Course Specification of Cloud Computing and IoT

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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Course Specification of Cloud Computing and IoT

I. Course Identification and General Information		
1	**Course Title:**	Cloud Computing and IoT
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:**	3rd Level -2nd Semester
5	**Pre –requisite (if any):**	Network fundamentals
6	**Co –requisite (if any):**	None
7	**Program (s) in which the course is offered:**	Computer Science
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. Sharaf Alhomdy
13	**Date of Approval**	

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I. Course Description:
This course aims to explore the cloud computing concepts from platforms and services to programming and infrastructure. It enhances students' understanding about Internet of Things (IoT) systems, including its' architecture, technologies on each layer. The topics includes cloud converging technologies, cloud frameworks, service models, virtualizations and different types of hypervisors, IoT components and architecture, sensor and sensing technology, IoT platform, and application of cloud and IoT.

	II. Course Intended learning outcomes (CILOs)	Referenced PILOs
a.1	Demonstrate knowledge of **cloud computing and IoT concepts**, components, **architecture**, **frameworks** and issues.	A3
a.2	Explain cloud and IoT enabling technologies, **sensing technology**, mechanisms, service models, deployment models **and application.**	
b.1	Compare the differences between various distributed computing middleware and their communication mechanisms.	

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b.2	Differentiated between the IoT technologies and the protocols employed at each layer.	B1,
b.3	Analyze the performance, scalability, and availability of the cloud and IoT systems and their applications.	B2
c.1	Build a private cloud computing environment to demonstrate the cloud functions.	C1 ,
c.2	Employ the concepts of IoT and cloud computing to create solutions for society problems.	C4
d.1	Demonstrate the ability to work in teams, conduct communication and management skills effectively.	D1,D
d.2	Effectively report and present the findings of study conducting in preferred domain.	3

(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. Demonstrate knowledge of **cloud computing and IoT concepts**, components, **architecture**, **frameworks** and issues.	Lectures, presentation, Class discussions	Written examinations, Quizzes.
a2. Explain cloud and IoT enabling technologies, **sensing technology**, mechanisms,		

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service models, deployment models **and application.**		

(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 the differences between various distributed computing middleware and their communication mechanisms.	Lectures Class discussions. Presentations	Written examinations Assignments
b2. Differentiated between the IoT technologies and protocols employed at each layer.	Class Discussions, Problems Solving.	Written examinations Assignments Technical report
b3. Analyze the performance, scalability, and availability of the cloud and IoT systems and their applications.		

© 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. Build a private cloud computing environment to demonstrate the cloud functions.	Short Lecture Lab experiment Problems Solving	Written examinations Quizzes Project assignment
c2. Employ the concepts of IoT and cloud computing to create solutions for society problems.		

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(D) Alignment Course Intended Learning Outcomes of Transferable Skills to Teaching Strategies and Assessment Strategies:		
Course Intended Learning Outcomes	Teaching strategies	Assessment Strategies
d1. Demonstrate the ability to work in teams, conduct communication and management skills effectively.	Group discussions presentation	Technical/Practical reports Presentations
d2. Effectively report and present the findings of study conducting in preferred domain.	Guided individual reading. Individual and group project work.	

III. Course Content:

A – Theoretical Aspect:

Order	Topic List / Units	Learning Outcomes	Sub Topics List	Number of Weeks	Contact hours
1	Introduction to Distributed and Cloud Computing	a1,a2	-Fundamental Concepts of Networking -Overview of Enterprise Networks and Internetworking -Network Function Virtualization -Network Model -Different Methods of Configuring Network Devices -Traditional computing models -Distributed and Cloud Computing Models -Client-server and peer-to-peer -Clusters and grids computing.	2	4

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			-Enabling Technologies		
2	**Fundamentals of Cloud Computing**	a1,a2,b1, c1,d2	**-Architecture of Cloud** **-Deployment Models and Cloud Services** - Deployment Models: public clouds; private clouds; hybrid clouds, **Multi-cloud** **-Service Class Models** - Infrastructure as a Service - Platform as a Service - Software as **a Service** **-Brief Overview of Existing Public Cloud Service** - Amazon Elastic Compute Cloud(EC2) - Amazon Simple Storage Service - Microsoft Azure - Google App Engine - Force.com - Salesforce.com	2	4
3	**Technological Foundations of Cloud**	a2, b1, b3, c1, c2, d1	**-Basic Foundations of Cloud Computing** **-Technological Drivers of Cloud Computing**	٢	٤

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	Computing		**-Multi-core Technology and Parallel Programming Models** **-Virtualization** **Server Virtualization Storage Virtualization Network Virtualization Memory Virtualization Desktop Virtualization Data Virtualization Application Virtualization**		
5	Service-Oriented Architecture	a2,b3, c1,d2	**Service and Service-Oriented Architectures**	1	2

