

CSE4357: LARGE LANGUAGE MODELS

Sl.No.	Lessons/Topics to be covered	Book Reference (sections)	Mapping with COs	Home Work/ Assignments/ Quizzes
1	Introduction to the course and its motivation. Course description, objective, credit, grading pattern, class session of the course. NBA provided program outcomes and departmental program specific outcomes.	-	-	
2	Comparison of Traditional ML with LLM	JA Chap-1, Pg. 25–26	CO1	
3	History of Language AI and Different Models (Non-Transformer—BoW, embedding-dense vector embedding)	JA Chap-1, Pg. 5–7	CO1	
4	Transformer Model, Encoder Decoder, Encoder-Decoder	JA Chap-1, Pg. 11–14	CO1	
5	Transformer Model, Encoder Decoder, Encoder-Decoder Contd., Open Models	JA Chap-1, Pg. 11–15	CO1	
6	Tokenization and its types, LLM tokenizer (BPE, SentencePiece, WordPiece)	JA Chap-2, Pg. 39–48	CO1	
7	LLM tokenizer (BPE, SentencePiece, WordPiece) Contd.	JA Chap-2, Pg. 48–54	CO1	
8	Tokenizer Properties, Token embeddings	JA Chap-2, Pg. 55–72	CO1	
9	Autoregressive model, Basics of Transformer Architecture, choosing a single token from probability distribution, parallel token processing	JA Chap-3, Pg. 73–83	CO2	
10	Components of the forward pass—tokenizer, stack of transformer blocks, LLM head	JA Chap-3, Pg. 83–95	CO2	
11	Components of the forward pass—tokenizer, stack of transformer blocks, LLM head Contd.	JA Chap-3, Pg. 95–104	CO2	
12	Text Classification with representation model—using task-specific model	JA Chap-4, Pg. 113–116	CO3	
13	Text Classification with representation model—using embedding model	JA Chap-4, Pg. 116–126	CO3	
14	Text Classification with generative model	JA Chap-4, Pg. 127–134	CO3	Quiz 1

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15	A common pipeline for text clustering—embedding models, dimensionality reduction models (PCA), cluster model	JA Chap-5, Pg. 139–145	CO3	
16	Text Clustering to Topic Modeling—BERTopic	JA Chap-5, Pg. 146–152	CO3	
17	Text Clustering to Topic Modeling—BERTopic Contd.	JA Chap-5, Pg. 152–163	CO3	
18	Using text generation models, Introduction to prompt engineering	JA Chap-6, Pg. 167–173	CO3	Assignment 1
19	Advanced Prompt Engineering—Potential complexity of a prompt, Chain prompting	JA Chap-6, Pg. 175–182	CO3	
20	Model I/O—Loading quantized models using LangChain, A single link in the chain, A Chain with multiple parameters	JA Chap-7, Pg. 200–208	CO3	
21	Memory—conversation buffer, windowed conversation buffer, Agents—ReAct in LangChain	JA Chap-7, Pg. 209–223	CO3	
22	Semantic Search—Dense Retrieval, Reranking, Retrieval evaluation metrics	JA Chap-8, Pg. 226–238	CO4	
23	Semantic Search—Dense Retrieval, Reranking, Retrieval evaluation metrics Contd.	JA Chap-8, Pg. 239–248	CO4	
24	Retrieval Augmented Generation (RAG)—Techniques and Evaluation	JA Chap-8, Pg. 249–257	CO4	
25	Transformers for vision, Multimodal embedding models—CLIP, OpenCLIP	JA Chap-9, Pg. 260–272	CO5	
26	Making text generation models multimodal—BLIP2 and its use cases	JA Chap-9, Pg. 273–283	CO5	
27	Embedding Models, Contrastive Learning, SBERT	JA Chap-10, Pg. 291–295	CO6	
28	Creating and Embedding Model—Contrastive examples, training, evaluation, loss function	JA Chap-10, Pg. 296–308	CO6	Quiz 2

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29	Fine-tuning an embedding model—supervised, augmented SBERT	JA Chap-10, Pg. 309–315	CO6	
30	Unsupervised Learning—TSDAE for domain adaptation	JA Chap-10, Pg. 316–319	CO6	
31	Supervised Classification—Fine-tuning a pretrained BERT model, freezing layers	JA Chap-11, Pg. 323–332	CO6	
32	Few-shot classification—SetFit, fine-tuning for few-shot classification	JA Chap-11, Pg. 333–339	CO6	
33	Pre-training with masked language modeling	JA Chap-11, Pg. 340–344	CO6	
34	Named-Entity Recognition—data prep and fine-tuning	JA Chap-11, Pg. 345–352	CO6	
35	Three LLM training steps—pretraining, supervised fine-tuning, preference tuning	JA Chap-12, Pg. 355–357	CO6	
36	Supervised Fine-Tuning—Full-tuning, Parameter Efficient Fine-tuning (PEFT)	JA Chap-12, Pg. 357–366	CO6	
37	Instruction tuning with QLoRA—templating instruction data, model quantization, LoRA configuration	JA Chap-12, Pg. 367–370	CO6	
38	Instruction tuning with QLoRA—templating instruction data, model quantization, LoRA configuration Contd., training and merging weights	JA Chap-12, Pg. 370–372	CO6	Assignment 2
39	Evaluating generative models—preference tuning, alignment, RLHF	JA Chap-12, Pg. 373–378	CO6	
40	Automating preference evaluation—reward model, preference tuning with DPO	JA Chap-12, Pg. 379–388	CO6	