



fie.hcmute.edu.vn

TRƯỜNG ĐẠI HỌC  
**SƯ PHẠM KỸ THUẬT TP. HỒ CHÍ MINH**  
**KHOA ĐÀO TẠO QUỐC TẾ**

## **22151FIE\_UNDERGRADUATE CURRICULUM MANUAL**

### **AUTOMATION AND CONTROL ENGINEERING TECHNOLOGY**

**2022**

## 22151FIE\_AUTOMATION AND CONTROL ENGINEERING TECHNOLOGY

### I. CURRICULUM

#### 1<sup>st</sup> Semester

No.	Course ID	Course Title	Credits	Prerequisite
1	LLCT130105E	Philosophy of Marxism and Leninism	3	
2	IEAC130046E	Introduction to Automation and Control Engineering Technology	2+1	
3	MATH132401E	Calculus 1	3	
4	PHYS130902E	Principles of Physics 1	3	
5	GCHE130603E	General Chemistry	3	
6	PHED110513E	Physical Education 1	0(1)	
7	ACEN340535E	Academic English 1	4	
8	ACEN340635E	Academic English 2	4	
<b>Total</b>			<b>23</b>	

**2<sup>nd</sup> Semester**

<b>No.</b>	<b>Course id</b>	<b>Course Title</b>	<b>Credits</b>	<b>Prerequisite</b>
2	LLCT120205E	Political economics of Marxism and Leninism	2	
3	MATH132501E	Calculus 2	3	
4	ELCI140144E	Electrical Circuits	4	
5	PHYS111202E	Physics - Laboratory 1	1	
6	PHYS130502E	Physics 2	3	
7	PHED110613E	Physical Education 2	0(1)	
8	ACEN340735E	Academic English 3	4	
9	ACEN340835E	Academic English 4	4	
Elective Social Science				
	INMA220305E	Introduction to Management	2	
<b>Total</b>			<b>23</b>	

**3<sup>rd</sup> Semester (June 3, 2022)**

<b>No.</b>	<b>Course id</b>	<b>Course Title</b>	<b>Credits</b>	<b>Prerequisite</b>
1	MATH132601E	Calculus 3	3	
2	AMEE341944E	Applied Mathematical in Electrical Engineering	4	
3	BAEL340662E	Basic Electronics	4	
4	PHYS111302E	Physics - Laboratory 2	1	
5	ELPR210644E	Electricity in Practice	1	
6	CPRL130064E	C programming language	3	
9	PHED130715E	Physical Education 3	0(3)	
10	PHED110613E	Physical Education 2	0(1)	
11	LLCT120405E	Scientific socialism	2	
1	LLCT120314E	Ho Chi Minh's ideology	2	
8	GELA220405E	General Laws	2	
<b>Total</b>			<b>22</b>	

#### 4th Semester

No.	Course id	Course Title	Credits	Prerequisite
2	MATH132901E	Mathematical Statistics for Engineers	3	
3	DIGI330163E	Digital Systems	3	
4	POEL330262E	Power Electronics	3	
5	ACSY330346E	Automatic Control Systems	3	
6	ELMA230344E	Electrical Machines	3	
7	ELPR320762E	Electronics in Practice	2	
Elective Fundamental course			2	
8	EMSE232244E	Instrumentation and Sensors, Elective Fundamental course 1	3	
9	ELPS330345E	Electrical Power Supply, Elective Fundamental course 2	3	
10	IEPR550935E	IELTS Preparation	5	Non-accumulation
11				
<b>Total</b>			<b>23</b>	

#### 5th Semester

No.	Course id	Course Title	Credits	Prerequisite
1	MICR330363E	Microprocessor	3	
2	PLCS330846E	Programmable Logic Controller	3	
3	PRDI310263E	Digital Systems in Practice	1	
4	PREM211244E	Electric Machine in Practice	1	
5	POEP320262E	Power Electronics in Practice	2	
6	PACS 320246E	Automatic Control System in Practice	2	
7	ARPR310746E	Project on Automatic Control	1	
9	LLCT220514E	History of Vietnamese communist party	2	
10		Elective Advanced course 1	3	
<b>Total</b>			<b>18</b>	