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			Web Services: simple object access protocol (SOAP)		
6	The IoT landscape	a1,b2, c2, d2	**-What is IoT** **-Applications** **-Architectures** **-Wireless networks(WSN) Devices** **- Security and privacy**	2	4
7	IoT System Architecture	a1,b2,c2 , d2	**-Introduction** **-Protocols concepts** **-IoT-Oriented protocols** **Databases** **Time bases** **Security**	2	4
8	IoT Devices	a2,b2,c2	**IoT device design space**	1	2

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			Cost of ownership and power consumption **Duty cycle and power consumption** **Platform design**		
9	Event-Driven System Analysis	a2, b3,c2,d2	**Introduction** **IoT network model** **IoT event analysis**	1	2
10	Industrial IoT	a2, b2,b3,c2, d1,d2	**Introduction** **Industrial IoT** **IIOT architecture** **Basic technologies** **Applications and challenges**	1	2
Number of Weeks /and Units Per Semester				**14**	**28**

B - Practical Aspect: (if any)				
Order	Tasks/ Experiments	CILOs (symbols)	Number of Weeks	Contact Hours

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1	**Programming Socket RMI, RPC**	a2,b1,c2,d1	**2**	**4**
2	**Web Services & Xml**	**a2,b1,c2,d1**	**1**	**2**
3	Virtualization	**a2,b3,c2,d1,d2**	**1**	**2**
4	Design a Private cloud	**b3,c1,d1,d2**	**2**	**4**
5	Mid Term Exam	**a2,b1,b3,c1,c2**	**1**	**2**
6	Sketch the architecture of IoT Toolkit and explain each entity in brief	a1, b2,c2,d2	**1**	**2**
7	Local processing on the sensor nodes	b2,c2,d1	**2**	**4**
8	Connecting devices at the edge and to the cloud	b2,c2,d2	**1**	**2**
9	Setting up wireless mesh networks	b3,c2,d2	**1**	**2**
10	Processing and analyzing data offline and in the cloud	a2,b3,c2,d2	**2**	**4**
Number of Weeks /and Units Per Semester			14	28

IV. Teaching strategies of the course:

- Lectures/short lecture
- Class discussions
- Lab experiments
- Problems Solving
- Guided individual reading.
- Individual and group project work
- Group discussions work
- Presentation

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V. Assignments:

No	Assignments	Aligned CILOs(symbols)	Week Due	Mark
1	Chatting Application using (RPC /RMI)	b1,c2,d1,d2	4th	5
2	Write a web service to calculate the currency exchange Rate	b1,b3,c2,d1,d2	8th	5
3	Real case problem which is required to solve it technically and deliver a smart IoT product.	b2,c1,c2,d1,d2	13th	5
Total				15

VI. 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, 8th,13th	15	15%	b1, b2,b3, c1,c2,d1,d2
2	Mid Term Exam practical	7th	5	5%	**a2,b1,b3,c1,c2**
3	Mid Term Exam Theoretical	7th	10	10%	a1,a2,b1,b3,c1,c2
4	Final Exam (practical)	15th	10	10%	**a1, a2,b1,b2, b3,c1,c2**
5	Final Exam (theoretical)	16th	60	60%	a1,a2,b1,b2,b3,c1,c2

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	Total	100	100%	

VII. Learning Resources:

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

1- Chellammal Surianarayanan and Pethuru Raj Chelliah, (2019). " Essentials of Cloud Computing, A Holistic Perspective", Springer Nature Switzerland AG, Switzerland.
2- Dimitrios Serpanos and Marilyn Wolf, 2018, Internet-of-Things (IoT) Systems Architecture s, Algorithms, Methodologies, Switzerland-Springer, Switzerland.

2- Essential References.

1- Andrew Minteer, 2017, Analytics for the Internet of Things (IoT): Intelligent analytics for your intelligent devices, Packt Publishing.
2- Geoffrey C. Fox, Jack Dongarra, Kai Hwang, (2013), "Distributed and Cloud Computing From Parallel Processing to the Internet of Things"
3- Pradeeka Seneviratne, 2015, Internet of Things with Arduino Blueprin Packt Publishing.
4- G. Coulouris, J. Dollimore, T. Kindberg, and G. Blair, (2012), "Distributed Systems: Concepts and Design", 5th Edition, Addison Wesley, USA.

3- Electronic Materials and Web Sites *etc*.

