LNCT University B.TECH-AIML

VI SEM

Introduction to Cloud computing (AL-601)

COURSE OUTCOMES:

After Completing the course student should be able to

CO1	Explain the core concepts of the cloud computing paradigm
CO2	Apply fundamental concepts in cloud infrastructures
CO3	Discuss system, network and storage virtualization
CO4	Illustrate the fundamental concepts of cloud storage
CO5	Analyze various cloud program and setups

Course Contents

UNIT-1Introduction of Cloud Computing: What is Cloud Computing?, How it works?, Types of Cloud, Goals & Challenges, Leveraging Cloud Computing, Cloud Economics and Total Cost of Ownership, Cloud Service Models Software as a Service (SaaS): Introduction, Challenges in SaaS Model, SaaS Integration Services, Advantages and Disadvantages. Infrastructure As a Services (IaaS): Introduction, Virtual Machines, VM Migration Services, Advantages and Disadvantages. Platform As a service (PaaS): Introduction, Integration of Private and Public Cloud, Advantages and Disadvantages

UNIT-II Virtualization and Abstraction: What is Virtualization and how abstraction is provided in cloud? Advantages and Disadvantages, Types of Hypervisor, and Load balancing.

UNIT-III Amazon Web Services Getting started with AWS, AWS Compute, Storage, and Networking, AWS Security, Identity, and Access Management, AWS Database Options, AWS Elasticity and Management Tools

UNIT-IV Architecting on AWS Introduction to System Design: AWS Essentials Review and System Design for High Availability, Automation and Serverless Architectures: Event-Driven Scaling, Well-Architected Best Practices: Security, Reliability, Performance Efficiency, Cost Optimization and Deployment and Implementation: Design Patterns and Sample Architectures

UNIT-V Cloud Security Tools and technologies to secure the data in Private and Public Cloud Architecture. Security Concerns, Legal issues and Aspects, Multi-tenancy issues, Cloud Simulation overview.

REFERENCES:

1. Cloud Computing Bible, Barrie Sosinsky, Wiley-India, 2010
2. Cloud Computing: Principles and Paradigms, Editors: Rajkumar Buyya, James Broberg, Andrzej M. Goscinski, Wile, 2011Cloud Computing: Principles, Systems and Applications, Editors: Nikos Antonopoulos, Lee Gillam, Springer, 2012
3. Cloud Security: A Comprehensive Guide to Secure Cloud Computing, s, Wiley-India, 2010

Suggested List of experiments

Implementation of storage as a Service on cloud through oogleDrive. working with google docs and google spreadsheets ,Installation and hands on of Google App Engine Study and Implementation of virtualization through any Hypervisor.

Prepare any one Case Study on Cloud Computing Architecture Design for i) Banking System ii)Smart Agriculture iii) Ronald L. Krutz, Russell Dean VineSmart Education Installation and Configuration of Hadoop/Eucalyptus Hands on AWS, Microsoft Azure

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Natural Language Processing and Gen AI(AL602)

COURSE OUTCOMES:

After Completing the course student should be able to

CO1	Understand linguistic concepts and deep learning models for NLP.
CO2	Design and implement NLP pipelines with real-world data and preprocessing techniques.
CO3	Analyze transformer architectures and large language models (LLMs).
CO4	Apply and evaluate text generation methods in GenAI using advanced sampling strategies.
CO5	Explore cross-modal GenAI, including image and code generation, and address risks and safety concerns in LLMs.

Course contents

Objectives: The objective of this course is to teach students the basic concepts of Natural Language Processing, NLP Project Pipeline & Data Processing, Transformers, LLMS, Generative AI

UNIT I –Basics of Natural Language Processing &Deep Learning Approaches What is NLP? NLP in the real world: assistants, search, chatbots, translation, Key NLP tasks: sentiment analysis, NER, POS tagging, summarization, Linguistic Foundations, Phonemes, Morphemes, Lexemes, Syntax, Semantics, and Context Language ambiguity and complexity Challenges in NLP, Ambiguity in interpretation, Sarcasm, idioms, and figurative language, Language diversity and code-switching, Naive Bayes, Support Vector Machine (SVM), Decision Trees, Deep Learning for NLP Neural Networks, RNNs, LSTMs, GRUs, Convolutional Neural Networks for text, Introduction to Transformers (BERT, GPT), Transfer learning in NLP, Limitations of Deep Learning

