Course Specification of: Advanced Embedded Systems Design

Course Code (MTE531)

• General Information About the Course:

49.	**Course Title:**	**Advanced Embedded Systems Design**			
50.	**Course Code and Number:**	**MTE531**			
51.	**Credit Hours:**	**Credit Hours**			**Total**
		Lecture	Practical	Seminar/Tutorial	
		3	--	--	**3**
52.	**Study Level and Semester:**	**2nd Semester**			
53.	**Pre-requisites (if any):**				
54.	**Co-requisites (if any):**				
55.	**Program (s) in which the course is offered:**	M. Sc. in Mechatronics Engineering Programs			
56.	**Language of teaching the course:**	English			
57.	**Study System:**	Courses & Thesis			
58.	**Prepared By:**	Assoc. Prof. Dr. Farouk Al-Fahaidy			
59.	**Reviewed by:**	Assoc. Prof. Dr. Radwan M. AL Bouthigy			
60.	**Date of Approval:**				

• Course Description:

This course provides advanced concepts on Embedded systems design, advanced microcontrollers architecture and capabilities, as well as, System on Chip (SoC) design. The future of embedded systems and IoT lies in the advancement of technologies that enable faster communication with high interwoven connections between different devices. Course covers, an overview on advanced 32-bit ARM microcontrollers, Embedded System Design concepts & Project Management, ESs Firmware/software, ESs Digital Signal Processing and ESs Communications. Throughout course projects & case study works, students develop their skills in ESs design and implementation.

• Course Intended Learning Outcomes (CILOs):

Upon successful completion of **Advanced Embedded Systems Design Course**, the graduates will be able to:

a1- Discuss hardware/software partitioning in system design and the strategies for embedded firmware design and development.

a2 - Explain architectural features of 32-bit ARM Microcontrollers, as well as, their instruction sets, programming and applications in sustainable design and development of embedded Systems.

b1 - Analyze a system both as whole and in the included parts, for understanding how these parts interact in the functionality and properties of the system.

b2- Suggest innovative embedded systems for solving practice problems, related to SoC designing and implementation considering their constituting elements limits. **c1- Develop an integrated development environment in embedded system based on software and electronical hardware tools.** **c2- Apply formal method, testing, verification, validation and simulation techniques and tools in order to engineer reliable and safe embedded systems.** **d1- Establish a high level of skills in writing, presenting and defending research/project activities through course works.** **d2- Balance professional and ethical responsibilities including contemporary issues and environmental awareness in the field of embedded systems design and integration.**

- **Alignment of Course Intended Learning Outcomes (CILOs) to Program Intended Learning Outcomes (PILOs)**

CILOs		PILOs
u. Knowledge and Understanding: Upon successful completion of **the Advanced Embedded Systems Design Course**, the graduates will be able to:		**U. Knowledge and Understanding:** Upon successful completion of the **MSc. In Mechatronics Engineering Program**, the graduates will be able to:
a1.	**Discuss hardware/software partitioning in system design and the strategies for embedded firmware design and development.**	**A1.** Demonstrate in-depth understanding of applied mathematics in Mechatronics engineering, control system, computer engineering and science, and electronics to design more functional, adaptable and cost-effective products.
a2.	**Explain architectural features of 32-bit ARM Microcontrollers, as well as, their instruction sets, programming and applications in sustainable design and development of embedded Systems.**	**A3.** Explain in-depth the principles of sustainable design and development of Mechatronics engineering.
v. Cognitive/ Intellectual Skills: Upon successful completion of the **Advanced Embedded Systems Design Course,** the graduates will be able to:		**V. Cognitive/ Intellectual Skills:** Upon successful completion of the **MSc. In Mechatronics Engineering Program,** the graduates will be able to:
b1.	**Analyze a system both as whole and in the included parts, for understanding how these parts interact in the functionality and properties of the system.**	**B2.** Identify, formulate and analyze research and solve complex Mechatronics engineering problems.
b2.	**Suggest innovative embedded systems for**	**B3.** Design Mechatronics system,