## 6th Semester

No.	Course id	Course Title	Credits	Prerequisite
1	ROBO 330246E	Robotics	3	
2	IASC323346E	Identification and System Control	2	
3	INCO 321546E	Intelligent Control	2	
4	PPLC311146E	Project on Programmable Logic Controller	1	
5	PRMI 320463E	Microprocessor in Practice	2	
6	EEPN 333746E	Electrical Equipment and Pneumatic	3	
7	PPLC321346E	Programmable Logic Controller in Practice	2	
8		Elective Advanced course 2	3	
<b>Total</b>			<b>18</b>	

## 7th Semester

No.	Course id	Course Title	Credits	Prerequisite
1	SCDA430946E	SCADA Systems	3	
2	RBPR310846E	Project on Robotics	1	
3	ROPR311246E	Robotics in Practice	1	
4	PMEM310846E	Electrical Equipment and Pneumatic in Practice	1	
5	ININ442346E	Industry Internship	4	
6	ERAC423446E	Enterprise Relations in Automation Control Field	2	
7	ENTW611038E	English for Thesis Writing	1	
8		Elective Advanced course 3	3	
<b>Total</b>			<b>16</b>	

## 8th Semester

No.	Course id	Course Title	Credits	Prerequisite
1	FIPR472546E	Graduation Thesis	7	
<b>Total</b>			<b>7</b>	

## ELECTIVE COURSES

### Elective Social Science Courses (2 credits)

No.	Course ID	Course Title	Credits	Note
1	GEEC220105E	General Economics	2	Select 1 courses
2		Creativity Methodologies	2	
3	PLSK320605E	Planning Skill	2	
4	INMA220305E	Introduction to Management	2	
5	INSO321005E	Introduction to Sociology	2	
6	IQMA220205E	Introduction to Quality Management	2	
7	INLO220405E	Introduction to Logics	2	
8	PRSK320705E	Presentation Skills	2	
9	SYTH220505E	Systems Thinking	2	
10	ULTE121105E	University Learning Methods	2	
11	IVNC320905E	Vietnamese Culture	2	
12	TDTS320805E	Writing Scientific and Technical Documents	2	

### Elective Fundamental Courses (6 credits)

No.	Course ID	Course Title	Credits	Note
1	ELFI230344E	Electromagnetic Field	3	Select 2 courses
2	EEMA330544E	Electronic and Electrical Materials	3	
3	ELPS330345E	Electrical Power Supply	3	
4	SISY330164E	Signals and Systems	3	
5	EMSE232244E	Instrumentation and Sensors	3	

### Elective Advanced course (9 credits)

No.	Course ID	Course Title	Credits	Note
1	ELDR330545E	Automatic Electric Drive	3	

2	CADA430546E	CAD for Automation and Control Engineering	3	Select 3 courses
3	IMPR 432446E	Image Processing in Industrial	3	
4	EMSY437764E	Embedded Systems	3	
5	MASC330146E	Modelling and Simulation using Computer	3	
6	PRCO431846E	Process Control	3	
7	FMCI431746E	FMS and CIM	3	
8	ELPS330345E	Power Supply System	3	
9	RENE321745E	Renewable Energy	3	

## II. COURSE DESCRIPTION

### Introduction to Automation and Control Engineering Technology

**Credits: 3**

*Prerequisites:* None

*Course Description:* This course provides students with knowledge about automation and control engineering technology, including roles, positions, and missions of an engineer in this field. It also provides a training field for students and offers an introduction to the technology applied in the field of automation and control.

*Textbook:*

1) Horowitz, P., and W. Hill. *Art of Electronics*. 3<sup>rd</sup> ed., Cambridge University Press, 2015.

*Reference books:*

1) Harris, David Money, and Sarah L. Harris. *Digital Design and Computer Architecture*. Morgan Kaufmann Publishers, 2007.

2) Moura, Luis, and Izzat Darwazeh. *Introduction to Linear Circuit Analysis and Modelling: From DC to RF*. Newnes, 2005.

3) Patterson, David A., and John L. Hennessy. *Computer Organization and Design: The Hardware/Software Interface*. 4<sup>th</sup> ed., Morgan Kaufmann, 2008.

4) Storey, Neil. *Electronics: A Systems Approach*. 4<sup>th</sup> ed., Prentice Hall, 2009.

### C Programming Language

**Credits: 3**

*Prerequisites:* None

*Course Description:* This course provides an introduction to computing and program development in the C programming language with a brief introduction to basic computer concepts while studying the syntax and semantics of the basic control structures of C, learning C's fundamental data types, structures, and pointer, understanding the design and methodical construction of computer programs, learning how to test and debug programs, etc.

