Course Specification
(Bachelor)

Course Title:	Data Engineering
Course Code:	SE4701
Program:	BSc in Software Engineering
Department:	Software Engineering
College:	College of Computing
Institution:	Umm Al Qura University
Version:	1.0
Last Revision Date:	22/04/2025

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A. General information about the course:

1. Course Identification

1. Credit hours: (3)					
2. Course type					
A.	☐University	☐College	☒ Department	☐Track	☐Others
B.	☐ Required		☒ Elective		
3. Level/year at which this course is offered: (3rd year/ 5th or 6th level) or (4th year/8th level)					
4. Course General Description:					
This course provides an in-depth exploration of data engineering techniques and tools necessary for designing, building, and managing scalable data pipelines and infrastructures. Leveraging comprehensive data engineering solutions (e.g. Oracle, IBM), students will learn to process, analyze, and secure data effectively using real-world tools and practices.					
5. Pre-requirements for this course (if any)**:**					
DS2201 - Introduction to Database					
6. Co-requisites for this course (if any)**:**					
N/A					
7. Course Main Objective(s):					
By the end of the course, students will: 1. Understand the end-to-end data engineering lifecycle, from data modeling to visualization. 2. Gain proficiency in using modern ETL tools, distributed storage, and cloud platforms. 3. Design and implement data pipelines for batch and real-time processing with high reliability. 4. Ensure data governance, security, and compliance across data workflows. 5. Stay updated on emerging trends in data engineering to apply innovative solutions in real-world scenarios.					

2. Teaching mode (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	45	100%
2	E-learning	0	0
3	Hybrid • Traditional classroom • E-learning	0	0
4	Distance learning	0	0

3. Contact Hours (based on the academic semester)

No	Activity	Contact Hours
1.	**Lectures**	45
2.	**Laboratory/Studio**	0
3.	**Field**	0
4.	**Tutorial**	0
5.	**Others (specify)**	0
Total		45

B. Course Learning Outcomes (CLOs), Teaching Strategies and Assessment Methods

Code	Course Learning Outcomes	Code of PLOs aligned with the program	Teaching Strategies	Assessment Methods
1.0	**Knowledge and understanding**			
1.1	Understand the architecture of modern data engineering systems, including batch and real-time pipelines.	K1	Lecture, Exercise	Quiz, Exams,

Code	Course Learning Outcomes	Code of PLOs aligned with the program	Teaching Strategies	Assessment Methods
1.2	Explain the principles of distributed data storage and processing systems.	K2	Lecture, Exercise	Quiz, Exams,
2.0	**Skills**			
2.1	Design and implement scalable ETL workflows	S1	Lecture, Exercise	Quiz, Exams,
2.2	Build and optimize data pipelines for real-time and batch processing	S2	Lecture, Exercise	Quiz, Exams,
2.3	Develop dashboards and visualizations	S4	Lecture, Exercise	Quiz, Exams,
3.0	**Values, autonomy, and responsibility**			
3.1	Demonstrate accountability in maintaining data security and privacy.	V1	Lecture, Exercise	Quiz, Exams,
3.2	Foster an innovative mindset to address complex data engineering challenges.	V2	Lecture, Exercise	Quiz, Exams,

C. Course Content

No	List of Topics	Contact Hours
1.	Introduction to Data Engineering	**3**

2.	Data Modeling for Analytics	3
3.	ETL Processes and Tools	3
4.	Distributed Data Storage	3
5.	Batch Data Processing	3
6.	Real-Time Data Processing	3
7.	Data Warehousing	3
8.	Data Governance and Quality	3
9.	Data Security and Compliance	3
10.	Building Dashboards and Reports	3
11.	Cloud Data Engineering	3
12.	Data Lake Architecture	3
13.	Advanced Distributed Systems for Big Data	3
14.	Data Observability and Monitoring	3
15.	Emerging Trends in Data Engineering	3
Total		45

D. Students Assessment Activities

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
1.	Quizzes	2-14	20
2.	Projects	2-14	10
3.	Assignments	2-14	10
4.	Mid Term	7	20
5.	Final Exam	16-17	40

*Assessment Activities (i.e., Written test, oral test, oral presentation, group project, essay, etc.).

E. Learning Resources and Facilities

1. References and Learning Resources

Essential References	• Reis, J., & Housley, M. (2022). *Fundamentals of data engineering: Plan and build robust data systems*. O'Reilly Media. ISBN 978-1098108304.
Supportive References	
Electronic Materials	
Other Learning Materials	

2. Required Facilities and equipment

Items	Resources
facilities (Classrooms, laboratories, exhibition rooms, simulation rooms, etc.)	Traditional Classroom
Technology equipment (projector, smart board, software)	Multimedia Projector
Other equipment (depending on the nature of the specialty)	N/A

F. Assessment of Course Quality

Assessment Areas/Issues	Assessor	Assessment Methods
Effectiveness of teaching	Students	Direct, Indirect
Effectiveness of Students assessment	Faculty, Peer reviewer	Direct, Indirect
Quality of learning resources	Faculty, Course coordinator	Direct, Indirect
The extent to which CLOs have been achieved	Course coordinator, Program management committee	Direct
Other		

Assessors (Students, Faculty, Program Leaders, Peer Reviewers, Others (specify)

Assessment Methods (Direct, Indirect)

G. Specification Approval

COUNCIL /COMMITTEE	**SOFTWARE ENGINEERING DEPARTMENT COUNCIL**
REFERENCE NO.	**THE 17TH MEETING FOR THE ACADEMIC YEAR 1446H**
DATE	**22/04/2025**