Course Specification of Database Systems

Course No (.....)

2020/2021

Head of Department	Vise Dean for Quality Assurance	Dean of the Faculty	Dean of Academic Development center and Quality
Dr. Ahmed Al-shalabi	Dr. Anwar Al-Shamiri	Dr. Nagi Al-Shibani	Assoc. Prof. Dr.Huda Al.Emad

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Prof. Dr. Qassim Mohammed Abbas

I. Course Identification and General Information:

1	**Course Title:**	Database Systems				
2	**Course Code &Number:**					
3	**Credit hours:**	C.H				Total
		Th.	Seminar	Pr	Tr.	
		2	-	2	-	3
4	**Study level/semester at which this course is offered:**	2nd Level -2nd Semester				
5	**Pre –requisite (if any):**	Database Fundamentals				
6	**Co –requisite (if any):**	None				
7	**Program (s) in which the course is offered:**	IS				
8	**Language of teaching the course:**	Arabic/English				
9	**Study System**	Term based system				
10	**Mode of delivery:**	Full Time				
11	**Location of teaching the course:**	Faculty of Computer and Information Technology				
12	**Prepared By:**	Dr.Ebraheem M.ALhaddad				
13	**Date of Approval**					

Head of Department	Vise Dean for Quality Assurance	Dean of the Faculty	Dean of Academic Development center and Quality
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II. Course Description:

This course introduces concepts and implementation schemes of data and information management. The potential topics covered in class include processing and optimization of declarative queries, transactions, crash recovery, self-tuning database systems, data mining, data warehouse and big data analytics. The course materials will be drawn from textbooks and it will be covered theoretically in the class and practically in the labs.

I. Course Intended learning outcomes (CILOs) of the course		Referenced PILOs
a1.	Illustrate the different modules that constitute a DBMS such as indexes, query processor and optimizer, concurrency control manager, and recovery and backup manager.	A
a2.	Explain data analysis technologies, data warehouse and mining, big data analytics.	A
b1.	Compare and contrast, physical database design decisions in the context of a high-performance database system, and analyze the suitability of such schemes for different kinds of workloads.	B
b2.	Experiment some popular analytics engines for large Datasets processing.	B

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c1.	Write stored procedures, functions and triggers.	C
c2.	Implement and evaluate complex, scalable database systems, with emphasis on providing experimental evidence for design decisions.	C
c3.	Apply simple data analysis tasks using tools such as OLAP and Map Reduce.	C
d1.	Negotiate and communicate effectively with the work environment in both written and oral formats.	D
d2.	Exhibit self-learning abilities in data management and analysis.	D

(A) Alignment Course Intended Learning Outcomes of Knowledge and Understanding to Teaching Strategies and Assessment Strategies:		
Course Intended Learning Outcomes	**Teaching strategies**	**Assessment Strategies**
a1. Illustrate the different modules that constitute a DBMS such as the query processor and optimizer, concurrency control manager, and recovery and backup manager.	Lectures, presentation, discussions	Quizzes, Exams.
a.2 Explain data analysis technologies, data warehouse and mining, big data analytics.	Lectures, presentation, discussions.	Quizzes, Exams.

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(B) Alignment Course Intended Learning Outcomes of Intellectual Skills to Teaching Strategies and Assessment Strategies:		
Course Intended Learning Outcomes	**Teaching strategies**	**Assessment Strategies**
b1.Compare and contrast, physical database design decisions in the context of a high-performance database system, and analyze the suitability of such schemes for different kinds of workloads.	Lectures Class discussions. Presentations	Assignments, Exams, Presentations.
b2.Experiment some popular analytics engines for large Datasets processing.	Lectures Discussions.	Assignments, Exams, Presentations.

