Course Specification of Programming languages techniques (Arduino)

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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وحدة ضمان الجودة

I. Course Identification and General Information:

1	**Course Title:**	Programming languages techniques (Arduino)				
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:**	3th Level -1st Semester				
5	**Pre –requisite (if any):**	Computer programming				
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 sytem				
10	**Mode of delivery:**	Full Time				
11	**Location of teaching the course:**	Faculty of Computer and Information Technology				
12	**Prepared By:**	Dr. Anwar Al-Shamiri				
13	**Date of Approval**					

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II.   Course Description:

This course will introduce graduate students to Arduino principles and programming concepts to create interactive environment using sensors and actuators. Topics include programming a microcontroller to respond to inputs and to control various devices, such as LEDs, sensors, and servo motors. It is designed for students who want to increase their understanding of microcontrollers and embedded programming.

III. Course Intended learning outcomes (CILOs) of the course		Referenced PILOs
a.1	Describe Arduino's architecture, including inputs and connectors for add-on devices.	A2,A3
a.2	Explain the use of a microcontroller in the integration of various inputs and outputs.	
b.1	Plan innovative tools to serve different real-world problems.	B2.B3
b.2	Design a circuit using a microcontroller to monitor and control connected devices.	
c.1	Program Arduino to control lights, motors, displays, sensors, and other devices	C4.C6
c.2	Build an autonomous control system that monitors sensors input and responds accordingly.	
d.1	Work effectively either individually or in groups to accomplish assigned tasks.	D1,D3
d.2	Exhibit self-learning abilities in the Microcontrollers advances and applications	

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

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Course Intended Learning Outcomes	Teaching strategies	Assessment Strategies
a1. Describe Arduino's architecture, including inputs and connectors for add-on devices.	Lectures, Lab Sessions	Written examinations, Quizzes.
a2. Explain the use of a microcontroller in the integration of various inputs and outputs.	Lectures, Lab Sessions	Written examinations, Quizzes

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

Course Intended Learning Outcomes	Teaching strategies	Assessment Strategies
b1. Plan innovative tools to serve different real-world problems.	Problem solving, case study	Assignments, Presentations.
b2. Design a circuit using a microcontroller to monitor and control connected devices.	Problem solving, case study	Assignments, Presentations.

© **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. Program Arduino to control lights, motors, displays, sensors, and other devices	Lab experiment, Problems Solving, case study	Projects, assignment

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c2. Build an autonomous control system that monitors sensors input and responds accordingly.	Lab experiment, Problems Solving, case study	Projects, assignment

(D) Alignment Course Intended Learning Outcomes of Transferable Skills to Teaching Strategies and Assessment Strategies:		
Course Intended Learning Outcomes	Teaching strategies	Assessment Strategies
d1. Work effectively either individually or in groups to accomplish assigned tasks.	Group discussions work. Seminar, Assignments	Technical or practical reports /Presentations
d2. Exhibit self-learning abilities in the Microcontrollers advances and applications	Guided individual reading./Assignments Individual and group project work.	Technical or practical reports /Presentations

IV. Course Content:

A – Theoretical Aspect:

Order	Topic List / Units	Learning Outcomes	Sub Topics List	Number of Weeks	Contact hours
1	Introduction	a1,a2	• Introduction to embedded system • Understanding Embedded System • Overview of basic electronics and	1	2

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			digital electronics. • Microcontroller vs. Microprocessor • Common features of Microcontroller. •		
2	Getting Started with Arduino	a1,a2	• Introduction to Arduino • Pin configuration and architecture. • Device and platform features. • Concept of digital and analog ports. • Familiarizing with Arduino Interfacing Board • Introduction to Embedded C and Arduino platform	1	2
3	Arduino i/o Functions	a2,b1,b2,c1	• Pins Configured as INPUT • Pull-up Resistors • Pins Configured as OUTPUT • pinMode() Function • digitalWrite() Function • analogRead() function • Arduino Interrupts	1	2
4	Arduino Time	a2,b1,b2,c1	• Incorporating Arduino time • delay() function	1	2