	solving practice problems, related to SoC designing and implementation considering their constituting elements limits.	component, or process to meet desired needs within realistic constraints.
w. Professional and Practical Skills: Upon successful completion of the **Advanced Embedded Systems Design Course,** the graduates will be able to:		**W. Professional and Practical Skills:** Upon successful completion of the **MSc. In Mechatronics Engineering Program,** the graduates will be able to:
c1.	**Develop an integrated development environment in embedded system based on software and electronical hardware tools.**	C2. Use advanced methodologies and skills to solve Mechatronics engineering problems.
c2.	**Apply formal method, testing, verification, validation and simulation techniques and tools in order to engineer reliable and safe embedded systems.**	C3. Apply acquired knowledge of analysis and design for mechatronics engineering systems and implementation process.
x. Transferable Skills: Upon successful completion of the **Advanced Embedded Systems Design Course,** the graduates will be able to:		**X. Transferable Skills:** Upon successful completion of the **MSc. In Mechatronics Engineering Program,** the graduates will be able to:
d1.	**Establish a high level of skills in writing, presenting and defending research/project activities through course works.**	D1. Prepare a complete thesis and term-courses works/ tasks, write their documents and defend on them.
d2.	**Balance professional and ethical responsibilities including contemporary issues and environmental awareness in the field of embedded systems design and integration.**	D2. Demonstrate ethical principles, awareness of professional and ethical responsibility as well as knowledge of the standards utilized in related fields.

• Alignment of CILOs to Teaching and Assessment Strategies

u. Alignment of Knowledge and Understanding CILOs:

Knowledge and Understanding CILOs		Teaching Strategies	Assessment Strategies
a1.	**Discuss hardware/software partitioning in system design and the strategies for embedded firmware design and development.**	▪ Lectures, ▪ Self-Learning Problems/Studies, ▪ Group/Individual Projects and Studies.	▪ Oral & Writing Exams ▪ Reports, ▪ Written Exam, ▪ Assignments.
a2.	**Explain architectural features of 32-bit ARM Microcontrollers, as well as, their instruction sets, programming and applications in sustainable design and**	▪ Lectures, ▪ Group/Individual Projects and Studies,	▪ Oral & Writing Exams ▪ Reports, ▪ Written Exam, ▪ Assignments

	development of embedded Systems.	▪ Active learning.	

v. Alignment of Intellectual Skills CILOs:

Intellectual Skills CILOs		Teaching Strategies	Assessment Strategies
b1.	**Analyze a system both as whole and in the included parts, for understanding how these parts interact in the functionality and properties of the system.**	▪ Lectures, ▪ Project Supervision, ▪ Self-Learning, ▪ Case Study, ▪ Simulation Exercises, ▪ Independent Study, ▪ Analysis and Problem Solving, ▪ Presentations,	▪ Oral & Writing Exams ▪ Reports, ▪ Survey, ▪ Written Exam, ▪ Assignments
b2.	**Suggest innovative embedded systems for solving practice problems, related to SoC designing and implementation considering their constituting elements limits.**	▪ Lectures, ▪ Project Supervision, ▪ Self-Learning, ▪ Case Study, ▪ Simulation Exercises, ▪ Independent Study, ▪ Analysis and Problem Solving, ▪ Presentations,	▪ Oral & Writing Exams ▪ Reports, ▪ Survey, ▪ Written Exam, ▪ Assignments

w. Alignment of Professional and Practical Skills CILOs:

