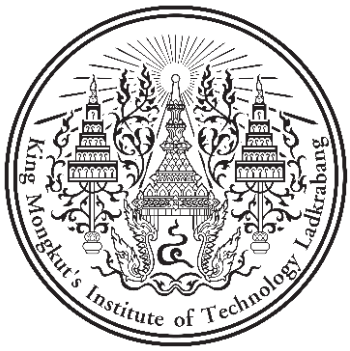

Doctor of Philosophy Program

In Advanced Manufacturing Systems Engineering

(International Program)

(2016 Revised Curriculum)

College of Advanced Manufacturing Innovation

King Mongkut's Institute of Technology Ladkrabang

Doctor of Philosophy Program

In Advanced Manufacturing Systems Engineering (International Program)

2016 Revised Program

The Institution Name King Mongkut's Institute of Technology Ladkrabang

Faculty / Campus / College College of Advanced Manufacturing Innovation

Part 1 General Information

1.Program Title **:** Doctor of Philosophy Program in Advanced Manufacturing System Engineering (International Program)

2. Degree and Field Title

Full title : Doctor of Philosophy (Advanced Manufacturing System Engineering)

Abbreviation : Ph.D (Advanced Manufacturing System Engineering)

3. Major or Minor Subjects (If any)

Advanced Manufacturing Systems Engineering Program aims to equip graduates with the knowledge of industrial systems and ability to design innovations in the industrial manufacturing.

4. Total Credits

Plan 1.1 For doctoral students who graduated with a master's degree, the total credits are not less than 48 credits

Plan 2.1 For doctoral students who graduated with a master's degree, the total credits are not less than 48 credits

Plan 2.2 For doctoral students who graduated with a bachelor's degree, the total credits are not less than 72 credits

5. Type of the Program

5.1. Type

☑ 3-year Doctoral Degree Program, Plan 1.1 and Plan 2.1

☑ 4-year Doctoral Degree Program, Plan 2.2

5.2 Language

☐ Thai with the English documents and textbooks in some courses.

☐ Foreign language (specify the language).....English.....

☑ Thai and foreign language (specify the language).....English.....

5.3 Admission

☐ Only Thai students

☐ Only international students

☑ Both Thai and foreign students

5.4. Collaborations with Other Institutes

☑ Program issued specifically by KMITL.

☐ Cooperation with other institutions

⇨ Institution name.....

⇨ The form of cooperation.....

☐ Joint Course with Other Institutions

⇨ Institution name.....Country.....

⇨ The form of joining

☐ Cooperate by the institute gives the degree.

☐ Cooperate by the other institutes give the degree.

☐ Cooperate by the student may receive a degree from two institutes (or more than 2 institutes).

5.5 Degree Conferment

☑ One degree from KMITL

☐ Giving the degree more than one field (For example Dual degree)

☐ Other (specify) .....

6. Status of the Program and Consideration for the Authorization/Agreement

☑ Revised Program Course begins on .....August..... .....2016.....

The program has been deliberated and endorsed by the Academic Committee of KMITL in its meeting No. .....2...../ .....2016.....

on .....23.....February.....2016.....

The program has been approved by the Academic Committee of KMITL in its meeting No. ...../ .....

on ....

7. Expected Date for Thai Qualifications Register (TGR)

Academic Year 2017

8. Career Paths

1) Manufacturing systems engineer or manufacturing systems manager
2) Project engineer or manufacturing systems consulting engineer
3) Government officer or engineer in the government sector who is responsible for manufacuring systems
4) Entrepreneur working in an industry

9. Instructor Details

Name-Surname (Academic Position)	Qualification (Field of Study), Year of Graduation	Identification Number
1. Assoc. Prof. Dr. Siridech Boonsang (Electronics engineering)	- B.Eng. (Electrical Engineering) King Mongkut's Institute of Technology Ladkrabang, 1994 - M.Sc. (Electrical Engineering) University of Manchester Institute of Science and Technology (UMIST), UK., 2001 - Ph.D. (Instrumentation), University of Manchester Institute of Science and Technology (UMIST), UK., 2004	3-1506-00041-41-1
2. Dr. Santhad Chuwongin	- B.Eng. (Telecommunications Engineering) King Mongkut's Institute of Technology Ladkrabang - M.sc. (Master of Science in EE) The University of Texas at Arlington - Doctor of Philosophy in EE The University of Texas at Arlington	3-7706-00728-13-5
3. Dr. Kamol Wasapinyokul	- B.Eng. (Mechanical Engineering) Chulalongkorn University - M.sc. (Optics and Photonics) Imperial College London - Ph.D. (Electrical Engineering) University of Cambridge	3-3414-00189-27-8

10. Location of Study

☑ College of Data Storage Innovation, King Mongkut's Institute of Technology Ladkrabang

11. External Situations of Development Needed to be Considered for the Planning of the Program

11.1 Economic Situation/Development

The future industrial development must driven to cover all fields of industrial systems especially in the manufacturing section, and be associated with the collective industrial manufacturing systems. Thus, the future industry will maintain the qualifying standards, including its potential and capability. Furthermore, the future industrial development must be merged with the Creative Industry—knowledge and innovation—to increase the effectiveness of industrial manufacturing system, especially of advanced manufacturing systems that relies on cutting-edge technology including information technology and robotic systems. Therefore, the industrial sector demands for graduates who specialize in advanced manufacturing systems mentioned above in order to increase the value and worth of products.

11.2 Social and Cultural Situation/Development

Currently, the manufacturing systems aim to apply advanced manufacturing technology, including artificial intelligence, robotic technology, automatic manufacturing technology, and so forth because these technologies play a significant role in developing innovations which help create sustainable society, and improve citizens' quality of life. Therefore, human resources in engineering are needed to be developed as it can be the standard for enhancing society and culture.

12. Effects from 11.1 and 11.2 on the Development of the Program and the Relation to the Mission of the Institute

12.1 Program Development

the Doctor of Philosophy Program in Advanced Manufacturing System Engineering aims to equip students with necessary qualifications in industrial systems and other related fields, and be able to conduct instructions in the disruption era. The program also aims to provide education to develop their quality of lives as education is the major key to support the country's potential for competition.

Likewise, education can enhance the quality of the society and culture by arousing moral conscience, social value and positive attitude as well as sharing knowledge, Thai wisdom, and related technology.

12.2 Relation to the Missions of the Institute

The objectives of the Doctor of Philosophy Program in Advanced Manufacturing System Engineering are concerned with the missions of King Mongkut's Institute of Technology Ladkrabang: learning and teaching, research, academic services, preservation of traditional art and culture.

13. Relation (if any) with Other Programs Open in the Faculty / Other Departments of the Institute (i.e. Subjects open for the Service of the Faculties / Departments or to be Studied with Other Faculties / Departments)

13.1. Subjects / Subject Groups in the Program Opened by the Other Faculties / Departments / Programs

☐ Compulsory Courses
☐ Electives
☐ Thesis/research
☑ None

13.2. Subjects / Subject Groups in the Program Open and Required to be Studied by Other Faculties / Departments / Programs

☐ Compulsory Courses
☐ Electives
☐ Thesis/research
☑ None

13.3 Management of the Cooperation

☑ None

Curriculum and Instructors

Curriculum, specify the details as follows

Total Credit Points

☑ Plan 1.1 (For students who graduated with a master's degree) 48 Credits

☑ Plan 2.1 (For students who graduated with a master's degree) 48 Credits

☑ Plan 2.2 (For students who graduated wiht a bachelor's degree) 72 Credits

Curriculum Structure

Plan 1.1. (For students who graduated with a master's degree) This curriculum emphasizes research conducted with a thesis for broadening knowledge, or may require students to take non-credit courses or academic activities.

Plan 1.1	**48**	**Credits**
A. Thesis	48	Credits
B. Seminar*	1	Credits **Non-credit course**
C. Research*	3	Credits **Non-credit course**
D. Qualifying Exam	0	Credits

Plan 2.1 (For students who graduated with a master's degree) This curriculum emphasizes research conducted with a thesis which maintains high quality and leads to advancement in academic matters and profession, and may require students to take coursework.

Plan 2.1	**48**	**Credits**
A. Thesis	36	Credits
B. Seminar*	1	Credits **Non-credit course**
C. Research*	3	Credits **Non-credit course**
D. Foundation Courses in Advanced Manufacturing Systems Engineering	6	Credits
E. Qualifying Exam	0	Credits
F. Electives	6	Credits

Plan 2.2 (For students who graduated with a bachelor's degree) This curriculum emphasizes research conducted with a thesis which maintains high quality and leads to advancement in academic matters and profession, and may require students to take coursework.

Plan 2.2	**72**	**Credits**
A. Thesis	48	Credits
B. Seminar*	1	Credits **Non-credit courses**
C. Research*	3	Credits **Non-credit courses**
D. Foundation Courses in Advanced Manufacturing Systems Engineering	9	Credits
E. Qualifying Exam	0	Credits
F. Electives	15	Credits

Subject in the Curriculum

Plan 1.1

A. Thesis **48 Credits**

		Credits (Lecture-Practice-Self-study)
12018401	THESIS	48 (0-12-6)

B. Seminar **1 Credits **Non-credit course****

		Credits (Lecture-Practice-Self-study)
12018001	SEMINAR	1 (0-3-2)

C. Research **3 Credits **Non-credit course****

		Credits (Lecture-Practice-Self-study)
12018602	RESEARCH MEDTHODOLOGY FOR MANUFACTURING PROCESS	3 (3–0–6)

D. Qualifying Exam **0 Credits**

Students are required to take the qualifying exam, and meet the criteria under the regulations of King Mongkut's Institute of Technology Ladkrabang Act on Graduate Study B.E. 2553 and the Proclamation of King Mongkut's Institute of Technology Ladkrabang on Graduate English Language proficiency standards.

