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Project Title

Enhancing Digital Capacities in Higher Education for Asian Universities

Project Acronym

Digi-CHE-Asia

Deliverable 1.3:
Report on Related VET Courses in the Subject Area

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Contents

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Introduction

This report gathers the information that has been collected by Asian HEIs regarding existing VET courses that may have in their institutions as well as their regions' needs in terms of required professional skills in the field of Electronics, Automation and Robotics, as well as similar lifelong-learning/ VET training programme. Therefore, through this identification, based on templates that NOVEL Group has prepared and distributed, a detailed presentation of each institution is analyzed in this document. Along with the reports that identified similar curricula in Asia and Europe, a final report will be compiled, providing us with the necessary knowledge to proceed with the next step of Digi-CHE-Asia project.

Survey Part I

Hue University of Sciences (HUS)

The institution of Hue University of Sciences does not have a centre or department in the field of Electronics, Automation and Robotics, as well as similar lifelong-learning/ VET training programmes. Therefore it cannot support students' interest in the field of Electronics, Automation and Robotics, as well as similar lifelong-learning/ VET training programmes issues or utilize students in any way in the development of project related to this topic. However, the institution runs different developed programmes with IT-based material in this field for academic staff and makes other efforts to increase the knowledge about the field of Electronics, Automation and Robotics, as well as similar lifelong-learning/ VET training programmes among academic staff, for example, ***thematic research projects for students***.

The institution does not offer a general introduction course on field of Electronics, Automation and Robotics, as well as similar lifelong-learning/ VET training programmes to undergraduate students, but it integrates Electronics, Automation and Robotics, as well as similar lifelong-learning/ VET training programmes aspects in subject courses. Partnerships or initiatives of the institution to support such internships are the projects Huetronics and HueCIT. Regarding other institutions in the region that offer VET, the Hue Industrial College offers such courses.

A shortlist of companies that Hus has cooperated with in the past or there are possibilities to cooperate that may offer internships to future students in the framework of the DCA project are the following:

Name	Type of company
Huetronics	Private

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HueCIT	Public
SAVARTI	Foreign
CME	Private
FPT Software	Private

University of Danang (UD)

The University of Danang (UD) has a department providing VET training and courses in the field of Electronics, Automation and Robotics, as well as similar lifelong-learning/ VET training programmes.

The institution supports students' interest in the field of Electronics, Automation and Robotics, as well as similar lifelong-learning/ VET training programmes issues or utilizes students in any way in the development of project related to this topic, for example, they hold robot competitions, student research activity and smart innovation idea every year for students who interest in the field of Electronics, Automation and Robotics.

The institution makes efforts to increase the knowledge about the field of Electronics, Automation and Robotics, as well as similar lifelong-learning/ VET training programmes among academic staff, for example, we encourage and invest researches focusing on smart technology, robot applications, AI robot and organize the scientific workshop or seminar related to this field.

The institution offers a general introduction course on field of Electronics, Automation and Robotics, as well as similar lifelong-learning/ VET training programmes to the undergraduate students. It integrates Electronics, Automation and Robotics, as well as similar lifelong-learning/ VET training programmes aspects in subject courses.

The institution offers VET courses which contain the field of Electronics, Automation and Robotics, as well as similar lifelong-learning/ VET training programmes. Three examples are as follows:

1. Nonlinear Control Systems: 3 credits, undergraduate level. This course aims at providing graduate students with knowledge on nonlinear systems and nonlinear control strategies, both on a theoretical and a practical way through simulations on Matlab/Simulink and lab experiments.

2. Embedded Systems: 6 credits, undergraduate level. This course covers the principles of embedded systems inherent to many hardware platforms and applications being developed for ubiquitous systems, robotics, communication and networking systems, multimedia devices, etc.

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3. Mechanics and Control of Robot Manipulators: 2 credits, undergraduate level. This course aims to introduce the student to the modelling, simulation, and control of industrial robots. In particular, we will study the kinematics and dynamics of robotic manipulators by using the standard Denavit-Hartenberg parameters.

Regarding a VET course supporting the field of Electronics, Automation and Robotics, as well as similar lifelong-learning/ VET training programmes which are particularly popular with the students, there are the following examples:

Internet of Things (3 credits) The aim of this course is that students should deepen their understanding of the Internet of Things (IoT) and how to design and engineer IoT-based systems. You will learn about smart technologies that can be implemented in such areas as transportation, cities, energy, health, learning, and more.

Computer Vision System (3 credits) The course topics include some basic computer vision theories and techniques such as image formation, edge detection, stereo vision, photometric stereo, and 3D reconstruction from multiple views. The course will introduce 3-dimensional geometry of imaging systems and high-level computer vision algorithms such as motion segmentation, boundary detection, symbolic image matching, motion segmentation, 3-dimensional scene reconstruction and object recognition through inference. Besides, H/W and S/ W techniques relating to the biological visual perception model will be introduced as well as the hand-eye coordination theory for the robot control.

Artificial Intelligence Robot (3 credits) In this course you will learn what Artificial Intelligence (AI) is, explore use cases and applications of AI in robotics.

Moreover, 300 students (approximately) received a degree/certificate in the last 3 years, which includes studies in the field of Electronics, Automation and Robotics, as well as similar lifelong-learning/ VET training programmes based on Virtual Learning Environment which is approximately 10% of the total number of students at the institution.

The institution also uses e-tools which you feel may support the development of sustainability and may serve as examples of good practice, for example:

Matlab: this software is used for physical modelling and control system design, it helps the student to design, parameterize, and test the closed-loop control software.

Moodle Learning Management System (LMS) provides functional, flexible, and interoperable digital learning solutions for E-learning.

The UD institution has been involved in any partnerships or initiatives to support internships, for example, SMC Vietnam Corporation: Manufacture, processing and sales of automatic control equipment.

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The vision of the institution regarding the approach of development of VET courses is going to become a top applied science university in the area of central and Western Highlands in Vietnam. Therefore, the development of VET courses in the field of Electronics, Automation and Robotics becomes an essential orientation to meet requirements of the Fourth Industrial Revolution in technology and development economic – society.

Other institutions or entities in the country/region that offer VET courses are the Danang Vocational Training College- Danang, Vietnam, and the Cao Thang Technical College, Ho Chi Minh City, Vietnam.

Examples of VET courses that there is need to be offered to the students are

-Applied Information Technology: provides a generalist education in information technology (IT), focus on information systems, software development, computer networks, web development.

- Industrial Automation and Control: provides competencies to assemble, set up and program, fault find, repair and maintain automated equipment, apparatus, associated circuits and systems.

- Robotics Control Systems: provide the basic electronics, programming, 3D printing and foundation skills involved with automation and robotics.

A shortlist of companies that UD has cooperated with in the past or there are possibilities to cooperate that may offer internships to future students in the framework of the DCA project are the following:

Name	Type of company	Availability for internships
FPT	Sofware	Yes
SMC	Manufacturing	Yes
Rubber Joint Stock Company Da Nang	Manufacturing	Yes
Daikin	Manufacturing	Yes
Chau Da Co., Ltd.	Manufacturing	Yes

Svay Rieng University (SRU)

The Svay Rieng University (SRU) does not have a department in the field of Electronics, Automation and Robotics, as well as similar lifelong-learning/ VET training programmes. However, it supports the students' interest in the field with courses such as Robotics and 3D Printing. The challenge, however, is the requirement of human resource capacity building and equipment.

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the institution runs different developed programmes with IT-based material in this field for academic staff and makes other efforts to increase the knowledge about the field of Electronics, Automation and Robotics, as well as similar lifelong-learning/ VET training programmes among academic staff, for example, invite a local partner to guide the course, training of trainer at the partner institution.

Some examples of VET courses which contain the field of Electronics, Automation and Robotics, as well as similar lifelong-learning/ VET training programmes are:

1. Electronics and Arduino
2. Control System and Robotics
3. Programmable Logic Controller

In a perspective of 3-5 years the institution will approach the development of VET courses in the field of Electronics, Automation and Robotics, in three ways:

- Collaborate with the local and DCA partner to develop the curriculum.
- Need assessment to identify the job market.
- Consultative Workshop on curriculum development.

There other institutions or entities in that country/region that offer VET courses, for example, the Institute of Technology of Cambodia (ITC), the National Polytechnic Institute of Cambodia (NPIC), the National Institute of the post, telecommunication and ICT (NIPTICT).