Professional and Practical Skills CILOs		Teaching Strategies	Assessment Strategies
c1.	**Develop an integrated development environment in embedded system based on software and electronical hardware tools.**	▪ Lectures, ▪ Project Supervision, ▪ Case Study, ▪ Simulation Exercises, ▪ Independent Study, ▪ Analysis and Problem Solving, ▪ Presentations,	▪ Oral & Writing Exams ▪ Seminar Report, ▪ Assignments, ▪ Written Research Proposal.
c2.	**Apply formal method, testing, verification, validation and simulation techniques and tools in order to engineer reliable and safe embedded systems.**	▪ Lectures, ▪ Project Supervision, ▪ Self-Learning, ▪ Case Study, ▪ Simulation Exercises, ▪ Analysis and Problem Solving, ▪ Presentations,	▪ Oral & Writing Exams ▪ Seminar Report, ▪ Assignments, ▪ Written Research Proposal.

x. Alignment of Transferable (General) Skills CILOs:

Transferable (General) Skills CILOs		Teaching Strategies	Assessment Strategies
d1.	**Establish a high level of skills in writing, presenting and defending research/project activities through**	▪ Dissertation Defenses and Presentation, ▪ Independent Study, ▪ Presentation,	▪ Written Research Proposal, ▪ Assignments, ▪ Presentation,

	course works.	▪ Brainstorming, ▪ Presenting Researches.	▪ Written Report.
d2.	**Balance professional and ethical responsibilities including contemporary issues and environmental awareness in the field of embedded systems design and integration.**	▪ Dissertation Defenses and Presentation, ▪ Independent Study, ▪ Presentation, ▪ Brainstorming, ▪ Presenting Researches.	▪ Written Research Proposal, ▪ Assignments, ▪ Presentation, ▪ Written Report.

• Course Content

16. Theoretical Aspect

Order	Topic List / Units	Sub -Topics List	Number of Weeks	Contact Hours	Course ILOs
1	Introduction to Embedded Systems	▪ An Overview on ESs & SoC design, implementation, software and applications, ▪ Review of Digital Logic and Computer Architecture Concepts, ▪ ESs & IoT growth & Advancements.	1	3	a1
2	Advanced Embedded Systems Microcontrollers	▪ Introduction & History of ARM Microcontrollers, ▪ ARM's Types & Classifications based on their internal features and Applications.	3	9	a2
		▪ A 32-bit ARM-Cortex M3: Architecture and Internal Organization, Registers, Bus & Advanced Bus and Memories, ▪ ARM Instruction Set.			
		▪ ARM Arithmetic, Logic & Shift Instructions, ▪ ARM Load Instructions, ▪ ARM Timers.			
3	Embedded System Design, Management & Control	▪ Combinational and Sequential Logic Circuit Design, ▪ Core of the embedded system, Memory, Sensors (resistive, optical, position, thermal) and Actuators (solenoid valves, relay/switch, opto-couplers),	3	9	a1, a2, b1, b2, c1

		Communication Interface, ▪ Embedded firmware (RTOS, Drivers, Application programs), Power-supply, PCB and Passive components, Safety and reliability, environmental issues. Ethical practice.			
		▪ Characteristics and quality attributes (Design Metric) of embedded system. Real time system's requirements, real time issues, and interrupt latency, ▪ Embedded Product development life cycle, Program modeling concepts: DFG, FSM, Petri-net, UML.			
		▪ Design, Programming of an Embedded System based ARM, ▪ ARM Programming in Assembly & High-Level Language: Interrupt service routines, macros, functions, modifiers, data types, device drivers, Multithreading programming. (Laboratory work on J2ME Java mobile application).			
4	Midterm Exam	▪ Midterm Exam include ALL Previous Topics.	1	3	a1, a2, b1, b2, c1
5	Embedded Serial Communication	▪ An overview on Serial Communications: Serial & Parallel Communications, ▪ Basic Serial Communication protocols like SPI, SCI (RS232, RS485), I2C, CAN, Field-bus (Profibus).	2	6	a1, b1, b2, c1
		▪ Wireless Communication Protocols like USB (v2.0), Bluetooth, Zig-Bee and Wireless sensor network, ▪ Case Study: Embedded Systems & IoT.			