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			• delay Microseconds () function • millis() function • micros() function .		
5	Giving Input to the controller	a2,b1,b2,c1	• Using serial input. • Controlling LEDs with keys. • Keys as toggle switch. • Interfacing a piezo Buzzer • Using a buzzer as an alarm unit	2	4
6	Arduino Sensors	a2,b1,b2,c1,c2	• Arduino – Humidity Sensor • Arduino – Temperature Sensor Arduino – Water Detector / Sensor • Arduino – PIR Sensor Arduino – Ultrasonic Sensor • Arduino – Connecting Switch (Magnetic relay switches)	2	4
7	Arduino Displays	a2,b1,b2,c1,c2	• Working with Serial Monitor • Line graph via serial monitor • Interfacing a 8 bit LCD to Arduino	2	4

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			• Fixed one-line static message display. • Running message display. • Using the LCD Library of Arduino.		
8	Arduino Secondary Integrations	a2,b1,b2,c1,c2	• Types of Relay • Controlling Electrical appliances with electromagnetic relays • Working of a matrix keypad • Using the keypad library to interface with Arduino. • Interfacing Servo motors to Arduino • Interfacing a RF Module	2	4
9	Arduino Communications	a2,b1,b2,c1,c2	• Parallel Communication • Serial Communication Modules • Types of Serial Communications • Arduino UART • GSM/GPRS Arduino Interfacing	2	4
Number of Weeks /and Units Per Semester				**14**	**28**

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B - Practical Aspect: (if any)

Order	Tasks/ Experiments	CILOs (symbols)	Number of Weeks	Contact Hours
1	Arduino IDE - **Installing the Environment** - **Getting started with the Arduino IDE**	a2	1	2
2	Test Arduino - **Programming Blinking LED** - **Multiple LEDs** - **RGB LED**	b1, c1,c2,d1	2	4
3	Arduino Programming - **Programming Inputs** - **Buttons/Switches** - **Buzzers**	b1, c1,c2,d1	2	4
4	Sensors - Infrared (IR) Sensors - Temperature Sensor - Relay Module	b1,b2 c1,c2,d1	2	4
5	**DISPLAY** - **LCD Display 16×2 / 20×4** - **7-Segment Display**	b1,b2, c1,c2,d1	2	4
6	**MOTORS** - **Servo Motors** - **DC Motors** - **Stepper Motors**	b1,b2,c1,c2,d1	2	4
7	**Connectivity** - **Bluetooth** - **WiFi**	b1,b2,c1,c2,d1	2	4
8	**Final Exam**	a1,a2,b1,b2,c1,c2	1	2

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Number of Weeks /and Units Per Semester	13	26

V. Teaching strategies of the course:

- Lectures
- Class discussions
- Lab experiments
- Problems Solving
- Guided individual reading.
- Individual and group project work
- Group discussions work
- Seminar/presentation

VI. Assignments:

No	Assignments	Aligned CILOs(symbols)	Week Due	Mark
1	**Assignment1**: Controlling LEDS from computer (Blinking, Even and odd states)	b1,b2,c1,d1,d2	3rd	5
2	**Assignment2**: Fire sensor for distance 1-2 meters.	b1,b2,c1,c2,d1,d2	7th	5
3	**Assignment3:** Display a message in LCD Screen	b1,b2,c1,d1,d2	10th	5
4	**Assignment4:** Controlling Servo Motor with Joystick	b1,b2,c1,d1,d2	13th	5

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5	**Project 1: Intelligent home locking system.**	b1,b2,c1,c2,d1,d2	7th	10
6	**Project 2: Bluetooth Controlled Robot**	b1,b2,c1,c2,d1,d2	15th	20

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	Assignments	3rd, 7th , 10th ,13th	20	10%	b2, bc1, c2,d1,d2
2	Projects (single\group)	7th , 15th	20	10%	b2, b1,c1,c2,d1,d2
3	Mid Term Exam practical	8th	20	5%	b1,b2,c1,c2,d1
4	Mid Term Exam Theoretical	9th	20	10%	a1,a2,b1,b2
5	Final Exam (practical)	15th	10	5%	a1,a2,b1,b2,c1,c2
6	Final Exam (theoretical)	16th	60	60%	a1,a2,b1,b2,c1,c2
	Total		**150**	**100%**	