Examples of VET courses that there is need to be offered to the students are:

1. Electronics and Arduino
    - Basic of electronic
    - Base programming Arduino
    - Serial Monitor and string function
    - Display LCD and OLED
2. Control System and Robotics
    - Basic Android Application developer
    - Advance communication and wireless
    - Method control system
    - CNC and stepper Motor
3. Programmable Logic Controller
    - Introduction to the Logic controller
    - Programming logic controller

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A list of companies that you have cooperated with in the past or there are possibilities to cooperate that may offer internships to future students in the framework of the DCA project are as follows:

Name	Type of company	Contact details	Availability for internships
KOLAO Group	Automobile	Mr Sourng Piset(+855977394800)	yes
Top Sports Textile Ltd.,	Textile	Mr Hul Sinh (+855 976266796)	yes
GIGA SEZ		Mr Prho HSU(+855978552901)	yes
Towa	UMBRELLA FABRIC	Mr Sim Nakry(+855719011621	yes
Beautiful windows	SPRINGS WINDOW FASHIONS	Mis.Rin Sochheata(+855976650441)	yes

SRU is located in Svay Rieng province, a province in the southeaster part of the country, which has much special economic zone. It has been planned to establish new program namely Electronics and Automation Engineering in 2 years.

The courses provided by DCA will be an essential complement to our program. These courses are also the students' dream.

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University of Battambang (UBB)

The University of Battambang (UBB) has a department providing VET training and courses in the field of Electronics, Automation and Robotics, as well as similar lifelong-learning/ VET training programmes. UBB has started to establish the department of Electronics and Automation in the Faculty of Science and Technology. It is expected to run this program in 2021 or 2022.

The institution support students' interest in the field of Electronics, Automation and Robotics, as well as similar lifelong-learning/ VET training programmes issues or utilize students in any way in the development of project related to this topic, for example, electronics and Automation, however, staff capacity building and equipment are required to support this program. The institution makes other efforts to increase the knowledge about the field of Electronics, Automation and Robotics, as well as similar lifelong-learning/ VET training programmes among academic staff, for example, invite a local partner to guide the course, training of trainer at a partner institution.

Three examples of VET courses related to the field are:

1. Electronics and Arduino
2. Control System and Robotics
3. Programmable Logic Controller

The institution has been involved in any partnerships or initiatives to support internships in the field of Electronics, Automation and Robotics, as well as similar lifelong-learning/ VET training programmes in the local/regional community for example with the Institute of Technology of Cambodia (ITC).

The institution has been involved in any co-operation projects with VET courses in the field, for example, Partnership with ITC for developing Bsc. in Electronics and Automation.

In a perspective of 3-5 years the institution will approach the development of VET courses in the field of Electronics, Automation and Robotics, in three ways:

- Collaborate with the local and DCA partner to develop the curriculum.
- Need assessment to identify the job market.
- Consultative Workshop on curriculum development.

There other institutions or entities in the country/region that offer VET courses, for example, Institute of Technology of Cambodia (ITC), the National Polytechnic Institute of Cambodia (NPIC), the National Institute of Post, the Telecommunication and ICT (NIPTICT), and the Institute of Technology of Battambang.

Examples of VET courses that there is need to be offered to the students are:

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1. Electronics and Arduino

Basic of electronic

Base programming Arduino

Serial Monitor and string function

Display LCD and OLED

2. Control System and Robotics

Basic Android Application developer

Advance communication and wireless

Method control system

CNC and stepper Motor

3. Programmable Logic Controller

Introduction to Logic controller

Programming logic controller

Companies that have cooperated with in the past or there are possibilities to cooperate that may offer internships to future students in the framework of the DCA project are:

Name	Type of company	Contact details	Availability for internships
KOLAO Group	Automobile	Mr Sourng Piset (+855977394800)	yes
Top Sports Textile Ltd.,	Textile	Mr Hul Sinh (+855 976266796)	yes
GIGA SEZ		Mr Prho HSU(+855978552901)	yes
Towa	UMBRELLA FABRIC	Mr Sim Nakry (+855719011621	yes
Beautiful windows	SPRINGS WINDOW FASHIONS	Mis. Rin Sochheata (+855976650441)	yes

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Champasack University (CU)

The Champasack University (CU) has a department providing VET training and courses in the field of Electronics, Automation and Robotics, as well as similar lifelong-learning/ VET training programmes. The institution support students' interest in the field for example by supporting staff and students to joint Robot competitions. It makes other efforts to increase the knowledge about the field of Electronics, Automation and Robotics, as well as similar lifelong-learning/ VET training programmes among academic staff, for example, pieces of training with other universities, both inside and outside the country. It offers a general introduction course on the field for all undergraduate students.

An example of an offered VET Course which is also very popular among students is Usage Arduino for automation control, length of course 3 weeks, this course provides for students in University and whoever is interested. Approximately 180 students received a degree/certificate in the last 3 years, which includes studies in the field which is approximately 15% of the total number of students at the institution.

The institution uses 1-2 out of books and programme e-tools that carry out a VET course related to the field. Examples are E-books as the references, and Programmes: Digdilent, tina, Mathlao. In a perspective of 3-5 years, the institution will support any way to improve this course to high quality. Three examples of VET courses that need to be offered to the students are:

- Computer Program Simulink relates to electronic and automation
- Industrial automatic control as well as control electric drive
- Usage Arduino for automation control

Companies that have cooperated with in the past or there are possibilities to cooperate that may offer internships to future students in the framework of the DCA project are:

Name	Type of company	Contact details	Availability for internships
Xeset 1,2,3 Hydro power plant	State Enterprise	Found on the Website of the company	15
Lao Brewery Plant Champasack Province	State Enterprise	Found on the Website of the company Km 19. 13th South Road, Phathoumphone District, Champasack Province Tel : (+856-31) 214 192	6
Electric Due Laos	State Enterprise	http://edl.com.la/	6

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Lao Mit Sugar Company	Private company	https://laoedaily.com.la/2019/11/18/65147/	5
CBF Pharma CO LTD (PAKSE BRANCH)	State Enterprise	Found on the Website of the company	6

Savannakhet University (SKU)

The Savannakhet University University does not have a centre or department in the field of Electronics, Automation and Robotics, as well as similar lifelong-learning/ VET training programmes, but it

supports students to attend and join the events associated with the field of electronic, automation and robotics such as organized by the National University of Laos (NOUL), or at neighbouring countries like Vietnam and Thailand. Additionally, it makes other efforts to increase the knowledge about the field, for example, organizing the courses aiming to introduce about Artificial intelligence (AI), IT application in Logistics, and Programmable Logic Controller (PLC) by putting them as an introductory course in the curriculum of the Faculty of Information Technology and Faculty of Engineering. So, the lecturers attempt to learn and seek different sources of references to provide the mentioned courses.

It offers a general introduction course on the field for some undergraduate students. There are some courses under the Faculty of Information Technology (such as Introduction to Artificial Intelligence, Introduction to Multimedia Technology, Security in Information Technology, Network Management and Design, Wireless Network Technology, and Linux) and Faculty of Engineering (IT Application in Logistics, Introduction to GIS, Utilization of Logistics equipment) offering the general introductory course on the field of robotics.

SKU does not directly have the VET courses, but there are some courses for undergraduate students only. The first batch of electrical engineering is expected to graduate in 2022.

Examples of e-tools that support the development of sustainability and may serve as examples of good practice in the field are Moodle and PLC.

There are also initiatives to support internships in the field, as students will do an internship at companies, government agencies and organization regarding with their fields of studies and interests. Students freely select the venues for their internship. In case they cannot find the organizations for doing an internship, they can consult with lecturer or departments to help them.

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In a perspective of 3-5 years, the institution will approach the development of VET courses in the field further. Faculty of Information Technology and Faculty of Engineering will be key entities providing the foundation for Electronics, Automation and Robotics for our institution. The VET courses will be delivered as fundamental knowledge for undergraduate students. It is unfortunate that in the next three years, post-graduate programs under the aforementioned faculties might not be ready to be delivered due to lack of qualified professors and lecturers in these fields.

Other institutions or entities in your country/region that offer VET courses are the Centre of Electricity Training, Electricites du Laos, Vientiane capital; and the Political and Vocational Training College, Savannakhet Province.