Plan 2.1

A. Thesis		**36**	**Credits**
		Credits (Lecture-Practice-Self-study)	
12018501	THESIS	36 (0-18-9)	

B. Seminar		**1**	**Credits *Non-credit courses****
		Credits (Lecture-Practice-Self-study)	
12018001	SEMINAR	1 (0-3-2)	

C. Research		**3**	**Credits *Non-credit courses****
		Credits (Lecture-Practice-Self-study)	
12018602	RESEARCH MEDTHODOLOGY FOR MANUFACTURING PROCESS	3 (3–0–6)	

D. Foundation Courses in Advanced Manufacturing Systems Engineering		**6**	**Credits (Take 2 Courses)**
		Credits (Lecture-Practice-Self-study)	
12018811	MATHEMATICAL MODELLING FOR MANUFACTURING INDUSTRY	3 (3-0-6)	
12018812	COMPUTER AIDED DESIGNS AND MANUFACTURING	3 (3-0-6)	
12018813	APPLIED AUTOMATION SYSTEMS FOR INDUSTRIAL PROCESS	3 (3-0-6)	
12018814	MATERIAL SCIENCE FOR MANUFACTURING INDUSTRY	3 (3-0-6)	
12018815	EMBEDDED SYSTEMS FOR LOGISTIC AND MANUFACTURING	3 (3-0-6)	
12018816	ANALYSIS FOR SIGNAL AND SYSTEMS FOR INDUSTRIAL APPLICATIONS	3 (3-0-6)	
12018817	STATISTICAL ANALYSIS FOR MANUFACTURING INDUSTRY	3 (3-0-6)	

12018818	DESIGN AND MANUFACTURING FOR MATERIAL FORMING PROCESSES	3 (3-0-6)
12018819	INDUSTRIAL ENERGY MANAGEMENT	3 (3-0-6)
12018820	ELECTROMAGNETIC COMPATIBILITY IN MANUFACTURING	3 (3-0-6)
12018821	SELECTED TOPICS IN ADVANCED MANUFACTURING SYSTEM 1	3 (3-0-6)
12018822	SELECTED TOPICS IN ADVANCED MANUFACTURING SYSTEM 2	3 (3-0-6)
12018823	SELECTED TOPICS IN ADVANCED MANUFACTURING SYSTEM 3	3 (3-0-6)

E. Qualifying Exam **0** **Credits**

Students are required to take the qualifying exam, and meet the criteria under the regulations of King Mongkut's Institute of Technology Ladkrabang Act on Graduate Study B.E. 2553 and the Proclamation of King Mongkut's Institute of Technology Ladkrabang on Graduate English Language proficiency standards.

F. Electives **6** **Credits**

Students can take the following elective courses:

1. Computer Simulation for Engineering
2. Advanced Engineering Materials
3. Automation System
4. Optics and Laser Engineering
5. Embedded System
6. Advanced Signal Processing for Data Storage
7. Statistical Productivity Improvement

1. Computer Simulation for Engineering Courses

		Credits (Lecture-Practice-Self-study)
12018121	APPLIED NUMERICAL ELECTROMAGNETICS IN ESD/EMI	3 (3-0-6)
12018122	HIGH-FREQUENCY ELECTRONICS	3 (3-0-6)
12018123	COMPUTER AIDED ENGINEERING	3 (3-0-6)
12018124	FINITE ELEMENT METHOD IN ENGINEERING	3 (3-0-6)
12018125	COMPUTATIONAL FLUID DYNAMICS (CFD)	3 (3-0-6)

2. Advanced Engineering Material Courses

		Credits (Lecture-Practice-Self-study)
12018221	ELECTRONIC MATERIALS	3 (3-0-6)
12018222	FERROELECTRIC MATERIALS AND APPLICATION	3 (3-0-6)
12018223	THIN FILM DEPOSITION PROCESSES AND TECHNOLOGIES	3 (3-0-6)
12018224	PHYSICAL AND CHEMICAL CHARACTERIZATIONS OF MATERIALS	3 (3-0-6)

3. Automation System Courses

		Credits (Lecture-Practice-Self-study)
12018302	MACHINE LEARNING	3 (3-0-6)
12018304	TECHNIQUES IN ARTIFICIAL INTELLIGENCE	3 (3-0-6)
12018321	IMAGE PROCESSING	3 (3-0-6)

12018322	MACHINE VISION	3 (3-0-6)
12018323	Pattern Recognition for Machine Vision	3 (3-0-6)
12018324	Introduction to Neural Networks	3 (3-0-6)
12018325	Genetic Neurobiology	3 (3-0-6)

4. Optics and Laser Engineering Courses

		Credits (Lecture-Practice-Self-study)
12018421	PHYSICS OF SEMICONDUCTOR DEVICES	3 (3-0-6)
12018422	OPTO-ELECTRONICS COMPONENTS AND DEVICES	3 (3-0-6)
12018423	ORGANIC AND PRINTED ELECTRONIC DEVICES	3 (3-0-6)
12018424	PRINCIPLE OF PHOTONICS AND OPTICAL ENGINEERING	3 (3-0-6)
12018425	LASERS	3 (3-0-6)
12018426	NANOPHOTONICS	3 (3-0-6)

5. Embedded System Courses

		Credits (Lecture-Practice-Self-study)
12018521	EMBEDDED SYSTEM DESIGN AND APPLICATION	3 (3-0-6)
12018522	MICROPROCESSOR AND INTERFACING FOR EMBEDDED SYSTEM	3 (3-0-6)

12018523	OPEN SOURCE OPERATING SYSTEM AND SOFTWARE DEVELOPMENT	3 (3-0-6)
12018524	SIGNAL AND IMAGE PROCESSING FOR EMBEDDED SYSTEM	3 (3-0-6)
12018525	ARTIFICIAL INTELLIGENCE AND BIG DATA ANALYTICSFOR INTERNET OF THINGS (IOT)	3 (3-0-6)

6. Advanced Signal Processing for Data Storage courses

		Credits (Lecture-Practice-Self-study)
12018621	FUNDAMENTAL OF HARD DISK DRIVE TECHNOLOGY	3 (3-0-6)
12018622	SIGNAL PROCESSING	3 (3-0-6)
12018623	SIGNAL PROCESSING IN DATA STORAGE	3 (3-0-6)
12018624	CODING THEORY	3 (3-0-6)
12018625	ADVANCED CODING THEORY AND APPLICATIONS	3 (3-0-6)

7. Statistical Productivity Improvement courses

		Credits (Lecture-Practice-Self-study)
12018721	STATISTICAL QUALITY CONTROL	3 (3-0-6)
12018722	DESIGN OF EXPERIMENTS IN PRODUCTION ENGINEERING	3 (3-0-6)
12018723	DATA MINING AND ANALYSIS TOOLS	3 (3-0-6)

Plan 2.2

A. Thesis		**48**	**Credits**
		Credits (Lecture-Practice-Self-study)	
12018401	THESIS		48 (0-12-6)
B. Seminar		**1**	**Credits *Non-credit courses***
		Credits (Lecture-Practice-Self-study)	
12018001	SEMINAR		1 (0-3-2)
C. Research		**3**	**Credits *Non-credit courses***
		Credits (Lecture-Practice-Self-study)	
12018602	RESEARCH MEDTHODOLOGY FOR MANUFACTURING PROCESS		3 (3–0–6)
D. Foundation Courses in Advanced Manufacturing Systems Engineering		**9**	**Credits (Take 3 Courses)**
		Credits (Lecture-Practice-Self-study)	
12018811	MATHEMATICAL MODELLING FOR MANUFACTURING INDUSTRY		3 (3-0-6)
12018812	COMPUTER AIDED DESIGNS AND MANUFACTURING		3 (3-0-6)
12018813	APPLIED AUTOMATION SYSTEMS FOR INDUSTRIAL PROCESS		3 (3-0-6)
12018814	MATERIAL SCIENCE FOR MANUFACTURING INDUSTRY		3 (3-0-6)
12018815	EMBEDDED SYSTEMS FOR LOGISTIC AND MANUFACTURING		3 (3-0-6)

12018816	ANALYSIS FOR SIGNAL AND SYSTEMS FOR INDUSTRIAL APPLICATIONS	3 (3-0-6)
12018817	STATISTICAL ANALYSIS FOR MANUFACTURING INDUSTRY	3 (3-0-6)
12018818	DESIGN AND MANUFACTURING FOR MATERIAL FORMING PROCESSES	3 (3-0-6)
12018819	INDUSTRIAL ENERGY MANAGEMENT	3 (3-0-6)
12018820	ELECTROMAGNETIC COMPATIBILITY IN MANUFACTURING	3 (3-0-6)
12018821	SELECTED TOPICS IN ADVANCED MANUFACTURING SYSTEM 1	3 (3-0-6)
12018822	SELECTED TOPICS IN ADVANCED MANUFACTURING SYSTEM 2	3 (3-0-6)
12018823	SELECTED TOPICS IN ADVANCED MANUFACTURING SYSTEM 3	3 (3-0-6)

E. Qualifying Exam **0** **Credits**

Students are required to take the qualifying exam, and meet the criteria under the regulations of King Mongkut's Institute of Technology Ladkrabang Act on Graduate Study B.E. 2553 and the Proclamation of King Mongkut's Institute of Technology Ladkrabang on Graduate English Language proficiency standards.

F. Electives **15** **Credits**

Students can take the following elective courses:

1. Computer Simulation for Engineering
2. Advanced Engineering Materials
3. Automation System
4. Optics and Laser Engineering
5. Embedded System
6. Advanced Signal Processing for Data Storage
7. Statistical Productivity Improvement

1. Computer Simulation for Engineering Courses

		Credits (Lecture-Practice-Self-study)
12018121	APPLIED NUMERICAL ELECTROMAGNETICS IN ESD/EMI	3 (3-0-6)
12018122	HIGH-FREQUENCY ELECTRONICS	3 (3-0-6)
12018123	COMPUTER AIDED ENGINEERING	3 (3-0-6)
12018124	FINITE ELEMENT METHOD IN ENGINEERING	3 (3-0-6)
12018125	COMPUTATIONAL FLUID DYNAMICS (CFD)	3 (3-0-6)

2. Advanced Engineering Material Courses

		Credits (Lecture-Practice-Self-study)
12018221	ELECTRONIC MATERIALS	3 (3-0-6)
12018222	FERROELECTRIC MATERIALS AND APPLICATION	3 (3-0-6)
12018223	THIN FILM DEPOSITION PROCESSES AND TECHNOLOGIES	3 (3-0-6)
12018224	PHYSICAL AND CHEMICAL CHARACTERIZATIONS OF MATERIALS	3 (3-0-6)

3. Automation System Courses

		Credits (Lecture-Practice-Self-study)
12018302	MACHINE LEARNING	3 (3-0-6)
12018304	TECHNIQUES IN ARTIFICIAL INTELLIGENCE	3 (3-0-6)
12018321	IMAGE PROCESSING	3 (3-0-6)
12018322	MACHINE VISION	3 (3-0-6)
12018323	Pattern Recognition for Machine Vision	3 (3-0-6)
12018324	Introduction to Neural Networks	3 (3-0-6)
12018325	Genetic Neurobiology	3 (3-0-6)

