Course Description Form

1. Course Name:
Intelligent Data Mining
2. Course Code:
3. Semester / Year:
PhD–Second Course– 2025–2026
4. Description Preparation Date:
20/1/2026
5. Available Attendance Forms:
Attendance Mandatory
6. Number of Credit Hours (Total) / Number of Units (Total)
30 Hours (2 Hours Theoretical)*15/ 2 Credit
7. Course administrator's name (mention all, if more than one name)
Name: Assistant Professor Dr. Khamael Al-Dulaimi Email :khamail.abbass@nahrainuniv.edu.iq

8. Course Objectives

Course Objectives	• **Understand the theoretical foundations of data mining** Students will develop a deep understanding of statistical modelling, computational approaches to data mining, and feature extraction, allowing them to critically analyse modern data mining systems data mining. • **Analyse the statistical limits and scalability of mining algorithms** Students will be able to evaluate the limitations of data mining techniques, including issues of dimensionality, sparsity, and statistical reliability, especially in large-scale datasets data mining. • **Design and evaluate large-scale data mining systems** Students will get the ability to design and implement mining algorithms using distributed frameworks such as MapReduce and understand their computational and communication costs

9. Teaching and Learning Strategies

Strategy	**Research-Based Learning** Students critically review recent journal and conference papers, focusing on methodology, assumptions, limitations, and research gaps. **Advanced Scholarly Discussions** Seminars and discussions are used to compare and debate pattern recognition models and algorithms, fostering high-level analytical thinking. **Open-Ended Problem Solving**

	Students are challenged with open research problems that require proposing novel approaches or improving existing techniques rather than applying predefined solutions. **Integration of Theory and Research Practice** Students conduct experimental studies using real-world or benchmark datasets and analyse results in a publication-oriented manner

10. Course Structure

Week(s)	Hours	Intended Learning Outcomes	Module / Topic	Teaching Method	Assessment Method
1	2	Understand the concept of data mining and distinguish between statistical and computational modelling approaches	**Module 1: Introduction to Data Mining** • What is Data Mining • Statistical Modelling • Computational Approaches to Modelling • Feature Extraction	Lectures	In-class questions
2	2	Analyse the theoretical limits of data mining and apply text-based weighting and hashing techniques	**Module 2: Statistical Foundations** • Statistical Limits on Data Mining • Importance of Words in Documents • Hash Functions	Lectures	Problem analysis
3	2	Evaluate distributed data mining algorithms and analyse their computational and communication complexity	**Module 3: MapReduce and Big Data Frameworks** • Algorithms Using MapReduce • Extensions to MapReduce • Communication-Cost Model • Complexity Theory for MapReduce	Seminar	Algorithm analysis and discussion
4	2	Design and analyse similarity detection techniques for large-scale datasets	**Module 4: Finding Similar Items** • Shingling of Documents • Similarity-Preserving Summaries • Distance Measures • Locality-Sensitive Hashing	Seminar	Applied problem solving
5	2	Apply stream mining techniques and evaluate approximation algorithms under memory constraints	**Module 5: Mining Data Streams** • Filtering Streams • Counting Distinct Elements • Estimating Frequency Moments	Seminar	Problem analysis
6	2	Analyse transactional datasets and extract frequent patterns	**Module 6: Frequent Itemset Mining** • Frequent Itemsets • Association Rule Concepts	Seminar	Applied data analysis
7		Mid term exm			

8	2	Compare clustering techniques and evaluate their suitability for complex data spaces	**Module 7: Clustering Techniques •** Clustering Techniques • Hierarchical Clustering • Clustering in Non-Euclidean Spaces	Lectures	Method comparison
9	2	Design and analyse recommendation systems using different filtering strategies	**Module 8: Recommendation Systems •** Content-Based Recommendation • Collaborative Filtering • Dimensionality Reduction	Student Seminar	Seminar presentation & discussion
10	2	Apply dimensionality reduction techniques and analyse their mathematical foundations	**Module 9: Dimensionality Reduction •** Eigenvalues and Eigenvectors • PCA • Singular Value Decomposition (SVD)	Lectures	Problem analysis
11		Mid term exm			
12+13+14+15		projects			

11. Course Evaluation

Assessment Type	Marks
Quizzes	7
Projects	8
Mid Exam	10
Final Exam	50
Total	100

12. Learning and Teaching Resources

Required textbooks (curricular books, if any)	Data Mining: Concepts and Techniques by Jiawei Han, Micheline Kamber, and Jian Pei (3rd edition).
Main references (sources)	
Recommended books and references (scientific journals, reports…)	• **Han, J., & Kamber, (2001/2011).** *Data Mining: Concepts & Techniques.* Morgan Kaufmann. • **Hastie, T., Tibshirani, R., & Friedm J. (2009).** *The Elements of Statisti Learning: Data Mining, Inference, & Prediction.* Springer.

	• **Hand, D. J., Mannila, H., & Smyth (2001).** *Principles of Data Mining.* M Press. • **Aggarwal, C. C. (2015).** *Data Mini The Textbook.* Springer. • **Larose, D. T. (2005).** *Discover Knowledge in Data: An Introduction Data Mining.* Wiley.
Electronic References, Websites	Research paper+ websites for dataset