



## Course Specification of Database Fundamentals

Course No ( ..... )

2020/2021

Head of Department	Vise Dean for Quality Assurance	Dean of the Faculty	Dean of Development center and Quality Assurance
Assoc. Prof. Mansour N. Ali	Dr. Anwar Al-Shamiri	Dr. Nagi Al-Shibani	Assoc. Prof. Dr. Huda Al-Emad
Rector of Sana'a University			
Prof. Dr. Qassim Mohammed Abbas			



## I. Course Identification and General Information:

1	Course Title:	Database Fundamentals			
2	Course Code & Number:				
3	Credit hours:	C.H			
		Th.	Seminar	Pr	Tr.
		2	-	2	
4	Study level/ semester at which this course is offered:	2 <sup>nd</sup> Level-1 <sup>st</sup> Semester			
5	Pre –requisite (if any):	None			
6	Co –requisite (if any):	None			
7	Program (s) in which the course is offered:	IS,IT,CS			
8	Language of teaching the course:	English/Arabic			
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				

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II. Course Description:		
This course introduces the basics of database systems, as well as modeling, design and manipulation of relational databases. At the end of this course, a student will be able to understand and apply the fundamental concepts required for the use and design of database systems. Topics include basic concepts and terminology of the database approach, data modeling (the entity relationship model, relational data model), database design theory (entity relationship to relational mappings, normalization using functional dependencies), data definition and manipulation languages (relational algebra, SQL). The course will enable the students to create and manipulate databases on the Oracle database management system.		
III. Course Intended learning outcomes (CILOs) of the course	Referenced PILOs	
a.1 Explain the role of database users and features of database systems, and architecture of database systems.	A	
a.2 Explain the main issues related to the design and use of structured data.		
b.1 Construct conceptual (E/R & EER) and logical data models applying database design principles.	B	
b.2 Evaluate data redundancy levels and their impact on database integrity and maintainability.		
b.3 Distinguish between good and bad database design.		
c.1 Implement a database using commercial DBMS.	C	
c.2 Implement queries, using SQL, to search, update and delete information in such databases.		
d.1 Exhibit self-learning abilities in data management and analysis.	D	
d.2 Work as an effective member or leader of diverse teams, communicating effectively and operating within cross-disciplinary and cross-cultural contexts in the workplace.		

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**(A) Alignment Course Intended Learning Outcomes of Knowledge and Understanding to Teaching Strategies and Assessment Strategies:**

Course Intended Learning Outcomes	Teaching strategies	Assessment Strategies
<b>a1-</b> Explain the role of database users and features of database systems, and architecture of database systems.	Lectures, presentation, discussions	Assignments, Exams, Presentations.
<b>a2-</b> Explain the main issues related to the design and use of structured data.	Lectures, presentation, discussions	Assignments, Exams, Presentations.

**(B) Alignment Course Intended Learning Outcomes of Intellectual Skills to Teaching Strategies and Assessment Strategies:**

Course Intended Learning Outcomes	Teaching strategies	Assessment Strategies
<b>b1-</b> Construct conceptual (E/R & EER) and logical data models applying database design principles.	Lectures Class discussions. Presentations	Assignments, Exams, Presentations.
<b>b2-</b> Evaluate data redundancy levels and their impact on database integrity and maintainability.	Lectures Discussions.	Assignments, Exams, Presentations.
<b>b3 -</b> Distinguish between good and bad database design.	Lectures Class discussions.	Assignments, Exams, Presentations.

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	Presentations	
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**(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
<b>C1-</b> Perform relational database normalization and relational algebra.	Lab experiment, Project	Quizzes, Exams, Project assignment
<b>C2-</b> Implement queries, using SQL, to search, update and delete information in such databases.	Lab experiment, Project	Quizzes, Exams, Project assignment

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

Course Intended Learning Outcomes	Teaching strategies	Assessment Strategies
<b>d1-</b> Exhibit self-learning abilities in data management and analysis.	Group projects, Interview, Discussion	Reports, Project assignment, Presentations
<b>d2-</b> Work as an effective member or leader of diverse teams, communicating effectively and operating within cross-disciplinary and cross-cultural contexts in the workplace.	Group projects, Discussion	Reports, Project assignment, Presentations