4. Optics and Laser Engineering Courses

		Credits (Lecture-Practice-Self-study)
12018421	PHYSICS OF SEMICONDUCTOR DEVICES	3 (3-0-6)
12018422	OPTO-ELECTRONICS COMPONENTS AND DEVICES	3 (3-0-6)
12018423	ORGANIC AND PRINTED ELECTRONIC DEVICES	3 (3-0-6)
12018424	PRINCIPLE OF PHOTONICS AND OPTICAL ENGINEERING	3 (3-0-6)
12018425	LASERS	3 (3-0-6)
12018426	NANOPHOTONICS	3 (3-0-6)

5. Embedded System Courses

		Credits (Lecture-Practice-Self-study)
12018521	EMBEDDED SYSTEM DESIGN AND APPLICATION	3 (3-0-6)
12018522	MICROPROCESSOR AND INTERFACING FOR EMBEDDED SYSTEM	3 (3-0-6)
12018523	OPEN SOURCE OPERATING SYSTEM AND SOFTWARE DEVELOPMENT	3 (3-0-6)
12018524	SIGNAL AND IMAGE PROCESSING FOR EMBEDDED SYSTEM	3 (3-0-6)
12018525	ARTIFICIAL INTELLIGENCE AND BIG DATA ANALYTICSFOR INTERNET OF THINGS (IOT)	3 (3-0-6)

6. Advanced Signal Processing for Data Storage courses

		Credits (Lecture-Practice-Self-study)
12018621	FUNDAMENTAL OF HARD DISK DRIVE TECHNOLOGY	3 (3-0-6)
12018622	SIGNAL PROCESSING	3 (3-0-6)
12018623	SIGNAL PROCESSING IN DATA STORAGE	3 (3-0-6)
12018624	CODING THEORY	3 (3-0-6)
12018625	ADVANCED CODING THEORY AND APPLICATIONS	3 (3-0-6)

7. Statistical Productivity Improvement courses

		Credits (Lecture-Practice-Self-study)
12018721	STATISTICAL QUALITY CONTROL	3 (3-0-6)
12018722	DESIGN OF EXPERIMENTS IN PRODUCTION ENGINEERING	3 (3-0-6)
12018723	DATA MINING AND ANALYSIS TOOLS	3 (3-0-6)

Study Plan

This study plan emphasizes reseach for advancement in profession, including

Plan 1.1 Students who graduated with a master's degree, and apply to a doctoral degree are required to enroll in the following courses:

1st Year, semester 1

Code	Title	Credits (Lecture-Practice-Self-study)
12018401	THESIS	6 (0-12-6)
12018401	RESEARCH MEDTHODOLOGY FOR MANUFACTURING PROCESS*	6 (0-12-6)
Total		**6**

Non-credit course

1st Year, semester 2

Code	Title	Credits (Lecture-Practice-Self-study)
12018401	THESIS	6 (0-12-6)
12018001	SEMINAR*	1 (0-3-2)
Total		**6**

Non-credit course

2nd Year, semester 1

Code	Title	Credits (Lecture-Practice-Self-study)
12018401	THESIS	9 (0-18-9)
Total		9

2nd Year, semester 2

Code	Title	Credits (Lecture-Practice-Self-study)
12018401	THESIS	9 (0-18-9)
Total		9

3rd Year, semester 1

Code	Title	Credits (Lecture-Practice-Self-study)
12018401	THESIS	9 (0-18-9)
Total		9

3rd Year, semester 2

Code	Title	Credits (Lecture-Practice-Self-study)
12018401	THESIS	9 (0-18-9)
Total		9
Total credits of the program		48

Plan 2.1 Students who graduated with a master's degree, and apply to a doctoral degree are required to enroll in the following courses:

1st Year, semester 1

Code	Title	Credits (Lecture-Practice-Self-study)
12018602	RESEARCH MEDTHODOLOGY FOR MANUFACTURING PROCESS*	3 (3–0–6)
120188XX	FUNDAMENTAL COURSES IN ADVANCED MANUFACTURING SYSTEM ENGINEERING	3 (3-0-6)
12018XXX	ELECTIVE COURSES	3 (3-0-6)
Total		**6**

Non-credit course

1st Year, semester 2

Code	Title	Credits (Lecture-Practice-Self-study)
12018001	SEMINAR*	1 (0-3-2)
120188XX	FUNDAMENTAL COURSES IN ADVANCED MANUFACTURING SYSTEM ENGINEERING	3 (3-0-6)
12018XXX	ELECTIVE COURSES	3 (3-0-6)
Total		**6**

Non-credit course

2nd Year, semester 1

Code	Title	Credits (Lecture-Practice-Self-study)
12018501	THESIS	9 (0-18-9)
Total		9

2nd Year, semester 2

Code	Title	Credits (Lecture-Practice-Self-study)
12018501	THESIS	9 (0-18-9)
Total		9

3rd Year, semester 1

Code	Title	Credits (Lecture-Practice-Self-study)
12018501	THESIS	9 (0-18-9)
Total		9

3rd Year, semester 2

Code	Title	Credits (Lecture-Practice-Self-study)
12018501	THESIS	9 (0-18-9)
Total		9
Total credits of the program		48

Plan 2.2 Students who graduated with a bachelor's degree, and apply to a doctoral degree are required to enroll in the following courses:

1st Year, semester 1

Code	Title	Credits (Lecture-Practice-Self-study)
12018602	RESEARCH MEDTHODOLOGY FOR MANUFACTURING PROCESS*	3 (3–0–6)
120188XX	FUNDAMENTAL COURSES IN ADVANCED MANUFACTURING SYSTEM ENGINEERING	3 (3-0-6)
120188XX	FUNDAMENTAL COURSES IN ADVANCED MANUFACTURING SYSTEM ENGINEERING	3 (3-0-6)
12018XXX	ELECTIVE COURSES	3 (3-0-6)
12018XXX	ELECTIVE COURSES	3 (3-0-6)
Total		**12**

Non-credit course

1st Year, semester 2

Code	Title	Credits (Lecture-Practice-Self-study)
120188XX	FUNDAMENTAL COURSES IN ADVANCED MANUFACTURING SYSTEM ENGINEERING	3 (3–0–6)
12018XXX	ELECTIVE COURSES	3 (3-0-6)
12018XXX	ELECTIVE COURSES	3 (3-0-6)
12018XXX	ELECTIVE COURSES	3 (3-0-6)

Code	Title	Credits (Lecture-Practice-Self-study)
12018001	SEMINAR	1 (0-3-2)
Total		**12**

Non-credit course

2nd Year, semester 1

Code	Title	Credits (Lecture-Practice-Self-study)
12018401	THESIS	6 (0-12-6)
Total		**6**

2nd Year, semester 2

Code	Title	Credits (Lecture-Practice-Self-study)
12018401	THESIS	6 (0-12-6)
Total		**6**

3rd Year, semester 1

Code	Title	Credits (Lecture-Practice-Self-study)
12018401	THESIS	9 (0-18-9)
Total		**9**

3rd Year, semester 2

Code	**Title**	**Credits (Lecture-Practice-Self-study)**
12018401	THESIS	9 (0-18-9)
Total		**9**

4th Year, semester 1

Code	Title	Credits (Lecture-Practice-Self-study)
12018401	THESIS	9 (0-18-9)
Total		**9**

4th Year, semester 2

Code	**Title**	**Credits (Lecture-Practice-Self-study)**
12018401	THESIS	9 (0-18-9)
Total		**9**
Total credits of the program		**72**

3.1.5 Course descriptions

See Appendix E

3.2 Name, National Identification Card Number, Academic Position, and Qualifications of Faculty Instructors

3.2.1 Faculty Instructors

Name - Surname	Qualification / Field of Study / Institution / Year of Graduation	Academic Portfolio
1. Assoc. Prof. Dr. Siridech Boonsang 3-1506-00041-41-1 (Electronics Engineering)	- B.Eng. (Electrical engineering) King Mongkut's Institue of Technology Ladkrabang, 1994 - M.Sc. (Electrical Engineering) University of Manchester Institute of Science and Technology (UMIST), UK., 2001 - Ph.D. (Instrumentation), University of Manchester Institute of Science and Technology (UMIST), UK., 2004	1.Research: Instrumentation Biomedical Photonics Optical Based Sensors and Applications Photoacoustic sensors and Applications Ultrasonic Techniques in Biomedical and Non Destructive Evaluation 2. Textbooks: N/A 3. Teaching: 9 hours / week
2. Dr. Santhad Chuwongin 3-1801-00256-58-2	- B.Eng. (Telecommunications Engineering) King Mongkut's Institute of Technology Ladkrabang - M.sc. (Master of Science in EE) The University of Texas at Arlington - Doctor of Philosophy in EE	1. Research: - Laser and Optics 2. Textbooks: N/A 3. Teaching: 9 hours / week

Name - Surname	Qualification / Field of Study / Institution / Year of Graduation	Academic Portfolio
	The University of Texas at Arlington	
3. Dr. Kamol Wasapinyokul 3-1009-01224-60-3	- B.Eng. (Mechanical Engineering) Chulalongkorn University - M.sc. (Optics and Photonics) Imperial College London - Ph.D. (Electrical Engineering) University of Cambridge	1. Research: - Optics and Photonics 2. Textbooks: N/A 3. Teaching: 9 hours / week

3.2.2 Full-time Instructors

Name – Surname Identification Card Number	Qualification / Field of Study / Institution / Year of Graduation	Academic Portfolio
1. Dr. Lertsak Lekawat 3-1014-00493-63-7	- B.Eng. (Electronics Engineering) King Mongkut's Institute of Technology Ladkrabang, 1987 - MS. (Electro - Physics), George Washington University, Washington, USA, 1989 - Ph.D. (Electrical and Computer	1. Research: - Statistical Productivity Improvement using Six-Sigma DMAIC approach and computer software for statistical data analysis 2. Textbooks: N/A 3. Teaching: Statistical quality control

