TRƯỜNG ĐẠI HỌC BÁCH KHOA HÀ NỘI
VIỆN ĐIỆN

HANOI UNIVERSITY OF SCIENCE AND TECHNOLOGY
SCHOOL OF ELECTRICAL ENGINEERING

CHƯƠNG TRÌNH
ĐÀO TẠO ELITECH TÍCH HỢP
2020

ĐIỀU KHIỂN TỰ ĐỘNG HÓA

INTEGRATED EDUCATION PROGRAM
2020

BACHELOR-MASTER OF SCIENCE
IN CONTROL ENGINEERING AND
AUTOMATION

CHƯƠNG TRÌNH ĐÀO TẠO TÍCH HỢP

CỬ NHÂN THẠC SỸ KHOA HỌC

KỸ THUẬT ĐIỀU KHIỂN TỰ ĐỘNG HÓA

T/M Hội đồng xây dựng và phát triển chương trình đào tạo

Ngày   tháng   năm

CHỦ TỊCH HỘI ĐỒNG

Phê duyệt ban hành

Ngày   tháng   năm

HIỆU TRƯỞNG

MỤC LỤC (CONTENTS)

CHƯƠNG TRÌNH ĐÀO TẠO TÍCH HỢP
CỬ NHÂN-THẠC SĨ KHOA HỌC
Integrated Education Program
Bachelor-Master of Science

Tên chương trình:	Kỹ thuật điều khiển tự động hóa
Name of program:	*Control Engineering and Automation*
Trình độ đào tạo:	Cử nhân – Thạc sỹ
Education level:	*Bachelor - Master*
Ngành đào tạo:	Kỹ thuật điều khiển tự động hóa
Major:	
Mã ngành:	7520114, 8520114
Program code:	*7520114, 8520114*
Thời gian đào tạo:	5,5 năm
Duration:	*5,5 years*
Bằng tốt nghiệp:	Cử nhân Kỹ thuật điều khiển Tự động hóa. Thạc sỹ khoa học Kỹ thuật điều khiển Tự động hóa
Degree	*Bachelor in Control Engineering and Automation*
	Master in Control Engineering and Automation
Khối lượng kiến thức toàn khóa:	180 tín chỉ
	180 credites
Credits in total:	

(Ban hành tại Quyết định số   /QĐ-ĐHBK-ĐT ngày   tháng   năm   của Hiệu trưởng Trường Đại học Bách khoa Hà Nội)

1   Mục tiêu chương trình đào tạo (Program Goals)

1.1   Mục tiêu chương trình đào tạo cử nhân (Bachelor's program goals)

Sinh viên tốt nghiệp chương trình Cử nhân Kỹ thuật Điều khiển và Tự động hoá:

On successful completion of the programme, students will have:

1. Có kiến thức cơ sở kỹ thuật và kiến thức chuyên môn vững chắc, có kỹ năng thực hành nghề nghiệp, đủ năng lực tham gia giải quyết các vấn đề liên quan đến thiết kế, chế tạo trong lĩnh vực rộng của ngành Kỹ thuật điều khiển - Tự động hóa.

    Have core engineering knowledge, problem-solving skills and competencies to participate in designing, manufacturing and operating systems on the field of Control Engineering and Automation

2. Có kỹ năng nghề nghiệp và kỹ năng cá nhân, có khả năng học tập ở trình độ cao hơn, khả năng tự học để thích ứng với sự phát triển không ngừng của khoa học và công nghệ và có khả năng học tập suốt đời.

Have professional and personal skills and attributes including lifelong learning and self-study abilities to pursue higher levels of education to get adapted to the ongoing scientific and technological development.

3. Có kỹ năng giao tiếp, ngoại ngữ và làm việc nhóm đủ để làm việc trong môi trường liên ngành, đa văn hóa, đa quốc gia.

    Have communication, foreign language and teamwork skills to work in interdisciplinary, cross-cultural, and multinational environments.

4. Có năng lực hình thành ý tưởng, tham gia thiết kế, thực hiện và vận hành các hệ thống trong doanh nghiệp và xã hội.

    Have abilities to conceive ideas, participate in designing, implementing and operating systems in enterprises and society.

1.2 Mục tiêu chương trình đào tạo thạc sĩ (Master's Program Goals)

Sinh viên tốt nghiệp chương trình thạc sĩ có:

On successful completion of the Master program, students will:

1. Kiến thức cơ sở chuyên môn rộng để có thể thích ứng tốt với những công việc khác nhau thuộc lĩnh vực rộng của ngành học để có khả năng làm việc độc lập, sáng tạo và tự đào tạo cao trong môi trường kinh tế xã hội phát triển nhanh và nhiều biến động sẵn sàng hội nhập, thích ứng với cuộc cách mạng 4.0.

    Have a wide background knowledge to such that they can adapt to different work profiles in the wide field of Control Engineering and Automation; be able to work independently, creatively and be able to self-educate to accommodate the rapid changes in the era of the 4th industrial revolution;

2. Kỹ năng chuyên nghiệp và phẩm chất cá nhân cần thiết để thành công trong nghề nghiệp: phương pháp làm việc khoa học và chuyên nghiệp, tư duy hệ thống và tư duy phân tích tốt; hòa nhập được trong môi trường quốc tế

    Have professional skills and personal qualities to succeed in their careers; have scientific and professional work methods; system thinking and analytical thinking; be able to integrate in multi-national workplaces

3. Kỹ năng xã hội cần thiết để làm việc hiệu quả trong nhóm đa ngành và hội nhập trong môi trường quốc tế

    Have abilities to work effectively in multi-disciplinary teams, in multi-national work environment.

4. Khả năng tự đào tạo, tự cập nhật kiến thức và tự nghiên cứu khoa học. Khả năng tìm tòi các vấn đề thực tiễn, vận dụng kiến thức và các thành tựu khoa học kỹ thuật sáng tạo để giải quyết các vấn đề thực tế.

    Have abilities to self-educate, to research and to keep updated with state-of-the-art knowledge and skills; Be able to research practical problems, to make creative use of scientific and technological tools to solve engineering problems.

2 Chuẩn đầu ra của chương trình đào tạo (Program Learning Outcomes)

2.1 Chuẩn đầu ra của chương trình đào tạo cử nhân (Bachelor's program learning outcomes)

Sinh viên tốt nghiệp Cử nhân ngành Kỹ thuật Điều khiển và Tự động hoá có các kiến thức, kỹ năng và năng lực như sau:

On successful completion of the programme, students will be able to:

2.1.1 Kiến thức cơ sở chuyên môn vững chắc để thích ứng tốt với những công việc khác nhau thuộc lĩnh vực rộng của ngành Kỹ thuật điều khiển và tự động hóa, chú trọng khả năng áp dụng kiến thức để tham gia thiết kế, đánh giá các giải pháp, hệ thống/quá trình/sản phẩm kỹ thuật điều khiển tự động hóa

Comprehensive knowledge of core and advanced engineering in control engineering and automation:

2.1.1.1 Khả năng áp dụng kiến thức cơ sở toán, vật lý, tin học để mô tả, tính toán và mô phỏng các hệ thống, quá trình và sản phẩm kỹ thuật có liên quan đến những ứng dụng của ngành kỹ thuật.

The ability to apply the basic knowledge of mathematics, physics, and computing in the calculation and simulation of engineering systems.

