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TEMPUS-project 544091-TEMPUS-1-2013-1-BE-TEMPUS-JPCR

P08 –State Engineering University of Armenia (Polytechnic), SEUA

P09- Yerevan State University of Architecture and Construction, YSUAC

P12-"Yerevan Telecommunication Research Institute" CJSC, YeTRI

Acronym report on activities
from 1.12.2014 till 1.05.2014

The actions which have been done

- Collaboration among partners
- Dissemination of information
- Dissemination meetings in partners university
- Dissemination meetings with responsible Chairs
- Dissemination through web resources
- Information collection

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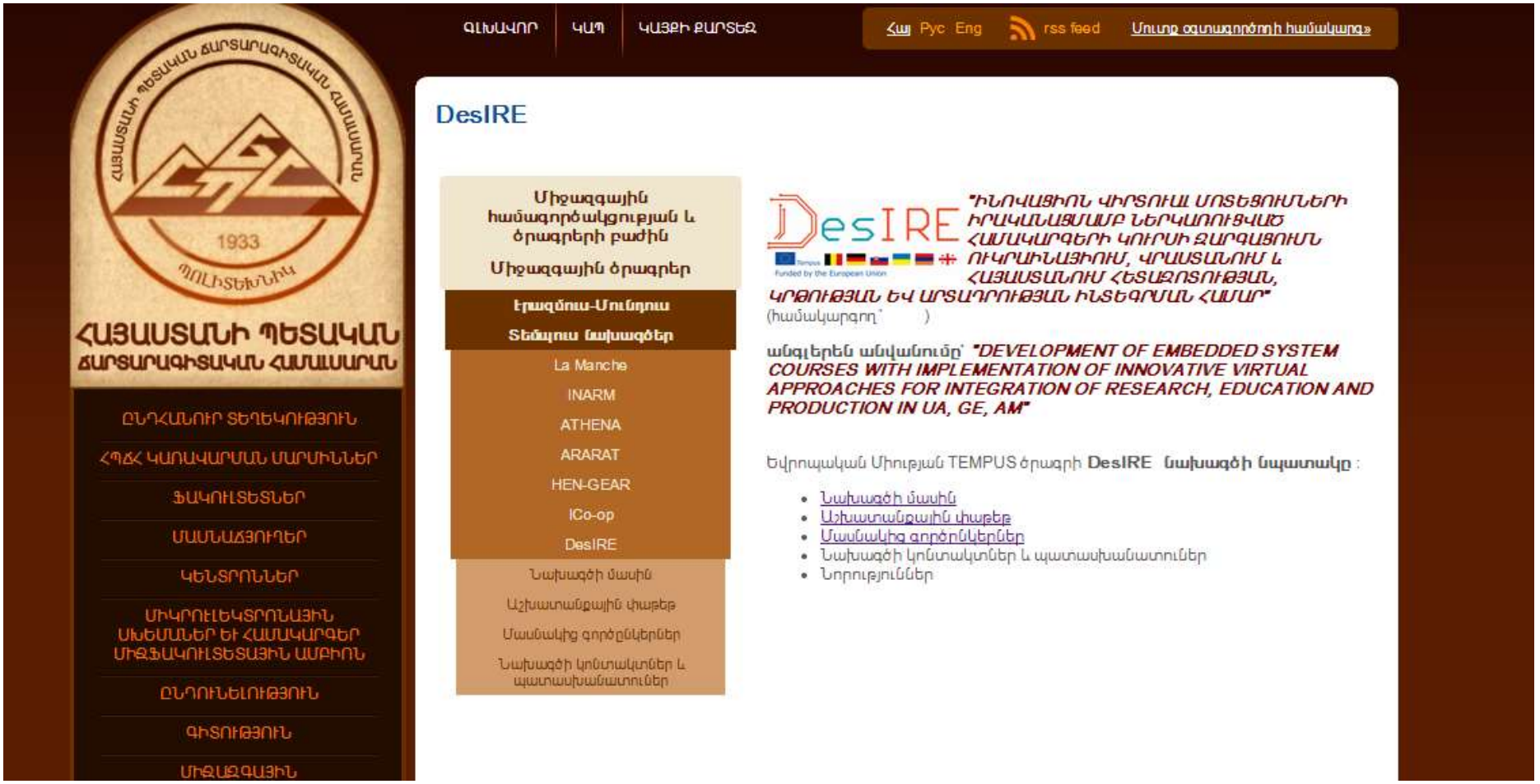
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Միջազգային ծրագրեր
Էրազմուս-Մունդուս
Տեմպուս նախագծեր
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ATHENA
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(համակարգող՝)
անգլերեն անվանումը՝ "DEVELOPMENT OF EMBEDDED SYSTEM COURSES WITH IMPLEMENTATION OF INNOVATIVE VIRTUAL APPROACHES FOR INTEGRATION OF RESEARCH, EDUCATION AND PRODUCTION IN UA, GE, AM"
Եվրոպական Միության TEMPUS ծրագրի DesIRE նախագծի նպատակը՝
Նախագծի մասին
Աշխատանքային փաթեթ
Մասնակից գործընկերներ
Նախագծի կոնտակտներ և պատասխանատուներ
Նորություններ

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WP1 Analysis of current curricula and competences in Embedded Systems in TC

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State Engineering University of Armenia (SEUA)

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Yerevan State University of Architecture and Construction (YSUAC)

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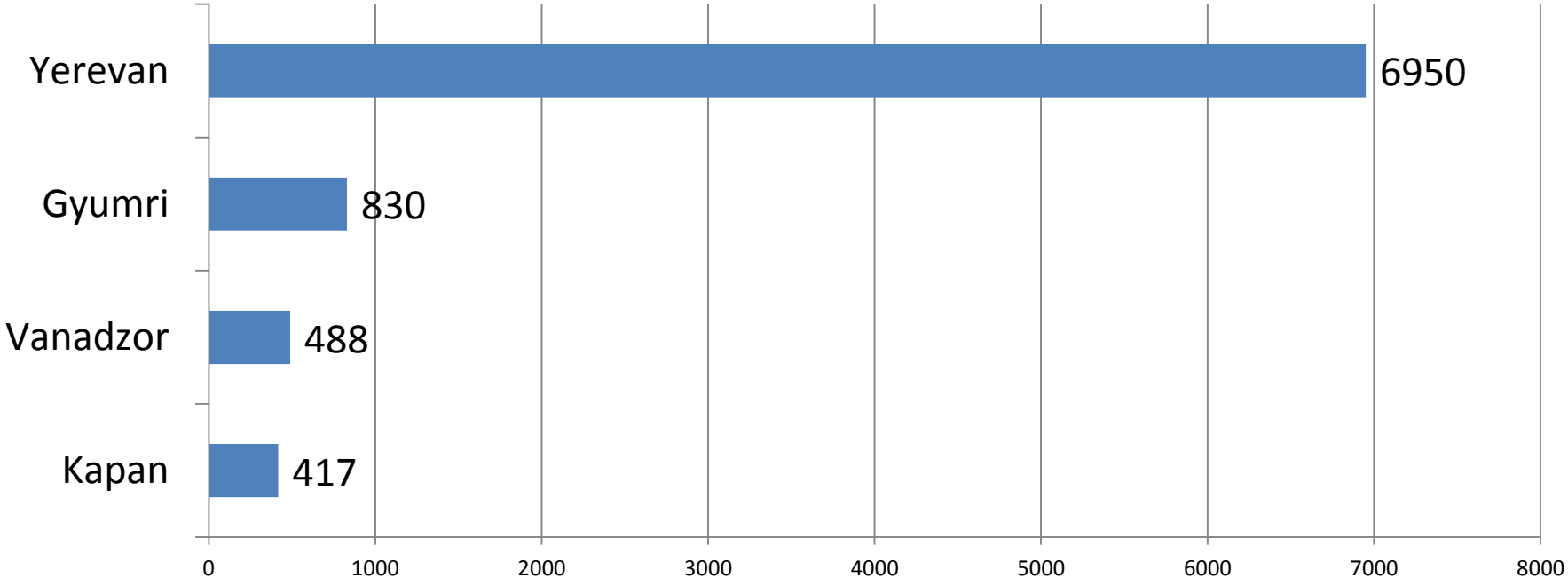
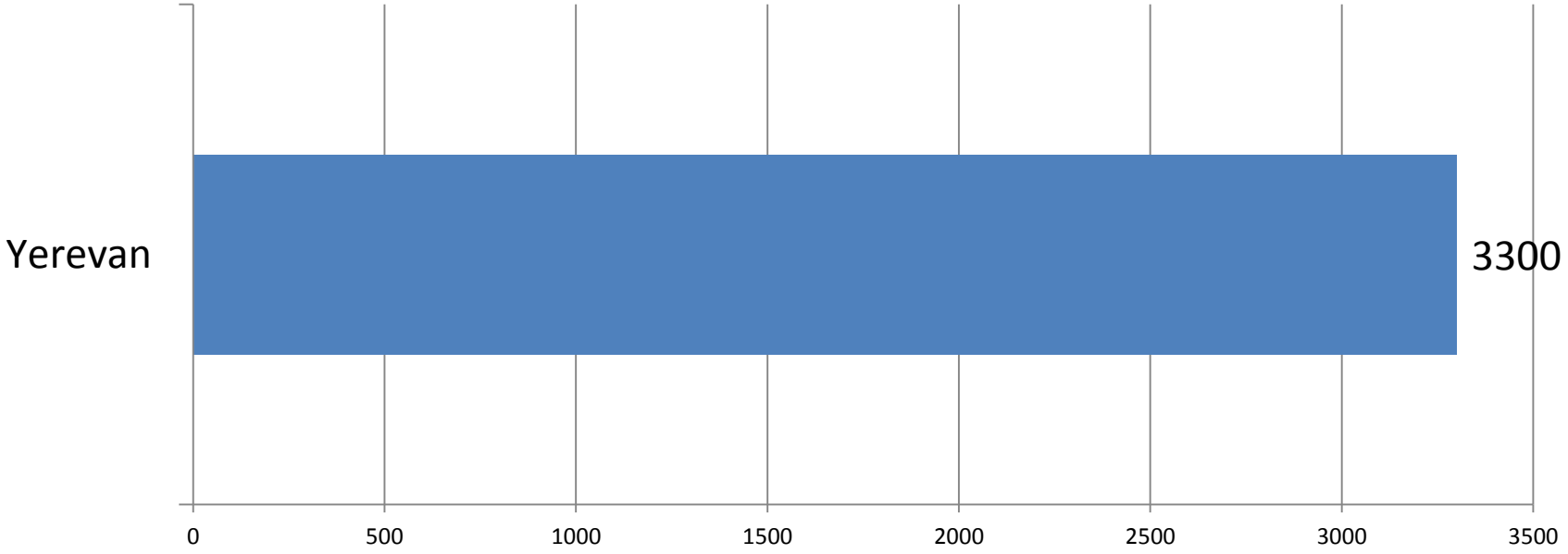
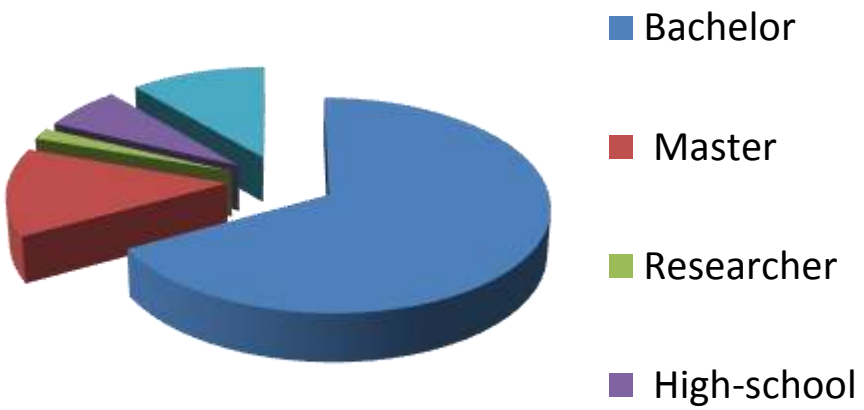
Yerevan Telecommunication Research Institute" CJSC YeTRI