(C) Alignment Course Intended Learning Outcomes of Professional and Practical Skills to Teaching Strategies and Assessment Strategies:		
Course Intended Learning Outcomes	**Teaching strategies**	**Assessment Strategies**
c1.Write stored procedures, functions and triggers.	Lab experiment, Problems Solving	Quizzes, Exams, Project assignment
c2.Implement and evaluate complex, scalable database systems, with emphasis on providing experimental evidence for design decisions.	Lab experiment, Problems Solving	Quizzes, Exams, Project assignment
c3. Apply simple data analysis tasks using tools such as OLAP and MapReduce.	Lab experiment, Problems Solving	Quizzes, Exams, Project assignment

(D) Alignment Course Intended Learning Outcomes of Transferable Skills to Teaching Strategies and Assessment Strategies:

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Course Intended Learning Outcomes	Teaching strategies	Assessment Strategies
d1.Negotiate and communicate effectively with the work environment in both written and oral formats.	Group projects, Presentation, Discussion	Reports, Project assignment, Presentations
d2.Exhibit self-learning abilities in data management and analysis.	Group projects,	Reports, Project assignment, Presentations

I. Course Content:

A – Theoretical Aspect:

Order	Units/Topics List	Learning Outcomes	Sub Topics List	Number of Weeks	contact hours
1	Physical Database Design	a1,b1,c1,c2	▪ Overview of Physical Storage Media - Cach, RAM, HD, SSD ▪ File Organizations: - Heap, Ordered, Hash - Column-Oriented Storage ▪ Parallelizing Disk Access - RAID - SAN,NAS.	2	4
2	Indexing Structures	a1,b1,c1,c2	▪ Single-Level Ordered Indexes: -Primary, Clustered, Secondary. ▪ Multilevel Indexes. - B-Trees and B+-Trees - Indexes on Multiple Keys. - Function-Base Index - Bitmap Index.	2	4

3	Query Processing & Optimization	a1,b1,c1,c2	▪ Definition of Query Processing and Query Optimization ▪ Steps of Query Processing and Query Optimization ▪ Measures of Query Cost ▪ Different techniques for cost estimation for All Operation (Select, Project,..)	2	4
4	Database Transaction & Concurrency Control Protocols	a1,b1,c1,c2	▪ Trans. Concepts ▪ ACID Properties ▪ Trans. States ▪ Concurrent Execution ▪ Schedules ▪ Serializability ▪ Conflict Serializability ▪ Testing for Serializability ▪ Precedence Graph ▪ Recoverable Schedules ▪ Cascadeless Schedule ▪ Lock-Based Protocol ▪ Lock Conversion ▪ The 3 Problems with LB-P ▪ Graph-Based Protocols ▪ Timestamp-Based Protocols	2	6
5	Database Security	a1,b1,c1,c2	▪ Discretionary Access Control Based on Granting and Revoking Privileges ▪ Mandatory Access Control and Role-Based	2	4

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			▪ Access Control for Multilevel Security ▪ SQL Injection. ▪ Statistical Database Security		
6	Data Warehouse	a2,b2,c2,c3	▪ Characteristics of Data Warehouses ▪ Data Modeling for Data Warehouses ▪ Building a Data Warehouse ▪ OLAP and OLTP	1	2
7	Data Mining	a2,b2,c2,c3	▪ Association Rules ▪ Classification ▪ Clustering	1	2
8	Big Data Technologies Based on MapReduce and Hadoop	a2,b2,c2,c3	▪ What Is Big Data? ▪ Introduction to MapReduce and Hadoop. ▪ Hadoop Distributed File System (HDFS) ▪ Hadoop v2 YARN	2	٤
Number of Weeks /and Units Per Semester				**14**	**32**

B - Practical Aspect: (if any)

Order	Tasks/ Experiments	Number of Weeks	contact hours	Learning Outcomes
1	Cursor	1	2	c1,c2,d1
2	Stored Functions	1	2	b1,c1,c2,d1
3	Stored Procedure	1	2	b1,c1,c2,d1