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IV. Course Content:					
A – Theoretical Aspect:					
Order	Units/Topics List	Learning Outcomes	Topics List	Number of Weeks	contact hours
1	Introduction to Databases	a1,a2,b3	<ul style="list-style-type: none"> <li>- Characteristics of the Database Approach</li> <li>- Advantages of Using the DBMS Approach</li> <li>- When Not to Use a DBMS</li> <li>- Data Models, Schemas, and Instances</li> <li>- Three-Schema Architecture and Data Independence</li> <li>- Classification of Database Management Systems</li> </ul>	2	4
2	The Relational Data Model and Relational Database Constraints	a1,a2,b1,b2	<ul style="list-style-type: none"> <li>- Relational Model Concepts.</li> <li>- Relational Model Constraints and Relational Database Schemas.</li> </ul>	1	2
3	SQL	a2,b2,c1,c2	<ul style="list-style-type: none"> <li>- SQL Data Definition and Data Types</li> <li>- Specifying Constraints in SQL</li> <li>- Basic Retrieval Queries in SQL</li> <li>- INSERT, DELETE, and UPDATE Statements in SQL.</li> <li>- Complex SQL Retrieval Queries</li> </ul>	3	6

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			<ul style="list-style-type: none"> <li>- Comparisons Involving NULL and Three-Valued Logic</li> <li>- Nested Queries</li> </ul>		
4	The Relational Algebra and Relational Calculus	a2,b2,c1,c2	<ul style="list-style-type: none"> <li>- Unary Relational Operations: SELECT and PROJECT</li> <li>- Relational Algebra Operations from Set Theory</li> <li>- Binary Relational Operations: JOIN and DIVISION</li> </ul>	1	2
5	Data Modeling Using the Entity-Relationship (ER) Model	a2,b1,b2,c1,c2,d1	<ul style="list-style-type: none"> <li>- Database design process</li> <li>- Entity Types, Entity Sets, Attributes, and Keys</li> <li>- Relationship Types, Relationship Sets, Roles, and Structural Constraints</li> <li>- Weak Entity Types</li> <li>- Relationship Types of Degree Higher than Two</li> </ul>	2	4
6	The Enhanced Entity-Relationship (EER) Model	a2,b1,b2,b3,c1,d1	<ul style="list-style-type: none"> <li>- Subclasses, Superclasses, and Inheritance</li> <li>- Specialization and Generalization</li> <li>- Constraints and Characteristics of Specialization and Generalization Hierarchies</li> <li>- Modeling of UNION Types</li> <li>- Using Categories</li> </ul>	1	2
7	Relational Database	a1,a2,b1,b2,b3,c1	<ul style="list-style-type: none"> <li>- Relational Database Design Using ER-to-Relational Mapping</li> </ul>	2	4

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	Design by ER- and EER-to-Relational Mapping		- Mapping EER Model Constructs to Relations		
8	Functional Dependencies and Normalization for Relational Databases	a1,a2,b1, b2,b3,c1	- Functional Dependencies - Normal Forms Based on Primary Keys	2	4
Number of Weeks /and Units Per Semester				14	28

B - Practical Aspect: (if any)				
Order	Tasks/ Experiments	Number of Weeks	contact hours	Learning Outcomes
1	Install ORACLE	1	2	c1,c2
2	Creating & managing tables	1	2	b2,c1,c2
3	Writing Basic SELECT statements	1	2	b2,b2,c2
4	Restricting and sorting data	1	2	b2,c1,c2
5	Single-Row Functions	1	2	b2,c1,c2
6	Including Constraints	1	2	b2,c2
7	Displaying data from multiple tables	1	2	c1,c2,d1
8	Mid Exam	1	2	a1,a2,b1,b2,c1,c2

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9	Manipulating Data	2	4	c1,c2,
10	Aggregating Data	2	4	b2,c1,c2
11	Creating Views	1	2	b2,c1,c2
12	Subqueries	2	4	b2,c1,c2
Number of Weeks /and Units Per Semester		14	28	