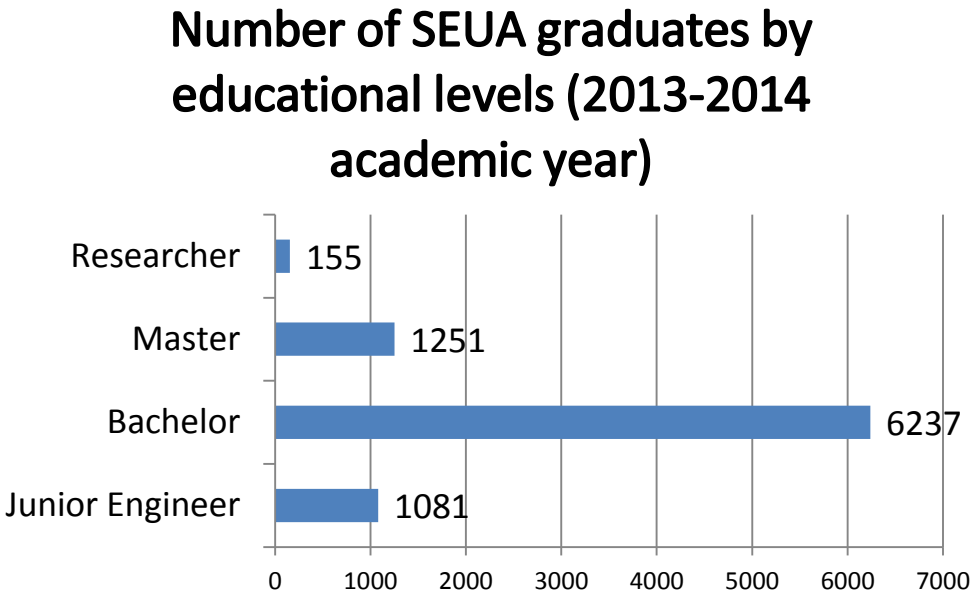
Total Number of students in SEUA campuses (2013-2014 academic year)



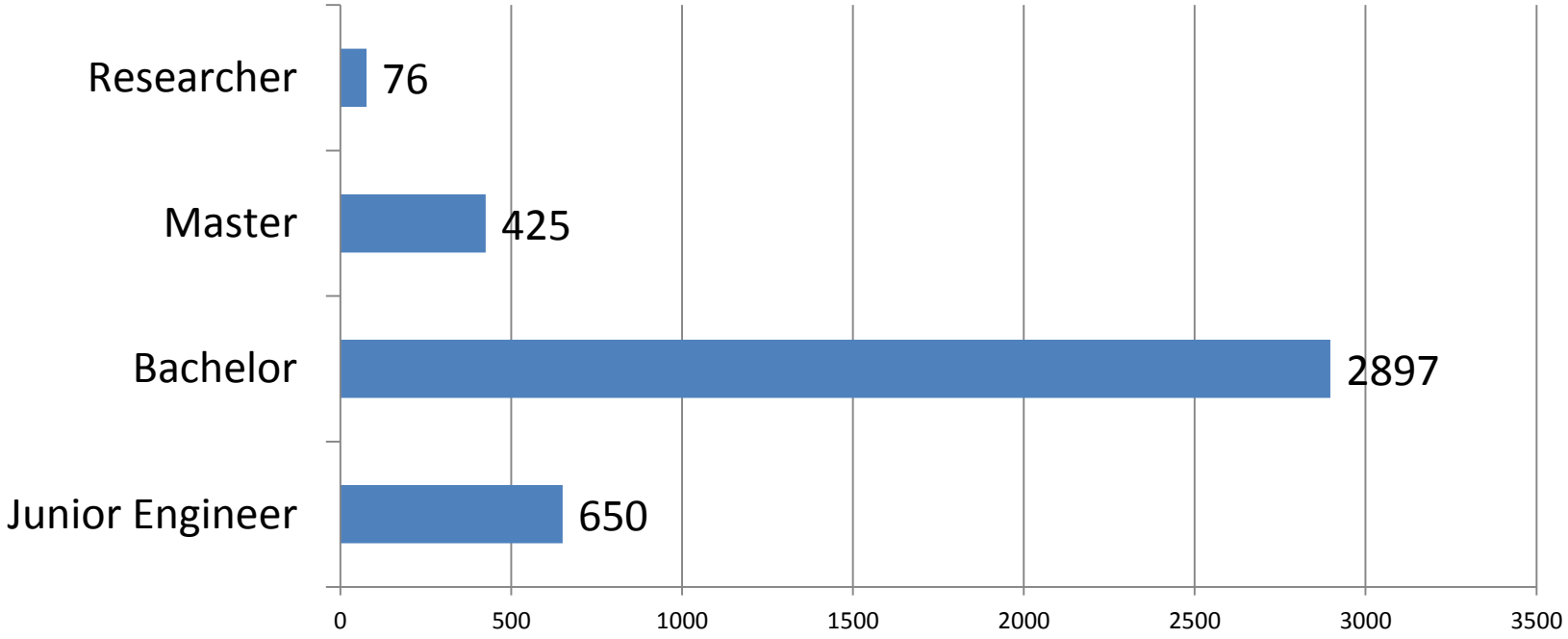
Total Number of students in YSUAC (2013-2014 academic year)



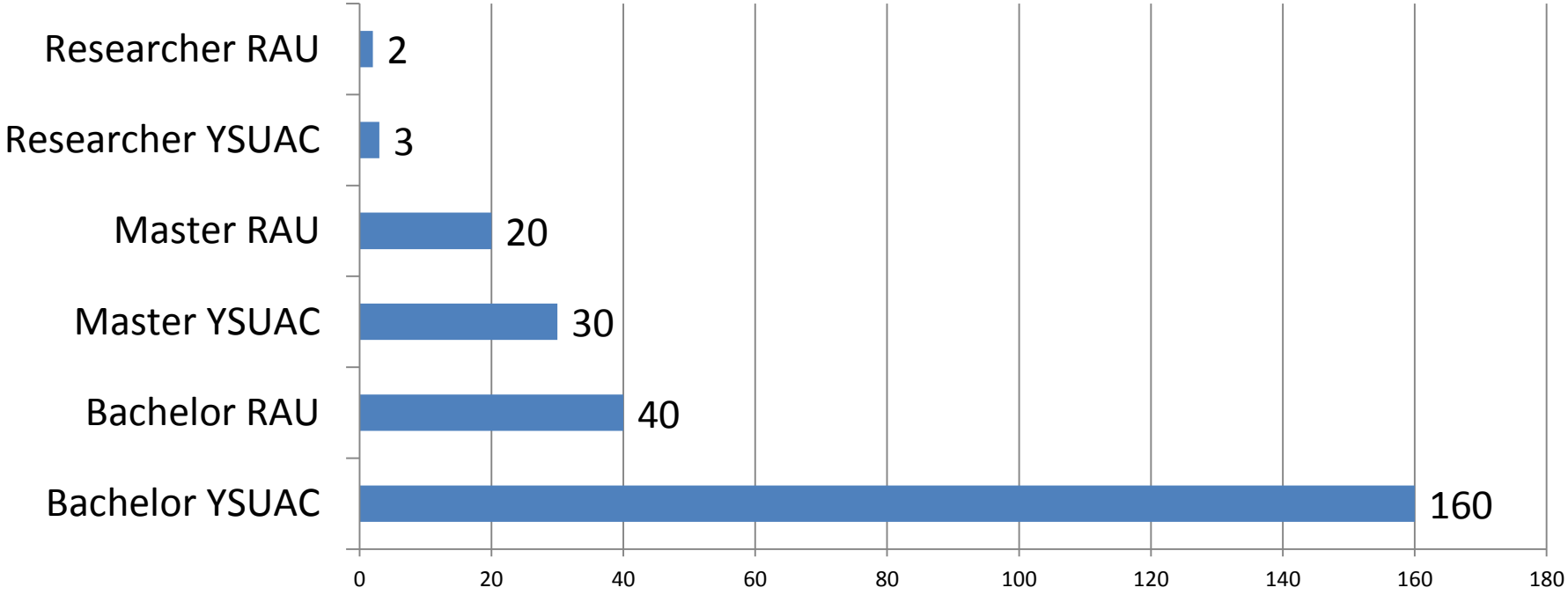

Bachelor
Master
Researcher
High-school


Number of SEUA graduates by educational levels (2013-2014 academic year)
Researcher
155
Master
1251
Bachelor
6237
Junior Engineer
1081
0
1000
2000
3000
4000
5000
6000
7000