2.1.1.2 Khả năng áp dụng kiến thức cơ sở kỹ thuật điện, kỹ thuật điều khiển, đo lường, tự động hóa để hiểu các vấn đề, các sản phẩm, thiết bị kỹ thuật có liên quan đến những ứng dụng của ngành kỹ thuật điều khiển tự động hóa.

The ability to apply basic knowledge of electrical engineering, control engineering and automation to understand the principles of products and systems in the control engineering and automation field.

2.1.1.3 Khả năng áp dụng kiến thức của lĩnh vực rộng của ngành kỹ thuật điện, kết hợp với khả năng sử dụng các phương pháp, công cụ tính toán hiện đại để tham gia thiết kế các giải pháp, dây chuyền sản xuất và sản phẩm kỹ thuật trong lĩnh vực Kỹ thuật điều khiển tự động hóa.

The ability to apply the core and advanced knowledge in electrical engineering and automation, combined with the ability to exploit the use of software tools to participate in the design, implementation of control engineering and automation.

2.1.2 Có kỹ năng chuyên nghiệp và phẩm chất cá nhân cần thiết để thành công trong nghề nghiệp (*personal and professional skills & attributes*):

2.1.2.1 Khả năng nhận dạng, lập luận phân tích và giải quyết vấn đề kỹ thuật.
Engineering problem identification, analytical reasoning and problem solving.

2.1.2.2 Tư duy hệ thống và tư duy phê bình
System thinking and critical thinking

2.1.2.3 Tư duy chủ động, linh hoạt, sáng tạo, tìm tòi và kỹ năng quản lý thời gian. Hiểu biết các vấn đề đương đại và ý thức học suốt đời.

Creative and critical thinking, time management skills, understanding of contemporary issues and life-long learning

2.1.2.4   Hiểu biết về đạo đức nghề nghiệp, sở hữu trí tuệ

Professional ethics, integrity and responsibility, understanding of intellectual property.

2.1.3   Có kỹ năng xã hội cần thiết để làm việc hiệu quả trong nhóm đa ngành và trong môi trường quốc tế (*interpersonal skills*):

2.1.3.1   Kỹ năng làm việc theo nhóm, trong môi trường làm việc đa ngành

Ability to operate in inter-disciplinary teams.

2.1.3.2   Kỹ năng giao tiếp hiệu quả bằng văn bản, thuyết trình và thảo luận, sử dụng phương tiện điện tử, truyền thông

Ability to communicate effectively, using text, electronic/multimedia platform, oral presentation and interpersonnal communication skills

2.1.3.3   Kỹ năng sử dụng tiếng Anh hiệu quả trong công việc, đạt điểm TOEIC theo quy định của trường Đại học Bách khoa Hà Nội

Effective use of English at work, achieve a TOEIC score conforming to the requirement of HUST.

2.1.4   Năng lực tham gia thiết kế, xây dựng/phát triển hệ thống/sản phẩm/giải pháp kỹ thuật thuộc lĩnh vực Kỹ thuật điều khiển tự động hóa trong bối cảnh kinh tế, xã hội và môi trường thực tế (*Conceiving, designing, implementing and operating control engineering and automation in the enterprise and societal context*)

2.1.4.1   Nhận thức về mối liên hệ mật thiết giữa giải pháp kỹ thuật với các yếu tố kinh tế, xã hội và môi trường trong thế giới toàn cầu hóa. Hiểu biết các quy định pháp lý trong lĩnh vực kỹ thuật điện, kỹ thuật điều khiển tự động hóa.

Understanding the impact of engineering solutions on the society, the economy and the enviroment in the global perspective. Understanding the society regulations in the field of electrical engineering, control and automation.

2.1.4.2   Năng lực nhận biết vấn đề và hình thành ý tưởng giải pháp kỹ thuật, tham gia xây dựng dự án (**C**)

Ability of engineering problem identification, conceiving engineering solutions and participating in the project development

2.1.4.3   Năng lực tham gia thực thi, chế tạo và triển khai hệ thống, sản phẩm và các giải pháp kỹ thuật có liên quan đến kỹ thuật điều khiển – tự động hóa (**I**)

Ability to participate in the implementation, manufacturing process of systems and products in control engineering and automation.

2.1.4.4   Năng lực vận hành, sử dụng và khai thác hệ thống, quá trình, sản phẩm có liên quan đến các ngành kỹ thuật điều khiển tự động hóa (**O**)

Ability to participate in the operation of systems and products in control engineering and automation.

2.2 Chuẩn đầu ra của chương trình thạc sỹ khoa học (Master program's learning outcomes)

Sinh viên tốt nghiệp Thạc sỹ khoa học ngành Kỹ thuật điều khiển tự động hóa có các kiến thức, kỹ năng và năng lực như sau:

On successful completion of the programme, students will be able to:

2.2.1   Kiến thức cơ sở chuyên môn vững chắc để thích ứng tốt với những công việc khác nhau thuộc lĩnh vực rộng của ngành kỹ thuật điều khiển tự động hóa, chú trọng khả năng áp dụng kiến thức để tham gia thiết kế, đánh giá các giải pháp, hệ thống/quá trình/sản phẩm (*Comprehensive knowledge of core and advanced engineering in control engineering and automation*):

2.2.1.1   Khả năng áp dụng kiến thức cơ sở toán, vật lý, tin học để mô tả, tính toán và mô phỏng các hệ thống, quá trình và sản phẩm kỹ thuật có liên quan đến những ứng dụng của ngành kỹ thuật.

The ability to apply the basic knowledge of mathematics, physics, and computing in the calculation and simulation of engineering systems.

2.2.1.2   Khả năng áp dụng kiến thức cơ sở kỹ thuật điện, kỹ thuật điều khiển, đo lường, tự động hóa để hiểu và phân tích các vấn đề, các sản phẩm, thiết bị kỹ thuật có liên quan đến những ứng dụng của ngành kỹ thuật điều khiển tự động hóa.

The ability to apply basic knowledge of electrical engineering, control engineering and automation to understand and analyze the principles of products and systems in control engineering and automation.

2.2.1.3   Khả năng áp dụng kiến thức của lĩnh vực rộng của ngành kỹ thuật điều khiển tự động hóa, kết hợp với khả năng sử dụng các phương pháp, công cụ tính toán hiện đại để tham gia thiết kế và đánh giá các giải pháp, dây chuyền sản xuất và sản phẩm kỹ thuật trong lĩnh vực Kỹ thuật điều khiển tự động hóa.

The ability to apply the core and advanced knowledge in control engineering and automation, combined with the ability to exploit the use of software tools to participate in the design, implementation, and evaluation, making process and products in control engineering and automation.

2.2.2   Có kỹ năng chuyên nghiệp và phẩm chất cá nhân cần thiết để thành công trong nghề nghiệp (*personal and professional skills & attributes*):

2.2.2.1   Khả năng nhận dạng, lập luận phân tích và giải quyết vấn đề kỹ thuật.

Engineering problem identification, analytical reasoning and problem solving.

2.2.2.2   Khả năng thiết kế và thực hiện các thí nghiệm, nghiên cứu, và khả năng phân tích kết quả

Formulation of hypothesis, perform experimental experiments and analysis of results

2.2.2.3   Tư duy hệ thống và tư duy phê bình

System thinking and critical thinking

2.2.2.4   Tư duy chủ động, linh hoạt, sáng tạo, tìm tòi và kỹ năng quản lý thời gian. Hiểu biết các vấn đề đương đại và ý thức học suốt đời.