6	Embedded Software, Firmware Concepts and Design	▪ Real time operating system: POSIX Compliance, Need of RTOS in Embedded system software, ▪ Multitasking, context switching, IPC, Scheduler policies, Asynchronous and Synchronous Languages, Modeling and Verification of RT Systems, ▪ Architecture of kernel, Real-Time Kernels, Real-Time Scheduling, RM, EDF, Task scheduler, ISR, ▪ Timers, Memory Management, RTOS services in contrast with traditional OS.	2	6	a1, b1, c1
7	Embedded SoC Design & Fault-Tolerance	▪ Design of the components: Memory, ALU, Datapath, ▪ Design and test of the µP, ▪ Digital Signal Processing, FIR, IIR, FFT. ▪ Fault-Tolerance Basics, Fault, Error, Failure, ▪ HW Fault-Tolerance, SW Fault-Tolerance.	2	6	a1, b1, b2, c1, c2
8	Case Studies & Course Projects Presentation	▪ Students Presents in an individual and in Groups their course Projects, Programming Implementation and Paper Presentations works.	1	3	a1, a2, b1, b2, c1, c2, d1, d2
9	Final Exam	▪ ALL Topics Except the Case Study & Course Project works.	1	3	a1, a2, b1, b2, c1, c2
Number of Weeks /and Contact Hours Per Semester			16	48	

17. Practical Aspect

Order	Practical / Tutorials topics	Number of Weeks	Contact Hours	Course ILOs

1	▪ **NONE**			
2	▪ ▪			
Number of Weeks /and Contact Hours Per Semester				

18. Tutorial Aspect:				
No.	**Tutorial**	**Number of Weeks**	**Contact Hours**	**Learning Outcomes (CILOs)**
1	NONE			
2				
Number of Weeks /and Units Per Semester		**15**	**30**	

• Teaching Strategies:

- Lectures,
- Seminars,
- Project Supervision,
- Self-Learning,
- Case Study,
- Simulation Exercises,
- Dissertation Defenses and Presentation,
- Independent Study,
- Analysis and Problem Solving,
- Brainstorming,
- Presenting Researches,
- Presentations,
- Group/Individual Projects and Studies,
- Active learning.

• Assessment Methods of the Course:

- Oral & Writing Exams
- Reports,
- Survey,
- Written Exam,

• Assessment Methods of the Course:

- Assignments
- Seminar Report,
- Written Research Proposal.

• Tasks and Assignments:

No	Assignments/ Tasks	Individual/ Group	Mark	Week Due	CILOs (symbols)
1	**Assignments:** **Assignment 1: ARM Programming & Interfacing and ARM Interrupts Mechanism** **Assignment 2: Embedded Systems Serial Communication** **Assignment 3: Embedded Systems Software & ROS** **Assignment 4: SoC Design & Implementation using VHDL**	**Individual**	**10**	**5th, 10th, 10th & 12th**	**a1, a2, b1, b2, c1, c2, d1, d2**
2	**Mini/Major Project:** **Graduates works and submit their individual & group Projects using Web searching, High-Level Programming to design and implement ESs & SoC products.**	**Individual/ Group**	**16**	**From the 4th to 14th**	**a1, a2, b1, b2, c1, c2, d1, d2**
3	**Papers presentation & Case studies**	**Individual/ Group**	**8**	**Work from the 4th to 14th weeks**	**a2, b1, b2, c1, c2, d1, d2**
	Total Score		**34**	==	===

• Learning Assessment:

No.	Assessment Tasks	Week due	Mark	Proportion of Final Assessment	CILOs
1	**Tasks and Assignments**	**4th to 14th**	**34**	**34%**	**a1, a2, b1, b2, c1, c2, d1, d2**
2	**Quizzes**	**6th & 12th**	**6**	**6%**	**a1, a2, b1, b2**
3	**Midterm Exam**	**8th**	**20**	**20%**	**a1, a2, b1, b2, c2**
4	**Final Exam (Theoretical)**	**16th**	**40**	**40%**	**a1, a2, b1, b2, c2**
Total				**100%**	**===**