VIII. **Learning Resources:**
1-
1- Required Textbook(s) (maximum two).
1. Ashwin Pajankar, 2018, Arduino made simple,1st Ed,BPB publication

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2- Essential References.
1- Massimo Banzi , Michael Shiloh, 2015, Getting Started with Arduino, 3rd Ed, Maker Media 2. William P. Osborne, 2017, Learn to Program in Arduino C: 18 Lessons, from setup() to robots, , Armadillo Books
3- Electronic Materials and Web Sites *etc*.
1. https://www.arduino.cc/en/Tutorial/HomePage?from=Main.Tutorials 2. https://www.tutorialspoint.com/arduino/index.htm 3. https://www.makerspaces.com/arduino-uno-tutorial-beginners/ 4. https://www.instructables.com/id/A-Beginners-Guide-to-Arduino/

IX. 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:** 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.

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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 Programming languages techniques (Arduino)

Course No   (………………)

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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:**	Programming languages techniques (Arduino)				
2-	**Course Number & Code:**					
3-	**Credit hours:**	**C.H**				Total
		Th.	Seminar	Pr.	F. Tr.	
		2	-	2		3
4-	**Study level/ semester at which this course is offered:**	1st Semester - 3th Level				
5-	**Pre –requisite (if any):**	Computer programming				
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				

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11-	**Location of teaching the course:**	Faculty of Computer and Information Technology

III. Course Description:

This course will introduce graduate students to Arduino principles and programming concepts to create interactive environment using sensors and actuators. Topics include programming a microcontroller to respond to inputs and to control various devices, such as LEDs, sensors, and servo motors. It is designed for students who want to increase their understanding of microcontrollers and embedded programming.

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

a1. Describe Arduino's architecture, including inputs and connectors for add-on devices.

a2. Explain the use of a microcontroller in the integration of various inputs and outputs.

b1. Plan innovative tools to serve different real-world problems.

b2. Design a circuit using a microcontroller to monitor and control connected devices.

c1. Program Arduino to control lights, motors, displays, sensors, and other devices

c2. Build an autonomous control system that monitors sensors input and responds accordingly.

d1. Work effectively either individually or in groups to accomplish assigned tasks.

d2. Exhibit self-learning abilities in the Microcontrollers advances and applications

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V. Course Content:

A – Theoretical Aspect:

Order	Topic List / Units	Sub Topics List	Number of Weeks	Contact hours
1	Introduction	• Introduction to embedded system • Understanding Embedded System • Overview of basic electronics and digital electronics. • Microcontroller vs. Microprocessor • Common features of Microcontroller. -	1	2
2	Getting Started with Arduino	• Introduction to Arduino • Pin configuration and architecture. • Device and platform features. • Concept of digital and analog ports. • Familiarizing with Arduino Interfacing Board - Introduction to Embedded C and Arduino platform	1	2

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3	Arduino i/o Functions	• Pins Configured as INPUT • Pull-up Resistors • Pins Configured as OUTPUT • pinMode() Function • digitalWrite() Function • analogRead() function - Arduino Interrupts	1	2
4	Arduino Time	• Incorporating Arduino time • delay() function • delay Microseconds () function • millis() function - micros() function .	1	2
5	Giving Input to the controller	• Using serial input. • Controlling LEDs with keys. • Keys as toggle switch. • Interfacing a piezo Buzzer - Using a buzzer as an alarm unit	2	4

6	Arduino Sensors	• Arduino – Humidity Sensor
		• Arduino – Temperature Sensor
		  Arduino – Water Detector / Sensor
		• Arduino – PIR Sensor
		  Arduino – Ultrasonic Sensor
		- Arduino – Connecting Switch (Magnetic relay switches)
			2	4