- http://msdn.microsoft.com

- All API functions http://www.pinvoke.net

- https://www.tutorialspoint.com/cloud_computing/index.htm

- https://data-flair.training/blogs/best-cloud-computing-books/

VIII. Course Policies:

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1	Class Attendance: - According to university rules that determine the attendance policy , the adoption of absence and how and when to deprive the student of maturity (the student must attend at least 75% of the number of lectures).
2	Tardy: - Late attendance is determined by the policy in cases of recurrences delayed depriving the student to attend some educational activities by the teacher.
3	Exam Attendance/Punctuality: - According to the university rules which determines attendance policy, delays and absence from the test
4	Assignments & Projects: - Determine the policies followed in cases of delay in submitted homework & projects and when it should be delivered to the teacher.
5	Cheating: - According to the university rules
6	Plagiarism: - According to the university rules
7	**Other policies:** The University official regulations in force will be strictly observed and students shall comply with all rules and regulations of the examination set by the Department, Faculty and University Administration.

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Faculty of Computer & Information Technology

Department of Computer Science

Program of Computer Science

Course syllabus of Cloud Computing and IoT

Course No (...................)

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Cloud Computing and IoT **Course Plan (Syllabus)**

I. - Information about Faculty Member Responsible for the Course:

Name of Faculty Member		Office Hours					
		SAT	SUN	MON	TUE	WED	THU
Location& Telephone No.							
E-mail							

II. Course Identification and General Information:

1-	**Course Title:**	Cloud Computing and IoT			
2-	**Course Number & Code:**				
3-	**Credit hours:**	**C.H**				**Total**

		Th.	Seminar	Pr.	F. Tr.	Total
3-	Credit hours:	2	-	2		3

4-	**Study level/ semester at which this course is offered:**	3rd Level -2nd Semester
5-	**Pre –requisite (if any):**	Network fundamentals
6-	**Co –requisite (if any):**	None
7-	**Program (s) in which the course is offered:**	Computer Science
8-	**Language of teaching the course:**	English/Arabic
9-	**Study System**	Term Based System

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10-	**Mode of delivery:**	Full Time
11-	**Location of teaching the course:**	Faculty of Computer and Information Technology (Room Lecture and Lab)

III. Course Description:

This course aims to explore the cloud computing concepts from platforms and services to programming and infrastructure. It enhance students' understanding about Internet of Things (IoT) systems, including its' architecture, technologies on each layer. The topics includes cloud converging technologies, cloud frameworks, service models, virtualizations and different types of hypervisors, IoT components and architecture, sensor and sensing technology, IoT platform, and application of cloud and IoT.

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

a1. Demonstrate knowledge of **cloud computing and IoT concepts**, components, **architecture**, **frameworks** and issues

a2. Explain cloud and IoT enabling technologies, **sensing technology**, mechanisms, service models, deployment models **and application.**

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b1.Compare the differences between various distributed computing middleware and their communication mechanisms.

b2. Differentiated between the IoT technologies and protocols employed at each layer.

b3. Analyze the performance, scalability, and availability of the cloud and IoT systems and their applications.

c1. Build a private cloud computing environment to demonstrate the cloud functions.

c2. Employ the concepts of IoT and cloud computing to create solutions for society problems.

d1. Demonstrate the ability to work in teams, conduct communication and management skills effectively.

d2. Effectively report and present the findings of study conducting in preferred domain.

V. Course Content:
Distribution of Semester Weekly Plan of Course Topics/Items and Activities.
A – Theoretical Aspect:

Order	Topic List / Units	Sub Topics List	Week Due	Contact hours
1	Introduction to Distributed and Cloud Computing	-Fundamental Concepts of Networking -Overview of Enterprise Networks and Internetworking -Network Function Virtualization -Network Model -Different Methods of Configuring Network Devices -Traditional computing models -Distributed and Cloud Computing Models	1st & 2nd	4

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		-Client-server and peer-to-peer -Clusters and grids computing. - -Enabling Technologies		
2	**Fundamentals of Cloud Computing**	**-Architecture of Cloud** **-Deployment Models and Cloud Services** - Deployment Models: public clouds; private clouds; hybrid clouds, **Multi-cloud** **-Service Class Models** - Infrastructure as a Service - Platform as a Service - Software as **a Service** **-Brief Overview of Existing Public Cloud Service** - Amazon Elastic Compute Cloud(EC2) - Amazon Simple Storage Service - Amazon Cloud Front - Microsoft Azure - Google App Engine - Force.com - Salesforce.com	3rd & 4th	4
3	**Technological Foundations**	**-Basic Foundations of Cloud Computing**	5th & 6th	٤

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	of Cloud Computing	-Technological Drivers of Cloud Computing -Multi-core Technology and Parallel Programming Models -Virtualization - Server Virtualization Storage Virtualization Network Virtualization Memory Virtualization Desktop Virtualization Data Virtualization Application Virtualization		
4	Midterm Exam	- Midterm exam	7th	2