## V. Teaching strategies of the course:

- Lectures
- Class discussions
- Laboratory work
- Group projects
- Presentation

## VI. Assignments:

No	Assignments	Aligned CILOs(symbols)	Week Due	Mark
1	Data Requirements	b1,c2,d1,d2	4 <sup>th</sup>	2
2	E/R Diagram	b1,c2,d1,d2	9 <sup>th</sup>	2
3	Relational Diagram	b2, bc1, c2,d1,d2	12 <sup>th</sup>	2
4	Final project Discussion	b2,c1,c2,d1,d2	15 <sup>th</sup>	4

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## VII. Schedule of Assessment Tasks for Students During the Semester:

No.	Assessment Method	Week Due	Mark	Proportion of Final Assessment	Aligned Course Learning Outcomes
1	Project	4 <sup>th</sup> , 9 <sup>th</sup> , 12 <sup>th</sup> , 15 <sup>th</sup>	10	10%	b2, bc1, c2, d1, d2
3	Mid Term Exam practical	8 <sup>th</sup>	5	5%	b1, b2, c1, c2, d1
4	Mid Term Exam Theoretical	10 <sup>th</sup>	10	10%	a1, a2, b1, b2
5	Final Exam (practical)	16 <sup>th</sup>	10	10%	a1, a2, b1, b2, c1, c2
6	Final Exam (theoretical)	16 <sup>th</sup>	60	60%	a1, a2, b1, b2, c1, c2
<b>Total</b>			<b>100</b>	<b>100%</b>	

## 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" – 7<sup>th</sup> edition – USA -PERSON

### 2- Essential References.

1. Thomas Connoll & Carolyn Begg – 2015 – "Database Systems A Practical Approach to Design, Implementation, and Management" - 6<sup>th</sup> edition – USA – PERSON.
2. Jeffrey D. Ullman – "A First Course in Database Systems"- 3<sup>rd</sup> edition – USA – PERSON.

### 3- Electronic Materials and Web Sites etc.

- 1- <http://infolab.stanford.edu/~ullman/fcdb.html>

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2- <https://15415.courses.cs.cmu.edu/fall2016/>

<b>IX. Course Policies:</b>	
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 ----- ----	
<b>1</b>	<b>Class Attendance:</b> 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
<b>2</b>	<b>Tardy:</b> 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.
<b>3</b>	<b>Exam Attendance/Punctuality:</b> 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.
<b>4</b>	<b>Assignments &amp; Project</b> The assignment is given to the students after each chapter; the student has to submit all the assignments for checking on time.
<b>5</b>	<b>Cheating:</b> 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.
<b>6</b>	<b>Plagiarism:</b> 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.
<b>7</b>	<b>Other policies:</b> - 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

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	<ul style="list-style-type: none"><li>- Mobile phones are not allowed in class during the examination.</li><li>- Lecture notes and assignments my given directly to students using soft or hard copy</li></ul>
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## Faculty of Computer & Information Technology

### Department of Computer Science

### Program of Computer Science

### Course syllabus of Database Fundamentals

Course No ( ..... )

Head of Department	Vise Dean for Qulity Assurance	Dean of the Faculty	Dean of Development center and Quality Assurance
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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 Fundamentals																	
2-	Course Number & Code:																		
3-	Credit hours:	<table border="1"> <thead> <tr> <th colspan="4">C.H</th> <th rowspan="2">Total</th> </tr> <tr> <th>Th.</th> <th>Seminar</th> <th>Pr.</th> <th>F. Tr.</th> </tr> </thead> <tbody> <tr> <td>2</td> <td>-</td> <td>2</td> <td></td> <td>3</td> </tr> </tbody> </table>				C.H				Total	Th.	Seminar	Pr.	F. Tr.	2	-	2		3
C.H				Total															
Th.	Seminar	Pr.	F. Tr.																
2	-	2		3															
4-	Study level/year at which this course is offered:	2 <sup>nd</sup> Level -1 <sup>st</sup> Semester																	
5-	Pre –requisite (if any):	None																	
6-	Co –requisite (if any):	None																	
7-	Program (s) in which the course is offered	IS,IT,CS																	
8-	Language of teaching the course:	English/Arabic																	
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																	

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### III. Course Description:

This course introduces the basics of database systems, as well as modeling, design and manipulation of relational databases. At the end of this course, a student will be able to understand and apply the fundamental concepts required for the use and design of database systems. Topics include basic concepts and terminology of the database approach, data modeling (the entity relationship model, relational data model), database design theory (entity relationship to relational mappings, normalization using functional dependencies), data definition and manipulation languages (relational algebra, SQL). The course will enable the students to create and manipulate databases on the Oracle database management system.