*Textbook:*

1) Deitel, Paul, and Harvey Deitel. *C: How to Program*. 7<sup>th</sup> ed., Pearson, 2012.

### Mathematical Statistics for Engineers

**Credit: 4**

*Prerequisites:* Calculus 1

*Course Description:* This course provides the learner with an understanding of the descriptive statistics, fundamental probability, random variables and probability distribution laws, characteristics of random variables, parameter estimation, hypothesis testing, regression, and analysis of variance.

*Textbook:*

1) Devore, Jay L. *Probability and Statistics for Engineering and Science*. 8<sup>th</sup> ed., Cengage Learning, 2011.

### **Electrical Circuits**

**Credit: 4**

*Prerequisites:* Calculus 1 & Principles of Physics 1

*Course Description:* This course provides the learner with an understanding of the following concepts: the basics of circuit analysis, established circuit under impact sine, circuit analysis methods, circuit theorems, two-port network, circuit analysis in time-domain, circuit analysis in the frequency domain, the frequency characteristics of the transfer function.

*Textbook:*

1) Svoboda, James A., and Richard C. Dorf. *Introduction to Electrical Circuits*. 8<sup>th</sup> ed., 2010.

### **Electronic and Electrical Materials**

**Credit: 2**

*Prerequisites:* Chemistry, Principles of Physics 1, and Mathematics Foundation Executive

*Course Description:* This course provides the learner with the following contents: technology type, manufacturing electrical materials, electronic materials featuring electrical com in the electricity sector, electronics, the electrical, mechanical, chemical nature of materials: conductive, insulating, superconductors, semiconductors and power flow control properties.

*Textbook:*

1) Jones, Ian P. *Materials Science for Electrical and Electronic Engineers*. Oxford University Press, 2001.

*Reference books:*

1) Callister, W. D. *Materials, Science and Engineering*. Wiley, 2000.

2) Morgan, D. V., and K. Board. *An Introduction to Semiconductor Microtechnology*. Wiley, 2002.

3) Ohring, M. *Engineering Materials Science*. Academic Press, 2001.

4) Shackelford, J. L. *Introduction to Materials Science and Engineering*. Prentice Hall, 2003.

5) Smith, W. F., and J. Hashemi. *Foundations of Materials Science and Engineering*. 3<sup>rd</sup> ed., McGraw-Hill, 2003.

### **Basic Electronics**

**Credit: 4**

*Prerequisites:* Calculus 3 & Principles of Physics 1

*Course Description:* This course provides the learner with knowledge of electronic components and the structure and principles of operation of the electronic components. It enables the students to analyse and explain the principles of operation of simple electronic circuits, analyse the

frequency response of the amplifier circuit, analyse and design the audio power amplifier circuits, distinguish the type of feedback, analyse and design application circuits using operational amplifier, analyse the principle of operation of the oscillator circuits, analyse and design the simple DC sources, and provide electronic circuits.

*Textbooks:*

- 1) Floyd, Thomas L. *Electronic Devices*. Prentice Hall, 2012.
- 2) Malvino, Albert. *Electronic Principle*. Mc Graw Hill, 2015.

### **Electricity in Practice**

**Credit: 1**

*Prerequisites:* Electrical Safety, Electrical Circuits

*Course Description:* In this course, learners will be introduced to contents related to basic electrical installation technology, such as calculation method for constructing and installing, quality inspection, electrical machine installation technology, and operating common electrical machines.

*Textbook:*

- 1) Jackson, Herbert W., Dale Temple, and Brian E. Kelly. *Introduction to Electric Circuits Lab Manual*, 9<sup>th</sup> ed., 2013.

### **Digital Systems**

**Credit: 3**

*Prerequisites:* Basic Electronics

*Course Description:* This course provides the learner with knowledge about digital systems, basic logic gate, fundamental theorem of Boolean algebra, combinational circuits, sequential circuits, basics of digital integrated circuits TTL and CMOS, characteristic parameters of digital integrated circuits, how to classify integrated circuits, the principle of changing between analog and digital signals, operational structure and application of the memory, and the principles of the digital oscillator circuit.

*Textbook:*

- 1) Maini, Anil K. *Digital Electronics*. John Wiley & Sons, 2007.
- 2) Tocci, Ronald J., and Neal S. Widmer. *Digital Systems: Principles and Applications*. 12<sup>th</sup> ed., Prentice Hall, 2015.