• Learning Resources :

15. Required Textbook(s) :

1. **Joseph Yiu, 2014, "The Definitive Guide to the ARM Cortex-M3 and Cortex-M4 Processors", Newnes, 3rd Ed.**
2. **James K Peckol, 2019, "Embedded Systems – A contemporary Design Tool", 2nd Ed, Weily-Blackwell.**
3. **David. A.Patterson & John L. Hennessy, 2020, "Computer Organization and Design RISC-V the Hardware Software Interface", 1st Edition, Morgan Kaufmann.**

16. Essential References:

1. **Shibu K V, 2009, "Introduction to Embedded Systems", Tata McGraw Hill Education Private Limited.**
2. **F. Vahid, Tony D Givargis, 2001, "Embedded System Design – A unified hardware and software introduction", 1st Ed. Wiley)**

17. Electronic Materials and Web Sites *etc.*

Websites:

1. **Syllabus, lecture notes and other materials can be found at http://www.iyte.edu.tr/~tolgaayav/courses/ceng563**
2. **To access some papers with codes http://www.githup.com**

Journals:

1. **Enquire the search engines by sub-topic mentioned in the course plan to get accurate and up-to-date information.**

IEEE Publisher

https://www.ieee.org

Elsevier Publisher

https://www.elsevier.org

Science Direct Publisher

https://www.Sciencedirect.com

vii. الضوابط والسياسات المتبعة في المقرر Course Policies	
بعد الرجوع للوائح الجامعة يتم كتابة السياسة العامة للمقرر فيما يتعلق بالآتي:	
1	**سياسة حضور الفعاليات التعليمية Class Attendance:** - يلتزم الطالب بحضور 75% من المحاضرات ويحرم في حال عدم الوفاء بذلك. - يقدم أستاذ المقرر تقريرا بحضور وغياب الطلاب للقسم ويحرم الطالب من دخول الامتحان في حال تجاوز الغياب 25% ويتم اقرار الحرمان من مجلس القسم.
2	**الحضور المتأخر Tardy:** - يسمح للطالب حضور المحاضرة إذا تأخر لمدة ربع ساعة لثلاث مرات في الفصل الدراسي، وإذا تأخر زيادة عن ثلاث مرات يحذر شفويا من أستاذ المقرر، وعند عدم الالتزام يمنع من دخول المحاضرة.
3	**ضوابط الامتحان Exam Attendance/Punctuality:** - لا يسمح للطالب دخول الامتحان النهائي إذا تأخر مقدار (20) دقيقة من بدء الامتحان - إذا تغيب الطالب عن الامتحان النهائي تطبق اللوائح الخاصة بنظام الامتحان في الكلية.
4	**التعيينات والمشاريع Assignments & Projects:** - يحدد أستاذ المقرر نوع التعيينات في بداية الفصل ويحدد مواعيد تسليمها وضوابط تنفيذ التكليفات وتسليمها. - إذا تأخر الطالب في تسليم التكليفات عن الموعد المحدد يحرم من درجة التكليف الذي تأخر في تسليمه.
5	**الغش Cheating:** - في حال ثبوت قيام الطالب بالغش في الامتحان النصفي أو النهائي تطبق عليه لائحة شؤون الطلاب. - في حال ثبوت قيام الطالب بالغش او النقل في التكليفات والمشاريع يحرم من الدرجة المخصصة للتكليف.
6	**الانتحال Plagiarism:** – في حالة وجود شخص ينتحل شخصية طالب لأداء الامتحان نيابة عنه تطبق اللائحة الخاصة بذلك
7	**سياسات أخرى Other policies:** - أي سياسات أخرى مثل استخدام الموبايل أو مواعيد تسليم التكليفات ..... الخ