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4	Stored Trigger	1	2	b1,c1,c2,d1
5	Stored Packaged & LOBs	1	2	b1,c1,c2,d1,
6	Creating & managing indexes	2	4	c1,c2,d1
7	Security: Managing Users, Privileges and Roles	2	4	a1,a2,b1,b2,c1,c2
8	Database Backup and recovery	1	2	c1,c2,d1
9	Create Data Warehouse & perform Simple OLAP	2	4	b1,b2c2,c3,d1
10	Install Hadoop & Perform simple Map reduce tasks	2	4	b1,b2,c2,c3d1
Number of Weeks /and Units Per Semester		**14**	**28**	

II. Teaching strategies of the course:

lectures
Seminar/ project/presentation
Interactive class discussions
Exercises and home works
Computer laboratory based sessions
Problem based learning
Team work (group learning)

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III. Assignments:

No	Assignments	Aligned CILOs(symbols)	Week Due	Mark
1	Assignment 1	b1,c2,d1,d2	4th	2
2	Assignment 2	b1,c2,d1,d2	7th	2
3	Assignment 3	b2, bc1, c2,d1,d2	10th	3
4	Assignment 4	b2,c1,c2,d1,d2	13th	3

IV. Schedule of Assessment Tasks for Students During the Semester:

No.	Assessment Method	Week Due	Mark	Proportion of Final Assessment	Aligned Course Learning Outcomes
1	Assignments	4th, 7th ,10th ,13th	10	10%	b2, bc1, c2,d1,d2
2	Projects (single\group)	12th	5	5%	b2, b1,c1,c2,d1,d2
3	Mid Term Exam practical	6th	5	5%	b1,b2,c1,c2,d1
4	Mid Term Exam Theoretical	7th	10	10%	a1,a2,b1,b2
5	Final Exam (practical)	16th	10	10%	a1,a2,b1,b2,c1,c2
6	Final Exam (theoretical)	16th	60	60%	a1,a2,b1,b2,c1,c2
7	**Total**		**100**	**100%**	

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V. Learning Resources:

- *Written in the following order: (Author - Year of publication – Title – Edition – Place of publication – Publisher).*

1- Required Textbook(s) (maximum two).

1- Ramez Elmasrim & Shamkant B. Navathe – 2016 –" Fundamentals of Database Systems" – 7th edition – USA –PERSON
2- Abraham Silberschatz, Henry F. Korth ,S. Sudarshan – 2020 – "Database System Concepts" – 7th edition – USA - McGraw-Hill.

2- Essential References.

1. Raghu Ramakrishnan & Johannes Gehrke – 2003 - "Database Management Systems" – 3rd edition – USA - McGraw-Hill.
2. Thomas Connoll & Carolyn Begg – 2015 – "*Database Systems A Practical Approach to Design, Implementation, and Management*" - 6th edition – USA –PERSON.

4- Electronic Materials and Web Sites *etc*.

1- https://15445.courses.cs.cmu.edu/fall2019/syllabus.html
2- https://web2.qatar.cmu.edu/~mhhammou/15415-s20/index.html

III. Course Policies:

Unless otherwise stated, the normal course administration policies and rules of the Faculty of Computer and Information Technology apply. For the policy, see: ----------

The University Regulations on academic misconduct will be strictly enforced. Please refer to ----------

1	**Class Attendance:** A student should attend not less than 75 % of total hours of the subject; otherwise he will not be able to take the exam and will be considered as exam failure. If the student is absent due to illness, he/she should bring a proof statement from university Clinic
2	**Tardy:** For late in attending the class, the student will be initially notified. If he repeated lateness in attending class, he will be considered as absent.
3	**Exam Attendance/Punctuality:**

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	A student should attend the exam on time. He is Permitted to attend an exam half one hour from exam beginning, after that he/she will not be permitted to take the exam and he/she will be considered as absent in exam.
4	**Assignments & Project** The assignment is given to the students after each chapter; the student has to submit all the assignments for checking on time.
5	**Cheating:** For cheating in exam, a student will be considered as fail. In case the cheating is repeated three times during his/her study the student will be disengaged from the Faculty.
6	**Plagiarism:** Plagiarism is the attending of a student the exam of a course instead of another student. If the examination committee proofed a plagiarism of a student, he will be disengaged from the Faculty. The final disengagement of the student from the Faculty should be confirmed from the Student Council Affair of the university.
7	**Other policies:** - Mobile phones are not allowed to use during a class lecture. It must be closed, otherwise the student will be asked to leave the lecture room - Mobile phones are not allowed in class during the examination. - Lecture notes and assignments my given directly to students using soft or hard copy

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Faculty of Computer & Information Technology

Department of Computer Science

Program of Computer Science

Course syllabus of Database Systems

Course No (.....)