Examples of VET courses that there is need to be offered to the students are:

1) Introduction to Artificial Intelligence

2) Programmable Logic Controller

3) MS Office – WORD, EXCEL and PowerPoint

Companies that have cooperated with in the past or there are possibilities to cooperate that may offer internships to the future student are:

Name	Type of company	Contact details
Nikon Lao Cooperation	Electronics Manufacturer	KM 28, Savan-Seno Special Economic Zone, Savannakhet Province, Lao P.D.R.
KoLao Developing Co LTD – Savannakhet Branch	Car assembling factory	Oudomvilay village, Kaysonphomvihane city Savanannakhet Lao PDR Tel: 041 260395
Lomakham Drinking Water Factory	Drinking water and ice factory	lattanalungsetai, phayapuoy Savannakhet, Savannahkhét, Laos Tel: 041 212181
Electricites du Laos – Savannakhet Branch	Electricity provider	Thahae village Kaysonphomvihane City Savannakhet Province, Lao PDR Tel: (856-41) 212046 Fax: (856-41) 213688

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Savan logistics company	Logistics provider	Land Lot No. 101, Savan Park Km10, Road No 9, Ban.Nongdeun, Kaysone Phomvihane City. P.D.R Tel: 041 210 045

Survey Part II

University of Danang (UD)

Embedded Systems

Course Information			
College / Institute / Centre	The University of Danang - University of Technology and Education	Department	Electrical and Electronic Engineering Department
Course Title	Embedded Systems	Course Code	
# Hours 40 Lecture/Presentations	50 Exercises/online activities etc.	6 Credit	
Pre Requisites: Good knowledge of IC digital design Good programming skills (in C/C++)			

Course Aim
This course covers the principles of embedded systems inherent to many hardware platforms and applications being developed for ubiquitous systems, robotics, communication and networking systems, multimedia devices, etc.

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Course Objectives
The course towards the development of skills to design and implement practical embedded systems. The lecture content will cover background material of embedded systems. Weekly lab sessions, in which the students will use FPGA boards and tools to design, optimize and test hardware and software components of an embedded system. The weekly labs will gradually build a processor-based System On Chip to implement an application using a variety of software and hardware methods: running as a single thread in an embedded processor and as a hardware accelerator. The students will evaluate the performance of each solution and will present their work in a technical report. Students will work in teams on an innovative project that will include hands-on design of a prototype of an embedded system of their own choice. Although FPGAs is a potential project platform, students are free to choose any platform such as DSPs, ARM microcontrollers, etc. Upon completion of this course, students should be able to: 1. Achieved the principles of embedded systems 2. Development of skills to design and implement practical embedded systems 3. Present and demo the final project work

Staff Requirements			
	Qualifications	Special Skills	Number
Lectures/Presentations	PhD of Electronic Engineering	C/C++; VHDL/Verilog	1
Exercises/online activities	PhD/Master of Electronic Engineering	C/C++; VHDL/Verilog	1

Lecture/Presentation Schedule			
Lecture/Presentation			Description
#	Week	Hrs	The numbers of Week and Hours will be adjusted to your VET course
1	1	2	Introduction to Embedded Systems

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2	2	2	FPGA design methodology
3	3	2	ASIC design methodology
4	4	4	Introduction to HDL and Verilog
5	5	2	Modern FPGAs - FPGA architecture and technology
6	6	2	Timing issues - Synthesis in FPGAs
7	7	2	Placement and Routing in FPGAs
8	8	4	Design methodologies Specification, Planning, Review, Implementation, Testing
9	9	4	Embedded Processors
10	10	2	Communication in Embedded Systems Buses, Switches, Network On Chips technologies
11	11	2	Memory Controllers (DRAM technology and organization)
12	12	2	System On Chip design
13	13	2	Hardware/Software partition and co-design;
14	14	2	Model and Methodology for hardware/software co-design
15	15	2	Optimization process: software and hardware approaches
16	16	4	Architectural Synthesis tools

Text Books/Material

Name	Description
"Computers as Components: Principles of Embedded Computing System Design", by Wayne Wolf , Morgan Kaufman Publishers, 2001.	This book mentions about some of the basic principles and techniques of this new discipline of embedded computing. Some of the challenges of embedded computing are well known in the desktop computing world. Similarly, the techniques developed in software engineering for specifying complex systems have become important with the growing complexity of embedded systems. Another example is the design of systems with multiple processes. It also captures some of the basic principles and techniques of this new discipline of embedded computing. Some of the challenges of embedded computing are well known in the desktop computing world. For example, getting the highest performance out of pipelined,

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	cached architectures often requires careful analysis of program traces. Similarly, the techniques developed in software engineering for specifying complex systems have become important with the growing complexity of embedded systems. Another example is the design of systems with multiple processes. The requirements on a desktop general-purpose operating system and a real-time operating system
Reference Books/Material	
	Description
Xilinx FPGA user guides	Provides guidance on how customers can use the architectural features of each product of Xilinx platform. Check for updates documentation on xilinx.com at: http://www.xilinx.com/support/documentation
"Computer Architecture: A Quantitative Approach", by J. Hennessy, D. Patterson, Morgan Kaufmann Publishers, 3rd or 4th edition	This book captures professional engineers and architects as it is for those involved in advanced computer architecture and design courses. It has a sharp focus on new platforms—personal mobile devices and warehouse-scale computers—and new architectures—multicore and GPUs. As much as its predecessors, this book aims to demystify computer architecture through an emphasis on cost-performance-energy trade-offs and good engineering design. The field has continued to mature and move toward the rigorous quantitative foundation of long-established scientific and engineering disciplines.

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Exercise/Activities Schedule			
Exercise/Activities			Topic
#	Week	Hrs	The numbers of Week and Hours will be adjusted to your VET course
1	1	2	Introduction to Embedded Systems
2	2	2	FPGA design methodology
3	3	2	ASIC design methodology
4	4	4	Introduction to HDL and Verilog
5	5	4	Modern FPGAs - FPGA architecture and technology: experiment with Xilinx Zedboard as a case study
6	6	2	Introduction and Practice with Vivado and ISE for :
7	7	4	1. Timing issues - Synthesis, Placement and Routing in FPGAs
8	8	4	2. Design methodologies Specification, Planning, Review, Implementation, Testing
9	9	4	3. Embedded Processors Case study: ARM9 processor, Hardware and Software
10	10	4	4. Embedded Processors Case study: Hardware and Software
11	11	2	5. Communication in Embedded Systems Buses (AMBA bus), Switches, Network On Chips technologies
12	12	2	6. DRAM technology and organization - Memory Controllers
13	13	4	7. System On Chip design
14	14	4	8. Hardware/Software partition and co-design
15	15	2	9. Optimization process: software and hardware approaches
16	16	4	10. Architectural Synthesis tools
Computer Usage			
Installed Vivado/ISE; C++			

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Grading and Assessment Method					
Week #	Points	Written	Oral	Paper	Continuous
	4	x		Weekly technical report	
	4		x	Presentation of the demo project	
	2	x		Final report	

Reading Material	
Code*	Description
TB	Chapter 1: Introduction to Embedded Systems
TB	Chapter 2: Instruction set and Introduction to HDL and Verilog,
RB	Xilinx FPGA user guides for FPGA/ ASIC design methodology and Modern FPGAs - FPGA architecture and technology: experiment with Xilinx Zedboard as a case study
TB	Chapter 4: Computing platforms looks at the combined hardware and software platform for embedded computing; Communication in Embedded Systems Buses (AMBA bus), Switches, Network On Chips technologies; DRAM technology and organization - Memory Controllers
TB	Chapter 7: Design methodologies: Specification, Planning, Review, Implementation, Testing. Based on our more detailed knowledge of embedded system design, we can better understand the role of methodology and the possible variations in methodologies.
TB	Chapter 8: Networks and multiprocessors: Embedded Processors
LN	System On Chip design
RB	Xilinx FPGA user guides: Hardware/Software partition and co-design
LN	Optimization process: software and hardware approaches
LN	Architectural Synthesis tools; Model and Methodology for hardware/software co-design
* TB: Text Book RB: Reference Book ST: Standards / Codes LN: Lecture Notes	

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Supplementary Material	
SW	Vivado/ISE
*PR: Periodical SW: Software VT: Video Tape OS: Overhead Slide MD: Model AC: Audio Cassette	

Mechanics and Control of Robot Manipulators

Course Information			
College / Institute / Centre	University of Technology and Education	Department	Mechanical Engineering
Course Title	Mechanics and Control of Robot Manipulators	Course Code	5504039
# Hours 20 Lecture/Presentations	10 Exercises/online activities etc.	2 Credit	
Pre Requisites: Differential Equations, Linear Algebra and the ability to program in a high-level language (Matlab)			

Course Aim
This course aims to introduce the student to the modelling, simulation, and control of industrial robots. In particular, we will study the kinematics and dynamics of robotic manipulators by using the standard Denavit-Hartenberg parameters.