Creative and critical thinking, time management skills, understanding of contemporary issues and life-long learning

2.2.2.5   Hiểu biết về đạo đức nghề nghiệp, sở hữu trí tuệ

Professional ethics, integrity and responsibility, understanding of interllectual property.

2.2.3   Có kỹ năng xã hội cần thiết để làm việc hiệu quả trong nhóm đa ngành và trong môi trường quốc tế (*interpersonal skills*):

2.2.3.1   Kỹ năng làm việc theo nhóm, trong môi trường làm việc đa ngành

Ability to operate in inter-disciplinary teams.

2.2.3.2   Kỹ năng giao tiếp hiệu quả bằng văn bản, thuyết trình và thảo luận, sử dụng phương tiện điện tử, truyền thông

Ability to communicate effectively, using text, electronic/multimedia platform, oral presentation and interpersonnal communication skills

2.2.3.3   Kỹ năng sử dụng tiếng Anh hiệu quả trong công việc, kỹ năng tiếng Anh tương đương IELTS 6.0

English proficiency level equivalent to IELTS 6.0.

2.2.4   Năng lực tham gia thiết kế, xây dựng/phát triển hệ thống/sản phẩm/giải pháp kỹ thuật thuộc lĩnh vực Kỹ thuật điều khiển tự động hóa trong bối cảnh kinh tế, xã hội và môi trường thực tế (*Conceiving, designing, implementing and operating in the enterprise and societal context*)

2.2.4.1   Nhận thức về mối liên hệ mật thiết giữa giải pháp kỹ thuật với các yếu tố kinh tế, xã hội và môi trường trong thế giới toàn cầu hóa. Hiểu biết các quy định pháp lý trong lĩnh vực kỹ thuật điều khiển tự động hóa.

Understanding the impact of engineering solutions on the society, the economy and the enviroment in the global perspective. Understanding the society regulations in the field of control engineering and automation.

2.2.4.2   Năng lực nhận biết vấn đề và hình thành ý tưởng giải pháp kỹ thuật, tham gia xây dựng dự án (C)

Ability of engineering problem identification, conceiving engineering solutions and leading engineering projects

2.2.4.3   Năng lực tham gia thiết kế hệ thống, quá trình, sản phẩm và đưa ra các giải pháp kỹ thuật có liên quan đến kỹ thuật điều khiển tự động hóa (D)

Ability to participate in the design of systems, process and engineering solutions in the control engineering and automation.

2.2.4.4   Năng lực tham gia thực thi, chế tạo và triển khai hệ thống, sản phẩm và các giải pháp kỹ thuật có liên quan đến kỹ thuật điều khiển tự động hóa (I)

Ability to participate in the implementation, manufacturing process of systems and products in control engineering and automation

2.2.4.5   Năng lực vận hành, sử dụng và khai thác hệ thống, quá trình, sản phẩm có liên quan đến các ngành kỹ thuật điều khiển tự động hóa (O)

Ability to participate in the operation of systems and products in control engineering and automation.

3 Nội dung chương trình (Program Content)

3.1 Cấu trúc chung của chương trình đào tạo (General Program Structure)

BẬC CỬ NHÂN		
Khối kiến thức *(Professional component)*	**Tín chỉ** *(Credit)*	**Ghi chú** *(Note)*
Giáo dục đại cương *(General Education)*	*51*	
Toán và khoa học cơ bản *(Mathematics and basic sciences)*	32	Thiết kế phù hợp theo nhóm ngành đào tạo *(Major oriented)*
Lý luận chính trị Pháp luật đại cương *(Law and politics)*	13	Theo quy định của Bộ GD&ĐT *(in accordance with regulations of Vietnam Ministry of Education and Training)*
GDTC/GD QP-AN *(Physical Education/ Military Education)* *Military Education is for Vietnamese student only.*	-	
Tiếng Anh *(English)*	6	Gồm 2 học phần Tiếng Anh cơ bản *(02 basic English courses)*
Giáo dục chuyên nghiệp *(Professional Education)*	*81*	
Cơ sở và cốt lõi ngành *(Basic and Core of Engineering)*	48 (±2)	Bao gồm từ 1÷3 đồ án thiết kế, chế tạo/triển khai. *(consist of at least 1÷3 projects)*
Kiến thức bổ trợ *(Soft skills)*	9	Gồm hai phần kiến thức bắt buộc: - Kiến thức bổ trợ về xã hội, khởi nghiệp và các kỹ năng khác (6TC); *Include of 02 compulsory modules:* - *Social/Start-up/other skill (6 credits);*
Tự chọn theo môđun *(Elective Module)*	16 (±2)	Khối kiến thức Tự chọn theo môđun tạo điều kiện cho sinh viên học tiếp cận theo một lĩnh vực ứng dụng. *Elective module provides specialized knowledge oriented towards different concentrations.*
Đồ án nghiên cứu *(Bachelor research-based thesis)*	8	Đồ án nghiên cứu là một báo cáo khoa học liên quan đến một hướng (hoặc đề tài) nghiên cứu **do người học đề xuất** dưới sự hướng dẫn của giảng viên. *Bachelor research-based thesis is in form of a scientific report, its research topic is proposed by student. Student must carry out thesis under lecturer's supervision.*
Tổng cộng chương trình cử nhân (Total)	**132 tín chỉ** *(132 credits)*	
BẬC THẠC SĨ		

Khối kiến thức (Professional component)	Tín chỉ (Credit)	Ghi chú (Note)
Kiến thức chung (General Education) Triết học (Philosophy) Tiếng Anh (English)	3	Môn Triết học đối với khối ngành kinh tế 4 TC Tiếng Anh tự học. Sinh viên đạt chuẩn đầu ra tương đương IELTS 6.0
Kiến thức ngành rộng (Major knowledge)	12	Sinh viên theo học CTĐT tích hợp sẽ được công nhận 12 tín chỉ. Sinh viên không theo học CTĐT tích hợp sẽ được công nhận tối đa 6 tín chỉ và cần thực hiện đồ án nghiên cứu đề xuất với thời lượng 6 tín chỉ.
Kiến thức ngành nâng cao (Advanced specialized knowledge)	12÷15	Đây là khối kiến thức ngành nâng cao, chuyên sâu theo các định hướng chuyên môn của ngành đào tạo. Khối kiến thức ngành nâng cao gồm 2 phần: (i) Tín chỉ dành cho các học phần dạng thông thường. (ii) Tín chỉ dành cho 02 chuyên đề/seminar; mỗi chuyên đề/seminar là 3 TC. Khối này là 6 tín chỉ.
Mô đun định hướng nghiên cứu (Research-oriented elective module)	15÷18	Có thể xây dựng nhiều mô đun định hướng nghiên cứu. Sinh viên có thể lựa chọn nhiều mô đun, nhưng khi đã chọn mô đun nào thì phải hoàn thành toàn bộ các học phần trong mô đun đó. Số lượng tín chỉ có thể điều chỉnh trong khoảng 12-15 tín chỉ; nhưng phải đảm bảo tổng số tín chỉ của khối kiến thức ngành nâng cao và mô đun định hướng nghiên cứu là 30 tín chỉ.
Luận văn thạc sĩ KH (Master thesis)	15	Nội dung luận văn thạc sĩ được phát triển từ nội dung Đồ án nghiên cứu tại bậc học cử nhân
Tổng cộng chương trình thạc sĩ khoa học (Total)	**48 tín chỉ** *(48 credits)* và **12 tín chỉ được công nhận** *(12 transfer credits from Bachelor program)*	
Tổng cộng chương trình tích hợp cử nhân-thạc sĩ khoa học (Total)	**180 tín chỉ** *(180 credits)*	