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2020/2021

I. - Information about Faculty Member Responsible for the Course:							
Name of Faculty Member		**Office Hours**					
Location& Telephone No.		**SAT**	**SUN**	**MON**	**TUE**	**WED**	**THU**
E-mail							

II. Course Identification and General Information:						
1	**Course Title:**	Database Systems				
2	**Course Number & Code:**					
3	**Credit hours:**	C.H				Total
		Th.	Seminar	Pr.	Tr.	
		2	-	2	-	3
4	**Study level/year at which this course is offered:**	2nd Level -2nd Semester				
5	**Pre –requisite (if any):**	Fundamentals of Database				
6	**Co –requisite (if any):**	None				
7	**Program (s) in which the course is offered**	IS				
8	**Language of teaching the course:**	Arabic/English				

Head of Department	Vise Dean for Quality Assurance	Dean of the Faculty	Dean of Academic Development center and Quality
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9	**System of Study:**	Term based System
10	**Mode of delivery:**	Full Time
11	**Location of teaching the course:**	Faculty of Computer and Information Technology

III. Course Description:

This course introduces concepts and implementation schemes of data and information management. The potential topics covered in class include processing and optimization of declarative queries, transactions, crash recovery, self-tuning database systems, data mining, data warehouse and big data analytics. The course materials will be drawn from textbooks and it will be covered theoretically in the class and practically in the labs.

VI. Course Intended learning outcomes (CILOs) of the course

a1.	Illustrate the different modules that constitute a DBMS such as indexes, query processor and optimizer, concurrency control manager, and recovery and backup manager.
a2.	Explain data analysis technologies, data warehouse and mining, big data analytics.
b1.	Compare and contrast, physical database design decisions in the context of a high-performance database system, and analyze the suitability of such schemes for different kinds of workloads.
b2.	Experiment some popular analytics engines for large Datasets processing.
c1.	Write stored procedures, functions and triggers.
c2.	Implement and evaluate complex, scalable database systems, with emphasis on providing experimental evidence for design decisions.
c3.	Apply simple data analysis tasks using tools such as OLAP and MapReduce.

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d1.	Negotiate and communicate effectively with the work environment in both written and oral formats.
d2.	Exhibit self-learning abilities in data management and analysis.

VII. Course Content:

A – Theoretical Aspect:

Order	Units/Topics List	Learning Outcomes	Topics List	Week Due	Contact Hours
1	Physical Database Design	a1,b1,c1,c2	▪ Overview of Physical Storage Media - Cach, RAM, HD, SSD ▪ File Organizations: - Heap, Ordered, Hash - Column-Oriented Storage ▪ Parallelizing Disk Access - RAID - SAN,NAS.	1st, 2nd	4
2	Indexing Structures	a1,b1,c1,c2	▪ Single-Level Ordered Indexes: -Primary, Clustered, Secondary. ▪ Multilevel Indexes. - B-Trees and B+-Trees - Indexes on Multiple Keys. - Function-Base Index - Bitmap Index.	3rd,4th	4
3	Query Processing & Optimization	a1,b1,c1,c2	▪ Definition of Query Processing and Query Optimization	5th,6th	4