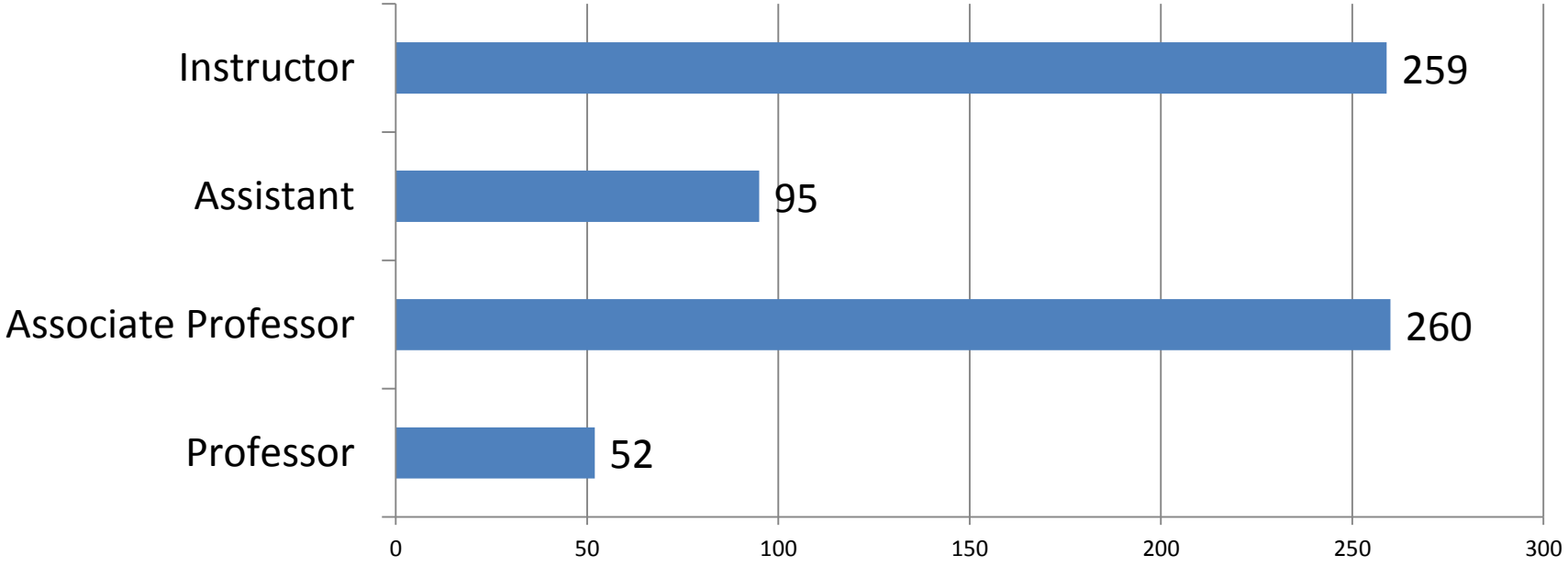
Number of YSUAC graduates by educational levels (2013-2014 academic year)



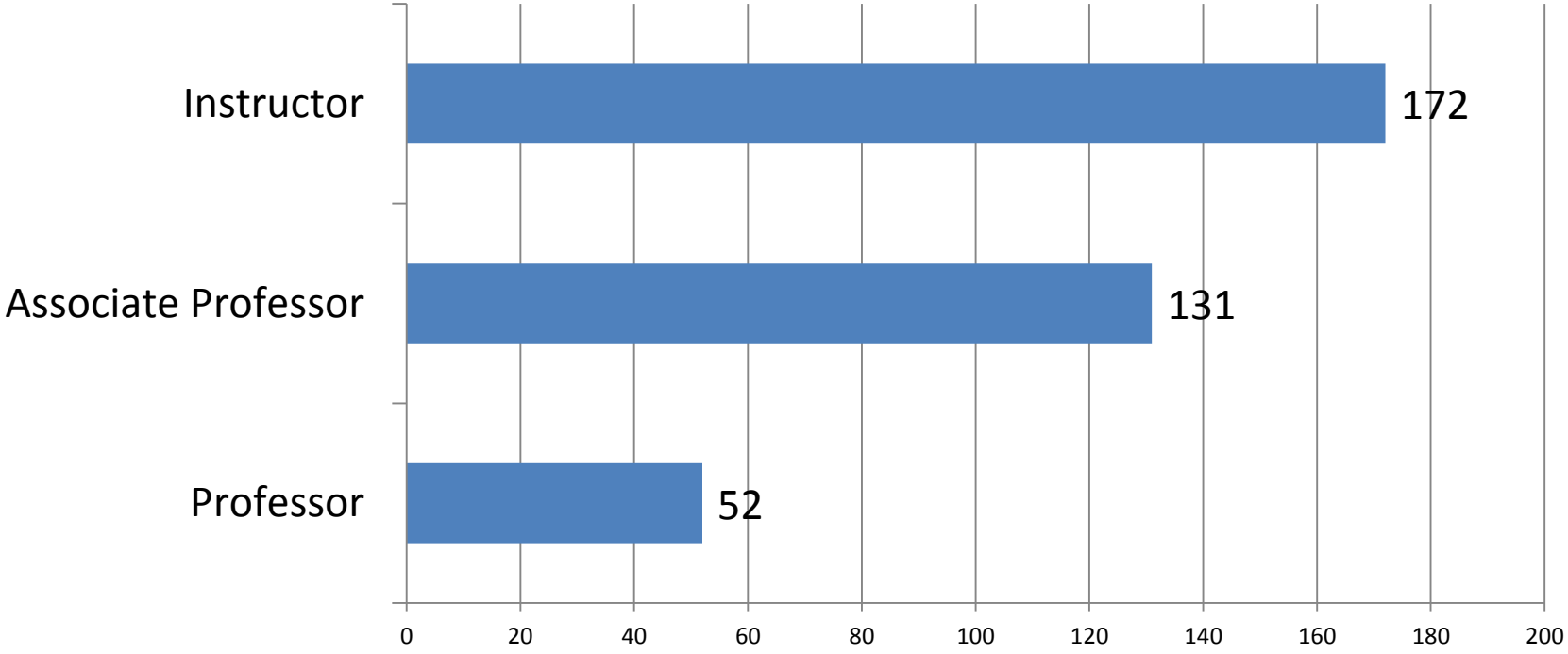
Number of YeTRI graduates by educational levels (2013-2014 academic year)



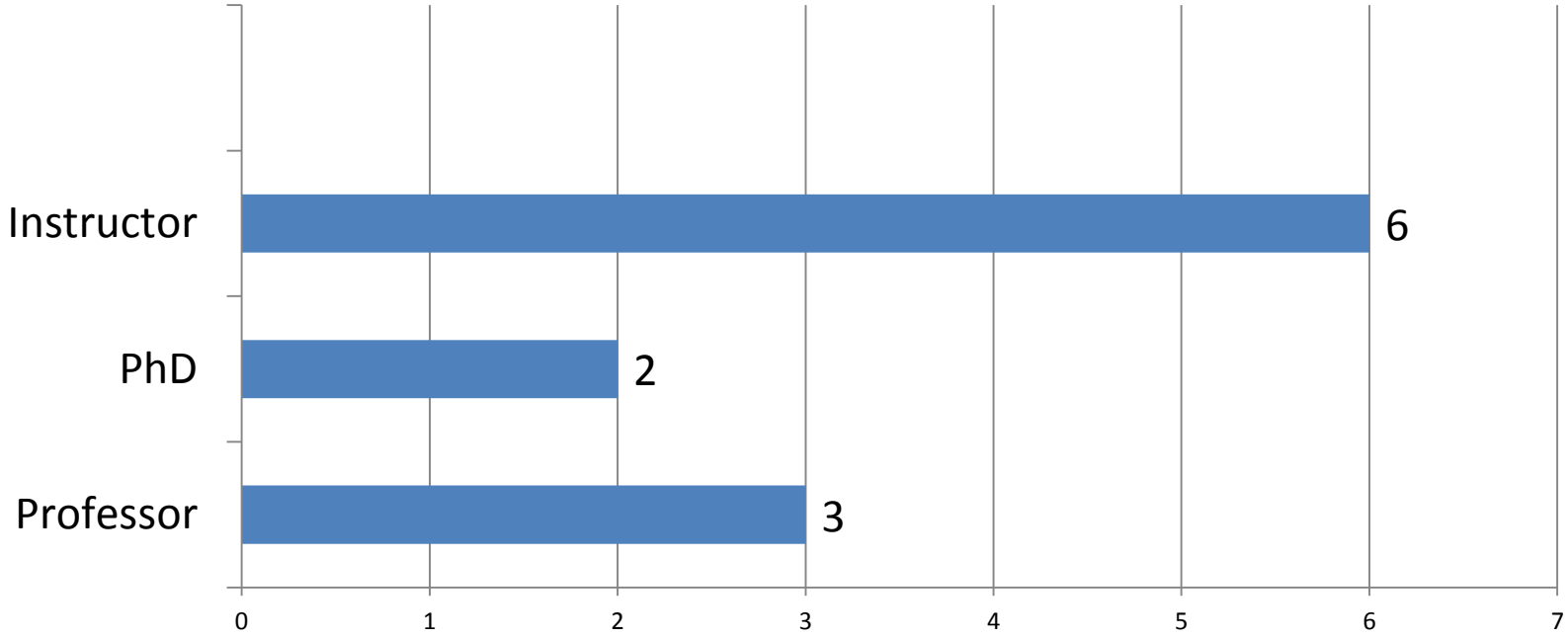
Number of SEUA teaching staff by academic ranks (2013-2014 academic year)