3.2 Danh mục học phần và kế hoạch học tập chuẩn (Course list & Schedule)

TT Ord	MÃ SỐ Course ID	TÊN HỌC PHẦN Course Name	KHỐI LƯỢNG Credits	KỲ HỌC (Semester)										
				1	2	3	4	5	6	7	8	9	10	11
		General knowledge												
		Laws and politics	**12**											
		Math and sciences	**29**											
9	MI1016	Calculus I	4(3-2-0-8)	4										
10	IT1016	General informatics	3(2-1-2-6)			3								
11	MI1026	Calculus 2	4(3-2-0-8)			4								
12	MI1036	Algebra	4(3-2-0-8)			4								
13	PH1016	Physics I	4(2-2-1-8)			4								
14	MI1046	Calculus I	3(2-2-0-6)				3							
15	PH1026	Physics II	4(2-2-1-8)				4							
16	MI2036	Probability	3(3-1-0-6)				3							
		English	**20**											
		Soft skills	**12**											
27	ED3280	Applied psychology	2(1-2-0-4)						2					
28	EM1010	Introduction to Management	2(2-1-0-4)						2					
29	EM1180	Business Culture and Entrepreneurship	2(1-1-0-4)						2					
30	ET3262	Technical product design	2(1-2-0-4)						2					
31	ED3220	Soft skills	2(1-2-0-4)							2				
32	TEX3123	Industrial fine arts	2(1-2-0-4)							2				
		Professional courses												
		Fundamental courses in Electrical Engineering	**46**											
33	EE1024E	Introduction to Electrical Engineering	2(1-1-1-4)				2							
34	EE2001E	Signals and Systems	3(3-0-1-6)					3						
35	EE2110E	Electronics design	3(3-0-1-6)					3						
36	EE3030E	Fundamentals of Electromagnetic Field Theory	3(3-0-1-6)					3						
37	EE3490E	Programming techniques	3(2-2-0-6)					3						
38	EE3706	Linear Circuit I	3(3-1-0-6)					3						
39	EE2130E	Digital system design	3(3-0-1-6)						3					
40	EE3020E	Linear Circuit II	3(3-1-0-6)						3					
41	EE3110E	Measurement and Instrumentation Principles	3(3-0-1-6)						3					
42	EE3140E	Electric machines I	3(3-0-1-6)						3					
43	EE3288E	Linear Control System	3(3-1-0-6)						3					
44	EE3480	Microprocessor	3(3-0-1-6)						3					
45	EE3810E	Project I	2(0-0-4-4)						2					

TT / Ord	MÃ SỐ / Course ID	TÊN HỌC PHẦN / Course Name	KHỐI LƯỢNG / Credits	1	2	3	4	5	6	7	8	9	10	11
46	EE3410E	Power Electronics	3(3-0-1-6)							3				
47	EE3423E	Power supply systems	3(3-1-0-6)							3				
48	EE3821E	Project II	2(0-0-4-8)							2				
Elective modules														
Control and Automation Engineering module			**18**											
49	EE3600E	Industrial Instrumentation and Control System	3(3-0-1-6)						3					
50	EE3510E	Electric drives	3(3-0-1-6)							3				
51	EE3550E	Process Control	3(3-1-0-6)							3				
52	EE4221E	Logic Control and PLC	3(3-0-1-6)							3				
53	EE4401E	Design of embedded control systems	3(2-2-0-6)							3				
54	EE4435E	Digital Control System	3(3-1-0-6)							3				
Bachelor thesis			**8**											
55	EE4922E	Bachelor graduate thesis	8(0-0-16-32)								8			
Master of Science courses														
General courses			**3**											
56	SS6013	Philosophy	3(3-0-0-6)							3				
General courses - transfer credits from elective bachelor modules			**12**											
Advanced courses														
Control and Automation Engineering module			**15**											
59	EE6312E	Analysis and control of nonlinear systems	3(3-1-0-6)								3			
60	EE6543E	Sensor and Conditioning	2(2-1-0-4)									2		
61	EE6503E	Digital Signal Processing	2(2-1-0-4)									2		
62	EE6551E	Advanced power electronics	2(2-1-0-4)									2		
63	EE6010E	Seminar I	3(0-0-6-6)									3		
64	EE6020E	Seminar II	3(0-0-6-6)										3	
Research oriented modules														
Control and Automation Engineering module			**15**											
65	EE6532E	Optimization and optimal control	3(3-1-0-6)									3		
66	EE6022E	Advanced process control	3(2-2-0-6)									3		
67	EE6445E	Fuzzy control and neural networks	3(3-1-0-6)										3	
68	EE6446E	Smart Sensor Systems	3(3-1-0-6)										3	

TT Ord	MÃ SỐ Course ID	TÊN HỌC PHẦN Course Name	KHỐI LƯỢNG Credits	KỲ HỌC (Semester)										
				1	2	3	4	5	6	7	8	9	10	11
69	EE6426E	Advanced power electronic control in renewable energy sources	3(3-0-0-6)										3	
Graduate thesis			**15**											
70	LV6001	Graduate thesis	15(0-0-0-30)											15

4   Mô tả tóm tắt học phần

4.1

MIL1110

Objectives: Đối tượng, phương pháp nghiên cứu môn học Giáo dục quốc phòng - an ninh; Quan điểm của chủ nghĩa Mác - Lênin, tư tưởng Hồ Chí Minh về chiến tranh, quân đội và bảo vệ Tổ quốc; Xây dựng nền quốc phòng toàn dân, an ninh nhân dân; Chiến tranh nhân dân bảo vệ Tổ quốc Việt Nam xã hội chủ nghĩa; Xây dựng lực lượng vũ trang nhân dân Việt Nam; Kết hợp phát triển kinh tế - xã hội với tăng cường củng cố quốc phòng - an ninh; Nghệ thuật quân sự Việt Nam.
Content:

MIL1120

Objectives:
Content:

MIL1130

Objectives:
Content:

EM1170 General laws

Objectives: This course equips students with general knowledge about concept of legal science of State and Law, basic content of fundamental laws, such as the Constitution,

Administration, Civil and Criminal Law in Vietnamese legal system. This module also equips students with specialized legal knowledge to help students apply the law in their life and work.
Content: Overview of origin of State and Law; Nature, function and types of State and Law; The state apparatus of the Socialist Republic of Vietnam;
The system of legal documents; Law enforcement, legal violations and liability. Introduction of the most basic content of the major law branches in Vietnam.

SSH1110 Foundation of Marxism and Leninism I

Objectives: Providing students with the most basic rationale from which to access the content of Ho Chi Minh Thought and the Revolution Policy of Vietnamese Communist Party courses, understanding the Party's ideological foundation; Building trust, revolutionary ideals for students; Step by step establishes the most general worldview, ecology and methodology to reach the professional majors.
Content: Introducing the concept of Marxism-Leninism and some general issues of the course. Basics of the worldview and methodology of Marxism-Leninism.

