SCHOOL OF ENGINEERING & TECHNOLOGY

COURSE FILE

Program: CSE
Course Code: CSE3023
Course Title: XAI: Explainable AI
Module Semester: Core Elective
Session: 7th Sem

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1.   Course Details

- Course Code: CSE3023
- Course Title: XAI: Explainable AI
- **Module/Semester: Core Elective**
- Session: 7th 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

The Explainable AI (XAI) course focuses on the principles and practices essential for understanding and interpreting AI systems. It covers foundational topics in machine learning, deep learning, generative AI, and large language models, emphasizing techniques like SHAP (SHapley Additive exPlanations), LIME (Local Interpretable Model-agnostic Explanations), saliency maps, and attention mechanisms. Students will learn to apply these tools to make complex AI models more transparent and interpretable, addressing both ethical and social implications.

This course integrates theoretical knowledge with practical applications, providing insights into the challenges and future directions of XAI, including its application to generative models and large language models. Students will gain skills in interpreting AI decisions, understanding various XAI techniques, and communicating findings to stakeholders. Through real-world case studies and practical exercises, participants will develop the expertise needed to enhance the transparency and accountability of AI systems.

7. Course Outcomes and CO-PO Mapping

Course Outcomes:

CO1: Understand what Explainable AI is, its scope, and impact on various domains.

CO2: Identify and evaluate the most used XAI techniques and algorithms.

CO3: Develop practical skills in Python for implementing and interpreting XAI methods and interpret the results

CO- PO and PSO Mapping

CO/PO Mapping	P01	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:

8. Course Syllabus

Sr. No.	Content	CO	Sessions
1	INTRODUCTION TO XAI	1	5
2	INTERPRETABILITY METHODS & MODEL-AGNOSTIC XAI	1	4
3	INTERACTIVE MACHINE LEARNING TECHNIQUES & DEEP EXPLANATION TECHNIQUES	2	4
4	POSTHOC EXPLANATION APPROACHES & ETHICAL CONSIDERATIONS IN XAI	2	3
5	USER-CENTRIC XAI AND EVALUATION	3	3
6	GENERATIVE ADVERSARIAL NETWORKS (GANs) AND GENERATIVE AI (GenXAI) IN EXPLAINABLE AI	2	2

9. Learning Resources

Text Books:

✓ Denis Rothman. Hands-On Explainable AI (XAI) with Python. Packt 2020

✓ Molnar, Christoph. Interpretable machine learning. Lulu.com, 2020

✓ Biecek, Przemyslaw, and Tomasz Burzykowski. Local interpretable model-agnostic explanations (LIME). Explanatory Model Analysis Explore, Explain and Examine Predictive Models 1(2021): 107-124

✓ Kleppmann, Martin. Designing data-intensive applications: The big ideas behind reliable, scalable, and maintainable systems. O'Reilly Media, Inc., 2017

Reference Links:

• Molnar, Christoph. Interpretable Machine Learning. Leanpub 2019 Online version publicly available at: https://christophm.github.io/interpretable-ml-book/scope-of-interpretability.html

• Schneider, Johannes. Explainable Generative AI (GenXAI): A Survey, Conceptualization, and Research Agenda. arXiv preprint arXiv:2404.09554(2024)

10. Weekly Timetable

Time	Monday	Tuesday	Wednesday	Thursday	Friday
9:15-10:10					
10:15-11:10					
11:15-12:10			XAI: Explainable AI (CSE3023)		
12:15-13:10					
13:15-14:10		XAI: Explainable AI (CSE3023)			
14:15-15:10					
15:15-16:10					
16:15-17:10					
17:15-18:10					

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
Programming	2 Weeks	20%		Continuous Participation+Viva
Assignments		20%		After Mid Assess
Quiz	20 mins	20%		Continuous
Project proposal, As per Literature survey, Methodology, and Project Evaluation		40%		During the Project-Based
End Term Project				Universit norms

12. Internal Assessment Data

13. Weak Students Data

uniqueId	studentName	totalMarks	grade
210C2030002	Aayush Dubey	83	A+
210C2030004	PelletiSujith Reddy	78.5	B

13. Weak Students Data

14. Actions taken for weak students

- njknii
- vdvdvdv

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

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