Number of YSUAC teaching staff by academic ranks (2013-2014 academic year)



Number of YeTRI teaching staff by academic ranks (2013-2014 academic year)



Teaching Methods

- The SEUA and YSUAC use the European Credit Transfer System (ECTS)
- Study is made up of:
  - ✓Lectures
  - ✓Seminars and tutorials
  - ✓Laboratory work
  - ✓Team work
  - ✓Self-study training
- Duration of classes - 80 minute (by 10 minute break)

Current curricula and competences in Embedded Systems

The universities have no special curriculum on Embedded Systems. The Universities programs involve different parts of Embedded System curricula in the curricula of the different Faculties for some specializations.

Embedded System Courses in Faculties programs

SEUA (1)

FACULTY OF CYBERNETICS			
Control Systems	Electronic Engineering	Measurements **Technology**, Standardization and Certification	Microelectronic circuits and systems

Embedded System Courses in Faculties programs SEUA (2)

FACULTY OF ELECTRICAL ENGINEERING	
Electrical Machines and Apparatuses	Theoretical and General Electrical Engineering and Electric Drive

FACULTY OF MACHINE BUILDING
Automation and Complex Mechanization in Machine Building

Embedded System Courses in Faculties programs SEUA (3)

FACULTY OF COMPUTER SYSTEMS AND INFORMATION	SEUA REGIONAL CAMPUSES		
Computer Engineering	Gyumri	Vanadzor	Kapan

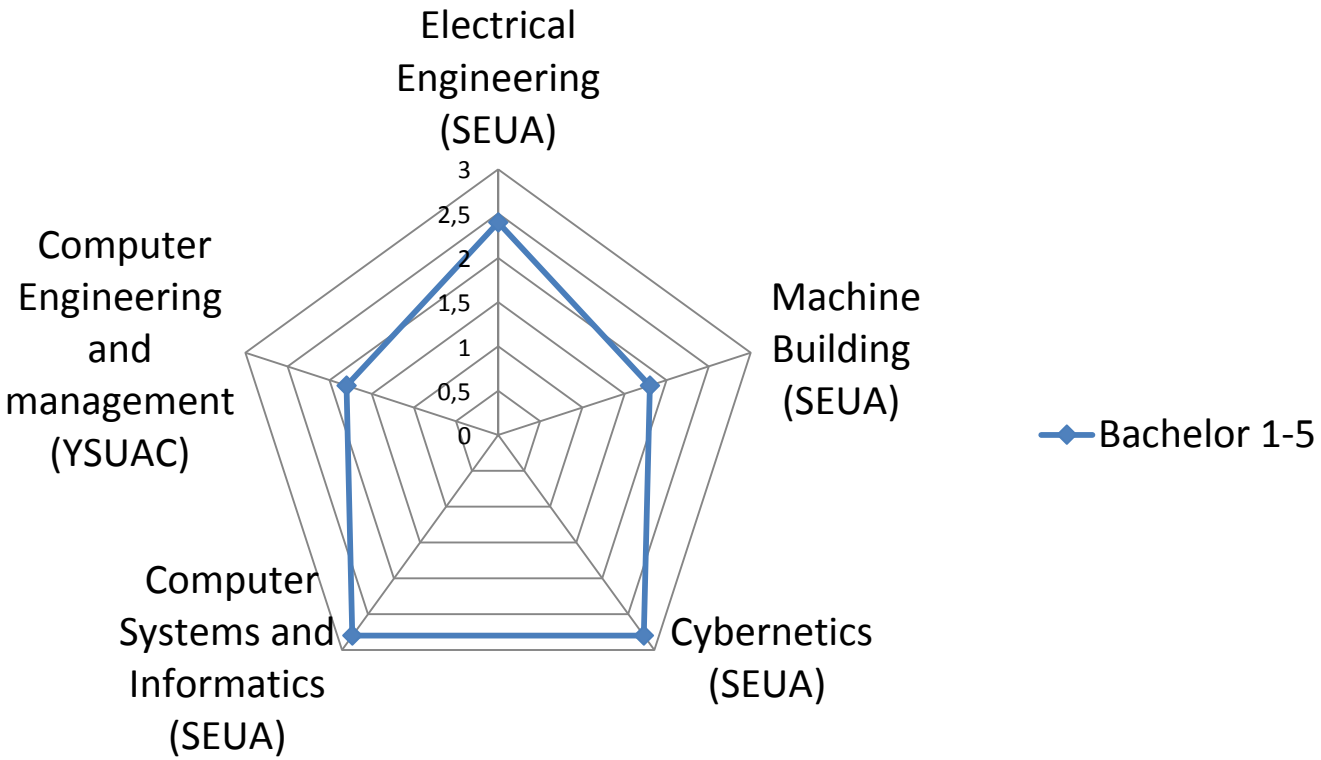
Embedded System Courses in Faculties programs

YSUAC

FACULTY OF COMPUTER ENGINEERING AND MANAGEMENT

Informatics, Computing Technologies and Management Systems

Evaluation Chart (Bachelor)
Embedded System Courses in Faculties programs (SEUA+YSUAC)



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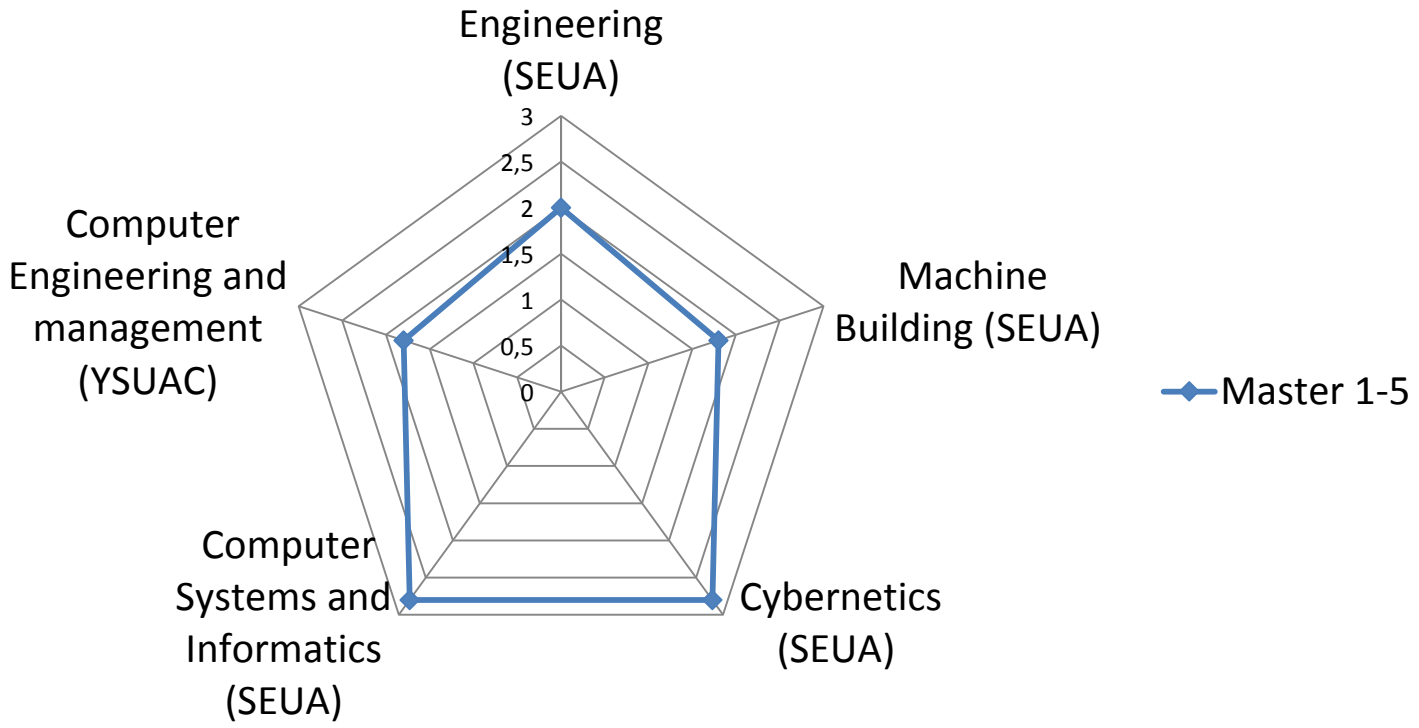
Evaluation Chart (Master)
Embedded System Courses in Faculties programs (SEUA+YSUAC)



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Information about preparation of the directions and Specialties related with Embedded System Courses at the Chair Electronic Engineering