Name – Surname Identification Card Number	Qualification / Field of Study / Institution / Year of Graduation	Academic Portfolio
	Engineering), Carnegie Mellon University, USA, 1993	
2. Assoc. prof. dr. Chanon Warisarn 3-3414-00189-27-8	- B.Eng. (Electronics Engineering) (First class honor) King Mongkut's University of Technology North Bangkok, 1987 - MS. (Electro - Physics), George Washington University, Washington, USA, 1989 - Ph.D. (Electrical and Computer Engineering), Carnegie Mellon University, USA, 1993	1. Research: 2D Modulation Code, 2D Detection, 2D Equalization 2. Textbooks: N/A 3. Teaching: Signal processing
3. Assoc. Prof. Dr. Jatuporn Thongsri 3-3204-00026-75-1 (Physics)	- B.Sc. (Physics) Khonkaen University, 2002 - M.Sc. (Physics) Chulalongkorn University, 2006 - D.Sc. (Physics) Chulalongkorn University, 2011	1. Research: - Finite Element Method, FEM - Computational Fluid Dynamics, CFD - Electrical Response of Dielectric 2. Textbooks: N/A 3. Teaching: Computer Aided designs and manufacturing

Name – Surname Identification Card Number	Qualification / Field of Study / Institution / Year of Graduation	Academic Portfolio
4. Dr. Worawut Makcharoen 3-7403-00472-09-7	- B.Sc. (Physics) Silpakorn University, 2002 - M.Sc. (Materials Science) Chiang Mai University, 2004 - Ph.D. (Materials Science) Chiang Mai University, 2011	1. Research: - Materials Science - Material testing - Ferroelectric materials - Resistive random-access memory - Thin film technology - Corrosion in materials - Energy Harvesting 2. Textbooks: N/A 3. Teaching: Materials science for manufacturing
5. Dr. Rachsak Sakdanuphab 3-7706-00728-13-5 (Physics)	- B.Sc. (Physics) (first class honor) Kasetsart University, 2002 - M.Sc. (Physics) Chulalongkorn University, 2005 - Ph.D. (Physics) Chulalongkorn University, 2011	1. Research: Thin films coating by PVD Hard coating materials 2. Textbooks: N/A 3. Teaching: Research Methodology for Manufacturing Process
6. Dr. Anakkapon Saenthon 3-6707-00083-77-3	- B.Eng. (Computer Engineering) Naresuan University, 2006 - M. Eng. (Electrical Engineering) Naresuan Universit, 2008	1. Research: - Image Processing - Automation System - Artificial Intelligent 2. Textbooks: N/A 3. Teaching:

Name – Surname Identification Card Number	Qualification / Field of Study / Institution / Year of Graduation	Academic Portfolio
	- D. Eng. (Electrical Engineering) King Mongkut's Institute of Technology Ladkrabang, 2011	Applied Automation systems for industrial process
7. Dr. Chatrpol Pakasiri 3-1024-00526-90-1	- B.Eng. (Electronics Engineering) King Mongkut's Institute of Technology Ladkrabang, 1996 - M.S. (Electrical Engineering) University of Houston, USA, 2001 - Ph.D. (Electrical Engineering) University of Houston, USA, 2005	1. Research: High frequency electronics Numerical electromagnetics Electronic Design Automation (EDA) applied on heat transfer, fluid dynamics, electromagnetic, RF and microwave sensor design 2. Textbooks: N/A 3. Teaching: 9 hours / week
8. Dr. Vilailuck Siriwongrungson 3-1015-00975-58-7	- B.Eng. (Chemical Engineering) Chulalongkorn University, 2001 - M.Sc. (Energy Conversion and Management) University of Applied Sciences Offenburg, Germany, 2004 - Ph.D. (Mechanical Eng.) University of Canterbury, New Zealand, 2010	1. Research: - Thin film deposition for waste water treatment, solar cell, biomedical and corrosion protection. - Corrosion and cleaning technologies for reader-writer heads. 2. Textbooks: N/A 3. Teaching: 9 hours / week

Name – Surname Identification Card Number	Qualification / Field of Study / Institution / Year of Graduation	Academic Portfolio
10. Dr. Santhad Chuwongin 3-1801-00256-58-2	- B.Eng. (Telecommunications engineering) King Mongkut's Institute of Technology Ladkrabang, 1995 - M.Sc. (Electrical Engineering) The University of Texas at Arlington - Ph.D. (Electrical Engineering) The University of Texas at Arlington	1. Research: - Laser and Optics 2. Textbooks: N/A 3. Teaching: 9 hours / week
11. Dr. Kamol Wasapinyokul 3-1009-01224-60-3	- B.Eng. (Mechanical Engineering) Chulalongkorn University, 2001 - M.sc. (Optics and Photonics) Imperial College London - Ph.D. (Electrical Engineering) University of Cambridge	1. Research: - Optics and Photonics 2. Textbooks: N/A 3. Teaching: 9 hours / week

3.2.3 Special Insturctor

Name – Surname	Qualification / Field of Study / Institution	Place of Instruction / Workplace
1. Asst. Prof. Dr.Piya Kovintavewat	- Ph.D. (Electrical Engineering) Georgia Institute of Technology, USA.	Nakhon Pathom Rajabhat University
2. Assoc. Prof. Dr. Songphol Kanjanachuchai	- Ph.D. Physics, Microelectronics) Cambridge University, UK.	Chulalongkorn University
3.Asst. Prof. Dr. Rardchawadee Silapunt	- Ph.D.(Electrical Engineering) University of Wisconsin-Madison, USA	King Mongkut's University of Technology Thonburi
4. Asst. Prof. Dr. Thavida Maneewarn	- Ph.D. (Electrical Engineering) University of Washington, Seattle USA	King Mongkut's University of Technology Thonburi
5. Mr. Rung Siwarat	- M. Eng. Chulalongkorn University	Seagate Technology (Thailand) Company Limited.
6. Mr. Sanchai Thongjantar	- M. Eng. (Industrial Engineering) University of new haven, CT, USA	Seagate Technology (Thailand) Company Limited.
7. Mr. Pricha Leelanukrom	- Master of Science (Electrical Engineering) Oregon State University	Western Digital (Thailand) Company Limited
8. Mr. Theerasak Sa-nguanmanasak	- M. Eng. (Hard Disk Drive Engineering) Khon Kaen University	Western Digital (Thailand) Company Limited

Course Descriptions

3.1.5 Course Descriptions

Plan 1.1 (For students who graduated with a master's degree)

A. Thesis 48 CP

		CP (Lecture-Practice-Self-study)
12018401	**THESIS**	**48 (0-12-6)**
	PREREQUISITE : NONE	

This course provides searching information technology to track and prepare initiative research and development on information and system engineering. Opportunities for a student to do research under the supervision of his/her advisor. The research should emphasize the originality and aim toward new and useful results in engineering sciences.

B. Seminar 1 CP *non-credit course*

		CP (Lecture-Practice-Self-study)
12018001	**SEMINAR**	**1 (0-3-2)**
	PREREQUISITE : NONE	

This is the required courses which must be taken consecutively by master and doctoral students. The purpose of the course is to develop the students' ability in reading, understanding and presenting the technical papers, the student must be assigned to have a presentation of research papers or his/her research under the supervision of advisor to an audience and committee in a seminar.

C. Research 3 CP *non-credit course*

		CP (Lecture-Practice-Self-study)
12018602	**RESEARCH METHODOLOGY FOR MANUFACTURING PROCESS**	**3 (3-0-6)**
	PREREQUISITE : NONE	

Principle of research methodology for manufacturing process including problem source literature survey, critical thinking, analysis and evaluation, preparation of research proposal, Research writing and presentation techniques.

Plan 2.1 (For students who graduated with a master's degree)

A. Thesis 48 CP

		CP (Lecture-Practice-Self-study)
12018501	**THESIS**	**36 (0-18-9)**

PREREQUISITE : NONE

This course provides searching information technology to track and prepare initiative research and development on information and system engineering. Opportunities for a student to do research under the supervision of his/her advisor. The research should emphasize the originality and aim toward new and useful results in engineering sciences.

B. Seminar 1 CP *non-credit course*

		CP (Lecture-Practice-Self-study)
12018001	**SEMINAR**	**1 (0-3-2)**

PREREQUISITE : NONE

This is the required courses which must be taken consecutively by master and doctoral students. The purpose of the course is to develop the students' ability in reading, understanding and presenting the technical papers, the student must be assigned to have a presentation of research papers or his/her research under the supervision of advisor to an audience and committee in a seminar.

C. Research 3 CP *non-credit course*

CP (Lecture-Practice-Self-study)

12018602 RESEARCH METHODOLOGY FOR MANUFACTURING PROCESS 3 (3-0-6)

PREREQUISITE : NONE

Principle of research methodology for manufacturing process including problem source literature survey, critical thinking, analysis and evaluation, preparation of research proposal, Research writing and presentation techniques.

D. Foundation courses in advanced manufacturing systems engineering 6 CP

Enroll in the following courses:

CP (Lecture-Practice-Self-study)

12018811 MATHEMATICAL MODELING OF PRODUCTION SYSTEMS ENGINEERING 3 (3-0-6)

PREREQUISITE : NONE

The course include overview of relevant topics of Probability Theory Serial lines, assembly systems, lines with re-work, re-entrant lines including mathematical models of machines, and mathematical models of material handling devices. Another purpose of this course is to discuss these standard models and indicate how a given production system can be reduced to one of them. The issue of parameter identification is also addressed. Performance measures in terms of throughput, work-in-process and finished goods inventory, blockages, starvations, product quality, customer demands satisfaction, and transient characteristics. Production Systems Engineering Toolbox and case studies of modeling.

12018812 **COMPUTER AIDED DESIGNS**

AND MANUFACTURING **3 (3-0-6)**

PREREQUISITE : NONE

This course focuses on the practical applications of computer software applied for solving actual problems in manufacturing processes such as the problems related to vibration, solid structure, fluid flow, multiphysics, optimization, thermal etc. The experience in the course can be applied to analyze the problem, design product, reduce cost and improve manufacturing process.

12018813 **APPLIED AUTOMATION SYSTEMS**

FOR INDUSTRIAL PROCESS **3 (3-0-6)**

PREREQUISITE : NONE

Applications of industrial automation systems, including identification of system requirements, equipment integration, motors, controllers, and sensors, Coverage of set-up, maintenance, and testing of the automated system. Industry 4.0 and engineering metrology.

12018814 **MATERIAL SCIENCE FOR**

MANUFACTURING INDUSTRY **3 (3-0-6)**

PREREQUISITE : NONE

The course consists of atomic structure, atomic bonding, crystal structures, defects, and diffusion in materials. It also will cover phase transformations and phase equilibrium. The electrical, magnetic, optical, thermal, and mechanical properties of materials will also be reviewed. The course is also modern fabrication technologies i.e. semiconductor devices and hard disk drive. Applications of metals, ceramics, semiconductors, and polymers are provided.