SSH1120 Foundation of Marxism and Leninism II

Objectives: Providing students with an understanding of the basic principles of Marxism-Leninism from which to establish a basic rationale to be able to access the content of Ho Chi Minh's Thought and the Revolution Policy of Vietnamese Communist Party courses. Step by step establishing the most general worldview and methodology for students to reach the professional majors. Developing revolutionary outlook on life and cultivating new human morality.
Content: Basic contents of Political Economy of Marxism-Leninism and Scientific socialism. The focus of economic theory of Marxism-Leninism on capitalist production methods; The basic contents of Marxism-Leninism theory of socialism; Real socialism and prospects.

SSH1050 Ho chi Minh ideology

Objectives: Providing students with a systematic understanding of Ho Chi Minh's ideology, ethics, cultural values and the basic knowledge of Ho Chi Minh's creative application of Marxism-Leninism in Vietnam. In combination with the course Fundamental Principles of Marxism-Leninism, the course will help students to have knowledge of ideological foundation, guideline of the Vietnamese Communist Party and Vietnam revolution.
Content: Overview of the basis, the process of formation and development of Ho Chi Minh's thought; The basic contents of Ho Chi Minh's thought regarding of the Vietnam revolution during revolution of national liberation and the construction of Socialism.

SSH1130 Revolulionary Policy of the Communist Party of Vietnam

Objectives: Providing students with the basic contents of the revolutionary policy of the Communist Party of Vietnam, which mainly focuses on policy of the Communist Party during reform process applied in some basic areas of social life. Building students' trust in the Communist Party's leadership following the Communist Party's goals and ideals. Helping students to apply major's knowledge to proactively and positively solve economic, political,

cultural and social issues according to the Communist Party's and State's guidelines, policies and laws.

Content: Systematic understanding of the Communist Party's policy in revolutionary periods, especially during national reform: industrialization guideline, guideline to build a socialist-oriented economy market, guideline to build political system, guidelien to develop culture and solve social problems, diplomacy in foreign policy.

ED3280 Applied psychology

Objectives:
Content:

EM1010 Introduction to Management

Objectives: The course provides basic knowledge of the concept, nature, and roles of management; a number of approaches to the management of an organization, business environment, decision-making process in an organization; managerial functions such as planning, organizing, leading, controlling in a company.

After completing this course, students will be able to: grasp the basic knowledge of business management, understand the operating environment of an organization, apply that knowledge into the learning process related to management of an organization at the university in the immediate future and future work; understand the management functions of planning, organizing, leading and controlling in an organization; improve the communication, presentation, teamwork, planning, time management, analytical, decision-making skills, .. and apply the knowledge and skills to manage a specific organization or business.

Content: Overview of management of an organization: including the concept of management, the management process, and identify who is the manager? Where do they work? What are the manager's roles? The concept of organization, the characteristics of an organization, the operating environment of an organization.

Planning function includes the definition of planning, the roles of planning, the types of plans, planning methods and processes, and factors affecting to the quality of a plan.

Organizing function includes definitions and roles of organizational function, the contents of organizational functions: organizational structure design, management process development and human resources management.

Leading function include definition of leadership, the contents and role of leadership functions, and popular leadership styles.

Controlling function includes the definition of controlling, the roles of controlling function, the methods and types of controlling, the characteristics of an effective control system and controlling principles.

EM1180 Business Culture and Entrepreneurship

Objectives: The course equips students with knowledge and skills about the basic knowledge of culture and business culture, the role of business culture as an important factor for business development in enterprises. After finishing the course, the students will be able to:

-   Understand and have an entrepreneur spirit in general; technology startup in particular.

- *Have the ability to create, assign tasks, coordinate work in group work.*
- *Identify necessary documents through books, observations, interviews.*

Content: - An overview of corporate culture and the role of corporate culture: Concept of culture; Corporate culture; Business culture.

- *Business philosophy: Concept, the role of business philosophy; Content of business philosophy; How to build business philosophy of enterprises; Business philosophy of Vietnamese enterprises.*

- *Business ethics and social responsibility: Concept, role of business ethics; Corporate social responsibility; Expressive aspects of business ethics.*

- *Entrepreneurial culture: The concept of entrepreneurial culture; Factors affecting entrepreneurial culture; The components of entrepreneurial culture; Entrepreneurial style; Evaluation standards for entrepreneurial culture.*

- *Corporate culture: Concept of corporate culture; Steps to build corporate culture; Business culture models in the world; Current situation of cultural construction in Vietnamese enterprises; Solutions to build a suitable corporate culture model in Vietnam.*

- *Entrepreneurial spirit: Concept and meaning of entrepreneurial spirit; Forms of entrepreneur and technology start-up; Select a start-up model.*

ET3262 Technical product design

Objectives: Provide students with thinking about the steps in the product design process. Providing knowledge and skills on steps to design products properly from the beginning helps to reduce the time to design technology products. Strengthen teamwork skills, presentation skills, skills in planning, writing reports as well as necessary attitudes at work.

Content: Knowledge:General process of technical design; Problem-solving skills; Engineering design process; techniques to create specifications of products; techniques to develop a plan to design products; techniques to select best alternatives; and techniques for Testing.

Introduction to Design of Experiment (DoE): The basic principles of DoE; go in depth in defining problems, methods of selecting influence factors; methods of determining sample size.

Competition between teams: Each team designs and completes a product defined in week 1; Final Report; Final Presentation on the whole product design process; Examination of all learned skills as the module's learning outcomes.

ED3220 Soft skills

Objectives: students is able to: Identify the importance of personal development skills at school, at work and in their life; Analyze the fundamental knowledge to develop personal skills; Practice the steps to basically form the personal development skills; Aware of the need to practice skills of studying and working adapting to modern society and future career.

Personal development skills include: Being proactive and setting personal goals; Developing positive thinking; Managing time effectively; Communicating (Small Talk and Big Talk, Listening Skills, Persuasion, Presentation); Working in a team.

Content: Team and Teamworking: Why to work in a team; Fundamental knowledge of a team; Introduction to basic personal skills of teamworking; Introduction to interpersonal skills in teamworking.

Basic Personal Skills – Personal Achievements: Positive Thinking; Living Values; Time-Management (Managing ourselves).

Interpersonal Skills – Team Achievements: Effective Communication & Listening; Presentation; Persuasion.

Organization Skills in Teamworking: Team Building; Meetings; Setting and Monitoring Plans; Solving Problems; Evaluating Teamworking.

TEX3123 Industrial fine arts

Objectives: This subject aims to provide learners with the most basic knowledge of design and a number of principles in the product design, the industrial design process, design elements, the principles in design layout, the design documentation. Besides, this subject helps learners have the skills to apply knowledge in researching, synthesizing, evaluating and presenting the solutions of the improvement and development of artistic designs in the industrial production. The subject also provides students with teamwork skills, presentations, and attitudes needed.

Content: Overview of Design: Provide the learners with the most basic knowledge about the industrial art design: product concept and the art design of industrial products (from single product design to design style of product system of the company or corporation), the role of industrial art design and thinking design and some principles in product design, Ergonomics principles in product design.