### **Automatic Control Systems**

**Credit: 3**

*Prerequisites:* Electrical Circuits, Electrical Measurement and Instruments, Complex Functions and Laplace Transforms, Basic Electronics

*Course Description:* This course provides the learner with knowledge of the components of an automatic control system and the method of building mathematical models of the automatic control system including: transfer function, signal graph and equation of state, the problem of control and observation, the stable survey methods of automatic control systems, survey methods of quality of control system (accuracy, time domain, frequency domain), and the design methods of automatic control system.

*Textbooks:*

- 1) Golnaraghi, Farid, and Benjamin C. Kuo. *Automatic Control Systems*. 9<sup>th</sup> ed., John Wiley & Sons, Inc., 2009.
- 2) Nise, Norman S. *Control Systems Engineering*. 6<sup>th</sup> ed., John Wiley & Sons, Inc., 2010.

### **Electrical Machines**

**Credit: 4**

*Prerequisites:* Electrical Circuits

*Course Description:* This course provides the learner with knowledge about basic structure, working principle, meaning of the electromagnetic relations of a DC machine, transformers, asynchronous machines, synchronous machines, special machines and electrical instruments. It also provides an understanding of the methods for calculating variables, technical parameters of electrical machines and electrical instruments, work characteristics (rule) of electrical machines and electrical instruments, the method of implementation, and control modes of electrical machines and electrical instruments.

*Textbook:*

- 1) Sen, P. C. *Principles of Electrical Machinery and Power Electronics*. 2<sup>nd</sup> ed., John Wiley & Sons, Inc. 1997.

*Reference books:*

- 1) Fitzgerald, A. E., C. Jr. Kingsley, and C. D. Umans. *Electrical Machinery*. 6<sup>th</sup> ed., McGraw-Hill, 2003.
- 2) Kelemen, J. A. *ECE 3300 Laboratory Manual*. 2<sup>nd</sup> ed. WMU IEEE Student Branch, 2003.
- 3) Say, M. G. *Alternating Current Machines*. 5<sup>th</sup> ed., Halstead Press, John Wiley & Sons, Inc., 1983.

### **Instrumentation and Sensors**

**Credit: 3**

*Prerequisites:* Electrical Circuits

*Course Description:* This course provides the learner with knowledge about concept of measurement, electrical measurement and sensors, measurement of electrical quantities structure, the method of measuring the electrical quantities such as current, voltage, resistance, capacitance, inductance, frequency, phase angle, power, how to analyze and estimate measurement errors and understand the principles and operation of the electrical measurement system, the measuring instruments, as well as the principle of sensors and its applications in the industry.

*Textbooks:*

- 1) Loughlin, C. *Sensors for Industrial Inspection*, Springer, 1993.
- 2) Purkait, P., et al. *Electrical and Electronics Measurements and Instrumentation*. McGraw Hill, 2013.

### **Power Supply System**

**Credit: 3**

*Prerequisites:* Electrical Circuits, Electric-Electronic Instruments; Electronic Measurement and Instrumentation; Electrical Safety

*Course Description:* This course equips learners with knowledge about the method for determining

the load calculation and the ability to calculate voltage loss, power loss, and short circuit calculations, as well as select the number and transformer capacity. The students are also introduced to the concepts of diagrams distribution substations and redundant power, function and operating principle of the switchgear, medium and low voltage protection, the method selected conductors, cables, switchgear protect-sectioning measurement, distribution cabinet low and medium voltage, offset low voltage network power plant, and industrial lighting calculations.

*Textbook:*

1) Sivanagaraju, S. *Electric Power Transmission and Distribution*. Pearson, 2008.

*Reference books:*

1) Gonen, T. *Electric Power Distribution Engineering*. 3<sup>rd</sup> ed., 2008.

2) McDonald, John D. *Electric Power Substations Engineering*. CRC Press, 2012.

3) Miller, Robert, and James Malinowski. *Power System Operation*. 3<sup>rd</sup> ed., McGraw Hill, 1994.

4) Pansini, Anthony J. *Electrical Distribution Engineering*. 3<sup>rd</sup> ed., Fairmont Press, 2006

5) Short, T. A. *Electric Power Distribution Equipment and Systems*. CRC Press, 2004.