12018815 **EMBEDDED SYSTEMS**

FOR LOGISTIC AND MANUFACTURING **3 (3-0-6)**

PREREQUISITE : NONE

This subject describes embedded system development process for manufacturing and logistics with example systems. Position tracking system for logistics. Big data analytics for new services and industrial real-time embedded systems.

12018816 **ANALYSIS FOR SIGNAL AND SYSTEMS**

FOR INDUSTRIAL APPLICATIONS **3 (3-0-6)**

PREREQUISITE : NONE

This course includes the following topics: fundamental of signal and systems, signal & signal processing, structure of digital signal processors, hardware realizations, digital filters, FFT processors, advantages & disadvantages of digital signal processing, the continuous time signals and systems with their impulse responses, frequency responses and zero, sampling theory and signal reconstruction considered before the discrete-time signals and systems and their transformation techniques, DFT and FFT, IIR and FIR digital filters designs for industrial applications and their hardware point of views.

12018817 **STATISTICAL ANALYSIS FOR**

MANUFACTURING INDUSTRY **3 (3-0-6)**

PREREQUISITE : NONE

A basic course in probability and statistics designed to give the student a foundation for future study in area such as design of experiment, stochastic systems, and simulation.

12018818 **DESIGN AND MANUFACTURING**

FOR MATERIAL FORMING PROCESSES **3 (3-0-6)**

PREREQUISITE : NONE

Types and properties of metal and plastic manufactured by forming processes, types of forming processes, design and manufacturing of stamping dies, casting dies, injection mold, testing of tooling and manufactured products.

12018819 INDUSTRIAL ENERGY MANAGEMENT 3 (3-0-6)

PREREQUISITE : NONE

This course covers the overview of principles of energy management from the industrial perspectives such as building envelope, lighting and HVAC systems, the use of alternative energy in industry, waste heat recovery, energy system outsourcing as well as carbon emission and carbon footprint, and sustainability in manufacturing.

12018820 ELECTROMAGNETIC COMPATIBILITY IN MANUFACTURING 3 (3-0-6)

PREREQUISITE : NONE

Broad knowledge in electromagnetic compatibility (EMC). Basic idea of electronic equipment and their compliance with EMC. Study of electromagnetic effects on system performance. Signal spectra, transmission lines and signal integrity, nonlinear behavior of electronic components. Study of electrostatic discharge, radiated emission. Shielding.

12017821 SELECTED TOPICS IN ADVANCED MANUFACTURING SYSTEM 1 3 (3-0-6)

The course will cover topics of interest selected by the instructor in the field of advanced manufacturing system.

12017822 SELECTED TOPICS IN ADVANCED MANUFACTURING SYSTEM 2 3 (3-0-6)

The course will cover topics of interest selected by the instructor in the field of advanced manufacturing system and related with the selected topics in advanced manufacturing system 1.

12017823 SELECTED TOPICS IN ADVANCED MANUFACTURING SYSTEM 3 3 (3-0-6)

The course will cover topics of interest selected by the instructor in the field of advanced manufacturing system and related with the selected topics in advanced manufacturing system 2.

E. Elective courses 6 CP

Select the following course groups (skipping over some groups are allowed)

1. Computer Simulation for Engineering
2. Advanced Engineering Materials
3. Automation System
4. Optics and Laser Engineering
5. Embedded System
6. Advanced Signal Processing for Data Storage
7. Statistical Productivity Improvement

1. COMPUTER SIMULATION FOR ENGINEERING

CP (Lecture-Practice-Self-study)

12018121 APPLIED NUMERICAL ELECTROMAGNETICSIN ESD/EMI 3 (3-0-6)

PREREQUISITE : NONE

Introduction to numerical electromagnetics. Fundamentals of electromagnetics theory. Fundamental equations. Numerical electromagnetics in frequency domain. Geometrical discretization. Numerical electromagnetics in time domain. Application in ESD/EMI.

12018122 HIGH-FREQUENCY ELECTRONICS 3 (3-0-6)

PREREQUISITE : NONE

Introduction to electromagnetic theory. Transmission line theory. Microwave network analysis. Matching network and signal flow graphs. Microwave transistor amplifier design. Microwave power amplifiers. Microwave Oscillators.

12018123 **COMPUTER AIDED ENGINEERING** **3 (3-0-6)**

PREREQUISITE : NONE

The broad usage of computer software to aid in engineering analysis tasks. It includes Finite Element Analysis (FEA), Computational Fluid Dynamics (CFD), multiphysics, optimization, etc.

12018124 **FINITE ELEMENT METHOD IN ENGINEERING** **3 (3-0-6)**

PREREQUISITE : NONE

A numerical technique for finding approximate solutions to boundary value problems for partial differential equations. It uses subdivision of a whole problem domain into simpler parts, called finite elements, and variational methods from the calculus of variations to solve the problem by minimizing an associated error function. In this course, students will apply the FEM to solve several problems in engineering such as vibration, heat transfer, multiphysics, etc.

12018125 **COMPUTATIONAL FLUID DYNAMICS** **3 (3-0-6)**

PREREQUISITE : NONE

A branch of fluid mechanics that uses numerical methods and algorithms to solve and analyze fluid flow problems, for example, compressible, incompressible flow, steady, unsteady, laminar and turbulent flows, etc.

2. ADVANCED ENGINEERING MATERIALS

CP (Lecture-Practice-Self-study)

12018221 **ELECTRONIC MATERIALS** **3 (3-0-6)**

PREREQUISITE : NONE

Study on the fundamental principle of materials: fabrication, materials: properties and application of electronic materials: conductors, dielectrics and insulators. Study on the material properties: piezoelectric materials, pyroelectric materials, electro-optics, magnetic materials.

12018222 **FERROELECTRIC MATERIALS**

AND APPLICATION **3 (3-0-6)**

PREREQUISITE : NONE

Study on the characteristics of the ferroelectric materials with dielectric properties. Techniques to measure the physical properties of the ferroelectric materials. Structure of ferroelectric materials and applications of ferroelectric materials.

12018223 **THIN FILM DEPOSITION PROCESSES**

AND TECHNOLOGIES **3 (3-0-6)**

PREREQUISITE : NONE

The course includes the following topics: the principles of operation of deposition equipment and its suitability, performance, control, capabilities, and limitations for production applications, the basic understanding of these systems such as physical vapor deposition and chemical vapor deposition techniques.

12018224 **PHYSICAL AND CHEMICAL**

CHARACTERIZATIONS OF MATERIALS **3 (3-0-6)**

PREREQUISITE : NONE

This course provides the characterization techniques for measuring semiconductor materials and devices. Coverage includes the full range of electrical and optical characterization methods, including the more specialized chemical and physical techniques.

3. Automation System

CP (Lecture-Practice-Self-study)

12018302 **MACHINE LEARNING** **3 (3-0-6)**

PREREQUISITE : NONE

Students understand basic knowledge of essential learning algorithms. The course will cover topics of maximum likelihood and maximum a posteriori estimator, Hidden Markov Models, Viterbi algorithm, Expectation Maximization algorithm, nonlinear neural networks and back prop, recurrence: BPTT/RTRL/LSTM, Maximal Margin Classifier, Support Vector Machines, Q-learning, TD-learning, Hill-climbing and genetic algorithms, information theory basics and universal search.

12018304 TECHNIQUES IN ARTIFICIAL INTELLIGENCE 3 (3-0-6)

PREREQUISITE : NONE

The course gives an overview of application areas and techniques in Artificial Intelligence. The course covers the following topics: design principles and specification mechanisms for rational agents, problem solving using heuristic search techniques, optimizing search; problem solving using knowledge-based techniques: logic and inference techniques, reasoning about space and time, representation of ontologies; representation and reasoning in the common sense world, problem solving using uncertain knowledge and information: basic concepts of probability and decision theory; Bayesian Networks; planning with Markov decision problems, action planning: automatic generation of partially order education plans; planning and execution machine learning: learning decision trees; inductive learning; probably approximately correct learning.

12018321 IMAGE PROCESSING 3 (3-0-6)

PREREQUISITE : NONE

An introductory course on computer vision and machine vision. Topics covered include difference between computer and machine vision, image capture and processing, filtering, thresholds, edge detection, shape analysis, shape detection, pattern matching, stereo ranging, 3D models from images, real-time vision systems, recognition of targets, and applications including inspection.

12018322 MACHINE VISION 3 (3-0-6)

PREREQUISITE : NONE

Machine Vision provides an intensive introduction to the process of generating a symbolic description of an environment from an image. Lectures describe the physics of image formation, motion vision, and recovering shapes from shading. Binary image processing and filtering are presented as preprocessing steps. Further topics include photogrammetry, object representation alignment, and computational vision. Applications to robotics and intelligent machine interaction are discussed.

12018323 **PATTERN RECOGNITION**

FOR MACHINE VISION **3 (3-0-6)**

PREREQUISITE : NONE

The applications of pattern recognition techniques to problems of machine vision is the main focus for this course. Topics covered include, an overview of problems of machine vision and pattern classification, image formation and processing, feature extraction from images, biological object recognition, bayesian decision theory, and clustering.

12018324 **INTRODUCTION TO NEURAL NETWORKS** **3 (3-0-6)**

PREREQUISITE : NONE

This course explores the organization of synaptic connectivity as the basis of neural computation and learning. Perceptrons and dynamical theories of recurrent networks 123 including amplifiers, attractors, and hybrid computation are covered. Additional topics include back propagation and Hebbian learning, as well as models of perception, motor control, memory, and neural development.

12018325 **GENETIC NEUROBIOLOGY** **3 (3-0-6)**

PREREQUISITE : NONE

This course deals with the specific functions of neurons, the interactions of neurons in development, and the organization of neuronal ensembles to produce behavior. Topics covered include the analysis of mutations, and molecular analysis of the genes required for nervous system function. In particular, this course focuses on research work done with applying to find the optimization value.

4. OPTICS AND LASER ENGINEERING

CP (Lecture-Practice-Self-study)

12018421 PHYSICS OF SEMICONDUCTOR DEVICES 3 (3-0-6)

PREREQUISITE : NONE

Atomic structure of solid-state materials; Energy band theory; Energy band, charge carriers, and density of states in semiconductors; Homo- and hetero-junction devices: pn junction, Diode; Transistors (Bipolar junction transistors, Field-effect transistors); Electronic sensors; Thin-film technologies; MEMS; Device fabrication techniques.