Academic Year: 2021

Course Plan (Syllabus): Advanced Embedded Systems Design

• Information about Faculty Member Responsible for the Course:

Name	**Farouk Al-Fahaidy**	**Office Hours**						
Location &Telephone No.	777909815	**SAT**	**SUN**	**MON**	**TUE**	**WED**	**THU**
E-mail	farouqakh@gmail.com						

• General information about the course:

46	**Course Title**	**Advanced Embedded Systems Design**			
47	**Course Code and Number**	**CCE580/MTE531**			
48	**Credit Hours**	**Credit Hours**			**Total**
		Lecture	**Practical**	**Seminar/Tutorial**	
		3	--	--	**3**
49	**Study Level and Semester**	**2nd Semester**			
50	**Pre-requisites**				
51	**Co –requisite**				
52	**Program (s) in which the course is offered**	**M. S. in Mechatronics Engineering Program**			
53	**Language of teaching the course**	**English**			
54	**Location of teaching the course**				

• Course Description:

This course provides advanced concepts on Embedded systems design, advanced microcontrollers architecture and capabilities, as well as, System on Chip (SoC) design. The future of embedded systems and IoT lies in the advancement of technologies that enable faster communication with high interwoven connections between different devices. Course covers, an overview on advanced 32-bit ARM microcontrollers, Embedded System Design concepts & Project Management, ESs Firmware/software, ESs Digital Signal Processing and ESs Communications. Throughout course projects & case study works, students develop their skills in ESs design and implementation.

• Course Intended Learning Outcomes (CILOs):

Upon successful completion of the **Advanced Embedded Systems Design** course, graduate students will be able to:

a1. Discuss hardware/software partitioning in system design and the strategies for embedded firmware design and development.

a2. Explain architectural features of 32-bit ARM Microcontrollers, as well as, their instruction sets, programming and applications in sustainable design and development of embedded Systems.

b1. Analyze a system both as whole and in the included parts, for understanding how these parts interact in the functionality and properties of the system.

b2. Suggest innovative embedded systems for solving practice problems, related to SoC designing and implementation considering their constituting elements limits.

c1. Develop an integrated development environment in embedded system based on software and electronical hardware tools.

c2. Apply formal method, testing, verification, validation and simulation techniques and tools in order to engineer reliable and safe embedded systems.

d1. Establish a high level of skills in writing, presenting and defending research/project activities through course works.

d2. Balance professional and ethical responsibilities including contemporary issues and environmental awareness in the field of embedded systems design and integration.

• Course Content

1. Theoretical Aspect

Order	Topic List / Units	Sub -Topics List	Number of Weeks	Contact Hours
1	Introduction to Embedded Systems	▪ An Overview on ESs & SoC design, implementation, software and applications, ▪ Review of Digital Logic and Computer Architecture Concepts, ▪ ESs & IoT growth & Advancements.	1	3
2	Advanced Embedded Systems Microcontrollers	▪ Introduction & History of ARM Microcontrollers, ▪ ARM's Types & Classifications based on their internal features and Applications.	3	9
		▪ A 32-bit ARM-Cortex M3: Architecture and Internal Organization, Registers, Bus & Advanced Bus and Memories, ▪ ARM Instruction Set.		
		▪ ARM Arithmetic, Logic & Shift Instructions, ▪ ARM Load Instructions, ▪ ARM Timers.		