Reparation of the directions		Specialties		Licensed volumes	
Code	Name	Code	Name	Intramural	Extramural
2.15.2.06	Microprocessor Systems Design	210100	Electronic Engineering	+	+
2.15.2.07	Microcontrollers' Devices	210100	Electronic Engineering	+	+
2.15.2.18	Applications of Microcontrollers	210100	Electronic Engineering	+	+
1.15.2.13	Microcontrollers	210100	Electronic Engineering	+	+
1.15.2.18	Design by Microcontrollers	210100	Electronic Engineering	+	+
1.15.2.08	Digital Electronics	210100	Electronic Engineering	+	+
2.15.2.13	Design of Digital Systems	210100	Electronic Engineering	+	+
1.15.2.16	Logical Design of Digital Systems	210100	Electronic Engineering	+	+
2.15.2.12	Signals converters	210100	Electronic Engineering	+	+
1.15.2.11	Informational Primary Converters	210100	Electronic Engineering	+	+
1.15.2.15	Digital Processing of signals	210100	Electronic Engineering	+	+
2.15.2.10	Signal Processing	210100	Electronic Engineering	+	+

Information about staff at the Chair of Electronic Engineering responsible for preparation of the directions and Specialties related with Embedded System Courses

Name of chair	Number of educators at the Chair		Number of educators related with embedded systems at the Chair	
	PhD. Prof.	PhD. Ass. Prof.	PhD. Prof.	PhD. Ass.Prof.
Electronic Engineering	3	5	1	4

Methodical and educational materials by subjects at the Chair of Electronic Engineering

Name of subject	Responsible person	Textbooks, methodical materials, literature's abstracts and etc.
Digital Integrated Circuits	V.M. Movsisyan, Ph.D., Associate Professor	1. Ch. Hawkins, J. Segura, P. Zarkesh-Ha. CMOS Digital Integrated Circuits: A First Course. SciTech Publishing. 2012 2. M. Mano, M. Ciletti. Digital Design: With an Introduction to the Verilog HDL. Prentice Hall; 5 edition. 2012 3. R. Morrison. Digital Circuit Boards: Mach 1 GHz. Wiley; 1 edition. 2012 4. K. Yeap. "Fundamentals of Digital Integrated Circuit Design". AuthorHouse, 2011 5. J.M. Rabaey, A. Chandrakasan, B. Nikolic. "Digital Integrated Circuits", Prentice Hall; 3rd edition, 2008 6. R. Baker, H. Li, D. Boyce. "CMOS. Circuit design, Layout, and Simulation"; 3rd edition, 2010 7. J. P. Uyemura, "CMOS Logic Circuit Design", Kluwer Academic Publisher, 1999
FPGA Prototyping	A.S. Aslanyan	1. D. Amos, Au. Lesea, R. Richter. "FPGA-Based Prototyping Methodology Manual", 2011 2. P. Chu Pong, "FPGA Prototyping By Verilog Examples", Xilinx Spartan, 3rd version, 2008 3. S. Kilts, "Advanced FPGA Design Architecture, Implementation, and Optimization", 2007 4. High-performance ASIC Prototyping Systems (HAPS) Datasheets 5. Spartan-3A/3AN FPGA Starter Kit Board User Guide, 2010
Design of Embedded System	H.R. Chukhajyan	1. C. Hamacher, Z. Vranesic, S. Zaky, N. Manjikian. Computer Organization and Embedded Systems. McGraw-Hill Science/Engineering/Math; 6 edition, 2011 2. Hayk Chukhajyan. Verilog in digital design. Yerevan, Edit Print, 2011 3. R. Sass, A. Schmidt. Embedded Systems Design with Platform FPGAs: Principles and Practices. Morgan Kaufmann; 1 edition, 2010 4. D. Gajski, S. Abdi, A. Gerstlauer, G. Schirner. Embedded System Design: Modeling, Synthesis and Verification. Springer; 1 edition, 2009 5. R. Kamal. Embedded Systems: Architecture, Programming and Design. McGraw-Hill Education, 2 edition, 2009 6. G. Ganssle. The Art of Designing Embedded Systems. Newnes; 2 edition, 2008
System Level Design of Embedded Systems	Ph.D. A. Martirosyan	1. N. Sklavos, M. Hübner, D. Goehringer, P. Kitsos. System-Level Design Methodologies for Telecommunication. Springer; 2014 2. T. Noergaard. Embedded Systems Architecture, Second Edition: A Comprehensive Guide for Engineers and Programmers. Newnes; 2 edition; 2012 3. D. Abbott. Linux for Embedded and Real-time Applications, Third Edition (Embedded Technology). Newnes; 3 edition; 2012 4. C. Hamacher, Z. Vranesic, S. Zaky, N. Manjikian. Computer Organization and Embedded Systems. McGraw-Hill Science/Engineering/Math; 6 edition, 2011 5. Hayk Chukhajyan. Verilog in digital design. Yerevan, Edit Print, 2011 6. Axel Jantsch: Modeling Embedded Systems and SoC's: Concurrency and Time in Models of Computation. - Morgan Kaufmann, 2003 7. Lopez-Vallejo M., Lopez J.C. On the Hardware-Software Partitioning Problem: System Modeling and Partitioning Techniques // ACM Transactions on DAES. – 2003. – Vol. 8, No 3 8. Schirrmeister F., Benchorin S., Thoen F. Using Virtual Platforms for Pre-Silicon software development // Synopsys White Paper, 2008

Laboratory works by subjects at the Chair of Electronic Engineering (1)

Subject name	Topics for laboratory works
Digital Integrated Circuits	• Study of a MOS Resistor-Transistor Inverter • Study of Transistor-Transistor Logic Gates • Study of an ECL Inverter • Study of a CMOS Inverter • Study of CMOS PASS Gates • Study of NAND and NOR cells • Study of CMOS OAI and AOI cells • Study of Dynamic Logic Circuits • Study of CMOS multiplexers and XOR circuits • Study of Logic Gate Based Latches • Study of CMOS Static Flip-Flops • Study of Dynamic Flip-Flops • Study of a Dynamic Shift Register • Study of Differential Logic Gates (CML gates) • Study of Schmidt Triggers
FPGA Prototyping	• Modeling of Rotary Encoder Controlled Multi-LED Dimmer • Modeling of SVGA Display Controller • Prototyping a SoC Design by FPGA
Design of Embedded System	• Modeling of Embedded Cores • RTL Development of Embedded Cores Components – LFSR and MISR • Synopsys Design Integration Tool (DIT) • Configuration and Generation of Embedded Cores

Laboratory works by subjects at the Chair of Electronic Engineering (2)

System Level Design of Embedded Systems	-
Embedded Applications	• Modeling of Embedded Cores • RTL Development of Embedded Cores Components – LFSR and MISR • Synopsys Design Integration Tool (DIT) • Configuration and Generation of Embedded Cores
Advanced Digital Integrated Circuits	• Current Starved Voltage Control Oscillators • Phase-Frequency Detector • Transmission Line Modeling
Microprocessor Systems	• Timer/Counter programming • Hardware implementation of A/D Conversions • Keyboard interfacing with Microcontroller • Software Display Control
Digital Signal Processing	• Analog Lowpass Butterworth Filters Design • Analog Lowpass Chebyshev Filters Design • Analog Lowpass Elliptic Filters Design • Analog-to-Digital Filter Transformations • Frequency-Band Transformations • Discrete-time FIR Filter Design

Information about Curricula by subject at the Chair of Electronic Engineering

Subject Name	Evaluation of students' knowledge	Subject volume		Hours		Distribution of work hours			Term project
		Hour	Credit	Classroom hours	Self-instruction	Lecturers	Practical work	Laboratory works	
Microprocessor Systems Design	Exam	128	5	64	64	48	-	16	-
Microcontrollers' Devices	Exam	128	5	64	64	48	-	16	-
Applications of Microcontrollers	Exam	128	5	64	64	32	-	32	-
Microcontrollers	Exam	128	4	64	64	32	-	32	-
Design by Microcontrollers	Exam	128	4	64	64	32	16	16	+
Digital Electronics	Exam	160	5	80	80	32	16	32	+
Design of Digital Systems	Exam	128	5	64	64	64	-	-	-
Logical Design of Digital Systems	Exam	160	5	80	80	48	16	16	-
Signals converters	Exam	128	5	64	64	48	16	-	-
Informational Primary Converters	Exam	96	3	48	48	32	16	-	-
Digital Processing of signals	Exam	96	3	48	48	32	16	-	-
Signal Processing	Exam	128	5	64	64	48	16	-	+

Information about Curricula by subject at the Chair of Electronic Engineering (Synopsys)

Subject Name	Evaluation of students' knowledge	Subject volume		Hours		Distribution of work hours			Term project
		Hour	Credit	Classroom hours	Self-instruction	Lecturers	Practical work	Laboratory works	
Digital Integrated Circuits	Exam	180				150	30	-	
FPGA Prototyping	Exam	54				32	22	-	
Design of Embedded System	Exam	64				48	16	-	
System Level Design of Embedded Systems	Exam	50				50	-	-	
Embedded Applications	Exam	64				48	16	-	
Advanced Digital Integrated Circuits	Exam	65				50	15	+	
Microprocessor Systems	Exam	120				90	30	-	
Digital Signal Processing	Exam	64				32	32	-	

YSUAC

		Full-time learning		Correspondence learning		
1.	**Students**	bachelor	115	bachelor		169
		master	23	master		7
2.	**Teaching staff**	professor: 2	associate prof.: 3	assistant 4	lecturer: 8	Total: 17
3.	**FACULTY OF COMPUTER ENGINEERING AND MANAGEMENT**					
4.	***Chair of Informatics, Computing Technologies and Management Systems***					
5.	1. Major: ***Informatics and Computing Technologies***					
6.	***a/*** Minor***: Programming of Computing Technologies and Automated Systems***	b/ Minor: ***Computing Machines, Systems, Networks***				
7.	2. Major: ***Management Information Systems***					
8.	a/ Minor: ***Financial and Computer Systems***	b/ Minor: ***Information Processing and Management of Automated Systems***				

Students opinion analysis

Within the Tempus project ***"Development of Embedded System Courses with implementation of Innovative Virtual approaches for Integration of Research, Education and Production in UA, GE, AM"*** student opinion analysis questionnaire has been filled in which about 125 students of YSUAC and SEUA participated.

