Introduction to Vehicular Networks

Course Code:

CSE 474

Course Period:

Spring

Course Type:

Area Elective

Credits:

3

Theoric:

3

Practice:

0

Laboratory Hour:

0

ECTS:

5

Course Language:

English

Course Objectives:

This course provides a thorough and comprehensive introduction to automotive multiplexed network buses, covering the technical principles, components, implementation issues, applications and as well as architectures for vehicular communication systems, smart and connected vehicle and the Internet of Things.

Course Content:

Presents a thorough coverage of the controller area network (CAN) protocol, including information on physical layers, conformity problems, hardware and software tools, and application layers.

Gives a detailed description of the new local interconnect network (LIN) bus, setting out its developments, properties, problems and ways to overcome these.

Examines the existing and emerging network buses such as time-triggered CAN (TTCAN), FlexRay and X-by-Wire.

Explores the possibilities for linking the various buses that are discussed, explaining how the Fail-Safe-System basis chip (SBC) and other gateways are designed and constructed.

Analyses wired and wireless internal and external serial links, including Safe-by-Wire plus, I2C, Media Oriented Systems Transport (MOST), remote keyless entry, tyre pressure monitoring systems (TPMS) and Bluetooth.

Course Methodology:

1: Lecture, 2: Question-Answer, 3: Lab, 4: Case-study

Course Evaluation Methods:

A: Testing, B: Experiment, C: Homework, D: Project

Course Learning Outcomes	Program Learning Outcomes	Teaching Methods	Assessment Methods
1) Adequate knowledge in vehicular networks	2, 4, 10, 11	1,2	A,B,C
2) Ability to devise, select, and use modern techniques and tools needed for automotive electronic systems	4,5	1,2,3	C
3) Ability to work individually	6	3	C

COURSE CONTENT

Week	Topics	Study Materials
1	CAN BUS, CONCEPTS OF BUS ACCESS AND ARBITRATION	Textbook
2	CAN: ITS PROTOCOL, ITS PROPERTIES, ITS NOVEL FEATURES	Textbook

3	TIME-TRIGGERED PROTOCOLS – FLEXRAY, TTCAN, X-BY-WIRE	Textbook
4	LIN – LOCAL INTERCONNECT NETWORK	Textbook
5	FAIL-SAFE SBCS: THEIR MULTIPLE ASPECTS AND REASONS FOR USING THEM	Textbook
6	MIDTERM I	Textbook
7	SAFE-BY-WIRE	Textbook
8	AUDIO-VIDEO BUSES	Textbook
9	INTELLIGENT TRANSPORTATION, CONNECTED VEHICLE EVOLUTION	Textbook
10	V2I, V2V	Textbook
11	FOG COMPUTING, ROADSIDE COMPUTING	Supplementary Material
12	IP MOBILITY, VEHICULAR AD HOC NETWORKS	Supplementary Material
13	MIDTERM EXAM II	Textbook
14	REVIEW	–

RECOMMENDED SOURCES

Textbook	MULTIPLEXED NETWORKS FOR EMBEDDED SYSTEMS: CAN, LIN, FLEXRAY, SAFE-BY-WIRE… AUTHORS: DOMINIQUE PARET, RODERICK RIESCO PUBLISHER: WILEY ISBN: 978-0-470-51170-1
Additional Resources	VEHICULAR COMMUNICATIONS AND NETWORKS: ARCHITECTURES, PROTOCOLS, OPERATION AND DEPLOYMENT AUTHOR: WAI CHEN PUBLISHER: ELSEVIER ISBN: 9781782422167

MATERIAL SHARING

Documents	coadsys.yeditepe.edu.tr/
Assignments	coadsys.yeditepe.edu.tr/
Exams	coadsys.yeditepe.edu.tr/

ASSESSMENT

IN-TERM STUDIES	NUMBER	PERCENTAGE
Midterms	2	50
Assignment	2	10
Term Project	1	30
Total		**100**
CONTRIBUTION OF FINAL EXAMINATION TO OVERALL GRADE		30
CONTRIBUTION OF IN-TERM STUDIES TO OVERALL GRADE		70
Total		**100**

COURSE'S CONTRIBUTION TO PROGRAM

No	Program Learning Outcomes	Contribution					
		0	1	2	3	4	5
1	Adequate knowledge in mathematics, science and engineering subjects pertaining to the relevant discipline; ability to use theoretical and applied information in these areas to model and solve engineering problems.	**X**					
2	Ability to identify, formulate, and solve complex engineering problems; ability to select and apply proper analysis and modeling methods for this purpose.						**X**
3	Ability to design a complex system, process, device or product under realistic constraints and conditions, in such a way as to meet the desired result; ability to apply modern design methods for this purpose.	**X**					
4	Ability to devise, select, and use modern techniques and tools needed for engineering practice; ability to employ information technologies effectively.						**X**
5	Ability to design and conduct experiments, gather data, analyze and interpret results for investigating engineering problems.	**X**					
6	Ability to work efficiently in intra-disciplinary and multi-disciplinary teams; ability to work individually.						**X**
7	Ability to communicate effectively both orally and in writing; knowledge of a minimum of one foreign language.	**X**					

8	Recognition of the need for lifelong learning; ability to access information, to follow developments in science and technology, and to continue to educate him/herself.	**X**		
9	Awareness of professional and ethical responsibility.	**X**		
10	Information about business life practices such as project management, risk management, and change management; awareness of entrepreneurship, innovation, and sustainable development.			**X**
11	Knowledge about contemporary issues and the global and societal effects of engineering practices on health, environment, and safety; awareness of the legal consequences of engineering solutions.			**X**

ECTS ALLOCATED BASED ON STUDENT WORKLOAD BY THE COURSE DESCRIPTION

Activities	Quantity	Duration (Hour)	Total Workload (Hour)
Course Duration (Excluding the exam weeks: 12x Total course hours)	12	3	36
Hours for off-the-classroom study (Pre-study, practice)	14	2	28
Midterm examination	2	4	8
Homework	2	4	8
Project	1	40	40
Final examination	1	6	6
Total Work Load			126
Total Work Load / 25 (h)			4.85
ECTS Credit of the Course			5