SCHOOL OF ENGINEERING & TECHNOLOGY

COURSE FILE

Program: CSE
Course Code: CSE3720
Course Title: Generative AI and LLMs
Module Semester: Core Elective
Session: 6th Sem

Index

S. No.	Topics
1.	Course Details: Course-Code; Course Title; Semester/Term/Module; Year
2.	Vision, Mission of the University
3.	Graduate Attributes of the BMU Students
4.	Vision, Mission of the School
5.	PEOs and POs & PSOs of the Program
6	Course Description and its objectives
7	Course Outcomes and CO-PO Mapping
8	Course Syllabus: (including Course Content with Module-wise teaching hours allocated; Readings, Activities, Teaching Strategy, and Module mapped to COs, Text Book(s), Reference Books, Other learning resources)
9	Detailed Session wise Plan
10	Weekly Timetable
11	Registered Students List
12	Details of Internal Assessments; weightages, due dates, mapping to CO
13	Mid Semester Question papers with sample solutions
14	Sample Evaluated Internal Submissions and Identification of weak students.
15	Reflections from the Mid-term semester feedback received, and interventions made to enhance the student learning and continuous improvement in teaching and learning strategies.

16	Interventions made for slow performers and advanced learners, highlighting initiatives taken for student improvements (retest, resubmissions etc.)
17	End Semester Question papers with sample solutions
18	Detail of Marks in all components up to the End Semester
19	Attendance Report
20	Final record of Results (including the grades)
21	Analyzing Direct Feedback received on Course Outcomes
22	CO Attainment Measurement Analysis
23	Interventions made for slow performers and advanced learners, highlighting initiatives taken for student improvements (retest, resubmissions etc.)
24	End Semester Question papers with sample solutions
25	Feedback (class committee or otherwise) and corrective actions (if any)
26	Faculty Course Review (if any, like Use of Innovative Pedagogies; Technology; Experiential Learning; Integration with the Vision and Mission of the University; Feedback; Course Outcome attainment for the next run of the course)
27	Any other additional information

1. Course Details

- Course Code: CSE3720
- Course Title: Generative AI and LLMs
- **Module/Semester: Core Elective**
- Session: 6th Sem

2. Vision, Mission of the University

Vision

BML Munjal University seeks to nurture ethical leaders who are skilled, knowledgeable and have the life skills required for leading their organizations to success. The university shall seek the advancement and dissemination of practically oriented knowledge benchmarked with the best global standards.

Mission

BML Munjal University aims to be a leading university for the quality and impact of its teaching, research and linkages with major stakeholders. The focus of the university is to find creative solutions to problems through application of knowledge. The university aims to create a talented community of students and faculty who excel in teaching, learning and research, in a creative and stimulating environment. The university will collaborate with other institutions for development of science, technology and arts in the global context.

3. Graduate Attributes

- Acquire and apply practical understanding of discipline knowledge.

- Demonstrate a sense of ethics and display excellence in both personal and professional life.

- Exhibit problem solving, critical thinking skills and investigative capability to address real world problems.

- Manifest leadership qualities and work effectively in teams across globally diverse environments.

- Be a lifelong learner with an entrepreneurial mindset to innovate in the constantly changing global scenario.

- Possess a strong sense of inquiry and design innovative solutions for positive societal impact.

- Be effective communicators and possess an empathetic outlook.

4. Vision, Mission of the School

Vision of School:

To be amongst the leading engineering schools of the country recognized globally for excellence in teaching and research with focus on experiential learning, innovation and entrepreneurship.

Mission of School:

* Providing high-quality learning experience to our students, preparing them to be global leaders, and contributing to the development of society through research, innovation, and entrepreneurship.
* Creating an inclusive and diverse learning environment that fosters creativity, critical thinking, and ethical values.

* Collaborating with industry, government, and other institutions to address complex societal challenges and promote sustainable development.

5. PEOs and POs & PSOs of the Program

Program Educational Objectives (PEO):
a) PEO 1: Identify real-life problems and develop creative and innovative hardware/software-based solutions.
b) PEO 2: Achieve professional development through self-learning to adapt to the technological changes in the ever changing field of computing.
c) PEO 3: Engage in life-long learning of computer engineering technologies, critical thinking and continuous ingenuity and apply them in real-life applications.
d) PEO 4: Accomplish leadership roles by imbibing ethics and professionalism with emphasis on sustainable development of the society.