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Course Objectives
Upon completion of this course, students should be able to: 1. Calculate the mobility (number of degrees-of-freedom) of planar and spatial structures, mechanisms, and serial and parallel robots. 2. Derive the standard Denavit-Hartenberg parameters for planar and spatial serial robot chains. 3. Use the mathematical basis of motion description, including rotation matrices. 4. Derive and calculate the forward and inverse pose kinematics solution for serial robots

Staff Requirements			
	Qualifications	Special Skills	Number
Lectures/Presentations	Senior lecturer (PhD in Robotics)		1
Exercises/online activities	Lecturer (master's degree required)		1

Lecture/Presentation Schedule			
Lecture/Presentation			Description
#	Week	Hrs	The numbers of Week and Hours will be adjusted to your VET course
1	1	2	Syllabus and videos, introduction to robotics
2	2	2	Vectors and Matrices
3	3	2	Vectors, spherical/Cartesian transform
4	4	2	Rotation matrices
5	5	2	Homogeneous transformation matrices
6	6	2	Transform equations & transform graphs

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7	7	2	Denavit-Hartenberg parameters
8	8	2	Forward Pose Kinematics (FPK)
9	9	2	Inverse Pose Kinematics (IPK)
10	10	2	Inverse Pose Kinematics: graphical, model, trajectory

Text Books/Material	
	Description
Lecture Notes	Lecture Notes are available on the Learning Management System (LMS)
Reference Books/Material	
	Description
WILLIAMS II, Robert L. Robot Mechanics. notebook Supplement for EE/ME, 2012, vol. 4290, p. 5290.	This book covers mobility, motion description, orthonormal rotation matrices, Denavit-Hartenberg parameters, forward and inverse pose kinematics, trajectory generation, velocity kinematics, kinematic redundancy for serial-chain robotic manipulators, plus parallel robot mechanics
SCIAVICCO, Lorenzo et SICILIANO, Bruno. Modelling and control of robot manipulators. Springer Science & Business Media, 2012.	Fundamental and technological topics are blended uniquely and developed clearly in nine chapters - with a gradually increasing level of complexity. A wide variety of relevant problems is raised throughout, and the proper tools to find engineering-oriented solutions are introduced and explained, step by step. Fundamental coverage includes kinematics, statics and dynamics of manipulators, and trajectory planning and motion control in free space.
Nguyễn Thiện Phúc. Robot công nghiệp NXB KH & KT 2003.	The purpose of this book is to present an introduction to the multidisciplinary field of automation and robotics for industrial applications

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Phạm Đăng Phước. Giáo trình Robot công nghiệp. ĐH Đà Nẵng 2001.	This book presents papers on the application of artificial intelligence to robots used in industrial plants.

Exercise/Activities Schedule

Exercise/Activities			Topic
#	Week	Hrs	The numbers of Week and Hours will be adjusted to your VET course
1	11	2	Each student group in class must give an oral presentation on a type of industrial robots that every manufacturer should know.
2	12	4	Exercises at the computer lab
3	13	4	Mini-Project: perform kinematic calculations for given examples of robots.

Computer Usage

Using EASY-ROB software to perform planning, programming and simulation of a wide range of industrial robots and kinematics.

Grading and Assessment Method

Week #	Points	Written	Oral	Paper	Continuous
15	1-10 point scale- 50% of the final grade	Final exam			
11	1-10 point scale- 10% of final grade		Oral presentation		
15	1-10 point scale- 20% of final grade			Mini-project report	
13	1-10 point scale-10% of the final grade				Laboratory exercises collected

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Reading Material	
Code*	Description
RB	Reading given reference books to find the ideas for mini-project
LN	The final exam will cover the problems presented in lecture notes.
* TB: Text Book RB: Reference Book ST: Standards / Codes LN: Lecture Notes	
Supplementary Material	
SW	EASY-ROB
*PR: Periodical SW: Software VT: Video Tape OS: Overhead Slide MD: Model AC: Audio Cassette	

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Linear Control Systems

Course Information			
College / Institute / Centre	University of Technology and Education	Department	Mechanical Engineering
Course Title	Linear Control Systems	Course Code	5040613
# Hours 30	15	3	
Lecture/Presentations	Exercises/online activities etc.	Credit	
Pre Requisites: Calculus and Linear Algebra			

Course Aim
The course is designed to help the student explore the modelling of linear dynamic systems via differential equations and transfer functions utilizing state-space and input-output representations; analysis of control systems in the time and frequency domains and using transfer function and state-space methods; study of the classical stability tests, such as the Routh-Hurwitz and Nyquist criteria, and design methods using root-locus plots and Bode plots; and the development of control techniques based on PID, lead and lag networks, using linear state or output feedback.

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Course Objectives
Upon completion of this course, students should be able to: 1. Develop mathematical models of various systems. 2. Analyze the stability aspects of linear time-invariant systems. 3. Understand the methods of the automatic control system, establish the transfer function of the elements and the system. 4. Establish the kinetic properties of some typical kinetic model. 5. Know the control standards of an automatic control system, understand the structure and function of the PID regulator. 6. Use SIMULINK simulation tool in Matlab software to simulate the control process of some control systems.

Staff Requirements			
	Qualifications	Special Skills	Number
Lectures/Presentations	Senior lecturer (PhD in Automatic Control)		1
Exercises/online activities	Lecturer (master's degree required)		1
Lecture/Presentation Schedule			
Lecture/Presentation	Description		

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#	Week	Hrs	The numbers of Week and Hours will be adjusted to your VET course
1	1	3	Mathematical models of control systems
2	2	3	Transfer functions and block diagrams
3	3	3	Time-domain responses
4	4	3	The Routh-Hurwitz stability criterion
5	5	3	Feedback control systems
6	6	3	Root-locus techniques
7	7	3	Bode plot techniques
8	8	3	The Nyquist stability criterion
9	9	3	Dynamic compensation in frequency-domain
10	10	3	State-space analysis and design

Text Books/Material	
	Description
Lecture Notes	Lecture Notes are available on the Learning Management System (LMS)
Reference Books/Material	
	Description
Gopal M., Control Systems Principles and Design, Tata McGraw Hill, 2008.	This is an introduction to control systems, their functions, and their current role in engineering design.
FRANKLIN, Gene F., POWELL, J. David, EMAMI-NAEINI, Abbas, et al. Feedback control of dynamic systems. Upper Saddle River: Prentice-Hall, 2002.	This book presents some problems concerning dynamic modelling and includes mechanical, electrical, electro-mechanical, fluid, and thermodynamic devices. It also discusses the state variable formulation of differential equations, dynamic response, he design methods based on

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	root locus, frequency response, and state variable feedback...
Nguyễn Doãn Phước, Cơ sở lý thuyết điều khiển tuyến tính, NXB Bách khoa Hà Nội, 2016	Introduction to linear control theory, the basic steps to be taken when solving a control problem. It also presents the steps to perform control problems when the mathematical model of the object is a model in a complex domain (frequency domain), performs control problems corresponding to the state model of the object (state space control).

Exercise/Activities Schedule

Exercise/Activities			Topic
#	Week	Hrs	The numbers of Week and Hours will be adjusted to your VET course
1	11	3	Lab exercises 1: Motor Identification
2	12	3	Lab exercises 2: Proportional Speed Control
3	13	3	Lab exercises 3: Proportional plus Integral Speed Control
4	14	3	Lab exercises 4: Motor Speed Control with Lead Compensation and Integral Control
5	15	3	Lab exercises 5: Pneumatic control system

Computer Usage

Using Simulink of Matlab software to solve the given problems in lab exercises.

Grading and Assessment Method

Week #	Points	Written	Oral	Paper	Continuous
17	1-10 point scale- 50% of the final grade	Final exam			
7	1-10 point scale- 20% of final grade	Midterm exam			

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17	1-10 point scale- 20% of final grade			Lab-project report	
1-10	1-10 point scale-10% of final grade				Homework-Quizzes

Reading Material	
Code*	Description
RB	Reading given reference books to complete the lab-project report
LN	The midterm and final exam will cover the problems presented in lecture notes.
* TB: Text Book RB: Reference Book ST: Standards / Codes LN: Lecture Notes	
Supplementary Material	
SW	Matlab
*PR: Periodical SW: Software VT: Video Tape OS: Overhead Slide MD: Model AC: Audio Cassette	

Process Control

Course Information			
College / Institute / Centre	University of Technology and Education	Department	Mechanical Engineering
Course Title	Process Control	Course Code	5504015

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# Hours	20	10	2
	Lecture/Presentations	Exercises/online activities etc.	Credit
Pre Requisites: Hydraulic and Pneumatic Transmission			

Course Aim
This course introduces control techniques related to automation of manufacturing processes which include the hydraulic system, hydraulic components, hydraulic system design, pneumatics system, pneumatic components, pneumatic system design, electro fluid power system and its design, as well as a programmable logic controller (PLC) and its design.