Students opinion analysis

The Coded Questionnaire with answers

Student questionaire

Group 1	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8
Student A	1	1	5	4	3	7	8	8
Student B	1	1	3	3	3	7	9	9
Student C	1	1	5	5	5	8	9	9
Student D	6	1	5	5	5	7	8	9
Student E	2	1	5	4	3	8	9	7
Student F	1	1	3	5	3	7	9	8
Student G	2	1	3	2	3	7	7	8
Student H	1	1	5	5	3	9	7	8
Student I	2	1	3	5	3	8	9	8
Student J	1	1	5	5	5	8	8	9

Students opinion analysis

The codes are	·Yes, know	1
	·Heard smth	2
Each question is coded	·Never heard before	3
with Q letter and	·Yes, used it during my study	4
corresponding number	·Yes heard about it	5
e.g. Q1	· Hear for the first time	6
The answer is coded with	·Yes, often	7
numbers.	·Sometimes	8
e.g. 1 or 2	·Don't use	9

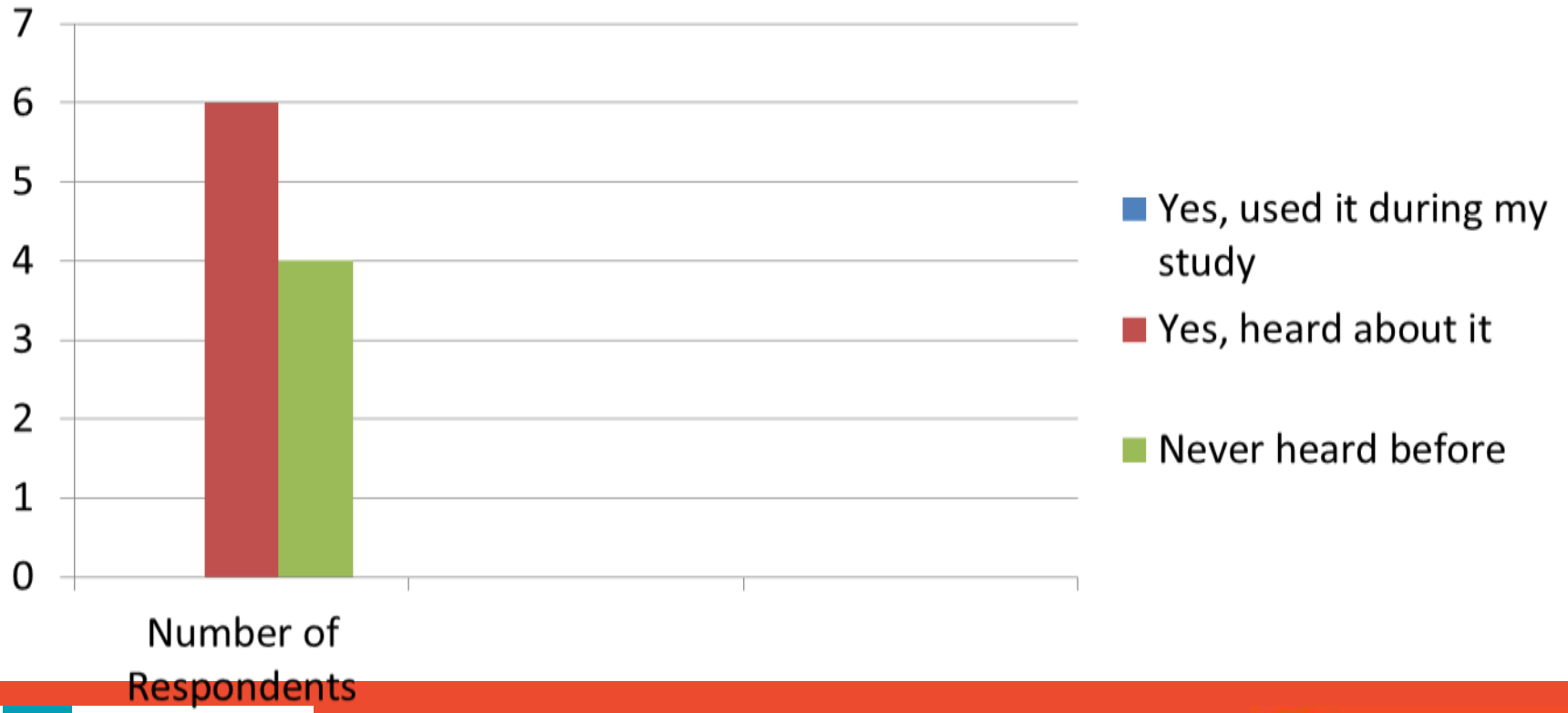
Question 1: Do you know what embedded systems are?

From *Question 1,* it is obvious that 65% of the students is aware of the embedded systems, 30% of them has heard something about them, and only 5% hears for the first time.

Question 2: Do you know what distance learning is?

From *Question 2,* it is obvious that 100 % percent of the students knows what distance learning is.

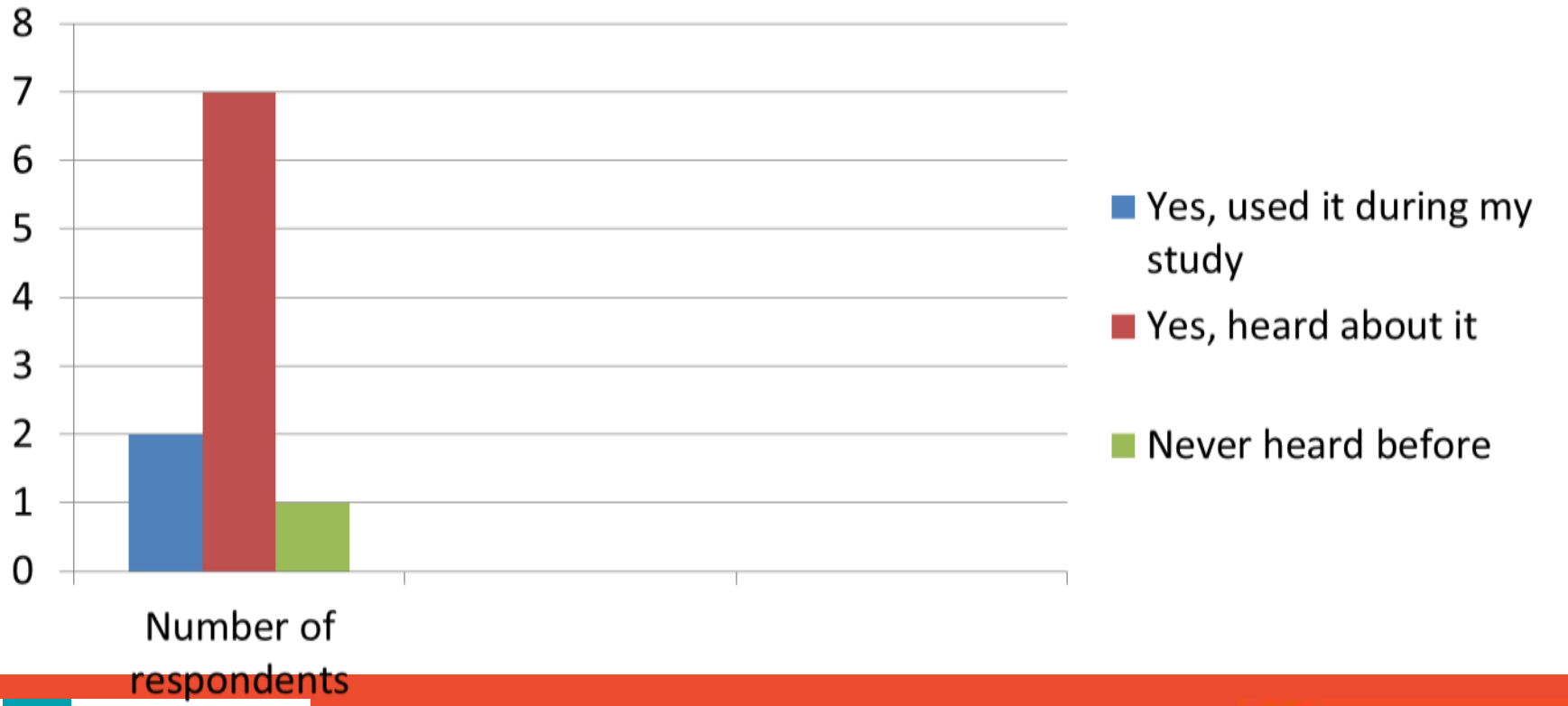
Question 3: Do you know what Learning management system Moodle is?