### **Basic Electronics in Practice**

**Credit: 2**

*Prerequisites:* Basic Electronics

*Course Description:* In this course, learners will be introduced to instruments in electronics and will engage in the following practical activities: recognition of basic electronic components such as R, L, C, diode, BJT, FET, Opam; verification of basic application circuits of the electronic components in theory and reality, analysis of circuit operation, and analysis of operation of basic electronic circuit.

*Textbook:*

1) Kybett, Harry, and Earl Boysen. *All New Electronics Self-Teaching Guide*. 3<sup>rd</sup> ed., Wiley Publishing, Inc. 2008.

### **Microprocessor**

**Credit: 3**

*Prerequisites:* Digital Systems

*Course Description:* This course provides the learner with knowledge about the role and functions of a processor and the processor system; historical development of processor generations, the basic parameters to assess the ability of the processor; the structure and role of the components in the block diagram of 8-bit microprocessors, principles of operation of 8-bit microprocessors; historical development of microcontrollers, advantages and disadvantages of using microcontrollers, internal and external structure of 8-bit microcontroller; function of peripheral devices: timer/counter, interrupts, data transfer of microcontroller, assembly language, C language to program a microcontroller.

*Textbooks:*

1) Barnett, Richard H., Sarah Cox, and Larry O'Cull. *Embedded C Programming and the Microchip PIC*. Delmar Publishers Inc., 2003.

2) Bates, Martin P. *PIC Microcontrollers: An Introduction to Microelectronics*. 3<sup>rd</sup> ed., Newnes, 2011.

### **Power Electronics**

**Credit: 3**

*Prerequisites:* None

*Course Description:* This course provides learners with specialized knowledge of basic power electronic accessories. The students will be introduced to the following topics: the structure, operating principles, waveform and parameters, the uncontrolled and controller rectifier circuits, modified circuit, switching voltage AC, transforming DC voltage, inverting and selecting the DC power supply.

*Textbook:*

1) Mohan, N., T. M. Undeland, and W. P. Robbins. *Power Electronics: Converters, Application and Design*. 3<sup>rd</sup> ed., John Wiley, 2002.

### **Automatic Electric Drive**

**Credit: 3**

*Prerequisites:* Advanced Mathematics, Computer Science Basic, Electric, Electric Tools, Basic Electronics, Power Electronics

*Course Description:* This course introduces students to the content related to the characteristics of the electric drive system, methods of adjusting the motor speed, direct current and alternating current, the calculation method features, engines in the different working state, characteristic construction methods, and instructs students on how to choose equipment for power transmission and working principles of the new powertrain.

*Textbook:*

- 1) El-Sharkawi, Mohamed A. *Fundamentals of Electric Drives*. Brooks/Cole, 2000.
- 2) Nisit, K. D., and Prasanta K. Sen. *Electric Drives*. India, Prentice-Hall, 1999.
- 3) Veltman, Andre, Duco W. J. Pulle, and R. W. de Doncker. *Fundamentals of Electrical Drives*. Springer International Publishing, 2016.

### **Electrical Machine in Practice**

**Credit: 2**

*Prerequisites:* Electrical Machine

*Course Description:* In this course, the students will take part in practical work in the following areas related to electrical machines: installation technology of basic electricity, calculation method for constructing and installing, quality inspection, repairing, installing technology of electrical machine, manufacturing technology of winding in detail, assembling and operating common electrical machines.

*Textbook:*

- 1) Chaturvedi, D. K. *Electrical Machines Lab Manual with MATLAB Programs*. I K International Publishing House, 2015.
- 2) Kothari, D. P., and B. S. Umre. *Laboratory Manual for Electrical Machines*. I K International Publishing House, 2014.

## **Programmable Logic Controller**

**Credit: 3**

*Prerequisites:* None

*Course Description:* This course provides students with contents regarding the method for determining the output of the sensors, how to calculate the value of output as required, the type of sensor connection and actuators with PLC controllers, functional and operational principles of PLC, and application scripts.

*Textbook:*

- 1) Bryan, L. A., and E. A. Bryan. *Programmable Controllers: Theory and Implementation*. 2<sup>nd</sup> ed., American Technical Publishers, 2002.
- 2) Jack, Hugh. *Automation Manufacturing Systems with PLCs*. April 14, 2005.