The process of industrial art design: Provide learners with basic knowledge about: The process of industrial art design (forming and creating the Designing tasks and the designing solutions, completing designing solutions). Design Elements: Providing learners with basic knowledge about the elements of industrial art design: shapes, lines, colors, sizes, materials, and space. This helps the learner to perceive the product from the point of view of product design, to explain and to understand more deeply about the visual elements of the industrial design. Design Composition Principles: Providing learners with basic knowledge about principles in industrial arts design: Balance, rhythm, unity, emphasis. This helps the learner to be aware of the harmony that is generated in the product through the use of design layout principles. Design Portfolio: Providing learners with knowledge on industrial design art profiles: Concept, role, classification, requirements, structure, presentation and evaluation. This helps the learner to understand the role of the design file, make a profile for a product design plan and present it.

MI1016 Calculus I

Objectives: Provide students with basic knowledge about single variable and multiple variables functions. On that basis, students can continue to study the following sections of Mathematics as well as other technical subjects, contributing to the foundation of Basic Mathematics for engineers of technology and economics.

Content:

IT1016 General informatics

Objectives: The course not only provides students with basic IT knowledge (according to Circular No. 03/2014 / TT-BTTTT on the regulation of IT use skill standards), including basic understanding of how information is presented and processed in computers, computer hardware, operating system, internet, utility software, office software, but also equip students with the ability to describe algorithms by various methods, comprehend the principles and programming structures of high-level programming languages and be able to implement algorithms in the C programming language.
Content: Information concept and information representation in computers. Computer system: hardware, operating system, internet, application software and office software. Algorithm and algorithm representation; Basic programming structures, basic data types and structured data type in the C programming language…

MI1026 Calculus 2

Objectives: Provide students with basic knowledge of dependent integral, Integrating multiples of two and three multiples, Integrating line and face, Application of differential equation to Geometry and Field theory. On that basis, students can continue to study the following sections of Mathematics as well as other technical subjects, contributing to the foundation of Basic Mathematics for engineers of technology and economics.
Content:

MI1036 Algebra

Objectives: Provide students with basic knowledge of Theory of matrices, Determinant, and System of linear equations, minimal knowledge of Logic, Collection, Logical mapping, Complex number fields, and simple ideas about second-order surface, second-order line. On that basis, students can continue to study the following sections of Mathematics as well as other technical subjects, contributing to the foundation of Basic Mathematics for engineers of technology and economics.
Content: Theory of set, mapping, group, field, complex sets. Basic problem in linear algebra: matrix, determinant, linear system, vector space, linear mapping, eigenvector, eigenvalues, quadratic and Euclide space, first and second order surface.

PH1016 Physics I

Objectives: provide students with the knowledge of the basis laws of classical mechanics, the conservation laws, vibration and mechanical waves, the methods of analyzing and solving relevant problems.
Content: Mechanical motion in which the main topics are: Vectors, Kinematics, Forces, Motion, Momentum, Energy, Angular Motion, Angular Momentum, Gravity, Planetary Motion, Moving Frames, and the Motion of Rigid Bodies. The motion of a simple body (ideal particle) and systems of bodies are considered. Specifically motion as mechanical vibration and waves with main topics: Oscillators, Energy, Poynting Vector. The Thermal motion is investigated by statistical and thermodynamic methods. The main topics are thermodynamic

systems, Kinetic Gas Theory, Distribution Function, Thermodynamic laws of ideal gas, Carnot cycle, Thermal Engine, Real gas, Phase Transitions and application.

MI1046 Calculus I

Objectives: Differential Equations and Series is intended for engineering students and others who require a working knowledge of differential equations and series; included are technique and applications of differential equations and infinite series. Since many physical laws and relations appear mathematically in the form of differential equations, such equations are of fundamental importance in engineering mathematics. Therefore, the main objective of this course is to help students to be familiar with various physical and geometrical problems that lead to differential equations and to provide students with the most important standard methods for solving such equations.
Content: First order separable, linear, and exact equations; second order linear equations, Laplace transforms, series solutions at an ordinary point, systems of first order linear equations, and applications.

PH1026 Physics II

Objectives: The goals of this part of the course are to provide students with the knowledge of the basis laws of electromagnetism, the way of describing electric and magnetic fields, as well as their interaction with matter, the methods of analyzing and solving relevant problems. The laboratory sessions help students to practice the skills at performing measurements of electromagnetic quantities, setting up simple experiments to investigate topics in the studied lectures, analyzing experiment data to obtain conclusions, evaluating measurement errors.
Content: Static electrical field - Insulator - Conducting objects and capacitor - Magnetic field - Electromagnetic induction - Magnetic material - Electromagnetic oscillations and waves - Electromagnetic field.

MI2036 Probability

Objectives: Provide students with the knowledge of probability such as concepts and rules of deductive probability as well as random variables and joint probability distributions (one and two dimensions); The basic concepts of mathematical statistics in order to help students handle statistical problems in estimating models, verification of linearity and linear regression. On that basis, students can approach actual models to gather needed knowledge for solving those problems.
Content: Random event and probability calculation, random quantities, probability distribution, random vector, statistical estimation theory, statistical decision theory.

EE1024E Introduction to Electrical Engineering

Objectives: Help new students get acquainted with Electrical Engineering, Automation and Control Engineering to further understand the industrial characteristics, knowledge and skills requirements for the engineer. At the same time helping students gain the passion and confidence in learning and career path; Facilitate students to take the first step in solving practical problems, practice at least minimum required skills as well as teamwork skills, writing reports and presentations skills.

Content: Teaching class or discussing subject: career introduction, introduction of training programs, skills in writing reports, presentations, teamwork, introduction to industrial projects. Divide students into groups of 3 to implement a simple automatic device at home or practical workshops under the guidance of instructors (according to the registration plan of each group). Require students to write a report and present it before the class.

EE2001E Signals and Systems

Objectives: Upon completing the course, students will be able to understand mathematical techniques and their use in modeling the behavior of both continuous-time and discrete-time systems. It also develops the student's ability to apply system concepts and transform techniques in formulating and solving engineering problems. Besides, the course builds up the students' skills such as programming, presentation, team work and technical English skills.

Content: The course provides basic knowledge of continuous-time (CT) signal and system modeling, analysis of CT linear-time invariant systems and CT signal processing: convolution intergral, CT Fourier series, CT Fourier transform, Laplace transform. Basic concepts and techniques associated with discrete-time signals and systems are also convered in this course including convolution sum and Z transform. The knowledge gained in this course will be a foundation for other courses in Control Engineering and Automation curriculum.

EE2110E Electronics design

Objectives:
Content:

EE3030E Fundamentals of Electromagnetic Field Theory

Objectives: After completing this course, students have knowledge on the concept of electrostatics, magnetostatics, time-varrying electromagnetic fields, and know how to use some basic methods to solve problems of electromagnetics

Content: This course consists of 5 chapters: chapter 1 - concept of electromagnetic field theory; chapter 2 - electrostatics; chapter 3 - steady electric currents; chapter 4 - magnetostatics; chapter 5 - time-varrying electromagnetics

EE3490E Programming techniques

Objectives: The objective of the proposed course would provide:
• Build and contruct the software on the basic of elementary modules using C/C++ programming languages
• Data structure in embedded system
• Design patterns in embedded system
• Concepts of real time operating system
• Debugin and Testing of embedded system

Content: The aim of this subject is to teach a student some fundamental's Techniques, that can be used in design and development of embedded software. The major deplyoment platform would be used in Automation field such as in Microcontroller and its application, Design of power electronics controllers, PLC, Data acquisition, using C/C++ programming

languages. There will be the introduction of basic system including software design pattern, time trigger events, and object oriented system. The completed course will provide to a student the capability to develop firmware for basic microcontrollers such as dsPICs, STM32s and Linux based Raspberry PI board.

