshua Bengio and Aaron Courville.

Reference Books:

1. Artificial Intelligence for Humans: Deep Learning and Neural Networks, Book 3, Jeff Heaton.
2. Deep Learning with Tensor Flow, Giancarlo Zaccone.

Course Outcomes:

- Upon completion of this course, the students will be able to:
- Understand machine learning basics and back propagation model.
- Regularize the deep models.
- Apply optimization techniques for training deep models.
- Apply convolution networks for computer vision problems.
- Use Deep Recurrent Architecture.

Chhattisgarh Swami Vivekananda Technical University, Bhilai (C.G.)

Program / Semester: **B.Tech (VII Sem)**	Branch: **Artificial Intelligence and Machine Learning**
Subject: **Data and Visual Analytics in AI**	Course Code: **D109712(022)**
Total / Minimum-Pass Marks (End Semester Exam): 100 / 35	**L: 2 T: 1 P: 0** Credits: **3**
Class Tests & Assignments to be conducted: **2 each**	**Duration (End Semester Exam): 03 Hours**

Course Objectives:

- To introduce the fundamental concepts of data Analysis and pre-processing.
- To introduce different types of data mining techniques
- To introduce effective visualizations using appropriate chart types, color schemes, and labeling techniques.
- To introduce the utilization of visualization tools and libraries to create interactive and static visualizations.
- To introduce the use of data visualization in high-dimension data handling and in Machine learning

UNIT-I: Introduction to Data Analytics: Introduction to data analytics and its significance, Types of data: structured, unstructured, and semi-structured, Exploratory data analysis (EDA) and data profiling, Data pre-processing techniques: cleaning, transformation, and integration.

UNIT-II: Statistical Analysis and Data Mining: Descriptive statistics: measures of central tendency and variability, Inferential statistics: hypothesis testing and confidence intervals, Correlation and regression analysis, Introduction to data mining concepts and algorithms

UNIT-III: Introduction to Data Visualization and Representation: Introduction to data visualization and its importance, Perception, and cognition in visualization, Types of data and visualization tasks, Data visualization pipeline, Tools and software for data visualization, Data types and structures for visualization, Graphs, and charts for categorical and numerical data, Bar charts, line charts, scatter plots, Pie charts, histograms, box plots, Heatmaps.

UNIT-IV: Principles of Visualization Design and Tools: Principles of visual perception and cognition, Color theory and color encoding, Layout and composition in visualization, Effective use of typography and labels, Visualization storytelling, and narrative techniques. Introduction to popular data visualization tools, Creating visualizations using Python libraries (Matplotlib, Seaborn, Plotly).

UNIT-IV: Advanced Data Visualization: Visualizing large and high-dimensional datasets, Information visualization and network visualization, Visualization for machine learning and AI applications, Evaluation and critique of visualizations, and Ethical considerations in data visualization. Text analytics and sentiment analysis. Time series analysis and forecasting

Textbooks:

1. "Interactive Data Visualization for the Web" by Scott Murray
2. "Data Science for Business" by Foster Provost and Tom Fawcett
3. "Data Mining: Concepts and Techniques" by Jiawei Han, Micheline Kamber, and Jian Pei
4. "Python for Data Analysis" by Wes McKinney

Reference Books:

1. "Information Visualization: Perception for Design" by Colin Ware
2. "The Wall Street Journal Guide to Information Graphics: The Dos and Don'ts of Presenting Data, Facts, and Figures" by Dona M. Wong
3. "Data Visualization: A Practical Introduction" by Kieran Healy
4. "Applied Predictive Analytics: Principles and Techniques for the Professional Data Analyst" by Dean Abbott

Course Outcome: By the end of this course, students will be able to:

- Understand the fundamental concepts of data analysis.
- Apply various visualization techniques to explore and analyze datasets.
- Design and create effective visualizations using appropriate tools and software.
- Critically evaluate and improve existing visualizations based on principles of perception and design.
- Apply data visualization techniques to real-world problems in AI and machine learning.

Chhattisgarh Swami Vivekananda Technical University, Bhilai (C.G.)

Program / Semester: **B.Tech (VII Sem)**	Branch: **Artificial Intelligence and Machine Learning**
Subject: **Natural Language Processing**	Course Code: **D109713(022)**
Total / Minimum-Pass Marks (End Semester Exam): 100 / 35	**L: 3 T: 1 P: 0** Credits: **4**
Class Tests & Assignments to be conducted: **2 each**	**Duration (End Semester Exam): 03 Hours**

Course Objectives:

- Upon completion of this course, the undergraduate students will be able to grasp the significance of natural language processing in solving real-world problems. They will be able to map the appropriate processing technique and implement them for Information Retrieval and Information Extraction from Text and speech.