## **Digital Systems in Practice**

**Credit: 1**

*Prerequisites:* Electricity in Practice and Electronics in Practice

*Course Description:* This course instructs students on how to use digital electronic circuits such as logic gates, Flip-Flops, counters, registers, integrated circuit designs and sequential circuits, memory ICs, ADC, DAC circuits, and applications.

*Textbook:*

- 1) Maini, Anil K. *Digital Electronics*. John Wiley & Sons, 2007.
- 2) Tocci, Ronald J., and Neal S. Widmer. *Digital Systems: Principles and Applications*. 12<sup>th</sup> ed., Prentice Hall, 2015.

## **Power Electronics in Practice**

**Credit: 2**

*Prerequisites:* Basic Electronics, Electronic and Electrical Materials

*Course Description:* This course provides learners with knowledge about the installation of circuits, operating of circuits, waveforms of circuits, DC-DC converter, DC-AC converter, AC-DC converter, and IGBT. The learners will be able to recognise and repair faults in the power electronics system, and design PWM circuits.

*Textbook:*

- 1) Arora, O. P. *Power Electronics Laboratory: Theory, Practice, and Organization*. Alpha Science International Ltd., 2006.

## **Supervisory Control and Data Acquisition**

**Credit: 3**

*Prerequisites:* Electrical Circuits, Electrical Machine-Instrument; Electrical Measurement and Instrument; Programmable Logic Controller

*Course Description:* The course content provides knowledge of the following concepts: components of SCADA in automatic system; actuator system; input/output remote terminal units (RTU) or Programmable Logic Controllers, center monitor and control station; communication system; Human-Machine Interface (HMI); hardware and software integrated method, in order to build a SCADA system in practice.

*Textbook:*

- 1) Maurizio, Di Paolo Emilio. *Data Acquisition Systems: From Fundamentals to Applied Design*. Springer, 2013.
- 2) Radvanovsky, Robert, and Jacob Brodsky. *Handbook of SCADA/Control Systems Security*. 2<sup>nd</sup> ed., CRC Press, 2013.

### **Project on Programmable Logic Controller**

**Credit: 1**

*Prerequisites:* Programmable Logic Controller

*Course Description:* This course provides the opportunity for solving some practical problems in the field of automation, including designing PLC and the process as automated packaging systems, traffic light systems, conveyor systems, heat oven system, conveyor control systems, drive systems, and systems related to temperature, pressure, flow, level, and volume.

*Textbooks:*

- 1) Bryan, L. A., and E. A. Bryan. *Programmable Controllers: Theory and Implementation*. 2<sup>nd</sup> ed., American Technical Publishers, 2002.
- 2) Jack, Hugh. *Automation Manufacturing Systems with PLCs*. April 14, 2005.
- 3) Johnson, Curtis D. *Process Control Instrumentation Technology*. 8<sup>th</sup> ed., Pearson New International Edition, 2014.

### **Microprocessor in Practice**

**Credit: 2**

*Prerequisites:* Electricity in Practice and Electronics in Practice

*Course Description:* This course gives students hands-on experience programming the microcontroller used to control objects to display information such as LED, LED 7-segment, LCD, GLCD, and matrix LED. The students will also get the opportunity for practical work related to the input objects such as buttons, keyboard matrix, temperature sensors, distance measurement sensor, motion sensor, and communication devices such as standard I2C real-time clock, serial EEPROM memory, ADC/DAC, as well as counting pulses and counter, timing control and timer, step motor and DC motors control, and PWM modulation.

*Textbooks:*

- 1) Barnett, Richard H., Sarah Cox, and Larry O' Cull. *Embedded C Programming and the Microchip PIC*. Delmar Publishers Inc., 2003.
- 2) Bates, Martin P. *PIC Microcontrollers. An Introduction to Microelectronics*. 3<sup>rd</sup> ed., Newnes, 2011.

### **Programmable Logic Controller in Practice**

**Credit: 2**

*Prerequisites:* Programmable Logic Controller

*Course Description:* This course provides learners with knowledge about sensors connecting to controllers. The learners will get the opportunity to design and choose programmable equipment and program for demanding industrial systems.

*Textbooks:*

- 1) Anderson, Gary D. *PLC Programming Using RSLogix 500: Ladder Logic Diagnostics & Troubleshooting*. CreateSpace Independent Publishing Platform, 2015.
- 2) Pawla, Andrzej M. *Sensors and Actuators in Mechatronics: Design and Applications*. CRC Press, 2006.