Course Objectives
Upon completion of this course, students should be able to: 1. Calculate pneumatic problems using basic gas laws, as well as explain the pneumatic systems and components. 2. Design and analyze basic and multiple pneumatic circuits as well as electro-pneumatic circuits. 3. Explain the components of Programmable Logic Controller (PLC) 4. Design, analyze and integrate a basic and repeated sequence of ladder diagram with hydraulic components. 5. Apply related software and equipment to simulate and setting up the hydraulic and pneumatic system

Staff Requirements			
	Qualifications	Special Skills	Number

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Lectures/Presentations	Senior lecturer (PhD in Mechatronics)		1
Exercises/online activities	Lab Engineer		1

Lecture/Presentation Schedule

Lecture/Presentation			Description
#	Week	Hrs	The numbers of Week and Hours will be adjusted to your VET course
1	1	2	Introduction to Pressure Force & Energy
2	2	2	Introduction to Fluid Power
3	3	2	Basic Principles of Hydraulics with Pascal's Law
4	4	2	Introduction to Hydraulic Pumps and Cylinders
5	5	2	Introduction to Hydraulic Motors
6	6	2	Hydraulic Directional Control
7	7	2	Hydraulic Pressure Control
8	8	2	Hydraulic Flow Control
9	9	2	Basic Principles of Pneumatics, Pneumatic Components Pneumatic Valve Logic
10	10	2	Electronic Control of Fluid Power: Programmable Logic Controllers

Text Books/Material

	Description
Lecture Notes	Lecture Notes available on the Learning Management System (LMS)

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Reference Books/Material	
	Description
PARR, Andrew. Hydraulics and pneumatics: a technician's and engineer's guide. Elsevier, 2011.	This book has been written by a process control engineer as a guide to the operation of hydraulic and pneumatic systems. It is intended for engineers and technicians who wish to have an insight into the components and operation of a pneumatic or hydraulic system
TOTTEN, George E. Handbook of hydraulic fluid technology. CRC Press, 2011.	This book treats hydraulic-fluids as a component of a hydraulic system and addresses all the major aspects of hydraulic -fluid technology.
BÙI Hải Triều, Giáo trình điều khiển thủy lực và khí nén, Trường Đại học Nông nghiệp Hà Nội.	This book is used as a textbook for mechanical engineering students. It covers both hydraulic and pneumatic machinery, their fundamental principles including safety standards and regulations.

Exercise/Activities Schedule

Exercise/Activities			Topic
#	Week	Hrs	The numbers of Week and Hours will be adjusted to your VET course
1	11	2	Quiz 1 on LMS: Hydraulic systems
2	12	2	Quiz 2 on LMS: Pneumatic systems
3	13	2	Lab exercises 1: Design and simulate an electro-pneumatic system on Automation studio
4	14	2	Lab exercises 2: Design and simulate a hydraulic system on Automation studio
5	15	2	Lab exercises 3: Make a PLC program for Siemen PLC using MicroWin STEP 7 software.

Computer Usage

Using Automation studio software to simulate and design the pneumatic and hydraulic systems in lab exercises.

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Using MicroWin STEP 7 software for PLC programming.					
Grading and Assessment Method					
Week #	Points	Written	Oral	Paper	Continuous
17	1-10 point scale- 50% of the final grade	Final exam			
7	1-10 point scale- 20% of final grade	Midterm exam			
17	1-10 point scale- 20% of final grade			Lab report	
13	1-10 point scale-10% of the final grade				Homework-Quizzes on LMS

Reading Material	
Code*	Description
RB	Reading given reference books to complete the quizzes on LMS
LN	The midterm and final exam will cover the problems presented in lecture notes.
* TB: Text Book RB: Reference Book ST: Standards / Codes LN: Lecture Notes	
Supplementary Material	
SW	Automation studio, MicroWin STEP 7
*PR: Periodical SW: Software VT: Video Tape OS: Overhead Slide MD: Model AC: Audio Cassette	

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Nonlinear Control Systems

Course Information			
College / Institute / Centre	University of Technology and Education	Department	Electrical and Electronic Engineering
Course Title	Nonlinear Control Systems	Course Code	
# Hours 30 Lecture/Presentations	15 Exercises/Project etc.	3 Credit	
Pre Requisites: Recommended previous knowledge: Control Systems and Linear System Theory, or similar knowledge**.**			

Course Aim
This course aims at providing graduate students with knowledge on nonlinear systems and nonlinear control strategies, both on a theoretical and a practical way through simulations on Matlab/Simulink and lab experiments. The students will go through the problem solving based on the methods for analysis and design of nonlinear systems, with an emphasis on nonlinear control systems. The course includes: - Mathematical models of nonlinear systems, and fundamental differences between the behaviour of linear and nonlinear systems. Equilibrium points, limit cycles and general invariant sets. - Phase plane analysis, Lyapunov stability, Input-to-state stability, Input-Output stability, and Passivity analysis. - Nonlinear control design, including Lyapunov-based control, Observer-based control, Sliding mode control, Passivity-based control, Input-Output linearization, and Backstepping. This course also develops other skills including teamwork, presentation, simulation…

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Course Objectives

Upon completion of this course, students should be able to:

1. Knowledge: A thorough knowledge of theory and methods for nonlinear dynamical systems.

- Know how to find the invariant sets of nonlinear dynamical systems and know-how to analyze the system behaviour around these sets.
- Know the methods Phase plane analysis, Lyapunov stability analysis, Input-to-state stability analysis, Input-Output stability analysis, Passivity analysis, Lyapunov-based control, Observer-based control, Sliding mode control, Passivity-based control, Input-Output linearization, and Backstepping control design.

2. Skills:

- Proficiency in independently assessing the advantages and disadvantages of the different nonlinear methods, and make a qualified choice of method for analysis and design of a dynamical system.
- Proficiency in independently applying the methods for analysis and design of nonlinear control systems.
- Proficiency in assessing the advantages and limitations of the resulting nonlinear control system.

3. General competence:

- Skills in applying this knowledge and proficiency in new areas and complete advanced tasks and projects.
- Skills in communicating extensive independent work and master the technical terms of nonlinear dynamical control systems.
- Ability to contribute to innovative thinking and innovation processes.

Staff Requirements

	Qualifications	Special Skills	Number
Lectures/Presentations	PhD in Automation/Mechatronics		1
Exercises/online activities	PhD in Automation/Mecɳatronics	Practical Skills	1

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Lecture/Presentation Schedule			
Lecture/Presentation			Description
#	Week	Hrs	The numbers of Week and Hours will be adjusted to your VET course
1	1	2	Introduction - Nonlinear Models and Nonlinear Phenomena. - Examples: Pendulum Equation, Tunnel-Diode Circuit, Mass-Spring System, Negative-Resistance Oscillator, Artificial Neural Network, Adaptive Control, and Common Nonlinearities.
2	2	2	Second-Order System - Qualitative Behavior of Linear Systems. - Multiple Equilibria. - Qualitative Behavior Near Equilibrium Points. - Limit Cycles. - Numerical Construction of Phase Portraits. - Existence of Periodic Orbits. - Bifurcation.
3	3	2	Fundamental Properties - Existence and Uniqueness. - Continuous Dependence on Initial Conditions and Parameters. - Differentiability of Solutions and Sensitivity Equations. - Comparison Principle.
4	4	2	Lyapunov Stability - Autonomous Systems. - The Invariance Principle. - Linear Systems and Linearization. - Linear Time-Varying Systems and Linearization. - Input-to-State Stability.
5	5	2	Input-Output Stability
6	6	2	Passivity - Memoryless Functions. - State Models.
7	7	2	Frequency Domain Analysis of Feedback Systems - Absolute Stability. - The Describing Function Method.

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8	8	2	Advanced Stability Analysis - The Center Manifold Theorem. - Region of Attraction. - Invariance-like Theorems.
9	9	2	Stability of Perturbed Systems - Vanishing Perturbations. - Nonvanishing Perturbations. - Slowly Varying Systems.
10	10	2	Perturbation Theory and Averaging - The Perturbation Method. - Perturbation on the Infinite Interval. Singular Perturbations - The standard Singular Perturbation Model. - Time-Scale Properties of the Standard Model. - Singular Perturbation on the Infinite Interval. - Slow and Fast Manifolds.
11	11	2	Feedback Control - Control Problem. - Stabilization via Linearization. - Integral Control. - Integral Control via Linearization. - Gain Scheduling.
12	12	2	Feedback Linearization - Input-Output linearization. - Full-State Linearization. - State Feedback Control.
13	13-15	6	Nonlinear Design Tools - Sliding Mode Control. - Lyapunov Redesign. - Backstepping Control. - Passivity-Based Control. - Sliding Mode Observers
14	17		Final written exam
Text Books/Material			
	Description		

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Nonlinear systems	Khalil, H. K., & Grizzle, J. W. (2002). Nonlinear systems (Vol. 3). Upper Saddle River, NJ: Prentice-Hall.
Reference Books/Material	
	Description
Advanced sliding mode control for mechanical systems	Liu, J., & Wang, X. (2012). Advanced sliding mode control for mechanical systems (pp. 31-35). Beijing: Springer.
Variable structure and Lyapunov control	Zinober, A. S. (Ed.). (1994). Variable structure and Lyapunov control (Vol. 193, pp. xxii+-401). Berlin: Springer.