### IV. Intended learning outcomes (ILOs) of the course:

- a1.Explain the role of database users and features of database systems, and architecture of database systems.
- a2.Explain the main issues related to the design and use of structured data.
- b1.Construct conceptual (E/R & EER) and logical data models applying database design principles.
- b2.Evaluate data redundancy levels and their impact on database integrity and maintainability.
- b3.Distinguish between good and bad database design.
- c1.Implement a database using commercial DBMS.
- c2.Implement queries, using SQL, to search, update and delete information in such databases.
- d1. Exhibit self-learning abilities in data management and analysis.
- d2.Work as an effective member or leader of diverse teams, communicating effectively and operating within cross-disciplinary and cross-cultural contexts in the workplace.

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## V. Course Content:

### A – Theoretical Aspect:

Order	Units/Topics List	Topics List	Week Due	contact hours
1	Introduction to Databases	<ul style="list-style-type: none"> <li>- Characteristics of the Database Approach</li> <li>- Advantages of Using the DBMS Approach</li> <li>- When Not to Use a DBMS</li> <li>- Data Models, Schemas, and Instances</li> <li>- Three-Schema Architecture and Data Independence</li> <li>- Classification of Database Management Systems</li> </ul>	1 <sup>st</sup> , 2 <sup>nd</sup>	4
2	The Relational Data Model and Relational Database Constraints	<ul style="list-style-type: none"> <li>- Relational Model Concepts.</li> <li>- Relational Model Constraints and Relational Database Schemas</li> </ul>	3 <sup>rd</sup>	2
3	SQL	<ul style="list-style-type: none"> <li>- SQL Data Definition and Data Types</li> <li>- Specifying Constraints in SQL</li> <li>- Basic Retrieval Queries in SQL</li> <li>- INSERT, DELETE, and UPDATE Statements in SQL.</li> <li>- Complex SQL Retrieval Queries</li> <li>- Comparisons Involving NULL and Three-Valued Logic</li> <li>- Nested Queries</li> </ul>	4 <sup>th</sup> -6 <sup>th</sup>	6

Head of Department

Vice Dean for Quality Assurance

Dean of the Faculty

Dean of Development center and Quality Assurance

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Dr. Anwar Al-Shamiri

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4	The Relational Algebra and Relational Calculus	<ul style="list-style-type: none"> <li>- Unary Relational Operations: SELECT and PROJECT</li> <li>- Relational Algebra Operations from Set Theory</li> <li>- Binary Relational Operations: JOIN and DIVISION</li> </ul>	7 <sup>th</sup>	2
5	Data Modeling Using the Entity–Relationship (ER) Model	<ul style="list-style-type: none"> <li>- Database design process</li> <li>- Entity Types, Entity Sets, Attributes, and Keys</li> <li>- Relationship Types, Relationship Sets, Roles, and Structural Constraints</li> <li>- Weak Entity Types</li> <li>- Relationship Types of Degree Higher than Two</li> </ul>	8 <sup>th</sup> , 9 <sup>th</sup>	4
6	Midterm Exam	- Midterm exam	10 <sup>th</sup>	2
7	The Enhanced Entity–Relationship (EER) Model	<ul style="list-style-type: none"> <li>- Subclasses, Superclasses, and Inheritance</li> <li>- Specialization and Generalization</li> <li>- Constraints and Characteristics of Specialization and Generalization Hierarchies</li> <li>- Modeling of UNION Types</li> <li>- Using Categories</li> </ul>	11 <sup>th</sup>	2
8	Relational Database Design by ER- and EER-to-Relational Mapping	<ul style="list-style-type: none"> <li>- Relational Database Design Using ER-to-Relational Mapping</li> <li>- Mapping EER Model Constructs to Relations</li> </ul>	12 <sup>th</sup> , 13 <sup>th</sup>	4
9	Functional Dependencies and Normalization for Relational Databases	<ul style="list-style-type: none"> <li>- Functional Dependencies</li> <li>- Normal Forms Based on Primary Keys</li> </ul>	14 <sup>th</sup> , 15 <sup>th</sup>	4