UNIT-I: Introduction:
Origins and challenges of NLP, Human languages, models, problem of ambiguity, processing paradigms; Phases in natural language processing, applications such as information extraction, question answering, and machine translation

UNIT-II: Syntactic Analysis:
Context Free Grammars, Grammar rules for English, Normal Forms for grammar. Syntax Analysis: Parsing Natural Language, Representing text data - Part of speech tagging, Representation of Syntactic Structure, Parsing Algorithms, Models for Ambiguity Resolution in Parsing, Multilingual Issues.

UNIT-III: Semantic Analysis:
Semantics- Meaning representation, Syntax-Driven Semantic analysis, lexical semantics, Word Net based similarity-Shallow parsing - Semantic representation, Word Sense Disambiguation Selection a restriction, machine learning approaches, dictionary based approaches.

UNIT-IV: Discourse Integration and Pragmatic Analysis:
Discourse Processing: Cohension, Reference Resolution, Discourse Cohension and Structure Language Modeling: Introduction, N-Gram Models, Language Model Evaluation, Parameter Estimation, Language Model Adaptation, Types of Language Models, Language-Specific Modeling Problems, Multilingual and Cross lingual Language Modeling.

UNIT-V: Speech Processing:
Speech Fundamentals: Articulatory Phonetics – Production and Classification of Speech Sounds; Acoustic Phonetics – Acoustics of Speech Production; SPEECH-ANALYSIS: Features, Feature Extraction And Pattern Comparison Techniques: Speech Distortion Measures– Mathematical And Perceptual, SPEECH MODELING: Hidden Markov Models: Markov Processes, HMMs –Evaluation.

Text Books:

1. Jurafsky, David, and James H. Martin. Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics and Speech Recognition. Upper Saddle River, NJ: Prentice-Hall, 2000. ISBN: 0130950696.
2. Christopher D. Manning and Hinrich Schutze, "Foundations of Statistical Natural Language Processing", MIT Press, 1999.

Course Outcomes:

- Describe the fundamental concepts and techniques of natural language processing.
- Verify the syntax of any sentences using parsing.
- Apply proper method to perform semantic analysis of a sentence.
- Analyze a sentence for discourse integration.

Chhattisgarh Swami Vivekananda Technical University, Bhilai (C.G.)

Program / Semester: **B.Tech (VII Sem)**	Branch: **Artificial Intelligence and Machine Learning**
Subject: **Deep Learning (Lab)**	Course Code: **D109721(022)**
Total / Minimum-Pass Marks (End Semester Exam): 40 / 20	**L: 0 T: 0 P: 2** Credits: **1**

List of Experiments:

1. Write a program to implement XOR gates using Perceptron.
2. Write a program to implement Wine Classification using Back propagation.
3. Design & implement a simple deep learning network for classification of Image.
4. Implement any one of the algorithms VGG to classify objects in objects.
5. Design a deep learning network for fine tuning of convolution networks use.
6. Implement Data Augmentation in Deep Learning use any medical image dataset.
7. Implement RNN for handwriting digit recognition.
8. Implement Bidirectional RNNs for music generation.
9. Implement Bidirectional LSTM for sentiment analysis.
10. Implement Region Based CNN for object detection.
11. Implement Variational Auto encoders for image denoising.
12. Implement Generative Adversarial Networks to generate realistic photographs.

Chhattisgarh Swami Vivekananda Technical University, Bhilai (C.G.)

Program / Semester: **B.Tech (VII Sem)**	Branch: **Artificial Intelligence and Machine Learning**
Subject: **DevOps (Lab)**	Course Code: **D109722(022)**
Total / Minimum-Pass Marks (End Semester Exam): 40 / 20	**L: 0 T: 0 P: 2** Credits: **1**

List of Experiments:

1. To understand DevOps: Principles, Practices, and DevOps Engineer Role and Responsibilities.
2. To understand Version Control System / Source Code Management, install git and create a GitHub account.
3. To Perform various GIT operations on local and Remote repositories using GIT Cheat-Sheet
4. To understand Continuous Integration, install and configure Jenkins with Maven/Ant/Gradle to setup a build Job.
5. To Build the pipeline of jobs using Maven / Gradle / Ant in Jenkins, create a pipeline script to Test and deploy an application over the tomcat server.
6. To understand Jenkins Master-Slave Architecture and scale your Jenkins standalone implementation by implementing slave nodes.
7. To Setup and Run Selenium Tests in Jenkins Using Maven.
8. To understand Docker Architecture and Container Life Cycle, install Docker and execute docker commands to manage images and interact with containers.
9. To learn Dockerfile instructions, build an image for a sample web application using Dockerfile.
10. To install and Configure Pull based Software Configuration Management and provisioning tools using Puppet.
11. To learn Software Configuration Management and provisioning using Puppet Blocks (Manifest, Modules, Classes, Function).
12. To provision a LAMP/MEAN Stack using Puppet Manifest.

Chhattisgarh Swami Vivekananda Technical University, Bhilai (C.G.)

Program / Semester: **B.Tech (VII Sem)**	Branch: **Artificial Intelligence and Machine Learning**
Subject: : **Generative AI** ***(Professional Elective-III)***	Course Code: **D109731(022)**
Total / Minimum-Pass Marks (End Semester Exam): 100 / 35	**L: 1 T: 1 P: 0** Credits: **2**
Class Tests & Assignments to be conducted: **2 each**	**Duration (End Semester Exam): 03 Hours**

Course Objectives:

- Develop proficiency in preprocessing and cleaning data in generative AI applications.
- Implement and optimize GANs and VAEs for image generation, including training, fine-tuning, and Advanced techniques.
- Master text generation techniques using LSTM and Transformer models, focusing on fine-tuning language models for various applications.
- Explore music generation through different models like LSTM and Transformer, evaluating and fine-tuning compositions for diverse music applications.

UNIT-I: Introduction to Generative AI:

Overview of Python and Tensor Flow 2, Preprocessing and cleaning data for Generative AI applications. Visualizing data distributions and patterns in Generative AI datasets. Introduction to Tensor Flow's computation graph and eager execution.

UNIT-II: Image Generation with Generative AI:

Introduction to Image Generation, Implementing GANs for Image Generation Training and Fine-Tuning GANs, Generating Images with VAEs, Advanced Techniques in Image Generation, and Image and Video Generation Applications.

UNIT-III: Text Generation with Generative AI:

Introduction to Text Generation, LSTM-based Text Generation, Transformer-based Text Generation, Fine-Tuning Language Models, and Text Generation Applications.

UNIT-IV: Music Generation with Generative AI:

Introduction to Music Generation, Music Representation, and LSTM-based Music Generation. Transformer- based Music Generation, Evaluation, and Fine-Tuning, Music Composition Applications**. MuseGAN:**

Overview of MuseGAN architecture, Multi-track music generation using MuseGAN, Training Muse GAN on polyphonic music datasets, Generating complex music compositions with MuseGAN.

UNIT-V: Advanced Techniques and Applications:

Transfer learning in music generation, Fine-tuning generative models for specific music genres orstyles, Ethical considerations in AI-generated music, Future directions, and emerging trends inAI-driven music composition.

Text Books:

1. Generative AI with Python and TensorFlow 2: Create images, text, and music with VAEs, GANs, LSTMs,
2. Transformer models", Joseph Babcock and Raghav Bali, 2024.
3. "Deep Learning" by Ian Goodfellow, YoshuaBengio, and Aaron Courville., 2016
4. "Neural Networks and Deep Learning: A Textbook" by Charu C. Aggarwal, 2023, Springer

Reference Books:

1. "Generative Adversarial Networks Cookbook: Over 100 recipes to build generative models using Python, TensorFlow, and Keras" by Josh Kalin, PACKT, 2018.
2. "Generative AI in Software Development: Beyond the Limitations of Traditional Coding" Jesse Sprinter, 2024.

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

- Understand generative AI principles and word embeddings for text representation.
- Apply Large Language Models effectively, including pre-training and transfer learning.
- Evaluate Generative AI models using appropriate metrics.
- Implement Generative Adversarial Networks (GANs) for image generation tasks using TensorFlow.
- Identify different types of generative AI models suitable for music generation.
- Analyze ethical considerations for music composition using GenAI

Chhattisgarh Swami Vivekananda Technical University, Bhilai (C.G.)