UNIT II – NLP Project Pipeline & Data Processing The NLP Workflow Define task, Collect data, Preprocess, Model, Evaluate, Deploy, Data Acquisition Using public datasets (e.g., Kaggle, Hugging Face), Web scraping for NLP (BeautifulSoup, newspaper3k), Data Augmentation in NLP, Synonym, replacement, Back translation, TF-IDF-based word substitution ,Bigram flipping, Named Entity perturbation, Text Cleaning & Preprocessing, Removing HTML, Unicode normalization, Lowercasing, punctuation, stopword removal, Spelling correction and noise injection

UNIT III - Data Processing cntd. Tokenization & Segmentation Sentence segmentation, Word tokenization (spaCy, Hugging Face Tokenizers), Subword methods: BPE, WordPiece, Text Representation, Bag of Words, TF-IDF Word Embeddings: Word2Vec, GloVe, FastText, Contextual Embeddings: BERT, ELMo, N-gram language models, Masked Language Modeling (MLM), Causal Language Modeling (CLM).

Unit IV - Deep Dive into Transformers and LLM Architectures Why Transformers? Self-Attention Mechanism, Multi-Head Attention overview, Encoder vs Decoder, Positional Encoding, Residual Connections + Layer Norm, Evolution from Transformer → BERT → GPT, BERT Architecture:, Encoder-only, Masked Language Modeling (MLM), GPT Architecture: Decoder-only, Causal Language Modeling (CLM), Fine-tuning Concepts, Fine-tuning vs Pretraining, Why Fine-tuning is important (adapt LLMs to tasks), Introduction to LoRA / PEFT ideas, Evaluating Language Models + Challenges, Perplexity, BLEU, ROUGE, Issues in LLMs: Hallucination, Bias, Computation Cost

Unit V: Text Generation and Evaluation in Generative AI How AI generates Text, Autoregressive Gereration, Conditional Generation, Strategies for Text Generation, Greedy Search, Beam Search, Top-k sampling, Top-p sampling, Evaluating Generated Text, Human evaluation, Fluency, Coherence, Relevance, Automatic metrics, Perplexity, BLEU Score, ROUGE Score, Bias, Hallucinations, and Toxicity in LLMs, Techniques to Control AI Behavior, Prompt Engineering, Conditioning, Safe Decoding Method.

Reference Books-

1. Natural Language Processing with Python by Steven Bird, Ewan Klein and Edward Loper.
2. Foundations of Statistical Natural Language Processing by Christophe

List of Experiment

1. Write a program to perform text preprocessing (tokenization, stopword removal, stemming, lemmatization) using NLTK and spaCy.
2. Write a program to perform sentiment analysis on a movie review dataset using a Naive Bayes classifier.
3. Write a program to implement POS tagging and Named Entity Recognition (NER) using spaCy.
4. Write a program to implement text vectorization using Bag-of-Words and TF-IDF on a corpus of documents.
5. Write a program to train a Word2Vec model using Gensim and visualize word embeddings using PCA or t-SNE.
6. Write a program to compare contextual embeddings from BERT with traditional embeddings (e.g., Word2Vec).
7. Write a program to implement a text classification pipeline using Scikit-learn (e.g., classify news headlines).
8. Write a program to implement a simple RNN or LSTM for text generation using Keras or PyTorch.
9. Write a program to fine-tune a pre-trained BERT model using Hugging Face Transformers for a classification task.
10. Write a program to implement a chatbot using rule-based and retrieval-based methods.
11. Write a program to apply transformer-based summarization (e.g., using T5 or BART on an article).
12. Write a program to implement greedy, top-k, and top-p sampling for text generation using GPT-2.
13. Write a program to evaluate generated text using BLEU and ROUGE metrics.
14. Write a program to generate text-to-image prompts using DALL·E API or similar models.
15. Write a program to convert natural language to code using OpenAI Codex or Gemini APIs.
16. Write a program to demonstrate Retrieval-Augmented Generation (RAG) using a simple custom knowledge base.
17. Write a program to apply prompt engineering techniques for a text completion task using LLMs.
18. Write a program to demonstrate LoRA or PEFT fine-tuning on a lightweight transformer model.
19. Write a program to identify and mitigate hallucinations and bias in LLM-generated responses.
20. Write a program to analyze AI-generated output for ethical risks and apply filtering/guardrails.