### **CAD for Automation and Control Engineering**

**Credit: 3**

*Prerequisites:* Electrical Circuits, Electrical Machines

*Course description:* This course introduces the learner to the basic principles of design and simulation, CAD applications, the method of solving problems of specialized techniques in design, creating electrical technical drawings, etc.

*Textbook:*

- 1) Eplan user guide, 2017
- 2) Visio 2010

### **Automatic Control System in Practice**

**Credit: 2**

*Prerequisites:* Automatic Control System, Microprocessor

*Course Description:* This course provides the learner with an understanding of how to survey and control automatic control systems including temperature control, pressure control, flow control, control position and velocity. It also provides knowledge of process control, the effect of the additional stage of an automatic control system, and the method of communication in an automation control system.

*Textbook:*

### **Embedded Systems**

**Credit: 3**

*Prerequisites:* Microprocessor, Programmable Logic Controller

*Course Description:* This course provides students with basic knowledge of embedded systems, including the basic concepts of embedded systems, the properties of embedded applications; basic components of an embedded system; embedded system design process; ARM microcontroller; ARM instruction set; C programming language for embedded systems; and embedded programming for arm microcontroller.

*Textbooks:*

- 1) Crowley, Patrick, and Peter Barry. *Modern Embedded Computing – Designing Connected, Pervasive, Media-Rich Systems*. Morgan Kaufmann Publishers, Inc., 2012
- 2) Lee, Edward A., and Sanjit A. Seshia. *Introduction to Embedded Systems – A Cyber-Physical Systems Approach*. MIT Press, 2014.

*References:*

- 1) Vahid, Frank, and Tony Givargis. *Embedded System Design: A Unified Hardware/Software Approach*. John Wiley & Sons Inc., 2002.
- 2) Valvano, Jonathan W. *Embedded Systems: Introduction to Arm®. Cortex(TM)-M Microcontrollers (Volume 1)*. 5<sup>th</sup> ed., CreateSpace Independent Publishing Platform, 2012.

- 3) Valvano, Jonathan W. *Embedded Systems: Real-Time Interfacing to Arm®. Cortex™-M Microcontroller*. 2<sup>nd</sup> ed., CreateSpace Independent Publishing Platform, 2012.  
Yiu, Joseph. *The Definitive Guide to the ARM Cortex-M3*. Elsevier Newnes, 2007.

### **Electrical Equipment and Pneumatics**

**Credit: 3**

*Prerequisites:* Electrical Machines - Electrical Equipment

*Course Description:* This course provides students with basic knowledge about the elements of electrical equipment, electronics, pneumatics, inverters, control circuit terminals, control inverter, control of machine tools, etc.

*Textbook:*

### **Measurement and Control by Computer**

**Credit: 3**

*Prerequisites:* Microprocessor, Automatic Control System

*Course Description:* This course provides students with basic knowledge about the structure, system, and method of communication between computers with peripherals used in the field of measurement, monitoring, and automatic control.

*Textbook:*

### **FMS and CIM**

**Credit: 3**

*Prerequisites:* None

*Course Description:* This course provides students with basic knowledge about FMS and CIM in automation, such as automatic feeders, automatic processing, automatic assembly, and automatic storage.

*Textbook:*

### **Intelligent Control**

**Credit: 3**

*Prerequisites:* Automatic Control System

*Course Description:* This course introduces the learner to the initial intelligent control systems, logic synthesis and application of control systems, neural network training algorithm with applications in the synthesis of automatic control systems, control scheme combined with logic trends, neural networks, and genetic algorithms in intelligent control systems.

*Textbook:*

### **Image Processing in Industry**

**Credit: 3**

*Prerequisites:* Modelling and Computer Simulations, Automatic Control System, Microprocessor, Robot Technology

*Course Description:* This course provides the learner with the following contents: fundamentals of image processing, noise removal, smoothing, edge detection, color recognition, segmentation, and motion detection. Besides, students will be introduced to the ideas of applying image processing to a real-life situation.

*Textbook:*

1) Gonzalez, R. C., and R. E. Woods. *Digital Image Processing*. 3<sup>rd</sup> ed., Pearson, 2007.

**Robotics in Practice**

**Credit: 1**

*Prerequisites:* Robotics

*Course Description:* This course provides the learner with a practical understanding of robotics, types of suture joints in robots, robot sensors, and robot programming.

*Textbook:*