Exercise/Activities Schedule

Exercise/Activities			Topic
#	Week	Hrs	The numbers of Week and Hours will be adjusted to your VET course
1	2	1	Assignment #1
2	4	1	Assignment #2
3	6	1	Assignment #3
4	8	1	Assignment #4
5	10	1	Assignment #5
6	13-15	3	Assignment #6
7	13-15	4	Project instruction (sliding mode control, sliding mode observer, backstepping control, adaptive control, and so on)

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8	16	3	Project presentation

Computer Usage
MATLAB and SIMULINK software

Grading and Assessment Method

Week	Assignment	Final Exam	Project		
			Oral presentation	Q&A	Product
2	2%				
4	2%				
6	2%				
8	2%				
10	2%				
13-15	10%				
16			10%	10%	10%
17		50%			

Reading Material	
Code*	Description
RB	Reading given reference books to find the ideas for the project
TB and LN	The final exam will cover the problems presented in the textbook and lecture notes.

* TB: Text Book RB: Reference Book ST: Standards / Codes
LN: Lecture Notes

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Supplementary Material	
SW	MATLAB and SIMULINK software
VT	Lecture Videos
*PR: Periodical SW: Software VT: Video Tape OS: Overhead Slide MD: Model AC: Audio Cassette	

Project Management

Course Information			
College / Institute / Centre	University of Technology and Education	Department	Mechanical Engineering
Course Title	Project Management	Course Code	5504039
# Hours 30 Lecture/Presentations	30 Exercises/online activities etc.	3 Credit	
Pre Requisites: Software Engineering, Programming Language			

Course Aim

This course aims to provide students with project management knowledge and skills, it is included theory and practice, as well as the roles and responsibilities of the project manager. The course offers a practical approach to managing projects, focusing on organizing, planning, and controlling the project. Major topics include project management process framework, project selection models, forming project organization, planning and budgeting techniques, scheduling and resource allocation techniques, monitoring and controlling techniques as well as project termination process. Case studies, additional readings and other learning activities will be used to provide students with a practical learning experience.

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Course Objectives
Upon completion of this course, students should be able to: 1. Understand clearly the concepts and framework of project management 2. Articulate the series of steps/processes to manage a project to achieve the desired results within the projects constrains 3. Understand the roles and responsibilities of the project manager 4. Apply knowledge gained in this course to a professional work environment

Staff Requirements

	Qualifications	Special Skills	Number
Lectures/Presentations	Senior lecturer	PM experiences	1
Exercises/online activities	Lecturer	Using tools of PM	1

Lecture/Presentation Schedule

Lecture/Presentation			Description
#	Week	Hrs	The numbers of Week and Hours will be adjusted to your VET course
1	1	3	Introductions, Syllabus Review Introduction to Project Management
2	2	3	Project Definition
3	3	3	Project Planning
4	4	3	Leadership
5	5	3	Communication
6	6	3	Operating Guidelines
7	7	3	Procurement Management
8	8	3	Quality Management
9	9	3	Monitoring and Controlling
10	10	3	Close-out

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Text Books/Material			
			Description
Lecture Notes			Lecture Notes are available on the Learning Management System (LMS)
Reference Books/Material			
			Description
Rapid Development, Steve McConnell, Microsoft Press, ISBN: 1-55615-900-5, 1996			Corporate and commercial software development teams all want solutions for one important problem--how to get their high-pressure development schedules under control. In Rapid Development, author Steve McConnell addresses that concern head-on with overall strategies, specific best practices, and valuable tips that help shrink and control development schedules and keep projects moving.
Information Technology Project Management, Kathy Schwalbe, Cengage Learning, ISBN: 3859777539919, 2013			This book demonstrates principles distinctive to managing projects involving information technology (IT). No other approach offers more insights or tools for IT project management success.
Quality Software Project Management, Robert T. Futrell, Donald F. Shafer, Linda Shafer, Prentice Hall Professional, ISBN 9780130912978, 2002			This book offers best practices identified at the Software Quality Institute and embodied in bodies of knowledge from the Project Management Institute, the American Society of Quality, IEEE, and the Software Engineering Institute, Quality Software Project Management teaches 34 critical skills that allow any manager to minimize costs, risks, and time-to-market.
Exercise/Activities Schedule			
Exercise/Activities			Topic
#	Week	Hrs	The numbers of Week and Hours will be adjusted to your VET course
1	3	10	Teamwork: project selection, project definition

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2	6	10	Teamwork: project plan
3	10	10	Teamwork: project management activities

Computer Usage					
Using Microsoft Project to develop a project plan.					
Grading and Assessment Method					
Week #	Points	Quick test	Oral	Paper	Continuous
15	20%	Every day in the class			
11	40%		Oral presentation		
15	40%			Final report on the project plan	

Reading Material	
Code*	Description
RB	Reading given reference books to find the ideas for mini-project
LN	The final exam will cover the problems presented in lecture notes.
* TB: Text Book RB: Reference Book ST: Standards / Codes LN: Lecture Notes	
Supplementary Material	
SW	Microsoft Project
*PR: Periodical SW: Software VT: Video Tape OS: Overhead Slide MD: Model AC: Audio Cassette	

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Champasack University (CU)

Industrial Automation Control as well as Control Electric Drive

Course Information			
College / Institute / Centre	University	Department	Electrical Engineering
Course Title	Industrial Automation Control as well as Control Electric Drive	Course Code	
# Hours -------30----- Lecture/Presentations	-------30-------- Exercises/online activities etc.	------14----- Credit	
- Pre Requisites : - Qualifications of participants must have a high school diploma and basic computer skills. - Basic knowledge in the field of electrical and electronic			

Course Aim

- To develop the skills of local workers
- Provide additional knowledge for students to apply in their major

Course Objectives

Upon completion of this course, students should be able to:

1. allow participants to be informed of the use PLC
2. understand the application of such PLC into related work

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Staff Requirements			
	Qualifications	Special Skills	Number
Lectures/Presentations	Master on Electronic engineering or Electrical Engineering	Computer program language	2
Exercises/online activities	Diploma or above on Electronic engineering or Electrical Engineering	Computer program language	4

Lecture/Presentation Schedule			
Lecture/Presentation			Description
#	Week	Hrs	The numbers of Week and Hours will be adjusted to your VET course
1	1	2	Introduction to PLC and PLC Wiring
2	1	2	How PLC Ladder Logic Programming Works
3			Introduction to PLC Trainer Device and PLC Software
4	1	2	Fundamental Commands of PLC
5	2	2	Introduction to Relays and Industrial Control
	2	2	Number Systems
	2	4	Relay Coils to Bits in Memory
	2	4	Evolution of the Control System
	3	4	Computer Control
	3	4	I/O Scan, Saga of Pencil and the Paychecks
	3	4	PLC Hardware
	3	4	The Original Rack of Memory PLC2 PLC5
	4	4	Memory Mapping RSLogix500 SLC500 Micrologix

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	4	4	I/O Structures RSLogix500 SLC500 Micrologix
	4	4	IO and the Memory, RSLogix500 SLC500 Micrologix
	4	4	Data Files vs Program Files – Sinking Sourcing

Text Books/Material

	Description
	Lecture PowerPoint presentation in the Lao Language on Programmable Logic Controller (PLC) and Ladder (LAD) Logic Diagram Text Books: Learn and use PLC in the Lao Language

Reference Books/Material

	Description
	[1]. Lutz Lampe; Andrea M. Tonello; Theo G. Swart, "PLC for Home and Industry Automation," in Power Line Communications: Principles, Standards and Applications from Multimedia to Smart Grid, Wiley, 2014, pp.449-472, DOI: 10.1002/9781118676684.ch7. [2]. Lutz Lampe; Andrea M. Tonello; Theo G. Swart, "PLC for Smart Grid," in Power Line Communications: Principles, Standards and Applications from Multimedia to Smart *Grid*, Wiley, 2014, pp.509-561, DOI: 10.1002/9781118676684.ch9

Exercise/Activities Schedule

Exercise/Activities			Topic
#	Week	Hrs	The numbers of Week and Hours will be adjusted to your VET course
1	2	3	How To Program a PLC – Basic Level 1
2	2	3	How To Program a PLC – Basic Level 2

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3	3	2	How To Program a PLC – Basic Level 3
4	3	2	How To Program a PLC – Basic Level 4
5	4	2	How To Program a PLC – Basic Level 5
6	4	2	How To Program a PLC – Basic Level 6