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Computer Vision: Detection, Segmentation, and Optimization (AL603)

COURSE OUTCOMES:

After Completing the course student should be able to

CO1	Understand practice and theory of computer vision
CO2	Elaborate computer vision algorithms and methods with CNN
CO3	Implement computer vision systems with transfer learning
CO4	Apply domain adaptation for real-time object detection
CO5	Design and implement model compression using edge devices

Course contents

Objectives: to teach the basic concepts of Image Processing and Feature Engineering, Modern CNN rchitecture, Transfer Learning, Semantic segmentation

UNIT I - Image Preprocessing & Feature Engineering What is Image Preprocessing, Good and Bad Preprocessing, OpenCV Techniques for Preprocessing, Resizing Images, Normalization (Pixel Scaling), Denoising Images, Contrast Enhancement with CLAHE, Edge Detection using Canny Detector, Feature Extraction with HOG, Image Thresholding, Image Cropping, Building Preprocessing Pipelines, Steps of Preprocessing Pipelines

UNIT II - Modern CNN Architectures Evolution of CNNs, What is CNN, LeNet, Vanishing Gradient Problem, ResNet, Problems with Bigger CNNs, MobileNet, EfficientNet, ConvNeXt, MobileNetV3, Building Blocks of MobileNetV3, Depthwise Separable Convolutions, Squeeze-and-Excite (SE) Blocks, Hard-Swish Activation, ConvNeXt, Bigger Convolutions, LayerNorm, GELU, Vision Transformers (ViT), How ViT works, Self-Attention, Position Embedding

UNIT III - Transfer Learning, Domain Adaptation, and Real-Time Detection Transfer Learning, Feature Extraction, Fine-tuning, TensorFlow Hub & HuggingFace models, Pre-Trained Models, Find a Model on TensorFlow Hub, Load a Model from TensorFlow Hub, HuggingFace Hub, Find a Model on HuggingFace, Load a Model from HuggingFace

UNIT IV - Domain Adaptation, and Real-Time Detection Domain Adaptation, What is a "Domain"?, Source Domain vs Target Domain, Feature-Level Adaptation, Fine-tuning Layers for Domain Adaptation, Real-Time Object Detection, Object Detection, "Real-Time", YOLO, YOLOv8, YOLOv9, YOLOv8 vs YOLOv9, EfficientDet, BiFPN, Compound Scaling, EfficientDet Variants (D0 to D7)

UNIT IV - Semantic Segmentation and Model Compression Semantic Segmentation, Semantic Segmentation vs Object Detection, Hard, U-Net, U-Net — Left Side (Encoder), U-Net — Right Side (Decoder), Skip Connections, How U-Net Works, Mask2Former, Model Compression Techniques, Model Compression, Quantization, Quantization Aware Training (QAT), Model Pruning, Why Pruning Helps, QAT vs Pruning, Why Compression, Edge Devices, What is Model Compression, Quantization, Pruning, Knowledge Distillation,

Reference and Books:

1. Computer Vision - A modern approach, by D. Forsyth and J. Ponce, Prentice Hall Robot Vision, by B. K. P. Horn, McGraw-Hill.
2. Introductory Techniques for 3D Computer Vision, by E. Trucco and A. Verri, Publisher:Prentice Hall.
3. R. C. Gonzalez, R. E. Woods. Digital Image Processing. Addison Wesley Longman, Inc.,1992.