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5	Service-Oriented Architecture	**Service and Service-Oriented Architectures** - **Web Services: simple object access protocol (SOAP)**	8th	2
6	The IoT landscape	**-What is IoT** **-Applications** **-Architectures** **-Wireless networks(WSN) Devices** - **- Security and privacy**	9th & 10th	4
7	IoT System Architecture	**-Introduction** **-Protocols concepts** **-IoT-Oriented protocols** **Databases** **Time bases**	11th &12th	4

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		- **Security**		
8	IoT Devices	**IoT device design space** **Cost of ownership and power consumption** **Duty cycle and power consumption** **Platform design**	13th	2
9	Event-Driven System Analysis	**Introduction** **IoT network model** **IoT event analysis**	14th	2
10	Industrial IoT	**Introduction** **Industrial IoT** **IIOT architecture** **Basic technologies** **Applications and challenges**	15th	2
11	Final Exam	Exam	16th	2
	Number of Weeks /and Units Per Semester		16	32

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\multicolumn{4}{l}{**B - Practical Aspect: (if any)**}
Order	**Tasks/ Experiments**	**Due Weeks**	**Contact Hours**
1	**Programming Socket RMI, RPC**	1st & 2nd	4
2	**Web Services & Xml**	3rd	2
3	Virtualization	4th	2
4	Design a Private cloud	5th & 6th	4
5	Mid Term Exam	7th	2
6	Sketch the architecture of IoT Toolkit and explain each entity in brief	8th	2
7	Local processing on the sensor nodes	9th & 10th	4
8	Connecting devices at the edge and to the cloud	11th	2
9	Setting up wireless mesh networks	12th	2
10	Processing and analyzing data offline and in the cloud	13th & 14th	4
	Number of Weeks /and Units Per Semester	15th	٣٠

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VI. Teaching strategies of the course:

- Lectures/short lecture
- Class discussions
- Lab experiments
- Problems Solving
- Guided individual reading.
- Individual and group project work
- Group discussions
- Presentation

VII.   Assignments:

No	Assignments	Week Due	Mark
1	Chatting Application using (RPC /RMI)	4th	5
2	Write a webservice to calculate the currency exchange Rate	8th	5
3	Real case problem which is required to solve it technically and deliver a smart IoT product.	13th	5
	Total Score		15

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, 12th 13th	15	15%
2	Mid Term Exam practical	7th	5	5%
3	Mid Term Exam Theoretical	7th	10	10%
4	Final Exam (practical)	16th	10	10%

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5	Final Exam (theoretical)	16th	60	60%
Total			100	100%

IX. Learning Resources:

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

1. Chellammal Surianarayanan and Pethuru Raj Chelliah, (2019). " Essentials of Cloud
   Computing, A Holistic Perspective", Springer Nature Switzerland AG 2019, Switzerland.
2. Dimitrios Serpanos and Marilyn Wolf, 2018, Internet-of-Things (IoT) Systems Architecture s, Algorithms, Methodologies, Switzerland- Springer, Switzerland.

2- Recommended Readings and Reference Materials.

1- Andrew Minteer, 2017, Analytics for the Internet of Things (IoT): Intelligent analytics for your intelligent devices, Packt Publishing.
2- Geoffrey C. Fox, Jack Dongarra, Kai Hwang, (2013), "Distributed and Cloud Computing From Parallel Processing to the Internet of Things"
3- Pradeeka Seneviratne, 2015, Internet of Things with Arduino Blueprints, Packt Publishing.
4- G. Coulouris, J. Dollimore, T. Kindberg, and G. Blair, (2012), "Distributed Systems: Concepts and Design", 5th Edition, Addison Wesley, USA.

3- Electronic Materials and Web Sites *etc*.

-http://msdn.microsoft.com

- All API functions http://www.pinvoke.net

- https://www.tutorialspoint.com/cloud_computing/index.htm

- https://data-flair.training/blogs/best-cloud-computing-books/

X.	**Course Policies**
1	Class Attendance: According to university rules that determine the attendance policy , the adoption of absence and how and when to deprive the student of maturity (the student must attend at least 75% of the number of lectures).
2	Tardy:

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		Late attendance is determined by the policy in cases of recurrences delayed depriving the student to attend some educational activities by the teacher.
3		Exam Attendance/Punctuality: According to the university rules which determines attendance policy, delays and absence from the test
4		Assignments & Projects: Determine the policies followed in cases of delay in submitted homework & projects and when it should be delivered to the teacher.
5		Cheating: According to the university rules
6		Plagiarism: According to the university rules
7		**Other policies:** The University official regulations in force will be strictly observed and students shall comply with all rules and regulations of the examination set by the Department, Faculty and University Administration.

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اللجنة الإشرافية

م.	الاســـم	الصــــــفة	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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