Computer Usage
IT Center of Champasak University is provided with the computers for usage

Grading and Assessment Method

Week #	Points	Written	Oral test	Paper	Continuous
1		x	x		
2		x	x		
3		x	x		

Reading Material	
Code*	Description
……	Lecture note in the Lao Language
TB	Learn and use PLC
……	……
* TB: Text Book	RB: Reference Book ST: Standards / Codes LN: Lecture Notes

Supplementary Material	
	Video Tape
	Model
SW	PLC Mitsubishi

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VT	https://electrical-engineering-portal.com/resources/plc-programming-training
*PR: Periodical SW: Software VT: Video Tape OS: Overhead Slide MD: Model AC: Audio Cassette	

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Model Creation, Load Flow and Short-Circuit Calculations In DIgSILENT

Course Information			
College / Institute / Centre	University	Department	Electrical Engineering
Course Title	Model Creation, Load Flow and Short-Circuit Calculations In DIgSILENT	Course Code	
# Hours -------28----- -------29-------- ------1----- Lecture/Presentations Exercises/online activities etc. Credit			
- Pre Requisites : - Electrical Engineer, Electrical Student. - Basic knowledge in the field of electrical and electronic			

Course Aim
• To develop the skills of local workers • Provide additional knowledge for students to apply in their major

Course Objectives
3. This course offers an introduction to the basic features of the DIgSILENT PowerFactorysoftware, including building a small network and carrying out load flow and short circuit calculations

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Staff Requirements			
	Qualifications	Special Skills	Number
Lectures/Presentations	Master of Electrical Engineering	Computer program language	2
Exercises/online activities	Diploma or above on Electrical Engineering	Computer program language	4

Lecture/Presentation Schedule			
Lecture/Presentation			Description
#	Week	Hrs	The numbers of Week and Hours will be adjusted to your VET course
1	1	4	Introduction to PowerFactory: Fundamental concepts, functionality, handling and terminology
2		3	Creation of a network model: The process of building a network model from scratch, including an introduction to the concept of Type objects, used for data obtained from manufacturers' datasheets
3			Load Flow calculation: Basic concepts of load flow analysis in PowerFactory. Execution of load flow calculations and reports
4		3	Voltage control in load flow calculations
5		6	Further network modelling, including the use of templates.
		6	Short Circuit calculation: Understanding the implementation of short-circuit calculations in PowerFactory
		6	Connecting grids: Simple methods for connecting grids within a project.

Text Books/Material	
	Description

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	Lecture PowerPoint presentation in Lao Language on Arduino Uno Programming and MATLAB & Simulink Lecture PowerPoint presentation in Lao Language C Language and Arduino

Reference Books/Material

	Description
	• [1]. Francisco M. Gonzalez-Longatt José Luis Rueda, "Power factory application power system analysis", Springer International Publishing Switzerland 2014, DOI: 978-3-319-12957-0

Exercise/Activities Schedule

Exercise/Activities			Topic
#	Week	Hrs	The numbers of Week and Hours will be adjusted to your VET course
1	2	4	Creation of a network model: The process of building a network model from scratch, including an introduction to the concept of Type objects, used for data obtained from manufacturers' datasheets
2		4	Load Flow calculation: Basic concepts of load flow analysis in PowerFactory. Execution of load flow calculations and reports
3		4	Voltage control in load flow calculations
4		8	Further network modelling, including the use of templates.
5		6	Short Circuit calculation: Understanding the implementation of short-circuit calculations in PowerFactory
6		3	Connecting grids: Simple methods for connecting grids within a project.

Computer Usage

IT Center of Champasak University is provided with the computers for usage

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Grading and Assessment Method					
Week #	Points	Written	Oral test	Paper	Continuous
1		x	x		
2		x	x		
3		x	x		

Reading Material	
Code*	Description
……	Lecture note in the Lao Language
* TB: Text Book RB: Reference Book ST: Standards / Codes LN: Lecture Notes	
Supplementary Material	
	Video Tape
	Model
*PR: Periodical SW: Software VT: Video Tape OS: Overhead Slide MD: Model AC: Audio Cassette	

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Usage Arduino for automation control

Course Information			
College / Institute / Centre	University	Department	Electrical Engineering
Course Title	Usage Arduino for automation control	Course Code	
# Hours -------20----- Lecture/Presentations	-------30-------- Exercises/online activities etc.	------1------ Credit	
- Pre Requisites : - Qualifications of participants must have a high school diploma and basic computer skills. - Basic knowledge in the field of electrical and electronic			

Course Aim
• To develop the skills of local workers • Provide additional knowledge for students to apply in their major

Course Objectives
Upon completion of this course, students should be able to: 4. allow participants to be informed of the use Arduino 5. understand the application of such Arduino into related work

Staff Requirements			
	Qualifications	Special Skills	Number

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Lectures/Presentations	Master on Electronic engineering or Electrical Engineering, and Computer Science	Computer program language	2
Exercises/online activities	PhD or Master on Electronic engineering or Electrical Engineering, and Computer Science	Computer program language	4

Lecture/Presentation Schedule

Lecture/Presentation			Description
#	Week	Hrs	The numbers of Week and Hours will be adjusted to your VET course
1	1	2	Information to NodeMCU V2 and Arduino UNO
2	2	2	How to setup board NodeMCU V2 and Arduino UNO
3	3	8	Study on C Language to control board NodeMCU V2 and Arduino UNO
4	4	4	Declare and applies the function Type name (Parameter1, Parameter2, …) {statements}
5	5	4	Study on the function to be defined controller board NodeMCU V2 and Arduino UNO - Void setup, void loop - Leaning to Library and setup Library

Text Books/Material

	Description
	Lecture PowerPoint presentation in the Lao Language on Arduino Uno Programming and MATLAB & Simulink Lecture PowerPoint presentation in Lao Language C Language and Arduino …… ……

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Reference Books/Material	
	Description
	[1]. Steven Barrett, "Arduino Microcontroller: Processing for Everyone! Second Edition," in *Arduino Microcontroller: Processing for Everyone! Second Edition*, Morgan & Claypool, 2012. [2]. Rochit Rajsuman, "System-on-a-Chip: Design and Test," in *System-on-a-Chip: Design and Test*, Artech, 2000. [3]. Yuan Jiang, "A Practical Guide to Error-Control Coding Using MATLAB," in *A Practical Guide to Error-Control Coding Using MATLAB*, Artech, 2010.

Exercise/Activities Schedule

Exercise/Activities			Topic
#	Week	Hrs	The numbers of Week and Hours will be adjusted to your VET course
1	2	3	NodeMCU workshop: Blink
2		3	NodeMCU workshop: control input/output via digital signal and analogue
3		2	NodeMCU workshop: How to use Ultrasonic Sensor
4		2	NodeMCU workshop: How to use Infrared Sensor
5		2	NodeMCU workshop: How to use Temperature Sensor
6		2	NodeMCU workshop: How to use Relay
7	3	4	Arduino workshop: Module WiFi connecting via AT command
8		4	Arduino workshop: Module Bluetooth connecting via AT command
9		4	Arduino workshop: Applies LCD
10		4	Arduino workshop: Data logger by SD card module

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Computer Usage					
IT Center of Champasak University is provided with the computers for usage					
Grading and Assessment Method					
Week #	Points	Written	Oral test	Paper	Continuous
1		x	x		
2		x	x		
3		x	x		

Reading Material	
Code*	Description
……	Lecture note in the Lao Language
…….	……
…….	……
* TB: Text Book RB: Reference Book ST: Standards / Codes LN: Lecture Notes	
Supplementary Material	
	Video Tape
	Model
*PR: Periodical SW: Software VT: Video Tape OS: Overhead Slide MD: Model AC: Audio Cassette	

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Savannakhet University (SKU)

Introduction to Computer

Course Information			
College / Institute / Centre	Faculty of Information Technology	Department	Information Technology
Course Title	Introduction to Computer	Course Code	40401CP11201
# Hours ----2---- Lecture/Presentations	----------2-------- Exercises/online activities etc.	--------3-------- Credit	
Pre-Requisites: Basic knowledge about hardware and software			

Course Aim
The course aims to create a basic understanding of how to use MS office

Course Objectives
Upon completion of this course, students should be able to: 1. Use basic MS WORD for preparing formal and informal documents 2. Use basic MS EXCEL to deal with basic statistics and daily work 3. Use MS PowerPoint for preparing presentations with at least its basic tools

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Staff Requirements			
	Qualifications	Special Skills	Number
Lectures/Presentations	Master/Bachelor degree	Know-how some advance tools of MS Office	1
Exercises/online activities	Master/Bachelor degree	Know-how some advance tools of MS Office	1