EE3706 Linear Circuit I

Objectives: The objective of this course is to introduce the basics of AC/DC and transient analysis. This course builds on the foundations of physics and mathematics and is essential for all upper division EE courses. The expected outcomes are the ability of students to determine all voltages and currents for a given DC circuit, Thevenim and Norton equivalent circuit of a given DC circuit, the transient characteristics of a given first and second order circuit, sinusoidal steady state response of a reactive circuit, the voltage gain and voltage and current values in a simple op amp circuit, power delivered and absorbed by all elements in an RLC circuit.

Content: Circuit laws and nomenclature, resistive circuits with DC sources, ideal operational amplifier, controlled sources, natural and complete response of simple circuits, steady-state sinusoidal analysis and power calculations.

EE2130E Digital system design

Objectives: Students will understand the representation of logical values in digital and analogue circuits; the technology of fabrication of digital/analogue circuits; The students will be able to identify and analyze the functions and fundamental principles of digital systems, to design basic digital systems.

Content: Logical value representation; basic logic ciruits; combinatory logic circuits; semiconductor memory, ADC and DAC circuits; programmable Logic circuit;

EE3726 Linear Circuit II

Objectives: The course provides the underlying principles of modern electric circuit analysis. Fundamental network circuit concepts are covered which include operational amplifiers, transients circuits, Laplace transform, convolution, frequency responses and Bode diagrams, two-port circuits, and mutual inductance circuits

Content: Laplace Transform and its applications to electrical circuits - Transients, passive and active circuits - Frequency response, forced response, stability and Bode plots - Two-port network analysis and transformer circuits.

EE3110E Measurement and Instrumentation Principles

Objectives: To provide students with basic knowledge of measurement techniques (error, the measurement range of measurement technology, processing measurement results, operation principles of equipment, constituent elements). Help students understand how to use measuring devices in production systems as well as independent working devices in laboratories. The module also provides students with the knowledge to access other modules such as process control, measurement ad industrial control.

Content: Content of modules divided into three parts: Part 1: The fundamental theory of measurement techniques: the basic concept of measuring accuracy, measurement, measuring

device and measurement process (estimate the uncertainty, the operated evaluation a measuring device). Part 2: Methods of measuring the electrical quantity, including the basic stages of measuring device (structural indicator, converter /transducer, comparator, communication), the universal electric quantities: current, voltage, charge current, resistance, inductance, capacitance, frequency, phase angle, power and electric power. Part 3: The methods and equipment for nonelectric quantity. Sensor's concept and devices in industry: measuring temperature, measuring force, pressure, weight, flow, engine speed.

EE3140E Electric machines I

Objectives: Provide students with basic knowledge of electrical machines. After completing this module, students must understand the structure and working principles of electrical machines, mathematical models of the physical processes in electrical machines and the main characteristics of electrical machines.
Content: Research on: transformers, asynchronous electrical machines, synchronous electrical machines, DC motors. The content includes the structure and working principle of electrical machines, mathematical and simplified models describing the process of energy transformation, methods to determine the main parameters and characteristics of electrical machines.

EE3288E Linear Control System

Objectives: This course provides basic knowledge of linear control system. Student has ability to analyze systems, design controllers and install them on analog or digital devices.
Content: Build systems using differential equation, transfer function and state space model, concepts of principle components of control system such as sensor, actuator; frequency domain, stability and stability criteria, overshoot and settling time, steady state error, phase and gain margins, controllability and observability, PID controller and PID tuning methods (classical and advanced methods), design methods for state feedback controller and Luenberger observer, PID controllers based on OP amps, microprocessors and PLC.

EE3480 Microprocessor

Objectives:
Content:

EE3810E Project I

Objectives: : Create a student can study and work in teams of industry content control and automation towards implementing transportation projects using knowledge of electronic analog, digital electronic, micro process, which technical and engineering control designed to automatically build product-specific guidance, advice of the instructors.
Content: Requires a simulation products / food at the request of instructors.

EE3410E Power Electronics

Objectives: Provide students with a basic understanding of the process of converting electrical energy using power semiconductor converters as well as the typical application areas of power transformations. Learners will have a firm understanding of the

characteristics of high-power semiconductor elements, AC - DC, AC - AC, DC - DC, DC - AC and frequency converters. The course requires learners to use some simulation software such as MATLAB, PLEC, ... to study the working modes of converters. After this subject, learners are able to calculate and design semiconductor converters in simple applications.

Content: Characteristics of semiconductor elements: diodes, tiristo, GTO, BJT, MOSFET, IGBT. Rectifier and inverter. Voltage transformers: AC, DC, DC converter. Independent inverter: current and voltage source rectifiers. Concepts of frequency inverters: low-frequency inverter has DC intermediary, direct inverter. Current inverter, sinusoidal output, high frequency for induction heating processes. Method of constructing pulse control system for converters.

EE3423E Power supply systems

Objectives: The course provide fundamental theory about power generation, transmision and distribution, as well as the structures and working principles of medium and low voltage network components. Students are capable of calculating, designing, planning and operating power distribution system to meet the load demand.

Content: General knowledge about power systems including economical and technical-related problems of generation, transmission and distribution systems. Medium and low voltage power network, single line diagram, measurement, control and protection circuit, device sizing, electric safety analysis, grounding and lightning protection, power quality, lighting design.

EE3821E Project II

Objectives: Create a student can study and work in teams of industry content control and automation projects towards implementation manipulate the knowledge of power electronics, kxy arts programming, electric power supply system and connected electrical measurement techniques applied and engineering controls designed to automatically build a product-specific guidance, advice of the instructors.

Content: Requires a simulation product at the request of instructors.

EE3600E Industrial Instrumentation and Control System

Objectives: The course helps students understand the structure of industrial control and measuring systems (HTC). Mastering the knowledge of industrial communication as well as the operation of some typical HTC.

Content: The course provides students with general knowledge about Industrial measurement and control system; main components of the system; facility of industrial communication; industrial protocols and some typical industrial control and measurement systems. The module helps students understand the structure of the industrial control and measurement system, so that they can easily access and master industrial measurement and control systems after graduation. In addition, students can also participate in the design and operation of industrial control and measurement systems in practice.

After completing this module, students have the ability to:

• Analyse solutions of industrial communication, choosing transmission mode, transmission mode for specific industrial solutions

• *Analyze and select equipment for the system*
• *Understand the structure of industrial measuring and control systems*
• *Understand industry protocols*
• *Understand the principles of operation organization, technical design for industrial measuring and control systems*
In addition, the course also provides students with teamwork skills and an honest attitude to work in industry later.

EE3510E Electric drives

Objectives: - Analyze and select suitable electrical drives for common applications.
- Design controllers for advanced electrical drives
- Integrate a complete electrical drive system
Content: Introduce a general information of electro-mechanical energy conversion in Converter-Electrical motor systems. Provide knowledge on generating torque, static characteristics, torque and speed control in different operating modes according to load requirements.