12018422 OPTO-ELECTRONIC COMPONENTS AND DEVICES 3 (3-0-6)

PREREQUISITE : NONE

Energy band and charge carriers in semiconductors; Charge-excitation mechanisms (Photo- and electrical-excitation), Principles of optoelectronic components and devices: Light emitting devices and display technologies (e.g. LEDs, liquid-crystal display, plasma displays, E-papers, micro-optics) and light sensing devices (photo-diode, phototransistors, solar cells).

12018423 ORGANIC AND PRINTED ELECTRONIC DEVICES 3 (3-0-6)

PREREQUISITE :OPTO-ELECTRONIC COMPONENTS AND DEVICES

Semiconducting behaviours in organic materials; Energy levels in organic semiconductors; organic light emitting devices (OLED, organic light-emitting transistors); organic field-effect transistors (OFET); organic photovoltaic devices (organic solar cells); nano-structured material devices (carbon nanotubes and zinc-oxide nanowires); Devices fabrication techniques (vacuum and solution-processed deposition methods); introduction to plastic electronics.

12018424 **PRINCIPLES OF PHOTONICS**

AND OPTICAL ENGINEERING **3 (3-0-6)**

PREREQUISITE :NONE

The course introduces the basics of optical fields and their applications to lasers, optical fibers, and photonic signal processing, i.e., how light is used in modern systems for encoding, manipulating, transmitting, storing, and retrieving information. It covers light propagation in isotropic and birefringent optical media, behavior at dielectric interfaces, interference, optical cavities and principles of laser action, the basics of optical waveguides (including optical fiber), and electro- and acousto-optic modulation. Emphasis is given to the design and analysis of optical devices, and their applications in communications and signal processing.

12018425 **LASERS** **3 (3-0-6)**

PREREQUISITE : PRINCIPLES OF PHOTONICS AND OPTICAL ENGINEERING

Propagation of optical rays and waves, Gaussian laser beams, laser resonators; active nanoparticle in a microcavity, atomic systems, lasing and population inversion, laser amplifiers, practical continuous-wave and pulsed lasers, mode locking, Q-switching, and applications of lasers.

12018426 **NANOPHOTONICS** **3 (3-0-6)**

PREREQUISITE : PRINCIPLES OF PHOTONICS AND OPTICAL ENGINEERING

Introduction of nanophotonics, with focus on the basic material systems (quantum dots, nanoparticles, and photonic crystals) to devices applications (lasers, detectors, sensors) and to system integration (photonic integrated circuits and silicon photonics).

5. Embedded Automation System

12018521 EMBEDDED SYSTEM DESIGN

AND APPLICATION 3 (3-0-6)

PREREQUISITE : NONE

Overviews, meanings, descriptions and examples of embedded system, embedded system components, embedded system design methodology, problem analysis, design pattern, controller, sensor and actuator, data flow model, object oriented methodology, processing levels for embedded system, system integration and communication, framework and platform design, system design based on innovative thinking :robotics and automatic system for automotive.

12018522 MICROPROCESSOR AND INTERFACING

FOR EMBEDDED SYSTEM 3 (3-0-6)

PREREQUISITE : NONE

Microprocessor architecture, various types of bus system, input ports, output ports and other components; schematic design for controller, printed circuit board (pcb) design, controller program using assembly language and/or higher level languages; design of interfacing circuit for communication and controlling external circuits via serial port, usb, ethernet andother types of communication protocols. Communication among distributed systems; interfacing with external environments; energy conservation; safety and reliability; design principles; methodologies; design tools; case studies including plc, microcontroller and embedded linux platform.

12018523 OPEN SOURCE OPERATING SYSTEM

AND SOFTWARE DEVELOPMENT 3 (3-0-6)

PREREQUISITE : NONE

Open source operating system and application software are vital important in research and development and industrial cost reduction. Because, unix operating system: linux and embedded linux, framework, library and device driver programming, c, c++, java, python and graphic user interface (gui) programming.

12018524 **SIGNAL AND IMAGE PROCESSING FOR EMBEDDED SYSTEM** **3 (3-0-6)**

PREREQUISITE : NONE

Data and signal processing in embedded system, analog and digital signal processing, sensors applications, control signal for control system, image processing and development for embedded system : edge detection, corner detection, surface detection and object detection, motion detection, face detection on embedded system; analysis of algorithm's benefits and disadvantages.

12018525 **ARTIFICIAL INTELLIGENCE AND BIG DATA ANALYTICS FOR INTERNET OF THINGS (IOT)** **3 (3-0-6)**

PREREQUISITE : NONE

This subject provides engineering statistic and big data processing, yield prediction and multi-attribute analysis, problem identification, fuzzy logic, artificial neural network, genetic algorithm, agent based swarm algorithm and hybrid artificial intelligent to solve the research problem, optimization and extract knowledge or solution within the mass data records.

6. Advanced Signal Processing for Data Storage

12018621 **FUNDAMENTAL OF HARD DISK DRIVE TECHNOLOGY** **3 (3-0-6)**

PREREQUISITE : NONE

HDD components and system integration, recording subsystem, Mechanical System, Servo Control, HDD Controller and Interface (SATA, SAS, ATI).

12018622 **SIGNAL PROCESSING** **3(3-0-6)**

PREREQUISITE :NONE

This course includes the following topics: signal & signal processing, structure of digital signal processors, hardware realizations, digital filters, FFT processors, advantages &disadvantages of digital signal processing, the continuous-time signals and systems with their impulse responses, frequency responses and zero, sampling theory and signal

reconstruction considered before the discrete-time signals and systems and their transformation techniques, DFT and FFT, IIR and FIR digital filters designs and their hardware point of views.

12018623 SIGNAL PROCESSING IN DATA STORAGE 3 (3-0-6)

PREREQUISITE : NONE

Block Diagram of Read/Write Process, Write Signal (NRZ, NRZI), Transition, Types of Noise, Front-End Processing, Recording Channels (LMR, PMR), Partial Response (PR) Target, MMSE equalizer, Adaptive equalizer, PRML, Runlength-limited codes, Linear Block codes, Timing Recovery, Iterative Channels, Channel Optimization, Timing Recovery, Pre Amplifier in Read Channel. Two dimensional signal processing for future magnetic recording system e.g., Bit-Patterned Media Recording, Two-Dimensional Magnetic Recording, and Heat-Assisted Magnetic Recording.

12018624 CODING THEORY 3 (3-0-6)

PREREQUISITE : NONE

Fundamental mathematics for encoding and decoding, i.e. finite field and abstract algebra; BCH codes; Cyclic polynomial codes; Decoding of BCH and Reed Solomon (RS) codes; Soft decoding of RS codes.

12018625 ADVANCED CODING THEORY AND APPLICATIONS 3 (3-0-6)

PREREQUISITE : NONE

Basic concepts and necessary terminology of coding theory; Linear block codes, Repetition codes, Hamming codes; Parity-check codes, Convolutional codes; Viterbi's decoding techniques, Soft decoding, Iterative decoding, Constrained codes, Capacity, RLL codes, MTR codes, (0, G/I) codes, Channel Optimization methods.

7. Statistical Productivity Improvement

12018721 STATISTICAL QUALITY CONTROL 3 (3-0-6)

Basic concepts of quality improvement, the DMAIC process (define, measure, analyze, improve, and control), statistical process control, control charts for variables, control charts for attributes, analysis of process capability and measurement system capability.

12018722 DESIGN OF EXPERIMENT IN PRODUCTION ENGINEERING 3 (3-0-6)

Concepts of design of experiments and be able to apply suitable techniques to conduct engineering and scientific research and development. Factorial Design, Blocking and Confounding, Latin Squares, Multi-variable Regression Models, Response Surface Designs, Robust Parameter Design, Nested and Split-Plot Designs.

12018723 DATA MINING AND ANALYSIS TOOLS 3 (3-0-6)

This course contains various data mining and analysis tools. SQL programming, R programming, Excel, JMP software, and Minitab Software are cover.

Plan 2.2 (For students who graduated with a bachelor's degree)

A. Thesis 48 CP

CP (Lecture-Practice-Self-study)

12018401 THESIS 48 (0-12-6)

PREREQUISITE : NONE

This course provides searching information technology to track and prepare initiative research and development on information and system engineering. Opportunities for a student to do research under the supervision of his/her advisor. The research should emphasize the originality and aim toward new and useful results in engineering sciences.

B. Seminar 1 CP *non-credit course*

CP (Lecture-Practice-Self-study)

12018001 SEMINAR 1 (0-3-2)

PREREQUISITE : NONE

This is the required courses which must be taken consecutively by master and doctoral students. The purpose of the course is to develop the students' ability in reading, understanding and presenting the technical papers, the student must be assigned to have a presentation of research papers or his/her research under the supervision of advisor to an audience and committee in a seminar.

C. Research 3 CP *non-credit course*

CP (Lecture-Practice-Self-study)

12018602 RESEARCH METHODOLOGY FOR MANUFACTURING PROCESS 3 (3-0-6)

PREREQUISITE : NONE

Principle of research methodology for manufacturing process including problem source literature survey, critical thinking, analysis and evaluation, preparation of research proposal, Research writing and presentation techniques.

D. Foundation courses in advanced manufacturing systems engineering 6 CP

Enroll in the following courses:

CP (Lecture-Practice-Self-study)

12018811 MATHEMATICAL MODELING OF PRODUCTION SYSTEMS ENGINEERING 3 (3-0-6)

PREREQUISITE : NONE

The course include overview of relevant topics of Probability Theory Serial lines, assembly systems, lines with re-work, re-entrant lines including mathematical models of machines, and mathematical models of material handling devices. Another purpose of this course is to discuss these standard models and indicate how a given production system can be reduced to one of them. The issue of parameter identification is also addressed.

Performance measures in terms of throughput, work-in-process and finished goods inventory, blockages, starvations, product quality, customer demands satisfaction, and transient characteristics. Production Systems Engineering Toolbox and case studies of modeling.

12018812 COMPUTER AIDED DESIGNS AND MANUFACTURING 3 (3-0-6)

PREREQUISITE : NONE

This course focuses on the practical applications of computer software applied for solving actual problems in manufacturing processes such as the problems related to vibration, solid structure, fluid flow, multiphysics, optimization, thermal etc. The experience in the course can be applied to analyze the problem, design product, reduce cost and improve manufacturing process. Industry 4.0 and engineering metrology.