Program / Semester: **B.Tech (VII Sem)**	Branch: **Artificial Intelligence and Machine Learning**
Subject: : **Cognitive Computing** ***(Professional Elective-III)***	Course Code: **D109732(022)**
Total / Minimum-Pass Marks (End Semester Exam): 100 / 35	**L: 1 T: 1 P: 0** Credits: **2**
Class Tests & Assignments to be conducted: **2 each**	**Duration (End Semester Exam): 03 Hours**

UNIT-I: Foundation of Cognitive Computing: cognitive computing as a new generation, the uses of cognitive systems, system cognitive, gaining insights from data, Artificial Intelligence as the foundation of cognitive computing, understanding cognition. Components of a cognitive system, building the corpus, bringing data into cognitive system, hypotheses generation and scoring, presentation and visualization services

UNIT-II: Natural Language Processing in support of a Cognitive System: Role of NLP in a cognitive system, semantic web, Applying Natural language technologies to Business problems **Representing knowledge in Taxonomies and Ontologies**: Representing knowledge, Defining Taxonomies and Ontologies, knowledge representation, models for knowledge representation, implementation considerations

UNIT-III: Relationship between Big Data and Cognitive Computing: Dealing with human-generated data, defining big data, architectural foundation, analytical data warehouses, Hadoop, data in motion and streaming data, integration of big data with traditional data **Applying Advanced Analytics to cognitive computing:** Advanced analytics is on a path to cognitive computing, Key capabilities in advanced analytics, Using advanced analytics to create value, Impact of open source tools on advanced analytics

UNIT-IV: **The Business Implications of Cognitive Computing**: Preparing for change, advantages of new disruptive models, knowledge meaning to business, difference with a cognitive systems approach, meshing data together differently, using business knowledge to plan for the future, answering business questions in new ways, building business specific solutions, making cognitive computing a reality, cognitive application changing the market.

UNIT-V: Smarter cities-Cognitive Computing in Government: Cities operation, characteristics of smart city, rise of open data movement with fuel cognitive cities, internet of everything and smarter cities, understanding the owner ship and value of data, cities area dopting smarter technology today for major functions, smarter approaches to preventative healthcare, building a smarter transportation infrastructure using analytics to close work forceskills gap, creating a cognitive community infrastructure, next phase of cognitive cities

Text Book:

1. Judith H Hurwitz, Marcia Kaufman, Adrian Bowles, “Cognitive computing and Big Data Analytics”, Wiley.

Reference Books:

1. Jerome R. Busemeyer, Peter D. Bruza, “Quantum Models of Cognition and Decision”, Cambridge University Press.
2. Emmanuel M. Pothos, Andy J. Wills, “Formal Approaches in Categorization”, Cambridge University Press.
3. Neil Stillings, Steven E. Weisler, Christopher H. Chase and Mark H. Feinstein, “Cognitive Science: An Introduction”, MITPress.
4. Artificial Intelligence and Cognitive Computing : Methods, Technologies, Systems, Applications and Policy Making, MDPI , Miltiadis D. Lytras A VAnna Visvizi Anna Visvizi.

Chhattisgarh Swami Vivekananda Technical University, Bhilai (C.G.)

Program / Semester: **B.Tech (VII Sem)**	Branch: **Artificial Intelligence and Machine Learning**
Subject: **Enterprise Resource Planning** ***(Professional Elective-III)***	Course Code: **D109733(022)**
Total / Minimum-Pass Marks (End Semester Exam): 100 / 35	**L: 1 T: 1 P: 0** Credits: **2**
Class Tests & Assignments to be conducted: **2 each**	**Duration (End Semester Exam): 03 Hours**

Course Objectives:

- Understand the technical aspects of ERP systems;
- Learn concepts of reengineering and how they relate to ERP system;
- Understand the steps and activities in ERP implementation;
- Understand the typical functional modules in ERP system;
- Understand the technology areas of ERP and enterprise applications.

UNIT-I: Definition, Need, Evolution, Benefits, Emerging Trends, Roll of the enterprises, business function and business processes, Risk of ERP, Justifying Investment, Common Myths, Life Cycle, Methodology for Implementation, Cost of Implementation.

UNIT-II: Selection-A Two Step Process, Roles and Responsibilities of Different Project Team Members, Core Team Selection, Consultant Selection, Requirement Gathering Process; BPR: Pros and Cons, Redesign, Reengineering, Benchmarking, Best Practices; Reasons for Gaps and Five Types of Gaps, ERP Project Management, Business Process Modelling and Business Modelling.

UNIT-III: Configuration, testing; Managing ERP Security: Types of Security Issues, System Access Security, Authorizations, Data Security and Technology for Managing Data Security; Data Migration: Migration of Data; Cutover, Go Live preparation; Training: Objective, Strategy, Environment and Technology, Train the Trainer Approach, Delivery, Content Development, Evaluation, Roles; Reasons for Failure of an ERP Implementation, Reasons for Success of ERP Implementation, Change Management.