3	Embedded System Design, Management & Control	▪ Combinational and Sequential Logic Circuit Design, ▪ Core of the embedded system, Memory, Sensors (resistive, optical, position, thermal) and Actuators (solenoid valves, relay/switch, opto-couplers), Communication Interface, ▪ Embedded firmware (RTOS, Drivers, Application programs), Power-supply, PCB and Passive components, Safety and reliability, environmental issues. Ethical practice.	3	9
		▪ Characteristics and quality attributes (Design Metric) of embedded system. Real time system's requirements, real time issues, and interrupt latency, ▪ Embedded Product development life cycle, Program modeling concepts: DFG, FSM, Petri-net, UML.		
		▪ Design, Programming of an Embedded System based ARM, ▪ ARM Programming in Assembly & High-Level Language: Interrupt service routines, macros, functions, modifiers, data types, device drivers, Multithreading programming. (Laboratory work on J2ME Java mobile application).		
4	Midterm Exam	▪ Midterm Exam include ALL Previous Topics.	1	3
5	Embedded Serial Communication	▪ An overview on Serial Communications: Serial & Parallel Communications, ▪ Basic Serial Communication protocols like SPI, SCI (RS232, RS485), I2C, CAN, Field-bus (Profibus).	2	6

		▪ Wireless Communication Protocols like USB (v2.0), Bluetooth, Zig-Bee and Wireless sensor network, ▪ Case Study: Embedded Systems & IoT.		
6	Embedded Software, Firmware Concepts and Design	▪ Real time operating system: POSIX Compliance, Need of RTOS in Embedded system software, ▪ Multitasking, context switching, IPC, Scheduler policies, Asynchronous and Synchronous Languages, Modeling and Verification of RT Systems, ▪ Architecture of kernel, Real-Time Kernels, Real-Time Scheduling, RM, EDF, Task scheduler, ISR, ▪ Timers, Memory Management, RTOS services in contrast with traditional OS.	2	6
7	Embedded SoC Design & Fault-Tolerance	▪ Design of the components: Memory, ALU, Datapath, ▪ Design and test of the µP, ▪ Digital Signal Processing, FIR, IIR, FFT. ▪ Fault-Tolerance Basics, Fault, Error, Failure, ▪ HW Fault-Tolerance, SW Fault-Tolerance.	2	6
8	Case Studies & Course Projects Presentation	▪ Students Presents in an individual and in Groups their course Projects, Programming Implementation and Paper Presentations works.	1	3
9	Final Exam	▪ ALL Topics Except the Case Study & Course Project works.	1	3
Number of Weeks /and Contact Hours Per Semester			16	48

2. Practical Aspect

Order	Practical / Tutorials topics	Number of	Contact	Course ILOs

		Weeks	Hours	
1	3. NONE			
Number of Weeks /and Contact Hours Per Semester				

8. Training/ Tutorials/ Exercises Aspects:			
Order	Tutorials/ Exercises	Week Due	Contact Hours
1	NONE		
2	▪		
Number of Weeks /and Contact Hours Per Semester			

• Teaching Strategies:

- Lectures,
- Seminars,
- Project Supervision,
- Self-Learning,
- Case Study,
- Simulation Exercises,
- Dissertation Defenses and Presentation,
- Independent Study,
- Analysis and Problem Solving,
- Brainstorming,
- Presenting Researches,
- Presentations,
- Group/Individual Projects and Studies,
- Active learning.

• Assessment Methods of the Course:

- Oral & Writing Exams
- Reports,
- Survey,
- Written Exam,
- Assignments

• Assessment Methods of the Course:

- Seminar Report,
- Written Research Proposal.

• Tasks and Assignments:

No	Assignments	Individual /Groups	Mark	Week Due
1	**Assignments:** **Assignment 1: ARM Programming & Interfacing and ARM Interrupts Mechanism** **Assignment 2: Embedded Systems Serial Communication** **Assignment 3: Embedded Systems Software & ROS** **Assignment 4: SoC Design & Implementation using VHDL**	Individual	10	5th, 10th, 10th & 12th
2	**Mini/Major Project:** **Graduates works and submit their individual & group Projects using Web searching, High-Level Programming to design and implement ESs & SoC products.**	Individual/ Group	16	From the 4th to 14th
3	**Papers presentation & Case studies**	Individual/ Group	8	Work from the 4th to 14th weeks
	Total Score		34	

• Learning Assessment:

No	Assessment Method	Week Due	Mark	Proportion of Final Assessment %
1	Tasks and Assignments	4th to 14th	34	34%
2	Quizzes	6th & 12th	6	6%
3	Midterm Exam	8th	20	20%
4	Final Exam (Theoretical)	16th	40	40%
	Total		100	100 %

• Learning Resources:

9. Required Textbook(s) :

1. **Joseph Yiu, 2014, "The Definitive Guide to the ARM Cortex-M3 and Cortex-M4 Processors", Newnes, 3rd Ed.**
2. **James K Peckol, 2019, "Embedded Systems – A contemporary Design Tool", 2nd Ed, Weily-Blackwell.**
3. **David. A.Patterson & John L. Hennessy, 2020, "Computer Organization and Design RISC-V the Hardware Software Interface", 1st Edition, Morgan Kaufmann.**

10. Essential References:

1. **Shibu K V, 2009, "Introduction to Embedded Systems", Tata McGraw Hill Education Private Limited.**
2. **F. Vahid, Tony D Givargis, 2001, "Embedded System Design – A unified hardware and software introduction", 1st Ed. Wiley)**

11. Electronic Materials and Web Sites *etc.*

Websites:

1. **Syllabus, lecture notes and other materials can be found at http://www.iyte.edu.tr/~tolgaayav/courses/ceng563**
2. **To access some papers with codes http://www.github.com**

Journals:

3. **Enquire the search engines by sub-topic mentioned in the course plan to get accurate and up-to-date information.**

IEEE Publisher

https://www.ieee.org

Elsevier Publisher

https://www.elsevier.org

Science Direct Publisher

https://www.Sciencedirect.com

viii. الضوابط والسياسات المتبعة في المقرر Course Policies	
بعد الرجوع للوائح الجامعة يتم كتابة السياسة العامة للمقرر فيما يتعلق بالآتي:	
سياسة حضور الفعاليات التعليمية Class Attendance: - يلتزم الطالب بحضور 75% من المحاضرات ويحرم في حال عدم الوفاء بذلك. - يقدم أستاذ المقرر تقريرا بحضور وغياب الطلاب للقسم ويحرم الطالب من دخول الامتحان في حال تجاوز الغياب 25% ويتم اقرار الحرمان من مجلس القسم.	1
الحضور المتأخر Tardy: - يسمح للطالب حضور المحاضرة إذا تأخر لمدة ربع ساعة لثلاث مرات في الفصل الدراسي، وإذا تأخر زيادة عن ثلاث مرات يحذر شفويا من أستاذ المقرر، وعند عدم الالتزام يمنع من دخول المحاضرة.	2
ضوابط الامتحان Exam Attendance/Punctuality: - لا يسمح للطالب دخول الامتحان النهائي إذا تأخر مقدار (20) دقيقة من بدء الامتحان - إذا تغيب الطالب عن الامتحان النهائي تطبق اللوائح الخاصة بنظام الامتحان في الكلية.	3
التعيينات والمشاريع Assignments & Projects: - يحدد أستاذ المقرر نوع التعيينات في بداية الفصل ويحدد مواعيد تسليمها وضوابط تنفيذ التكليفات وتسليمها. - إذا تأخر الطالب في تسليم التكليفات عن الموعد المحدد يحرم من درجة التكليف الذي تأخر في تسليمه.	4
الغش Cheating: - في حال ثبوت قيام الطالب بالغش في الامتحان النصفي أو النهائي تطبق عليه لائحة شؤون الطلاب. - في حال ثبوت قيام الطالب بالغش او النقل في التكليفات والمشاريع يحرم من الدرجة المخصصة للتكليف.	5
الانتحال Plagiarism:	6

	– في حالة وجود شخص ينتحل شخصية طالب لأداء الامتحان نيابة عنه تطبق اللائحة الخاصة بذلك
7	**سياسات أخرى Other policies:** **- أي سياسات أخرى مثل استخدام الموبايل أو مواعيد تسليم التكليفات ..... الخ**