Program Outcomes (PO):
e) PO1: Apply the foundational concepts of mathematics, science and computer engineering to find novel solutions for complex real-life engineering problems.
f) PO2: Identify, formulate, review literature and analyze complex computer engineering problems reaching substantiated conclusions and derive a coherent logic that can be implemented by computers.
g) PO3: Design analytical and computational models for solving complex engineering problems giving due consideration to issues related to public health and safety, cultural and societal constraints, and environmental concerns.
h) PO4: Use research-based knowledge, methods, tools and techniques for data collection, designing digital computing systems, analyzing and interpreting the results to provide substantiated conclusions.
i) PO5: Use appropriate tools to model complex computer engineering problems through identification of the limitations and creating solutions to predict the real-world phenomena.
j) PO6: Use appropriate contextual knowledge of computer engineering to review and assess societal, health, legal, cultural, safety and contemporary issues and rationalize the ensuing responsibilities towards the society.
k) PO7: Adopt computer engineering practices in congruence with societal need, understand the working practices and its impact on natural resources for sustainable development.
l) PO8: Use ethical principles to pursue excellence in developing computer engineering systems and behave appropriately to develop a reliable and trustworthy relationship with others.
m) PO9: Function effectively as a reliable and responsible individual, and as a member or leader in diverse computer engineering teams, and in multidisciplinary settings, thereby placing team goals ahead of individual interests.
n) PO10: Communicate effectively by capturing the desirable computer system requirements for preparation of specification documents, write clear and concise report such as laboratory files, research papers, thesis, and presentation materials.
o) PO11: Demonstrate knowledge of computer engineering and management principles for the completion of individual or group projects in multidisciplinary environments.
p) PO12: Recognize the evolving technological changes and engage as an independent and life-long learner in both computing and non-computing fields.

Program Specific Outcomes (PSO):
q) PSO1: Identify applicable tools and techniques related to data science practice such as data

collection, cleaning, analysis, modelling, evaluation and result interpretation and apply them for deriving hidden and meaningful patterns for appropriate actionable insights.

r) PSO2: Develop intelligent systems for various real-life domains like healthcare, transportation, finance etc. using Artificial Intelligence methodologies.

s) PSO3: Understand the foundational concepts and techniques to protect computing systems against constantly evolving cybersecurity threats and analyze security breaches and violations of cyber systems and networks to provide appropriate solutions.

t) PSO4: Design effective security systems to mitigate risks, threats and vulnerabilities for protecting the organizations against cyber threats.

6. Course Description and its objectives

This course aims to provide students with a comprehensive understanding of generative artificial intelligence, focusing on large language models. Students will learn how to design, train, and deploy generative AI systems, with a particular emphasis on Large Language Models. They will explore the principles, applications, and ethical considerations surrounding these technologies. The course describes in detail the transformer architecture that powers LLMs, how they're trained, and how fine-tuning enables LLMs to be adapted to a variety of specific use cases.

7. Course Outcomes and CO-PO Mapping

Course Outcomes:

CO1: Develop a deep understanding of generative AI principles, encompassing various generative models and their practical applications for diverse real-world scenarios.

CO2: Apply Generative Adversarial Networks (GANs), LLMs, and Sequence Models specifically Seq2Seq models and Variational Autoencoders (VA2Es), strategies for designing effective prompts.

CO3: Evaluate frameworks that ensure the responsible deployment of generative models, fostering a commitment to ethical considerations.

CO/PO Mapping:

CO- PO and PSO Mapping

CO/PO Mapping	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1			3	3	3	2				3		3	3	3		
CO2	2	3		3	3	2					1		3	3		
CO3		2	3	3	2			3	3	1		3	3	3	1	1

Experiential Learning Component:

Project as mentioned in the above table, is the experiential learning component for this course. Students will be given challenging real-life problems. They will be asked to build solutions by applying suitable learning algorithms. The students are also expected to implement and show results of the proposed solution and perform a comparative analysis with different available algorithms. A separate assessment will be conducted for evaluating the solution provided by each student. The students are also expected to implement and show the results of the proposed solution or attempt to reimplement and improve on a research paper on a topic of their choice. Approximately 60-70% is experiential learning.

Assessment Pattern: The final grade will be based on the marks/ grades obtained in the mid-semester and end-semester evaluation and other assessments defined in the assessment table. The relative grading method described in the university's academic regulations will be followed to grade the students. The student must secure a minimum of 40% of marks after completing all the assessments in the following table to become eligible for grading.