From *Question 3,* it is obvious that 60% percent of the students has heard about it, and 40% of them has never heard before and none of the inquired students has used

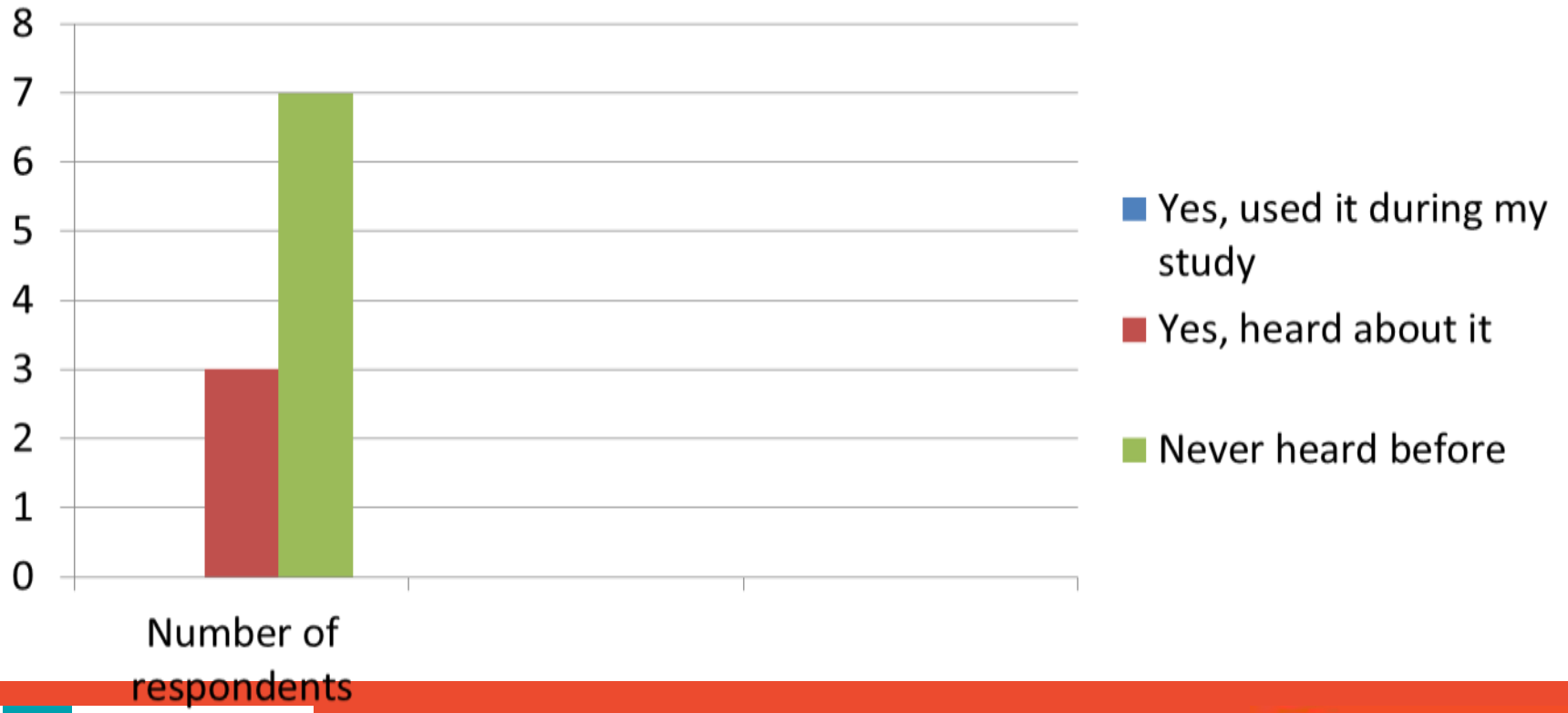
During their studies.

Question 4: Do you know what virtual laboratory is?



From *Question 4,* it is obvious that 70% percent of the students has used it during their study, 20% of them has some knowledge about it, and only 10% has never heard about it.

Question 5: Do you know what remote laboratory is?



From ***Question 5,*** it is obvious that 70% percent of the students has never heard about it before, and only 30% is aware of it and, finnaly, none of them used at their studies.

Question 6: Do your teachers use innovative technologies during lectures ((multimedia, virtual tools)?

From *Question 6,* it is obvious that 50% percent of the students has mentioned that their teachers **often** use innovative technologies during lectures, 40% of them has underlined that teachers **sometimes** use innovative technologies during lectures and 10% has only mentioned that their teachers **don't use** them.

Question 7: Do your teachers use innovative technologies during lab-sessions (virtual, remote laboratories, LMS Moodle)?

From *Question 7,* it is obvious that 20% percent of the students has mentioned that their teachers **often** use innovative technologies during lectures, 30% of them has underlined that teachers **sometimes** use innovative technologies during lectures and 50% has only mentioned that their teachers **don't use** them.

Question 8: Do your teachers use on-line testing for knowledge control, for example during the exams (Moodle, other systems)?

From *Question 8,* it is obvious that 10% percent of the students has mentioned that their teachers **often** use innovative technologies during lectures, 50% of them has underlined that teachers **sometimes** use innovative technologies during lectures and 40% has only mentioned that their teachers **don't use** them.

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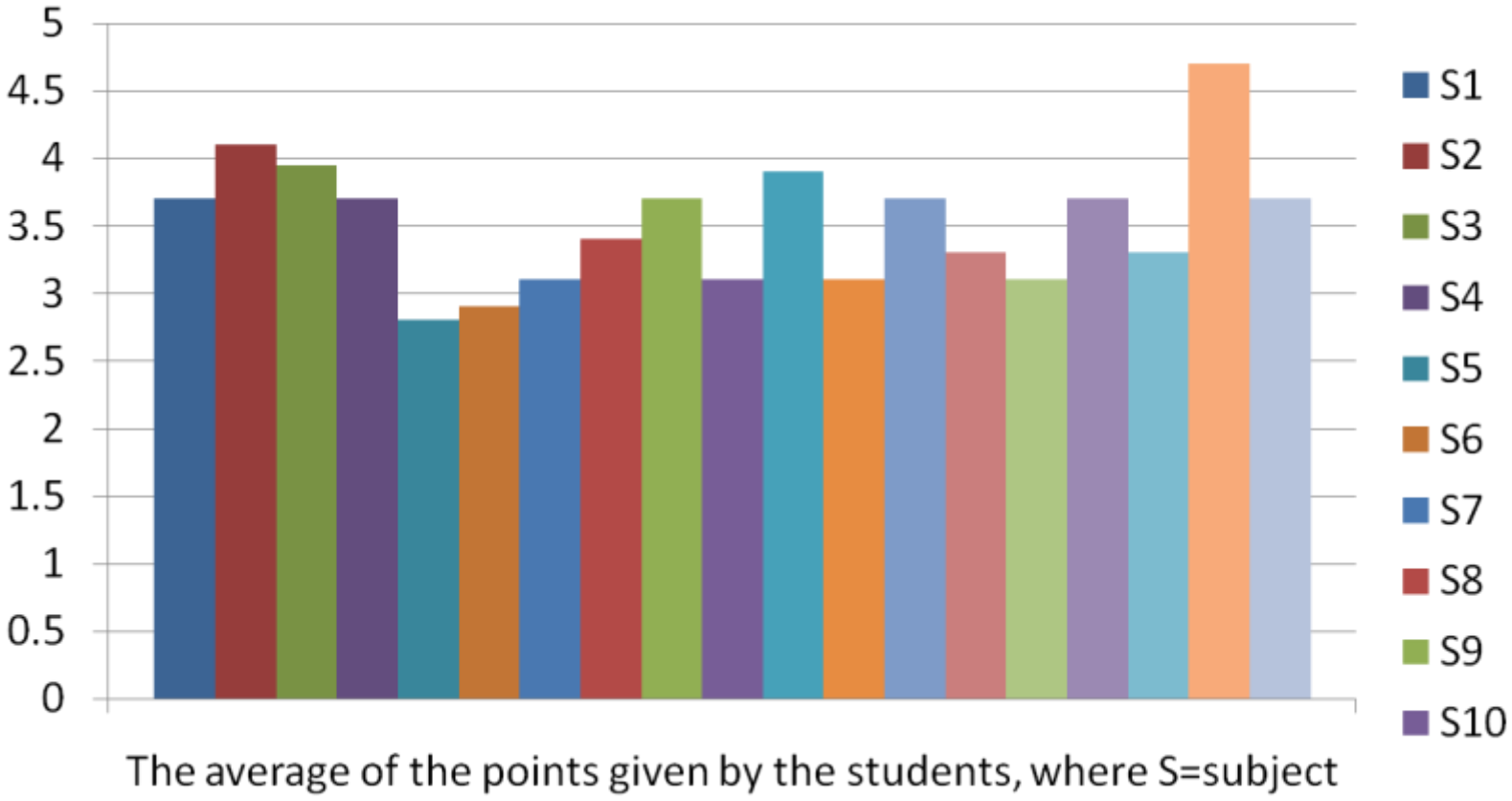
The Table of the importance of 19 courses rated by the students and presented in elective way