			▪ Steps of Query Processing and Query Optimization ▪ Measures of Query Cost ▪ Different techniques for cost estimation for All Operation (Select, Project,..)		
4	Midterm Exam		-	7th	2
5	Database Transaction & Concurrency Control Protocols	a1,b1,c1,c2	▪ Trans. Concepts ▪ ACID Properties ▪ Trans. States ▪ Concurrent Execution ▪ Schedules ▪ Serializability ▪ Conflict Serializability ▪ Testing for Serializability ▪ Precedence Graph ▪ Recoverable Schedules ▪ Cascadeless Schedule ▪ Lock-Based Protocol ▪ Lock Conversion ▪ The 3 Problems with LB-P ▪ Graph-Based Protocols ▪ Timestamp-Based Protocols	8th ,9th	4
6	Database Security	a1,b1,c1,c2	▪ Discretionary Access Control Based on Granting and Revoking Privileges ▪ Mandatory Access Control and Role-Based	10th,11th	4

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			▪ Access Control for Multilevel Security ▪ SQL Injection. ▪ Statistical Database Security		
7	Data Warehouse	a2,b2,c2,c3	▪ Characteristics of Data Warehouses ▪ Data Modeling for Data Warehouses ▪ Building a Data Warehouse ▪ OLAP and OLTP	12th	2
8	Data Mining	a2,b2,c2,c3	▪ Association Rules ▪ Classification ▪ Clustering	13th	2
9	Big Data Technologies Based on MapReduce and Hadoop	a2,b2,c2,c3	▪ What Is Big Data? ▪ Introduction to MapReduce and Hadoop. ▪ Hadoop Distributed File System (HDFS) ▪ Hadoop v2 YARN	14th, 15th	4
10	Final Exam		-	16th	2
Number of Weeks /and Units Per Semester				**16**	**32**

B– Practical Aspect: *(if any)*

Order	Topics List	Week Due	Contact Hours
1	Cursor	1st	2
2	Stored Functions	2nd	2

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3	Stored Procedure	3rd	2
4	Stored Trigger	4th	2
5	Stored Packaged & LOBs	5th	2
6	Mid Exam	6th	2
7	Creating & managing indexes	7th,8th	4
8	Security: Managing Users, Privileges and Roles	9th ,10th	4
9	Database Backup and recovery	11th	2
10	Create Data Warehouse & perform Simple OLAP	12th,13th	4
11	Install Hadoop & Perform simple Map reduce tasks	14th,15th	4
12	Final Exam	16th	2
Number of Weeks /and Units Per Semester		16	48

VI. Teaching strategies of the course:

lectures
Seminar/ project/presentation
Interactive class discussions
Exercises and home works
Computer laboratory based sessions
Problem based learning
Team work (group learning)

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VII. Assignments:

No	Assignments	Week Due	Mark
1	Assignment 1	4th	2
2	Assignment 2	7th	2
3	Assignment 3	10th	3
4	Assignment 4	13th	3

VIII. Schedule of Assessment Tasks for Students During the Semester:

Assessment	Type of Assessment Tasks	Week Due	Mark	Proportion of Final Assessment
1	Assignments	4th, 7th ,10th ,13th	10	10%
2	Projects (single\group)	12th	5	5%
3	Mid Term Exam practical	6th	5	5%
4	Mid Term Exam Theoretical	7th	10	10%
5	Final Exam (practical)	16th	10	10%
6	Final Exam (theoretical)	16th	60	60%

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7	**Total**		**100**	**100%**

IX. Learning Resources:

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4- Electronic Materials and Web Sites *etc*.

3- https://15445.courses.cs.cmu.edu/fall2019/syllabus.html
4- https://web2.qatar.cmu.edu/~mhhammou/15415-s20/index.html

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2	**Tardy:**

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اللجنة الإشرافية			
م.	الاســـم	الصـــــفة	التوقيع
١	أ.م.د. عبد الماجد الخليدي	نائب عميد الكلية للشؤون الأكاديمية	
٢	أ.م.د. احمد مجاهد	نائب عميد مركز التطوير الأكاديمي وضمان الجودة	
٣	د. حسين الأشول	ممثل المركز في الكلية	
٤	أ.د. إبراهيم المطاع	نائب رئيس الجامعة للشؤون الأكاديمية	

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