Lecture/Presentation Schedule			
Lecture/Presentation			Description
#	Week	Hrs	The numbers of Week and Hours will be adjusted to your VET course
1	1	2	Introduction to hardware and software, Introduction to MS WORD
2	2	2	MS Word components, menu bar, toolbar, page set up, create a new document
3	3	2	Commands in MS Word (1)
4	4	2	Commands in MS Word (2), and how to print out
5	5	2	Exercise 1
6	6	2	Introduction to MS Excel
7	7	2	Insert, Merge, copy, remove, add column and row, insert units
8	8	2	Adding tables, calculating in Excel
9	9	2	Using Functions in Excel and Graphs, and how to print
10	10	2	Exercise 2
11	11	2	Introduction to PowerPoint
12	12	2	PPT interface
13	13	2	Typing and preparing presentation via PPT

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14	14	2	Basic commands in PPT
15	15	2	Exercise 3
16	16	2	Introduction to Internet ()

Text Books/Material	
	Description
	Introduction to Computer textbook compiled by the SKU lecturer

Reference Books/Material	
	Description
	1. Office 2010 All-in-One For Dummies 2. Step by Step Microsoft Office 2013

Computer Usage
PCs, Laptop, Computer Lab room

Grading and Assessment Method

Week #	Points	Written	Oral	Paper	Continuous
7	30%	Yes		Yes	
17	40%	Yes		Yes	

Reading Material	
Code*	Description

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LN	Introduction to computer
TB	Introduction to computer
RB	Microsoft Office 2013 Introductory
RB	Microsoft Office 2013 Professional Step by Step
* TB: Text Book RB: Reference Book ST: Standards / Codes LN: Lecture Notes	
Supplementary Material	
OS	Projector
SW	MS Office
*PR: Periodical SW: Software VT: Video Tape OS: Overhead Slide MD: Model AC: Audio Cassette	

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Conclusions

Taking everything into consideration, a clear picture of the existing VET courses and engagement in internships in Asian University partners has been depicted. More specifically, six Higher Education Institutions shared all needed information to comprehend the needs, gaps, opportunities and challenges of the VET courses in the field of Electronics, Automation and Robotics, as well as similar lifelong-learning/ VET training programmes in Asian universities.

To demonstrate in a comprehensible way, the information that has been collected there will be a division into the categories of:

- provided activities for students and academic staff in the field;
- VET courses;
- internships and plans.

Before the analysis of the above categories, it should be mentioned that no university has a department or a centre of excellence in the field of Electronics, Automation and Robotics. While UD, BRB and CU have a centre or department in this field.

Starting with the first category, the ways that Universities use to support students' interest in the field of DCA project and **increase the knowledge and skills of academic staff in this field** are:

different developed programmes with IT-based material in this field for academic staff

- thematic research projects for students;
- robot competition, student research activity and smart innovation ideas
- encouragement and invest researches focusing on smart technology, robot applications, AI robot and organize the scientific workshop or seminar related to this field;
- Invitations to a local partner to guide the course, training of trainer at a partner institution
- Robotics, 3D Printing
- Electronics and Automation
- support to staff and students to joint Robot contest
- Training with other universities, both inside and outside the country
- Support to students to attend and join the events associated with the field of electronic, automation and robotics such as organized by the National University of Laos (NOUL), or at neighbouring countries like Vietnam and Thailand.

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- organizing the courses aiming to introduce about Artificial intelligence (AI), IT application in Logistics, and Programmable Logic Controller (PLC) by putting them as an introductory course in the curriculum of the Faculty of Information Technology and Faculty of Engineering.
- Lecturers' attempts to learn and seek different sources of references to provide the mentioned courses.

The institutions that offer a general introduction course on the field are HUS and UD, which integrate Electronics, Automation and Robotics, as well as similar lifelong-learning/ VET training programmes aspects in subject courses; SRU makes other efforts to increase the knowledge about the field of Electronics, Automation and Robotics, as well as similar lifelong-learning/ VET training programmes among academic staff, for example, they invite local partners to guide the course, training of trainer at a partner institution, UBB does not offer such a course; CU offers such a course for all undergraduate students, and SKU offers it for some undergraduate students.

Regarding offering VET courses which either contain or support the field, HUS, SRU and UBB do not comply; UD and CU do offer such courses; while SKU does not offer those but there are some courses for undergraduate students only. Regarding the use of e-tools, the institutions of HUS, SRU, UBB and SKU do not use e-tools to carry out such a course; while UD uses 3-5 e-tools; and CU uses 1-2.

In terms of involvement in any initiatives and co-operation project, HUS does not comply to either of these parameters, UD is involved in initiatives (SMC Vietnam Corporation: Manufacture, processing, and sales of automatic control equipment) but not in co-operation projects); UBB is involved in both initiatives (Institute of Technology Cambodia (ITC) and Partnership with ITC for developing Bsc. in Electronics) and co-operation projects (Automation); CU is involved in initiatives but not in co-operation projects; SKU involves students in initiatives (students will do an internship at companies, government agencies and organization regarding with their fields of studies and interests) but not in co-operation projects, while SRU is not involved in either category.

Regarding other institution or entities in the country or region of the partner institutions, HUS has mentioned the HUE Industrial College; UD the Danang Vocational Training College- Danang, Vietnam and the Cao Thang Technical College, Ho Chi Minh City, Vietnam; SRU reported the Institute of Technology of Cambodia (ITC), National Polytechnic Institute of Cambodia (NPIC), National Institute of a post, telecommunication and ICT (NIPTICT); UBB included the Institute of Technology of Cambodia (ITC), National Polytechnic Institute of Cambodia (NPIC), National Institute of Post, Telecommunication and ICT (NIPTICT), and Institute of Technology of Battambang.; while SKU mentioned the Centre of Electricity Training, Electricites du Laos, Vientiane capital and the political and Vocational Training College, Savannakhet Province.

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Internships is a significant feature for the identification of needs in professional sector. All institutions provide different forms of internship which is an encouraging fact that they already know how to implement internships in the field.

Below there is a list of the available companies that have cooperated with the partner institutions in the past, or there are possibilities to cooperate that may offer internships to future students in the framework of DCA project.

HUS	1. Huetronics 2. HueCIT 3. SAVARTI 4. CME 5. FPT Software
UD	1. FPT 2. SMC 3. Rubber Joint Stock Company Da Nang 4. Daikin 5. Chau Da Co., Ltd.
SRU	1. KOLAO Group 2. Top Sports Textile Ltd., 3. GIGA SEZ 4. Towa 5. Beautiful windows
UBB	1. KOLAO Group 2. Top Sports Textile Ltd., 3. GIGA SEZ 4. Towa 5. Beautiful windows
CU	1. Xeset 1,2,3 Hydro power plant 2. Lao Brewery Plant Champasack Province 3. Electric Due Laos 4. Lao Mit Sugar Company 5. CBF Pharma CO LTD (PAKSE BRANCH)
SKU	1. Nikon Lao Cooperation 2. KoLao Developing Co LTD – Savannakhet Branch 3. Lomakham Drinking Water Factory

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	4. Electricites du Laos – Savannakhet Branch 5. Savan logistics company

Finally, the last category has to do with future plans that each University has. The perspectives for near future, as they were expressed by some Universities, are:

UD has expressed that the vision of the institution is going to become a top applied science university in the area of central and Western Highlands in Vietnam. Therefore, the development of VET courses in the field of Electronics, Automation and Robotics becomes an essential orientation to meet requirements of the Fourth Industrial Revolution in technology and development economic – society; SRU has included that it plans to approach the development of VET courses in the field of Electronics, Automation and Robotics, in three ways; Collaborate with the local and DCA partner to develop curriculum, need assessment to identify the job market and a Consultative Workshop on the curriculum development

UBB has included that it plans to approach the development of VET courses in the field of Electronics, Automation and Robotics, in three ways; Collaborate with the local and DCA partner to develop curriculum, need assessment to identify the job market, and a Consultative Workshop on the curriculum development; while SKU replied that the Faculty of Information Technology and Faculty of Engineering will be key entities providing the foundation for Electronics, Automation and Robotics for our institution. The VET courses will be delivered as fundamental knowledge for undergraduate students. It is unfortunate that in the next three years, post-graduate programs under the aforementioned faculties might not be ready to be delivered due to lack of qualified professors and lecturers in these fields.

Consequently, a general review of the existing situation of Asian HEIs is that VET courses need to be a part of students' education as now they have a secondary or even non-existent presence in their curriculum. Also, a positive feature is that there is a connection with companies or the local community to support internships and help students be integrated into the labour market and have a practical experience as well.

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