Philadelphia University

Faculty of Engineering & Technology – Mechatronics Department

First Semester 2023/2024

Course Details:

Title: Distributed & Embedded Real-Time Systems (0640751)

Prerequisite: None

Credit Hours: 3 credit hours (16 weeks per semester, approximately 45 contact hours)

Textbooks:

- Real-Time Systems: Design Principles for Distributed Embedded Applications, By: Hermann Kopetz, Springer, 2011, ISBN: 144198237X.

References:

- J. Cooling, Software Engineering for Real-Time Systems, Addison Wesley, UK 2003. www.pearsopneduc.com.
- Timothy D. Green, EMBEDDED SYSTEMS PROGRAMMING WITH THE PIC16F877, Second Edition, 2008.
- J.W.S. LIN, Real-Time Systems, Prentice Hall, 2000. 4. N. NISSANKE, Real-Time Systems, Prentice Hall, 1997.
- R.J.A. BUHR & D.L. BAILEY, An Introduction to Real-Time Systems, Prentice Hall, 1999.
- Stuart Bennett, Real-Time Computer Control, By: Prentice-Hall, 2nd edition, 1994.
- J. Cooling, Software Engineering for Real-Time Systems, Addison Wesley, UK 2003.
- W. VALVANO, Embedded Microcomputer Systems: Real-Time Interfacing, Brooks-Cole Publisher, 2000.

Course Description: The main objective of this course is to cover the principles and design methods of real-time computer systems. It covers the interfacing techniques and microprocessor system realization. The principles of real-time operating systems and real-time software system will be covered in this course.

Website: http://www.philadelphia.edu.jo/academics/kaubaidy/page.php?id=7

Instructor: Prof. Kasim M. Al-Aubidy

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Office: Engineering building, Room 6713, Ext: 2504

Class hours: Saturday: 11:15-14:15

Office hours: Monday: 12:00-14:00

Course Outlines:

Week	Topic
1	An introduction to distributed and embedded real-time systems.
2	Elements and classification of distributed and embedded real-time systems
3	Computer control systems; Sequence control, DDC, PID control, Supervisory control, Adaptive control, Intelligent control. Hierarchical and Distributed systems.
4	Real-time environment, Why a distributed solution?
5	Hardware design requirements; analog, digital, pulse interfacing
6	Embedded system design requirements; single- chip and single-board design.
7	Microcontroller architecture and interfacing.
8	Microcontroller programming: instruction sets, timing & subroutines.
9	Realization of real-time algorithms, Hardware and software co-design
10	Stability analysis of real-time systems.
11	Real-time communications, Wireless sensor networks

12	Real-time operating systems,
13	Real-time scheduling.
14	Real-time systems design, Testing, Validating & debugging.
15	Time-triggered systems
16	Mini Projects of DERTS: Discussion

Course Learning Outcomes with reference to ABET Student Outcomes:

Upon successful completion of this course, the student should:

1.	Identify distributed and embedded real-time systems, and the components of the system	[h, j]
2.	Be able to design and implement an embedded real-time controller.	[a, b, c, e]
3.	Understand the basic tools and techniques of real-time systems	[a, b]
4.	Understand the operation of distributed embedded real-time systems	[a]
5.	Task implementation for real-time mechatronics systems	[a, b, c]
6.	Have the ability to modify IoT based Real-time systems	[e]

Assessment Guidance:

Evaluation of the student performance during the semester (total final mark) will be conducted according to the following activities:

Sub-Exams: Students will take a scheduled written exam in the middle of the semester. The exam will cover the material presented in the previous weeks' lectures.

Assignments: (3) assignments related to the distributed and embedded real-time systems will be submitted during the semester.

Projects: The project is an implementation of an embedded microcontroller for real-time applications. It is divided into three graded phases, Design, Simulation, and Implementation. Each student should work individually on the project and it should be submitted before or on a set agreed date.
Cheating by copying homework from others is strictly forbidden and punishable by awarding the work with zero mark.

Collective Participation: Brain storming and collective discussions will be carried out during any lecture. Individual studentwill be assessed accordingly.

Final Exam: The students will undergo a scheduled final exam at the end of the semester covering the whole materials taught in the course.

Grading policy:

Mid Exam	30%
Projects	20%
Assignments	10%
Final Exam	40%
Total:	100%

Attendance Regulation:

The semester has in total 45 credit hours. Total absence hours from classes and tutorials must not exceed 15% of the total credit hours. Exceeding this limit without a medical or emergency excuse approved by the deanship will prohibit the student from sitting the final exam and a zero mark will be recorded for the course. If the excuse is approved by the deanship the student will be considered withdrawn from the course.

October, 2023