8. Course Syllabus

Sr. No.	Content	CO	Sessions
1	Generative AI: What is generative AI, Different types of generative AI models, Understand the principles and applications of Generative AI in creating new data instances, Understand the principles behind Generative AI: Get familiar with building and tweaking generative models for any real-world use case. Generative AI Project Lifecycle.	1	4
2	Seq2Seq Models and Variational Autoencoders (VAEs): Sequence-to-Sequence models, Variational Autoencoders Text-to-Text generation, Image and text-based VAE applications.	2	3
3	Generative Adversarial Networks (GANs): Understanding GAN architecture, GAN training process, GAN applications in image and video generation.	2	2
4	Transformers: Learn about the architecture of Transformer models, including attention mechanisms, encoders, and decoders, Understand pre-training and fine-tuning strategies. Dive into popular Transformer models: BERT (encoder-only), GPT (decoder-only), and T5 (encoder-decoder) etc. Gain deeper insights into the capabilities and potential of Transformer technology.	2	5
5	LLMs: Learn about Language Models (LLMs) and their role in understanding and generating human-like text. Different types of LLMs, Different training datasets for LLMs, Training methods for LLMs, Challenges in training LLMs, Different evaluation metrics for LLMs, Challenges in evaluating LLMs, Practical Implementation of LLMs, and how fine-tuning enables LLMs to be adapted to a variety of specific use cases.	2	6
6	Prompts Module: Understanding the concept and significance of prompt engineering, Strategies for designing effective prompts, Techniques for controlling model behavior and output quality, Introduction to LangChain and its objectives, Overview of the LangChain framework and its component.	2	5
7	Ethical Considerations of Generative AI and LLMs: Potential biases in generative AI models, Misinformation and disinformation generated by LLMs and Other ethical concerns Addressing bias and fairness in generative AI systems Ensuring responsible use and deployment of generative models.	3	7

9. Learning Resources

Text Books:

✓ Generative Deep Learning: Teaching Machines to Paint, Write, Compose, and Play by David Foster, O'Reilly Media. Second edition: June 6, 2023 (ISBN: 978-1098134181)

✓ Generative AI with LangChain: Build large language model (LLM) apps with Python, ChatGPT, and other LLMs by Ben Auffarth, Packt Publishing, first edition : December 22, 2023 (ISBN-13: 978-1835083468)

Reference Links:

• Vaswani, Ashish, Noam Shazeer, Niki Parmar, Jakob Uszkoreit, Llion Jones, Aidan N. Gomez, Łukasz Kaiser, and Illia Polosukhin. Attention is all you need. Advances in neural information processing systems 30 (2017).

• Yenduri, Gokul, Gautam Srivastava, Praveen Kumar Reddy Maddikunta, Rutvij H. Jhaveri, Weizheng Wang, Athanasios V. Vasilakos, and Thippa Reddy Gadekallu. Generative Pre-trained Transformer: A Comprehensive Review on Enabling Technologies, Potential Applications, Emerging Challenges, and Future Directions. arXiv preprint arXiv:2305.10435 (2023).

• Liu, Yang, Yuanshun Yao, Jean-Francois Ton, Xiaoying Zhang, Ruocheng Guo Hao Cheng, Yegor Klochkov, Muhammad Faaiz Taufiq, and Hang Li. Trustworthy LLMs: a Survey and Guideline for Evaluating Large Language Models' Alignment. arXiv preprint arXiv:2308.05374 (2023).

10. Weekly Timetable

Time	Monday	Tuesday	Wednesday	Thursday	Friday
9:15-10:10					
10:15-11:10			Generative AI and LLMs (CSE3720)		
11:15-12:10		Generative AI and LLMs (CSE3720)			
12:15-13:10		Generative AI and LLMs (CSE3720)			
13:15-14:10		Generative AI and LLMs (CSE3720)	Generative AI and LLMs (CSE3720)		
14:15-15:10		Generative AI and LLMs (CSE3720)			
15:15-16:10		Generative AI and LLMs (CSE3720)	Generative AI and LLMs (CSE3720)		
16:15-17:10					
17:15-18:10		Generative AI and LLMs (CSE3720)			

11. Student List

uniqueId	studentName
210C2030002	Aayush Dubey
210C2030004	PelletiSujith Reddy
210C2030007	Malladi Sai Prabhas
210C2030010	SubhranshBehura
210C2030014	Abhimanyu Gulati

12. Internal Assessment Data

Component	Duration	Weightage	Evaluationweek	Remarks
Assignment	2 Weeks	20%	Continuous	Participation + Viva
Quiz	20 mins	20%	Continuous	Understanding of theoretical concepts
Project proposal		40%	Mid-Semester	Literature survey, Methodology, and Preliminary Results
Project Evaluation		40%	End Term	Project-Based

13. Weak Students Data

uniqueId	studentName	totalMarks	grade
210C2030002	Aayush Dubey	83	A+
210C2030010	SubhranshBehura	87	A+
210C2030014	Abhimanyu Gulati	47	R

13. Weak Students Data

14. Actions taken for weak students

- Hey

15. Marks Details

uniqueId	studentName	totalMarks	grade
210C2030002	Aayush Dubey	83	A+
210C2030004	PelletiSujith Reddy	78.5	B
210C2030007	Malladi Sai Prabhas	81.5	B+
210C2030010	SubhranshBehura	87	A+
210C2030014	Abhimanyu Gulati	47	R

15. Marks Details

17. Attendance Report

uniqueId	studentName	attendance
210C2030002	Aayush Dubey	88
210C2030004	PelletiSujith Reddy	90
210C2030007	Malladi Sai Prabhas	78
210C2030010	SubhranshBehura	82
210C2030014	Abhimanyu Gulati	68