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10	Final Exam	Final Exam	16 <sup>th</sup>	2
Number of Weeks /and Units Per Semester			16	32

B – Practical Aspect: (if any)			
Order	Topics List	Week Due	Contact Hours
1	Install ORACLE	1 <sup>st</sup>	2
2	Creating & managing tables	2 <sup>nd</sup>	2
3	Writing Basic SELECT statements	3 <sup>th</sup>	2
4	Restricting and sorting data	4 <sup>th</sup>	2
5	Single-Row Functions	5 <sup>th</sup>	2
6	Including Constraints	6 <sup>th</sup>	2
7	Displaying data from multiple tables	7 <sup>th</sup>	2
8	Mid Exam	8 <sup>th</sup>	2

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9	Manipulating Data	9 <sup>th</sup> , 10 <sup>th</sup>	4
10	Aggregating Data	11 <sup>th</sup> , 12 <sup>th</sup>	4
11	Creating Views	13 <sup>th</sup>	2
12	Subqueries	14 <sup>th</sup> , 15 <sup>th</sup>	4
13	Final Exam	16 <sup>th</sup>	2
Number of Weeks /and Units Per Semester		16	32

#### V. Teaching strategies of the course:

- Lectures
- Class discussions
- Laboratory work
- Group projects
- Presentation

#### VI. Assignments:

No	Assignments	Week Due	Mark
1	Data Requirements	4 <sup>th</sup>	2
2	E/R Diagram	9 <sup>th</sup>	2
3	Relational Diagram	12 <sup>th</sup>	2
4	Final project Discussion	15 <sup>th</sup>	4

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## VII. Schedule of Assessment Tasks for Students During the Semester:

Assessment	Type of Assessment Tasks	Week Due	Mark	Proportion of Final Assessment
1	Project	4 <sup>th</sup> , 9 <sup>th</sup> , 12 <sup>th</sup> , 15 <sup>th</sup>	10	10%
2	Mid Term Exam practical	8 <sup>th</sup>	5	5%
3	Mid Term Exam Theoretical	10 <sup>th</sup>	10	10%
4	Final Exam (practical)	16 <sup>th</sup>	10	10%
5	Final Exam (theoretical)	16 <sup>th</sup>	60	60%
	<b>Total</b>	<b>100</b>	<b>100%</b>	

## VIII. 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" – 7<sup>th</sup> edition – USA -PERSON

### 2- Essential References.

1. Thomas Connoll & Carolyn Begg – 2015 – "Database Systems A Practical Approach to Design, Implementation, and Management" - 6<sup>th</sup> edition – USA – PERSON.
2. Jeffrey D. Ullman – "A First Course in Database Systems"- 3<sup>rd</sup> edition – USA – PERSON.

### 3- Electronic Materials and Web Sites etc.

- 1- <http://infolab.stanford.edu/~ullman/fcdb.html>

Head of Department

Assoc. Prof. Mansour N. Ali

Vise Dean for Quality Assurance

Dr. Anwar Al-Shamiri

Dean of the Faculty

Dr. Nagi Al-Shibani

Dean of Development center and Quality Assurance

Assoc. Prof. Dr.Huda Al.Emad

Rector of Sana'a University

Prof. Dr. Qassim Mohammed Abbas



2- <https://15415.courses.cs.cmu.edu/fall2016/>

<b>X. Course Policies:</b>	
Unless otherwise stated, the normal course administration policies and rules of the Faculty of Computer and Information Technology apply. For the policy, see: -----	
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The University Regulations on academic misconduct will be strictly enforced. Please refer to -----	
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<b>1</b>	<b>Class Attendance:</b> 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
<b>2</b>	<b>Tardy:</b> 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.
<b>3</b>	<b>Exam Attendance/Punctuality:</b> 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.
<b>4</b>	<b>Assignments &amp; Project</b> The assignment is given to the students after each chapter; the student has to submit all the assignments for checking on time.
<b>5</b>	<b>Cheating:</b> 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.
<b>6</b>	<b>Plagiarism:</b> 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.
<b>7</b>	<b>Other policies:</b> - 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.

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**Rector of Sana'a University**  
Prof. Dr. Qassim Mohammed Abbas



	- Lecture notes and assignments my given directly to students using soft or hard copy
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اللجنة الإشرافية			
م.	الاسم	الصفة	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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