EE3550E Process Control

Objectives: Students have basic knowledge of process control principles, structure and property of process control system components, are able to apply mathematics, physics and automatic control theory to make production process model, simulate, analyse process control system, build control strategy and design, tuning controllers for processes in the processing, mining, and energy industries.
Content: The basis of analysis and design of process control systems. Set up process control problem: Determine control objectives and process variables; Describe components and functions of the process control system; Construct production process model: theoretical and empirical methods; Design the control structure and select the control strategy; Analyse and evaluate the process control system quality; Design and adjust PID controllers; For examples, application to level, flow rate, pressure, concentration/ composition control in typical processes: liquid-storage system, heat exchanger, reactor, evaporator, boiler etc.,

EE4221E Logic Control and PLC

Objectives: Equipping the student knowledge about the most common control logic of the production process, including process flow diagram, states supervision, system safety assuarance using the PLC (Programmable Logic Controler). Students learn the analyzing methos, logic control system design, harware, industrial communication network, programming with PLC
Content: The function of Logic control and PLC in process control; Control programming language namely LD, STL, FB, SFC complied with IEC611313. This is the systemacticaly approach to design the automated system using PLC.

EE4401E Design of embedded control systems

Objectives: This course provides student the knowleadge and skill as follow:
+ General understanding about embedded system and embedded control system.

+ *Hardware structure of embedded control systems.*
+ *Design reliable embedded system hardware for industrial environment.*
+ *Microcontroller and peripheral in embedded control system.*
+ *Use finite states machine to describe operation behaviour of embedded control system.*
+ *Embedded software structure using finite state machine*
+ *Software structure of embedded control system.*
Content: After finishing the course, students should have following knowleadge and skills:

EE4435E Digital Control System

Objectives: After finishing the course, students are able to meet the requirements in the ability to analyze and design a digital control system, the team work ability.
Content: This course gives students an overview of digital control systems. Students understand what a digital control system is, the structure and components of the system, how to analyze and design a digital control system. The subject is mainly analyzed in the frequency domain. The time domain is presented briefly and will be studied in depth at higher levels. In addition, the course also provides students with the ability to analyze and build an experimental numerical control system appropriate to the student's level and content of the subject.

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EE6312E Analysis and control of nonlinear systems

Objectives: After this master course, students have the skill establising model of arbitrary systems and appropriate trajectory tracking control systems, motion-force control of several practical systems such as robot manipulators,...
Content: This course provides basic knowledge on nonlinear control technique for advanced systems, such as robot manipulators, wheeled mobile robotic systems, unmanned aerial vehicles,...

EE6543E Sensor and Conditioning

Objectives: This course provides students with fundamental knowledges on some common active and passive sensors and on several methods signal conditioning.
Content: The course includes 5 chapters. Chapter 1: Overview of sensors. Chapter 2: Principle, structure, measuring circuit and application analysis of some common types of sensors. Chapter 3: S ignal Conditioning. Chapter 4: Smart sensor. Chapter 5: Micro sensor.e provides basic description

EE6503E Digital Signal Processing

Objectives: This course provides students with fundamental knowledges on signal processing, including the notions of digital signals and digital systems, sampling theorem, convolution, impulse response, z-transform, Fourier transform. Students can also acquire basic knowledges of digital filters (classification, structures, characteristics). The course also provides students with knowledges to study concerning courses, such as Digital Filters.
Content: This course includes six chapters: Chapter 1 - Introduction; Chapter 2 - Digital signal representation in continous frequency domain; Chapter 3 - Digital systems; Chapter 4

- Digital signal and system representation in z-domain; Chapter 5 - Digital signal representation in discrete frequency domain; Chapter 6 - Introduction to digital filters.

EE6551E Advanced power electronics

Objectives: The course equips students with the ability to research, develop, and apply power electronic converters with advanced features such as high power density DC-DC converters (high frequency resonant dc-dc converter, DC-DC interleave, Dual active bridge DAB converter, ...), multi-level DC-AC converters, matrix inverters. In addition, students are also equipped with advanced control knowledge for power electronic control systems such as: Nonlinear control, Model predictive control, Neural network.
Content: The course content consists of two parts:
I. High power DC-DC converter, high power density,modelling, control, and applications:
- DC-DC interleaved converters,
- Dual active bridge DAB,
II. High-power, high-efficiency DC-AC converters, high voltage, modelling, controlling, and applications:
- Multilevel converter: Topologies, PWM, SVM modulation method,
- Matrix converter: Topologies, PWM, SVM modulation method.

EE6010E Seminar I

Objectives: Students undertake research issues that complement the research direction and research plan of the master thesis.
Content: Students follow the content of the instructor according to the chosen research direction. Students in addition to the content of the review must report to the committee on research directions and plans during their master's degree

EE6020E Seminar II

Objectives: Students undertake research issues that are complementary to the research direction.
Content: Students follow the content of the instructor according to the chosen research direction.

EE6532E Optimization and optimal control

Objectives: This course provides students all fundamental and essentially advanced knowledge related to applying unconstrained/constrained optimization approaches in control engineering, including model parameter identification, determining optimality the parameters for controllers, design methods of optimal states observers as well as synthesizing a disturbances compensation controller.
Content: This course will provide students also the ability for solving fundamentally optimal control problems according to some fixed and

EE6022E Advanced process control

Objectives: This course provides advanced knowledge on designing mutivariable process control systems. After completing this course, student has ability to:

+ Understand the basics of multivariable control system, analyze and design control systems for multivariable processes based on decentralized-, decoupling-, multivariable PID-, state-feedback- and output-feedback control structures and the MPC method.

+ Understand how to pose a problem and methodologies to solve the plant-wide process control problem.

Content: Analysis of multivariable process control systems. Multivariable process control structures: Decentralized control, decoupling control, multivariable control, multivariable PID structures, state feedback and output feedback. Predictive control: DMC and GPC, transfer function and state-space models. Set point optimization. Sequencial control and interlock. Plant-wide process control

EE6445E Fuzzy control and neural networks

Objectives: Provide advanced control methods using fuzzy systems and neural networks. Student is able to apply these advanced controller for robots and industrial processes.

Content: Fuzzy models: Mamdani, Sugeno and Takagi-Sugeno-Kang, Fuzzy PID control, fuzzy sliding mode control, fuzzy adaptive control; neural networks, dynamic backpropagation, network training methods, system identification using networks, network reference model control, network predictive control, network adaptive control.

EE6446E Smart Sensor Systems

Objectives: Provide students with the structure and model of smart sensors and their applications in smart measuring devices. Students know how to analyze and implement algorithms according to intelligent functions in sensors, measuring devices and systems. One of the important points of this course is to provide an analysis and design of a smart sensor, a measuring system, a way to select key elements and a communication in the system. Students will also learn some examples of typical smart sensors and measuring systems.

Content: The course provides students with some knowledge about sensor structures, devices and intelligent systems. Basic smart algorithms in sensors and smart measuring devices. Smart systems: structure, standards for communication, functions in the system. The method of designing an intelligent sensor chip. Communication and communication techniques in intelligent sensor networks. Examples of intelligent sensor systems in health, the environment, industry and smart buildings

EE6426E Advanced power electronic control in renewable energy sources

Objectives: The course "Renewable energy control systems" equips students with the knowledge about principle diagrams, specific control structure for power electronic converter in grid-conneted renewable energy systems. The course equips students with the requirements for gird-connected renewable system to ensure the quality of power system. Knowledge of modeling and simulation is also provided for students to develop operating scenarios for grid-conneted renewable system.

Content: Power electronic converters for renewable energy systems.

Power electronic control in Renewable energy systems: Independent or grid mode.

Power Quality problems in Grid-Connected renewable energy Systems

Shunt converter operation mode