7	Mid test	-	1	2
8	Arduino Displays	• Working with Serial Monitor • Line graph via serial monitor • Interfacing a 8 bit LCD to Arduino • Fixed one-line static message display. • Running message display. - Using the LCD Library of Arduino.	2	4
9	Arduino Secondary Integrations	• Types of Relay • Controlling Electrical appliances with electromagnetic relays • Working of a matrix keypad	2	4

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		• Using the keypad library to interface with Arduino. • Interfacing Servo motors to Arduino - Interfacing a RF Module		
10	Arduino Communications	• Parallel Communication • Serial Communication Modules • Types of Serial Communications • Arduino UART - GSM/GPRS Arduino Interfacing	2	4
11	Final Exam	- Final Exam	1	2
	Number of Weeks /and Units Per Semester		16	32

B - Practical Aspect: (if any)			
Order	Tasks/ Experiments	Number of Weeks	Contact Hours
1	**Arduino IDE** - **Installing the Environment** - **Getting started with the Arduino IDE**	1	2
2	**Test Arduino** - **Programming Blinking LED** - **Multiple LEDs** - **RGB LED**	2	4
3	**Arduino Programming** - **Programming Inputs** - **Buttons/Switches** - **Buzzers**	2	4
4	Sensors - Infrared (IR) Sensors - Temperature Sensor - Relay Module	2	4

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5	Mid Exam	1	2
6	**DISPLAY** - **LCD Display 16×2 / 20×4** - **7-Segment Display**	2	4
7	**MOTORS** - **Servo Motors** - **DC Motors** - **Stepper Motors**	2	4
8	**Connectivity** - **Bluetooth** - **WiFi**	2	4
9	Final Exam	1	2
	Number of Weeks /and Units Per Semester	**15**	**30**

VI. Teaching strategies of the course:

- Lectures
- Class discussions
- Lab experiments
- Problems Solving
- Guided individual reading.
- Individual and group project work
- Group discussions work
- Seminar/presentation

VII. Assignments:

No	Assignments	Week Due	Mark
1	Assignment1: Controlling LEDS from computer (Blinking, Even and odd states)	3rd	5

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2	Assignment2: Fire sensor for distance 1-2 meters.	7th	5
3	Assignment3: Display a message in LCD Screen	10th	5
4	Assignment4: Controlling Servo Motor with Joystick	13th	5
5	Project 1: Intelligent home locking system.	7th	10
6	Project 2: Bluetooth Controlled Robot	15th	20
Total Score			100

VIII.	**Schedule of Assessment Tasks for Students During the Semester:**			
Assessment	**Type of Assessment Tasks**	**Week Due**	**Mark**	**Proportion of Final Assessment**
1	Assignments	3rd, 7th, 10th ,13th	20	10%
2	Projects (single\group)	7th , 15th	20	10%
3	Mid Term Exam practical	8th	20	5%
4	Mid Term Exam Theoretical	9th	20	10%
5	Final Exam (practical)	15th	10	5%
6	Final Exam (theoretical)	16th	60	60%
Total			150	100%

IX. Learning Resources:

1. Dan C. Marinescu, 2017, Cloud Computing: Theory and Practice,2nd Ed ,Morgan Kaufmann Publishers
2. G. Coulouris, J. Dollimore, T. Kindberg, and G. Blair, (2013), "Distributed Systems: Concepts and Design", 6th Edition, Pearson.

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1- Required Textbook(s) (maximum two).
1. Ashwin Pajankar, 2018, Arduino made simple,1st Ed,BPB publication

2- Essential References.
1. Massimo Banzi , Michael Shiloh, 2015, Getting Started with Arduino, 3rd Ed, Maker Media 2. William P. Osborne, 2017, Learn to Program in Arduino C: 18 Lessons, from setup() to robots, , Armadillo Books

3- Electronic Materials and Web Sites *etc.*
1. https://www.arduino.cc/en/Tutorial/HomePage?from=Main.Tutorials 2. https://www.tutorialspoint.com/arduino/index.htm 3. https://www.makerspaces.com/arduino-uno-tutorial-beginners/ 4. https://www.instructables.com/id/A-Beginners-Guide-to-Arduino/

X. 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:** 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.

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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

اللجنة الإشرافية

م.	الاســـــم	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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