List of Elective Courses Offered by B. Tech. CSE Artificial Intelligence & Machine Learning (AI&ML)

Scheme

Course Code	Course Name	L	T	P	Credits
CSL469	Mobile Application Development	3	0	2	4
CSL470	Cognitive Computing	3	0	0	3
CSL471	Foundations of Generative AI	3	0	2	4

Note: The elective courses from elective buckets of B.Tech in CSE (with specialization) can be offered to B.Tech CSE (Core) students and Vice-versa.

Syllabus

<table>
<tr><td>Course Code:</td><td>CSL 469</td><td>Course Title:</td><td>Mobile Application Development</td></tr>
<tr><td>Category:</td><td>Elective</td><td>Credit Assigned</td><td><table><tr><td>L</td><td>T</td><td>P</td><td>C</td></tr><tr><td>2</td><td>1</td><td>2</td><td>4</td></tr></table></td></tr>
<tr><td>Pre-Requisite (if Any)</td><td>None</td><td>Type of Course</td><td>Computer Science and Engineering</td></tr>
<tr><td colspan="4">Course Outcomes:
On successful completion of the course, students will be able to:
1. Build native Android apps using programming languages.
2. Develop iOS applications using latest technologies.
3. Create cross-platform apps with latest technologies.
4. Implement backend integration and cloud storage solutions.
5. Optimize, test, and deploy mobile apps to app stores.</td></tr>
<tr><td colspan="4">Course Contents:

Module 1: Introduction to Mobile App Development
Overview of Mobile Platforms (Android vs. iOS), Native vs. Cross-Platform Development, Mobile App Development Lifecycle, Setting Up Development Environments (Android Studio, Xcode, VS Code), Introduction to UI/UX for Mobile Apps

Module 2: Android App Development
Android Architecture & Components (Activities, Fragments, Intents), UI Design with XML & Jetpack Compose, Layouts and Views (TextView, Button, EditText, RecyclerView, etc.) Event Handling and Intents (Explicit & Implicit) Resource Management: Strings, Colors, Dimensions, Styles, Themes, Fragments and Navigation, RecyclerView, Navigation Component, ViewModel&LiveData, Data Storage (Room Database, SharedPreferences), Networking (REST API Integration with Retrofit/Volley)

Module 3: iOS App Development
Introduction to Swift & SwiftUI, iOS Architecture (MVC, MVVM), User Interface Design with SwiftUI, Core Data & SQLite for Local Storage, Firebase connectivity, Networking in iOS (URLSession, Alamofire)</td></tr>
</table>

Module 4: Cross-Platform Mobile Development
Introduction to React Native, Setting Up and Building UI Components, Navigation and Routing, Accessing APIs and Local Databases, State Management (Redux, Provider, Riverpod), API Integration and Data Handling, Performance Optimization for Cross-Platform Apps. Introduction to Flutter

Module 5: Advanced Topics & Deployment
Firebase for Authentication & Cloud Storage, Push Notifications (FCM & APNs), Firebase for real-time data-driven apps, App Monetization Strategies (Ads, In-App Purchases), App Testing & Debugging (Unit Testing, UI Testing), App Deployment (Google Play Store & Apple App Store)

Text Books:

1. Android Programming: The Big Nerd Ranch Guide, Bill Phillips, Chris Stewart, and Kristin Marsicano, 5th Edition, Big Nerd Ranch, 2022.
2. Kotlin for Android Developers, Antonio Leiva, 1st Edition, Leanpub, 2018.

Reference Books:

1. React Native Cookbook, Dan Ward, 2nd Edition, Packt Publishing, 2019.
2. Flutter for Beginners, Alessandro Biessek, 1st Edition, Packt Publishing, 2019.
3. iOS Programming: The Big Nerd Ranch Guide, Christian Keur and Aaron Hillegass, 8th Edition, Big Nerd Ranch, 2019.

CO PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2		1	1	1				1	1	1
CO2	1	1	1	2	3	1				1	1	1
CO3		1	3	1	1	2			1	1	1	1
CO4		1	2	1	2	1			1	1	1	1

Note:
3: High
2: Medium
1: Low

Course Code:	**CSL 470**	**Course Title:**	**Cognitive Computing**			
Category:	**Elective**	**Credit Assigned**	**L**	**T**	**P**	**C**
			3	**0**	**0**	**3**
Pre-Requisite (if Any)	**None**	**Type of Course**	**Computer Science and Engineering**			

Course Outcomes:
On successful completion of the course, students will be able to:

1. Understand the fundamental concepts of cognitive computing and its relationship with artificial intelligence.
2. Explore key cognitive computing techniques, including natural language processing, machine learning, and knowledge representation.
3. Develop and implement cognitive computing models for real-world applications in domains like healthcare, finance, and smart cities.
4. Evaluate the performance of cognitive computing systems and compare them with traditional AI approaches.

Course Contents:

Module 1:
Foundations of Cognitive Computing: Introduction to Cognitive Computing, Difference Between AI, Machine Learning, and Cognitive Computing, Characteristics of Cognitive Systems, Gaining Insights from Data, Understanding Cognition (System 1 & System 2 Thinking), Infrastructure of Cognitive Systems, Data Access, Metadata, and Corpus Management, Continuous Learning and Hypothesis Generation, Applications of Cognitive Computing.

Module 2:
Cognitive System Design & Learning: Components of a Cognitive System, Corpus Development & Management, Feature Extraction and Data Preprocessing, Machine Learning for Cognitive Computing: Supervised, Unsupervised, and Reinforcement Learning, Pattern Recognition and Knowledge Representation, Advanced Analytics in Cognitive Systems, Predictive, Text, Image, and Speech Analytics, Business Value of Advanced Analytics.