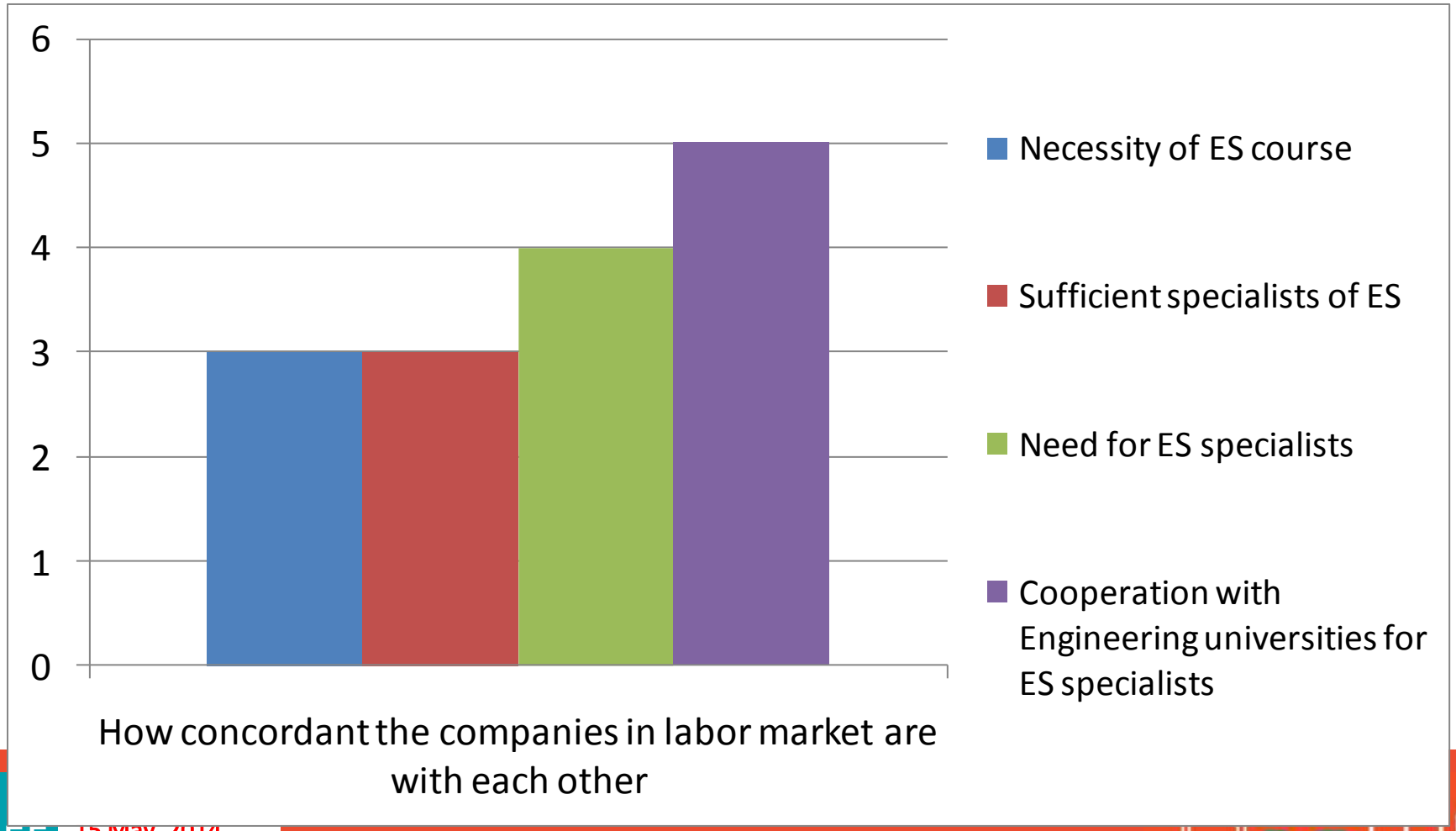
Course/Module											0
Microcontrollers	5	3	2	3	3	5	1	5	5	5	3.7
Digital Electronics	5	5	3	4	4	4	1	5	5	5	4.1
Digital System Design	3	4.5	1	5	5	5	2	5	5	4	3.95
Embedded Communication	4	3	4	5	5	2	1	5	5	3	3.7
Sensors, Actuators and Interfacing	1	4	0	5	3	5	1	5	0	4	2.8
C for Embedded Systems	2	4	3	5	4	5	1	5	0	0	2.9
Embedded Software Development	2	3	5	3	5	1	2	5	0	5	3.1
Embedded Operating Systems	5	5	1	5	3	3	2	5	0	5	3.4
GUI development	4	5	3	5	3	5	3	4	5	0	3.7
Multicore Programming	4	4	2	0	5	4	3	5	0	4	3.1
Testing	4	5	4	0	5	5	1	5	5	5	3.9
ECAD- electronic design system ALTIUM designer	2	3	2	0	5	5	0	5	5	4	3.1
MCAD- structural design system PTC CREO	3	4	3	4	5	4	0	5	5	4	3.7
Digital Signal Processing	4	5	4	5	0	4	2	5	0	4	3.3
Remote Labs and Virtualization	5	5	0	5	2	3	2	5	0	4	3.1
Quality Engineering	0	5	4	5	3	4	3	5	5	3	3.7
New teaching approaches in Engineering	0	5	2	5	5	1	3	5	5	2	3.3
Soft Skills for engineers	5	5	5	5	5	5	4	5	5	3	4.7
Management and Marketing for Engineers	0	5	3	5	5	5	2	5	4	3	3.7


5
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
S1
S2
S3
S4
S5
S6
S7
S8
S9
S10
The average of the points given by the students, where S=subject

Tempus

Labor Market Analysis

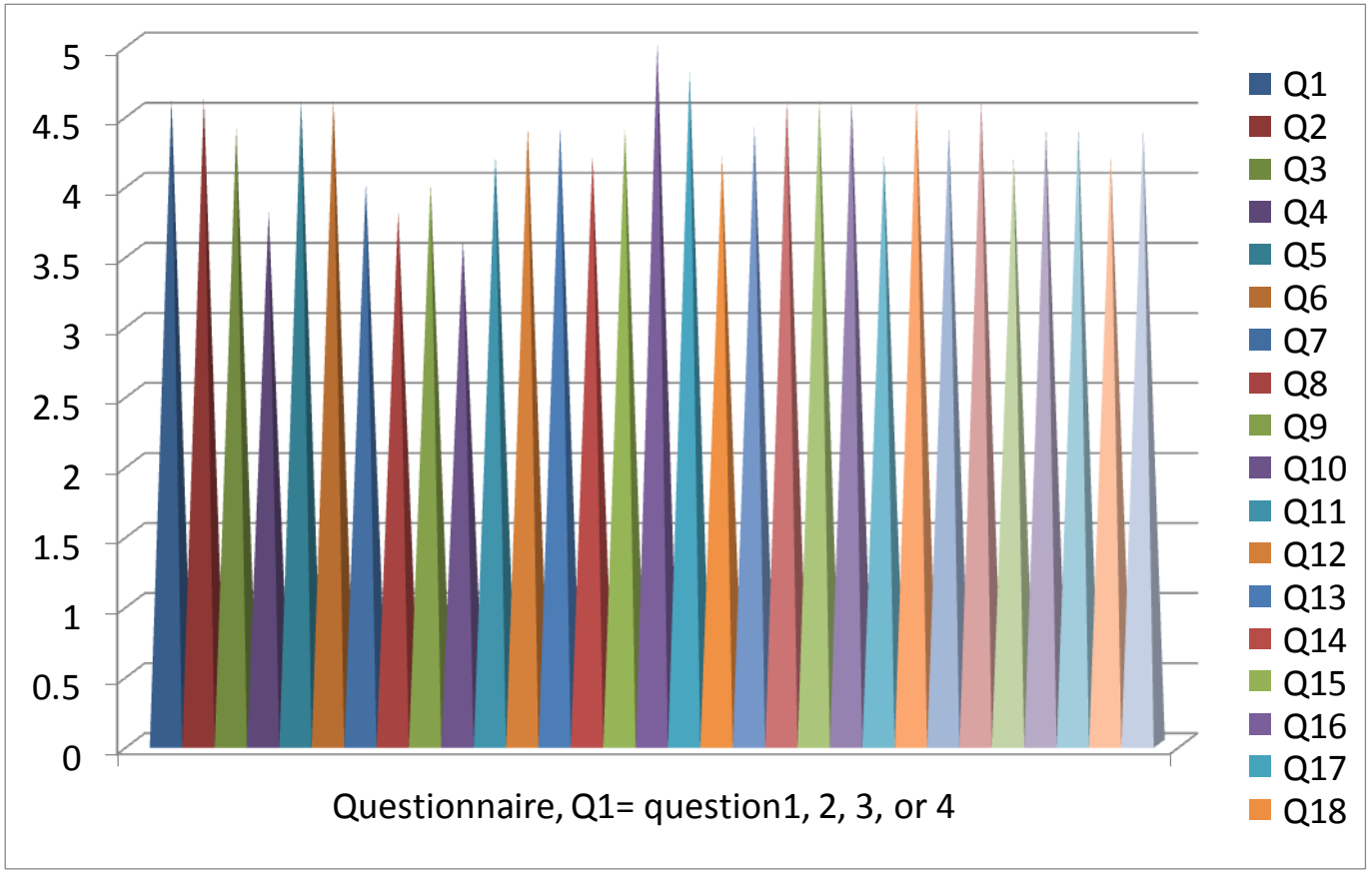
49 companies and organizations participated in the survey



Labor Market Analysis

The chart above shows that companies share the same opinion on several issues connected with ES (Embedded Systems): a)necessity of ES course and b)sufficient specialists in ES about 60%, b) need for ES specialists about 80% and d) cooperation with engineering universities for ES specialists about 100%.

Labor Market Analysis



Labor Market Analysis

The companies and organizations presenting RA labour market which have taken part in the survey mostly answered the 31 questions in a similar way fluctuating from 3.6 to 4.6 points.

Criteria for teachers election for the re-training

The teachers should be classified into two groups: A) those who teach subjects closely connected to Embedded Systems and B)those who have specialties of Computer Programming, Cybernetics, Electrical Engineering.

The teachers of ***Group A*** are supposed to have retraining or requalification, the teachers of ***Group B*** should have trainings to be able to deliver lectures to students.

Departments Involved in the Project

SEAU

1. *Cybernetics*
2. *Computer Systems and Informatics*
3. *Electrical Engineering*
4. *Machine Building*

YSUAC

1. *Computer Engineering and management*

Conclusion

1. Within the scope of DesIRE project a collaborative work has been set between the three institutions: SEUA, YSUAC and YeTRI.
2. A) Creation and implementation of methodical works, laboratory basis with the help of the equipments disposed within the DesIRE project.

Conclusion

2 B) Adaptation and implementation of the laboratory and methodical bases (existing at the universities) in Embedded Systems.

3. Yerevan Telecommunication Research Institute appears to be the supporter of practical work at the universities.

Conclusion

4. Working out the Strategic Plan, reviewing and matching the existing academic plans.
5. Start-up creation in the field of automatisation and lift system

Thank You for Your Attention