UNIT-IV: Human Capital Management, Financial Management, Procurement and Inventory Management Through ERP, Production Planning and Execution, Supplier Relationship Management Supply Chain Planning, Sales and Service, Quality Management, Logistics Execution: Warehouse and Transport Management, Customer Relationship Management.

UNIT-V: Implementation Issues: Pre implementation issues, financial justification of ERP, evaluation of commercial software during implementation, ERP for industries: ERPs for Auto Industry, ERPs for Pharma, ERPs for Retail, ERPs for Educational Institutions, ERPs for Banks, ERPs for Insurance Companies; Case studies: mySAP Business Suite Implementation at ITC, Oracle ERP Implementation at Maruti Suzuki, Siebel CRM Implementation at Bharti Airtel.

Text books:

1. Enterprise Resource Planning by Rajesh Ray, Tata McGraw Hill Education, 2011.
2. ERP Demystified, 2nd Edition by Alexis Leon, Tata McGraw Hill Education, 2008.

References:

1. 1 ERP, Concepts & Practices by V.K. Garg & N.K. Venkatkrishnan, PHI, 2004.
2. Enterprise Resource Planning by Ashim Raj Singla, Cengage Learning, 2008

Course Outcome: At the completion of the course a student will be able to,

- Describe the Basic concepts and technologies used in ERP.
- Describe ERP package selection process.
- Describe the process of developing and implementing ERP systems.
- Identify and describe typical functional modules in ERP system.
- Explain the different applications of ERP systems.

Chhattisgarh Swami Vivekananda Technical University, Bhilai (C.G.)

Program / Semester: **B.Tech (VII Sem)**	Branch: **Artificial Intelligence and Data Sciences**
Subject: **NN and Fuzzy Application** ***(Professional Elective-III)***	Course Code: **D109734(022)**
Total / Minimum-Pass Marks (End Semester Exam): 100 / 35	**L: 1 T: 1 P: 0** Credits: **2**
Class Tests & Assignments to be conducted: **2 each**	**Duration (End Semester Exam): 03 Hours**

Course Objectives:

- To provide the student with the basic understanding of neural networks and fuzzy logic fundamentals, Program the related algorithms and Design the required and related systems.
- To cater the knowledge of Neural Networks and Fuzzy Logic Control and use these for controlling real time systems.

UNIT-I: Introduction to Artificial Neural Networks: Elementary Neurophysiology, Models of a Neuron, Neural Networks viewed as directed graphs, Feedback, from neurons to ANN, Artificial Intelligence and Neural Networks; Network Architectures, Single-layered Feed forward Networks, Multi-layered Feed forward Networks, Recurrent Networks, Topologies.

UNIT-II: Learning and Training: Activation and Synaptic Dynamics, Hebbian, Memory based, Competitive, Error-Correction Learning, Credit Assignment Problem: Supervised and unsupervised learning, Memory models, Stability and Convergence, Recall and Adaptation.

UNIT-III: A Survey of Neural Network Models: Single-layered Perceptron – least mean square algorithm, Multi-layered Perceptrons – Back propagation Algorithm, XOR – Problem, The generalized Delta rule, BPN Applications, Adalines and Madalines – Algorithm and applications.

UNIT-IV: Applications: Talking Network and Phonetic typewriter: Speech Generation and Speech recognition, Neocognitron – Character Recognition and Handwritten Digit recognition, Pattern Recognition Applications.

UNIT-V: Neural Fuzzy Systems: Introduction to Fuzzy sets, operations, relations, Examples of Fuzzy logic, Defuzzification, Fuzzy Associative memories, Fuzziness in neural networks and examples.

Text Books:

1. Artificial Neural Networks by B. Yagna Narayan, PHI.
2. Neural Networks Fuzzy Logic & Genetic Alogrithms by Rajshekaran& Pai, Prentice Hall.

Reference Books:

1. Neural Networks by James A. Freeman and David M. Strapetuns, Prentice Hall.
2. Neural Network & Fuzzy System by Bart Kosko, PHI.
3. Neural Network Design by Hagan Demuth Deale Vikas Publication House.

Course Outcome:

- To provide adequate knowledge about concepts of feed forward neural networks and feedback neural networks.
- To teach about the concept of fuzziness involved in various systems.
- To provide adequate knowledge about fuzzy set theory.