Suggested List of Experiments:

Image processing tasks on sample imageset with Open CV techniques, CNN architecture, YOLO models and U-Net

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Design Thinking and Innovation (AL604)

Course objectives To expose the student with state of the art perspectives, ideas, concepts, and solutions• related to the design and execution of projects using design thinking principles To prepare the mindset and discipline of systemic inspiration driven by a desire to identify• new sources of ideas, and new models especially outside their regular working atmosphere To propose a concrete, feasible, viable and relevant innovation project/challenge

COURSE OUTCOMES:

After Completing the course student should be able to

CO1	Learn basic terminology design thinking.
CO2	Apply empathizing techniques for real life design problems.
CO3	Develop maps as design thinking tools for primary and secondary research
CO4	Implement story telling and scenario planning to strengthen innovation.
CO5	Create business model for engineering domain real life challenges.

Course Contents

Unit 1 What is Different About Design thinking? Design Thinking Skill ,Principles of Design Thinking, The Basis for Design Thinking, Process, tools, project and case study, models of design thiniking

Unit 2 Listening and Empathizing Techniques – observation – structured open ended approach - , Analysis, Design Thinking Frameworks, Ideation tools – brainstorming, innovation heuristics, behaviour models, overcoming cognitive fixedness – Exercises and case based discussions

Unit 3 Use of Diagrams and Maps in Design Thinking – Empathy map. Affinity diagram, mind map, journey map, combining ideas into complex innovation concepts. Secondary research and primary research, contextual inquirt

Unit 4 Story telling – improvisation, scenario planning, development of scenarios, evaluation tools, frog design and prototyping – soft,medium,final – apply frameworks to strengthen communication – sustain a culture of innovation, usability studies

Unit 5 Engineering aspect of design, Electrical, Mechanical, Design, Material, Aspect, Safety and Reliability aspect , Creating business model, Introduction of Startup with entrepreneurship approach: What is entrepreneurship, being an entrepreneurship, Challenges and possibilities of Entrepreneurship? How to Start up, Start-up Fundamental, Being Successful

References:

- Roger Martin, "The Design of Business: Why Design Thinking is the Next Competitive Advantage",Harvard Business press , 2009.
- Hasso Plattner, Christoph Meinel and Larry Leifer (eds), "Design Thinking: Understand – Improve– Apply", Springer, 2011
- Idris Mootee, "Design Thinking for Strategic Innovation: What They Can't Teach You at Business or Design School", John Wiley & Sons 2013
- Jeanne Liedtka , Andrew King, Kevin Bennett , “Book - Solving Problems with Design Thinking - Ten Stories of What Works” (Columbia Business School Publishing), 2013
- Maurício Vianna, Ysmar Vianna, Isabel K. Adler, Brenda Lucena, Beatriz Russo, “Design thinking: Business Innovation” MJV Press, 2011
- Burgelman, Christensen, and Wheelwright, “Strategic Management of

Technology and Innovation"5th Edition, McGraw Hill Publications,

www.dsource.in
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https://dsource.in/dti
https://dsource.in/case-study
https://dsource.in/course
https://dsource.in/tools
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List of experiments

1. Case study Jellow Communication . Practice Project selection and brain storming
2. Mindmapping of selected project Examples – Smaran design for elderly ,GOGO app for elderly
3. Perform user participating mapping for the project , ex. Smart agriculture, Solar powered Pesticide Sprayer
4. Design Cue cards for sample project for ex. Lapcrate
5. Perform storytelling for E-commerce websites ::Identify project artifacts, activity, spatial mappings for the same
6. Complete analysis of Project Geolight and apply tools brain storming, idea sketching, scamper
7. Perform usability study for any one project

AL 606 Major Project Syllabus

The major project involves designing and developing a comprehensive full stack application/Deep learning that solves a real-world problem. Students will start with requirement analysis, system design, and data modeling for the application. The frontend development will include dynamic pages, routing, user authentication, and effective state management. The backend will handle complex logic, secure data transactions, and seamless integration with the database using APIs. The project will include robust testing, performance tuning, and deployment on a scalable hosting environment. A detailed project report, including system architecture, challenges faced, and future enhancements, will be submitted along with a live demonstration.