Module 3:
Natural Language Processing & Knowledge Representation: Role of NLP in Cognitive Systems, Contextual Understanding & Word-Sense Disambiguation, Language Identification, Syntax, and Semantics, Knowledge Representation, Taxonomies and Ontologies in Cognitive Systems, Semantic Web and Graph-Based Knowledge Representation, Big Data & Cognitive Computing, Role of Structured and Unstructured Data, Hadoop, and Streaming Data for Cognitive Systems

Module 4:
Cognitive Decision Making & Cloud Computing: Cognitive Decision Models, Hypothesis Generation and Scoring, Explainability in Cognitive Systems, Cloud & Distributed Computing for Cognitive AI: Cloud Models (Public, Private, Hybrid), AI Workloads in the Cloud Security and Governance in Cognitive Systems, Ethical Considerations & Bias in Decision-Making, Regulatory Compliance for Cognitive AI.

Module 5:
Applications & Future Trends in Cognitive Computing: Industry Applications, Cognitive Healthcare Systems, Smart Cities and Cognitive IoT, Cognitive Finance and Fraud Detection, Building Cognitive AI Systems, Designing a Chatbot or Cognitive Assistant, Real-World Use Cases of IBM Watson, Future of Cognitive Computing, Neurosynaptic & Quantum Architectures, Next-Gen AI & Cognitive Systems

Text Books:

1. **"**Cognitive Computing and Big Data Analytics**"**, *Judith Hurwitz, Marcia Kaufman, Adrian Bowles;* John Wiley & Sons 2015

Reference Books:

1. "Quantum Models of Cognition and Decision", Jerome R. Busemeyer and Peter D. Bruza; Cambridge University Press 2012
2. "COGNITIVE SCIENCE An Introduction to the Study of Mind", Jay Friedenberg and Gordon Silverman, Sage Publications 2006.
3. "Big-Data Analytics for Cloud, IoT and Cognitive Computing", Kai Hwang and MinChen, Wiley 2017.

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2		1	1	1				1	1	1
CO2	1	1	1	2	3	1				1	1	1
CO3		1	3	1	1	2			2	1	2	1
CO4		1	2	1	2	1			1	1	1	1

Note:
3: High
2: Medium
1: Low

Course Code:	**CSL 471**	**Course Title:**	**Foundations of Generative AI**
Category:	**Elective**	**Credit Assigned**	**L** **T** **P** **C** **3** **0** **2** **4**
Pre-Requisite (if Any)	**None**	**Type of Course**	**Computer Science and Engineering**

Course Outcomes:

On successful completion of the course, students will be able to:

1. Understand the fundamentals and applications of Generative AI
2. Implement and optimize GANs for high-quality content generation.
3. Fine-tune Large Language Models (LLMs) for text generation.
4. Explore diffusion models for image and video synthesis.
5. Analyze ethical considerations and future trends in Generative AI

Course Contents:

Module 1: Introduction to Generative AI & Advanced Probability Models

Fundamentals of Generative AI and its evolution, Foundations of Generative AI (Principles, Paradigms, and Techniques), Advanced Probability & Statistical Methods for Generative Models, Bayesian Learning and Probabilistic Graphical Models (PGMs), Information Theory in Generative AI (Entropy, KL Divergence, Mutual Information), Energy-Based Models (EBMs) and Boltzmann Machines

Module 2: Deep Learning Architectures for Generative AI

Advanced Neural Network Architectures (ResNets, EfficientNets, Vision Transformers), Autoencoders (AEs) and Variational Autoencoders (VAEs) in Depth, Normalizing Flows for Efficient Sampling, Neural Style Transfer and Deep Dream, TensorFlow/PyTorch Techniques for Large-Scale Generative Models

Module 3: Generative Adversarial Networks (GANs) & Variants
Theoretical Foundations of GANs (Minimax Game Theory), Advanced GAN Architectures (BigGAN, StyleGAN, CycleGAN, StarGAN), Conditional GANs (cGANs) for Controlled Data Generation, Self-Supervised Learning in GANs, GAN Inversion and Interpretability Techniques

Module 4: Large Language Models (LLMs) & Advanced Text Generation
Self-Attention and Transformer-based Architectures (GPT, BERT, T5), Pre-training vs. Fine-tuning Strategies for LLMs, Reinforcement Learning from Human Feedback (RLHF) in Text Generation, Prompt Engineering and Prompt-Tuning Techniques, Retrieval-Augmented Generation (RAG) and Memory-Augmented LLMs

Module 5: Diffusion Models, Multi-Modal AI & Future Trends
Denoising Diffusion Probabilistic Models (DDPM), Score-Based Generative Models & Latent Diffusion Models (LDMs), Text-to-Image Models (DALL·E, Stable Diffusion, Imagen), Multi-Modal AI (CLIP, Flamingo, Gemini), Generative AI for 3D and Video Synthesis (NeRF, DreamFusion), Agent AI (Autonomous AI Agents, AutoGPT, BabyAGI), Ethical AI, Explainability, and Future Directions.

Text Books:

1. "Applied Generative AI for Beginners", Akshay Kulkarni,Adarsha Shivananda, Anoosh Kulkarni, Dilip Gudivada , Apress Publishing, 2023.
2. "Foundations of Large Language Models", Tong Xiao and Jingbo Zhu,NLP; NLP Lab, Northeastern University & NiuTrans Research 2025

Reference Book:

1. "Build a Large Language Model (From Scratch)" – Sebastian Raschka, Manning Publications 2025

CO PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2		1	1	1				1	1	1
CO2	1	1	1	2	3	1				1	1	1
CO3		1	3	1	1	2			1	1	1	1
CO4		1	2	1	2	1			1	1	1	1

Note:
3: High
2: Medium
1: Low