12018813 APPLIED AUTOMATION SYSTEMS FOR INDUSTRIAL PROCESS 3 (3-0-6)

PREREQUISITE : NONE

Applications of industrial automation systems, including identification of system requirements, equipment integration, motors, controllers, and sensors, Coverage of set-up, maintenance, and testing of the automated system.

12018814 MATERIAL SCIENCE FOR MANUFACTURING INDUSTRY 3 (3-0-6)

PREREQUISITE : NONE

The course consists of atomic structure, atomic bonding, crystal structures, defects, and diffusion in materials. It also will cover phase transformations and phase equilibrium. The electrical, magnetic, optical, thermal, and mechanical properties of materials will also be reviewed. The course is also modern fabrication technologies i.e. semiconductor devices and hard disk drive. Applications of metals, ceramics, semiconductors, and polymers are provided.

12018815 EMBEDDED SYSTEMS

FOR LOGISTIC AND MANUFACTURING 3 (3-0-6)

PREREQUISITE : NONE

This subject describes embedded system development process for manufacturing and logistics with example systems. Position tracking system for logistics. Big data analytics for new services and industrial real-time embedded systems.

12018816 ANALYSIS FOR SIGNAL AND SYSTEMS

FOR INDUSTRIAL APPLICATIONS 3 (3-0-6)

PREREQUISITE : NONE

This course includes the following topics: fundamental of signal and systems, signal & signal processing, structure of digital signal processors, hardware realizations, digital filters, FFT processors, advantages & disadvantages of digital signal processing, the continuous time signals and systems with their impulse responses, frequency responses and zero, sampling theory and signal reconstruction considered before the discrete-time signals and systems and their transformation techniques, DFT and FFT, IIR and FIR digital filters designs for industrial applications and their hardware point of views.

12018817 STATISTICAL ANALYSIS FOR

MANUFACTURING INDUSTRY 3 (3-0-6)

PREREQUISITE : NONE

A basic course in probability and statistics designed to give the student a foundation for future study in area such as design of experiment, stochastic systems, and simulation.

12018818 DESIGN AND MANUFACTURING

FOR MATERIAL FORMING PROCESSES 3 (3-0-6)

PREREQUISITE : NONE

Types and properties of metal and plastic manufactured by forming processes, types of forming processes, design and manufacturing of stamping dies, casting dies, injection mold, testing of tooling and manufactured products.

12018819 INDUSTRIAL ENERGY MANAGEMENT 3 (3-0-6)

PREREQUISITE : NONE

This course covers the overview of principles of energy management from the industrial perspectives such as building envelope, lighting and HVAC systems, the use of alternative energy in industry, waste heat recovery, energy system outsourcing as well as carbon emission and carbon footprint, and sustainability in manufacturing.

12018820 ELECTROMAGNETIC COMPATIBILITY IN MANUFACTURING 3 (3-0-6)

PREREQUISITE : NONE

Broad knowledge in electromagnetic compatibility (EMC). Basic idea of electronic equipment and their compliance with EMC. Study of electromagnetic effects on system performance. Signal spectra, transmission lines and signal integrity, nonlinear behavior of electronic components. Study of electrostatic discharge, radiated emission. Shielding.

12017821 SELECTED TOPICS IN ADVANCED MANUFACTURING SYSTEM 1 3 (3-0-6)

The course will cover topics of interest selected by the instructor in the field of advanced manufacturing system.

12017822 SELECTED TOPICS IN ADVANCED MANUFACTURING SYSTEM 2 3 (3-0-6)

The course will cover topics of interest selected by the instructor in the field of advanced manufacturing system and related with the selected topics in advanced manufacturing system 1.

12017823 SELECTED TOPICS IN ADVANCED MANUFACTURING SYSTEM 3 3 (3-0-6)

The course will cover topics of interest selected by the instructor in the field of advanced manufacturing system and related with the selected topics in advanced manufacturing system 2.

E. Elective courses 6 CP

Select the following course groups (skipping over some groups are allowed)

1. Computer Simulation for Engineering
2. Advanced Engineering Materials
3. Automation System
4. Optics and Laser Engineering
5. Embedded System
6. Advanced Signal Processing for Data Storage
7. Statistical Productivity Improvement

1. COMPUTER SIMULATION FOR ENGINEERING

CP (Lecture-Practice-Self-study)

12018121 APPLIED NUMERICAL ELECTROMAGNETICSIN ESD/EMI 3 (3-0-6)

PREREQUISITE : NONE

Introduction to numerical electromagnetics. Fundamentals of electromagnetics theory. Fundamental equations. Numerical electromagnetics in frequency domain. Geometrical discretization. Numerical electromagnetics in time domain. Application in ESD/EMI.

12018122 HIGH-FREQUENCY ELECTRONICS 3 (3-0-6)

PREREQUISITE : NONE

Introduction to electromagnetic theory. Transmission line theory. Microwave network analysis. Matching network and signal flow graphs. Microwave transistor amplifier design. Microwave power amplifiers. Microwave Oscillators.

12018123 COMPUTER AIDED ENGINEERING 3 (3-0-6)

PREREQUISITE : NONE

The broad usage of computer software to aid in engineering analysis tasks. It includes Finite Element Analysis (FEA), Computational Fluid Dynamics (CFD), multiphysics, optimization, etc.

12018124 FINITE ELEMENT METHOD IN ENGINEERING 3 (3-0-6)

PREREQUISITE : NONE

A numerical technique for finding approximate solutions to boundary value problems for partial differential equations. It uses subdivision of a whole problem domain into simpler parts, called finite elements, and variational methods from the calculus of variations to solve the problem by minimizing an associated error function. In this course, students will apply the FEM to solve several problems in engineering such as vibration, heat transfer, multiphysics, etc.

12018125 COMPUTATIONAL FLUID DYNAMICS 3 (3-0-6)

PREREQUISITE : NONE

A branch of fluid mechanics that uses numerical methods and algorithms to solve and analyze fluid flow problems, for example, compressible, incompressible flow, steady, unsteady, laminar and turbulent flows, etc.

2. ADVANCED ENGINEERING MATERIALS

CP (Lecture-Practice-Self-study)

12018221 ELECTRONIC MATERIALS 3 (3-0-6)

PREREQUISITE : NONE

Study on the fundamental principle of materials: fabrication, materials: properties and application of electronic materials: conductors, dielectrics and insulators. Study on the material properties: piezoelectric materials, pyroelectric materials, electro-optics, magnetic materials.

12018222 FERROELECTRIC MATERIALS AND APPLICATION 3 (3-0-6)

PREREQUISITE : NONE

Study on the characteristics of the ferroelectric materials with dielectric properties. Techniques to measure the physical properties of the ferroelectric materials. Structure of ferroelectric materials and applications of ferroelectric materials.

12018223 THIN FILM DEPOSITION PROCESSES AND TECHNOLOGIES 3 (3-0-6)

PREREQUISITE : NONE

The course includes the following topics: the principles of operation of deposition equipment and its suitability, performance, control, capabilities, and limitations for production applications, the basic understanding of these systems such as physical vapor deposition and chemical vapor deposition techniques.

12018224 **PHYSICAL AND CHEMICAL**

CHARACTERIZATIONS OF MATERIALS **3 (3-0-6)**

PREREQUISITE : NONE

This course provides the characterization techniques for measuring semiconductor materials and devices. Coverage includes the full range of electrical and optical characterization methods, including the more specialized chemical and physical techniques.

3. Automation System

CP (Lecture-Practice-Self-study)

12018302 **MACHINE LEARNING** **3 (3-0-6)**

PREREQUISITE : NONE

Students understand basic knowledge of essential learning algorithms. The course will cover topics of maximum likelihood and maximum a posteriori estimator, Hidden Markov Models, Viterbi algorithm, Expectation Maximization algorithm, nonlinear neural networks and back prop, recurrence: BPTT/RTRL/LSTM, Maximal Margin Classifier, Support Vector Machines, Q-learning, TD-learning, Hill-climbing and genetic algorithms, information theory basics and universal search.

12018304 **TECHNIQUES IN ARTIFICIAL INTELLIGENCE** **3 (3-0-6)**

PREREQUISITE : NONE

The course gives an overview of application areas and techniques in Artificial Intelligence. The course covers the following topics: design principles and specification mechanisms for rational agents, problem solving using heuristic search techniques, optimizing search; problem solving using knowledge-based techniques: logic and inference techniques, reasoning about space and time, representation of ontologies; representation and reasoning in the common sense world, problem solving using uncertain knowledge and information: basic concepts of probability and decision theory; Bayesian Networks; planning with Markov decision problems, action planning: automatic generation of partially order education plans; planning and execution machine learning: learning decision trees; inductive learning; probably approximately correct learning.

12018321 **IMAGE PROCESSING** **3 (3-0-6)**

PREREQUISITE : NONE

An introductory course on computer vision and machine vision. Topics covered include difference between computer and machine vision, image capture and processing, filtering, thresholds, edge detection, shape analysis, shape detection, pattern matching, stereo ranging, 3D models from images, real-time vision systems, recognition of targets, and applications including inspection.

12018322 **MACHINE VISION** **3 (3-0-6)**

PREREQUISITE : NONE

Machine Vision provides an intensive introduction to the process of generating a symbolic description of an environment from an image. Lectures describe the physics of image formation, motion vision, and recovering shapes from shading. Binary image processing and filtering are presented as preprocessing steps. Further topics include photogrammetry, object representation alignment, and computational vision. Applications to robotics and intelligent machine interaction are discussed.

12018323 **PATTERN RECOGNITION FOR MACHINE VISION** **3 (3-0-6)**

PREREQUISITE : NONE

The applications of pattern recognition techniques to problems of machine vision is the main focus for this course. Topics covered include, an overview of problems of machine vision and pattern classification, image formation and processing, feature extraction from images, biological object recognition, bayesian decision theory, and clustering.

12018324 INTRODUCTION TO NEURAL NETWORKS 3 (3-0-6)

PREREQUISITE : NONE

This course explores the organization of synaptic connectivity as the basis of neural computation and learning. Perceptrons and dynamical theories of recurrent networks 123 including amplifiers, attractors, and hybrid computation are covered. Additional topics include back propagation and Hebbian learning, as well as models of perception, motor control, memory, and neural development.

12018325 GENETIC NEUROBIOLOGY 3 (3-0-6)

PREREQUISITE : NONE

This course deals with the specific functions of neurons, the interactions of neurons in development, and the organization of neuronal ensembles to produce behavior. Topics covered include the analysis of mutations, and molecular analysis of the genes required for nervous system function. In particular, this course focuses on research work done with applying to find the optimization value.

4. OPTICS AND LASER ENGINEERING

CP (Lecture-Practice-Self-study)

12018421 PHYSICS OF SEMICONDUCTOR DEVICES 3 (3-0-6)

PREREQUISITE : NONE

Atomic structure of solid-state materials; Energy band theory; Energy band, charge carriers, and density of states in semiconductors; Homo- and hetero-junction devices: pn junction, Diode; Transistors (Bipolar junction transistors, Field-effect transistors); Electronic sensors; Thin-film technologies; MEMS; Device fabrication techniques.

12018422 OPTO-ELECTRONIC COMPONENTS AND DEVICES 3 (3-0-6)

PREREQUISITE : NONE

Energy band and charge carriers in semiconductors; Charge-excitation mechanisms (Photo- and electrical-excitation), Principles of optoelectronic components and devices: Light emitting devices and display technologies (e.g. LEDs, liquid-crystal display, plasma displays, E-papers, micro-optics) and light sensing devices (photo-diode, phototransistors, solar cells).

12018423 ORGANIC AND PRINTED ELECTRONIC DEVICES 3 (3-0-6)

PREREQUISITE :OPTO-ELECTRONIC COMPONENTS AND DEVICES

Semiconducting behaviours in organic materials; Energy levels in organic semiconductors; organic light emitting devices (OLED, organic light-emitting transistors); organic field-effect transistors (OFET); organic photovoltaic devices (organic solar cells); nano-structured material devices (carbon nanotubes and zinc-oxide nanowires); Devices fabrication techniques (vacuum and solution-processed deposition methods); introduction to plastic electronics.

12018424 PRINCIPLES OF PHOTONICS AND OPTICAL ENGINEERING 3 (3-0-6)

PREREQUISITE :NONE

The course introduces the basics of optical fields and their applications to lasers, optical fibers, and photonic signal processing, i.e., how light is used in modern systems for encoding, manipulating, transmitting, storing, and retrieving information. It covers light propagation in isotropic and birefringent optical media, behavior at dielectric interfaces, interference, optical cavities and principles of laser action, the basics of optical waveguides (including optical fiber), and electro- and acousto-optic modulation. Emphasis is given to the design and analysis of optical devices, and their applications in communications and signal processing.

12018425 LASERS 3 (3-0-6)

PREREQUISITE : PRINCIPLES OF PHOTONICS AND OPTICAL ENGINEERING

Propagation of optical rays and waves, Gaussian laser beams, laser resonators; active nanoparticle in a microcavity, atomic systems, lasing and population inversion, laser amplifiers, practical continuous-wave and pulsed lasers, mode locking, Q-switching, and applications of lasers.

12018426 NANOPHOTONICS 3 (3-0-6)

PREREQUISITE : PRINCIPLES OF PHOTONICS AND OPTICAL ENGINEERING

Introduction of nanophotonics, with focus on the basic material systems (quantum dots, nanoparticles, and photonic crystals) to devices applications (lasers, detectors, sensors) and to system integration (photonic integrated circuits and silicon photonics).

5. Embedded Automation System

12018521 EMBEDDED SYSTEM DESIGN AND APPLICATION 3 (3-0-6)

PREREQUISITE : NONE

Overviews, meanings, descriptions and examples of embedded system, embedded system components, embedded system design methodology, problem analysis, design pattern, controller, sensor and actuator, data flow model, object oriented methodology, processing levels for embedded system, system integration and communication, framework and platform design, system design based on innovative thinking :robotics and automatic system for automotive.

12018522 MICROPROCESSOR AND INTERFACING FOR EMBEDDED SYSTEM 3 (3-0-6)

PREREQUISITE : NONE

Microprocessor architecture, various types of bus system, input ports, output ports and other components; schematic design for controller, printed circuit board (pcb) design, controller program using assembly language and/or higher level languages; design of interfacing circuit for communication and controlling external circuits via serial port, usb,

ethernet andother types of communication protocols. Communication among distributed systems; interfacing with external environments; energy conservation; safety and reliability; design principles; methodologies; design tools; case studies including plc, microcontroller and embedded linux platform.

12018523 **OPEN SOURCE OPERATING SYSTEM AND SOFTWARE DEVELOPMENT** **3 (3-0-6)**

PREREQUISITE : NONE

Open source operating system and application software are vital important in research and development and industrial cost reduction. Because, unix operating system: linux and embedded linux, framework, library and device driver programming, c, c++, java, python and graphic user interface (gui) programming.

12018524 **SIGNAL AND IMAGE PROCESSING FOR EMBEDDED SYSTEM** **3 (3-0-6)**

PREREQUISITE : NONE

Data and signal processing in embedded system, analog and digital signal processing, sensors applications, control signal for control system, image processing and development for embedded system : edge detection, corner detection, surface detection and object detection, motion detection, face detection on embedded system; analysis of algorithm's benefits and disadvantages.

12018525 **ARTIFICIAL INTELLIGENCE AND BIG DATA ANALYTICS FOR INTERNET OF THINGS (IOT)** **3 (3-0-6)**

PREREQUISITE : NONE

This subject provides engineering statistic and big data processing, yield prediction and multi-attribute analysis, problem identification, fuzzy logic, artificial neural network, genetic algorithm, agent based swarm algorithm and hybrid artificial intelligent to solve the research problem, optimization and extract knowledge or solution within the mass data records.

6. Advanced Signal Processing for Data Storage

12018621 FUNDAMENTAL OF HARD DISK DRIVE TECHNOLOGY 3 (3-0-6)

PREREQUISITE : NONE

HDD components and system integration, recording subsystem, Mechanical System, Servo Control, HDD Controller and Interface (SATA, SAS, ATI).

12018622 SIGNAL PROCESSING 3 (3-0-6)

PREREQUISITE :NONE

This course includes the following topics: signal & signal processing, structure of digital signal processors, hardware realizations, digital filters, FFT processors, advantages &disadvantages of digital signal processing, the continuous-time signals and systems with their impulse responses, frequency responses and zero, sampling theory and signal reconstruction considered before the discrete-time signals and systems and their transformation techniques, DFT and FFT, IIR and FIR digital filters designs and their hardware point of views.

12018623 SIGNAL PROCESSING IN DATA STORAGE 3 (3-0-6)

PREREQUISITE : NONE

Block Diagram of Read/Write Process, Write Signal (NRZ, NRZI), Transition, Types of Noise, Front-End Processing, Recording Channels (LMR, PMR), Partial Response (PR) Target, MMSE equalizer, Adaptive equalizer, PRML, Runlength-limited codes, Linear Block codes, Timing Recovery, Iterative Channels, Channel Optimization, Timing Recovery, Pre Amplifier in Read Channel. Two dimensional signal processing for future magnetic recording system e.g., Bit-Patterned Media Recording, Two-Dimensional Magnetic Recording, and Heat-Assisted Magnetic Recording.

12018624 **CODING THEORY** **3 (3-0-6)**

PREREQUISITE : NONE

Fundamental mathematics for encoding and decoding, i.e. finite field and abstract algebra; BCH codes; Cyclic polynomial codes; Decoding of BCH and Reed Solomon (RS) codes; Soft decoding of RS codes.

12018625 **ADVANCED CODING THEORY**

AND APPLICATIONS **3 (3-0-6)**

PREREQUISITE : NONE

Basic concepts and necessary terminology of coding theory; Linear block codes, Repetition codes, Hamming codes; Parity-check codes, Convolutional codes; Viterbi's decoding techniques, Soft decoding, Iterative decoding, Constrained codes, Capacity, RLL codes, MTR codes, (0, G/I) codes, Channel Optimization methods.

7. Statistical Productivity Improvement

12018721 **STATISTICAL QUALITY CONTROL** **3 (3-0-6)**

Basic concepts of quality improvement, the DMAIC process (define, measure, analyze, improve, and control), statistical process control, control charts for variables, control charts for attributes, analysis of process capability and measurement system capability.

12018722 **DESIGN OF EXPERIMENT**

IN PRODUCTION ENGINEERING **3 (3-0-6)**

Concepts of design of experiments and be able to apply suitable techniques to conduct engineering and scientific research and development. Factorial Design, Blocking and Confounding, Latin Squares, Multi-variable Regression Models, Response Surface Designs, Robust Parameter Design, Nested and Split-Plot Designs.

12018723 **DATA MINING AND ANALYSIS TOOLS** **3 (3-0-6)**

This course contains various data mining and analysis tools. SQL programming, R programming, Excel, JMP software, and Minitab Software are cover.

Revised Doctor of Philosophy Program

Subject Field Advanced Manufacturing Systems Engineering Academic Year 2016

Faculty of Agro-Industry, King Mongkut's Institute of Technology Ladkrabang

1. Approved by Academic Council in its meeting No.../.... on....., ...

2. Approved by KMITL Council in its meeting No.../.... on....., ...

3. Revised Program will be applied in 1st semester in Academic Year 2017

4. Revised Program under the reason of

    4.1 Revising the course number overlapping with former program

5. Content of Revising

    5.1 Course Number of two subjects are revised.

Subject (former)			Subject (Revised)		
12018401	THESIS	48(0-12-6)	12018407	THESIS	48(0-12-6)
12018501	THESIS	36(0-18-9)	12018505	THESIS	36(0-18-9)

6. The comparison between the revised program and the former program, and the criteria of graduate academic year 2015 in accordance with the Ministry of Education can be seen as follows:

Plan 1.1 For students who graduated with a Master degree

Courses	Credit Points		
	Criteria of the Ministry of Education	Former program	Revised program
Seminar (*non-credit course)	Not less than 48 for thesis	1*	1*
Thesis		48	48
Total credit not less than	48	48	48

Plan 2.1 For students who graduated with a Master degree

Courses	Credit		
	Criteria of the Ministry of Education	Former program	Revised program
Seminar (*non-credit course)	Not less than 12 for courses	1*	1*
Research (*non-credit course)		3*	3*
Foundation courses		6	6
Elective courses		6	6
Thesis	Not less than 36	36	36
Total credit not less than	Not less than 48	48	48

Plan 2.2 For students who graduated with a Bachelor degree

Courses	Credit		
	Criteria of the Ministry of Education	Former program	Revised program
Foundation courses	Not less than 36 for courses	9	9
Elective courses		15	15
Research (*non-credit course)		3*	3*
Seminar		1*	1*
Thesis	Not less than 48	48	48
Total credit not less than	Not less than 72	72	72