D M S E

Digital Manufacturing System Engineering

Bachelor of Engineering Program
Digital Manufacturing System Engineering
(Multidisciplinary Program)
New Program 2022

Bachelor of Engineering Program in Digital Manufacturing System Engineering (Multidisciplinary Program)
New Program 2022

Program Philosophy

To be a hub to produce the graduates that are capable of applying the digital technology to the industrial sector, and their attributes are aligned with the engineering standards including ethical and moral excellence.

Program Objective

To produce the system integrator engineers that are capable of improving the manufacturing system by applying the suitable digital technologies.

Area of Concentration

The program focuses on providing the students with a unique learning opportunity to develop in-depth knowledge and skills in future manufacturing system, aiming to produce the leading engineers required for Industry 4.0 oriented smart manufacturing system to improve products and production processes. Therefore the program includes the multidiscipline knowledges and skills of Industrial and Systems Engineering, Electrical and Electronics Engineering, Computer Engineering and Informatics, and Robotics and Automation System Engineering.

Program Learning Outcome

1. *Knowledge in engineering and basic sciences*
   able to apply the basic knowledge of sciences and engineering to determine the concept of engineering model.
2. *Engineering Problem Analysis*
   able to identify the problem to create the inital solution by using principle, tools, and digital technology.

3. *Design and develop the solutions*

   able to develop the initial solution to suitable solution, under the concern of surrounding factors, by applying digital technology in collecting data, searching, researching, experimenting, testing.

4. *Examination*

   able to examine, diagnose, and evaluate the results in order to reach a conclusion logically under the statistical data or simulation results.

5. *Applying modern equipment*

   able to apply the suitable digital technology to develop the process and working system be more effective.

6. *Teamworking*

   able to work together with multidisciplinary persons effectively, both as member and leader.

7. *Communication*

   able to communicate in engineering work, other carreers, and general persons effectively, either speaking, report, or listening

8. *Social, environmental, sustainable development activities and engineering ethics*

   able to evaluate the effect of complex engineering solution on social, environmental, and sustainable aspects.

9. *Ethics*

   understand and insist on engineering ethics and standard framework.

10. *Engineering Administration*

    able to apply the digital technology to indicate cost analysis, risk, and feasibility of the developed solutions.

11. *Life-long Learning*

    aware the importance and has life-long learning skill to explore new digital technology for new solution

Bachelor of Engineering Program in Digital Manufacturing System Engineering
(Multidisciplinary Program)
New Program 2022
Total number of credits requirement : 140 credits

(1) General Education	minimum	30	credits

- Wellness	minimum	3	credits

01175xxx	Physical Education Activity		1(0-2-1)

and select minimum 2 credits from any courses offered in Wellness

- Entrepreneurship	minimum	6	credits

and select minimum 6 credits from any courses offered in Entrepreneurship

- Language and Communication		13	credits

01355xxx	English		9(- -)
	Thai language		3(- -)
	Information/Computer	minimum	1(- -)

- Thai Citizen and Global Citizen	minimum	5	credits

01999111	Knowledge of the Land		2(2-0-4)

and select minimum 3 credits from any courses offered in Thai Citizen and Global Citizen

- Aesthetics		3	credits

and Select minimum 3 credits from any courses offered in Aesthetics

(2) Core Courses   minimum   104 credits

2.1) Basic Core Courses   37 credits

2.1.1) Basic Mathematics and Sciences   10 credits

01417167	Engineering Mathematics I	3(3-0-6)
01417168	Engineering Mathematics II	3(3-0-6)
01420111	General Physics I	3(3-0-6)
01420113	Laboratory in Physics I	1(0-3-2)

2.1.2) Basic Engineering   27 credits

03601101	Introduction to Industrial Electronics Engineering	3(3-0-6)
03601102	Introduction to Industrial Electrical Engineering	3(3-0-6)
03601206	Introduction to Industrial Electronics Engineering Laboratory	1(0-3-2)
03601207	Introduction to Industrial Electrical Engineering Laboratory	1(0-3-2)
03602221	Applied Probability and Statistics for Engineers	3(3-0-6)
03603101	Introduction to Computer Programming	3(2-3-6)
03603102	Basic Computer Architecture and Embedded System	3(3-0-6)
03603103	Basic Digital Circuit Design	3(3-0-6)
03609111	Basic Digital Modelling and Applications	3(2-3-6)
03609161	Digital Manufacturing System Engineering Exploration	1(0-3-2)
03609271	Fundamentals of Computation for Digital Manufacturing System Engineering	3(3-0-6)

2.2) Area of Concentration Courses   minimum   67 credits

2.2.1) Compulsory Courses   55 credits

03601208	Automation System in Manufacturing	3(3-0-6)
03601304	Automation System in Manufacturing Laboratory	1(0-3-2)
03602201	Introduction to Materials and Manufacturing Processes	3(3-0-6)
03602401	Financial and Economic Analysis	3(3-0-6)
03607331	Machine Vision and Applications in Automation System	3(3-0-6)
03607332	Artificial Intelligence for Robot and Machinery	3(3-0-6)
03609221	Production and Project Management	3(3-0-6)
03609223	Digital Work Analysis and Design	3(3-0-6)

03609231	Industrial Data Communication and Internet of Things	3(3-0-6)
03609299	Digital Manufacturing System Engineering Project I	1(0-3-2)
03609322	Virtual Factory	3(2-2-5)
03609324	Preventive and Predictive Maintenance	3(3-0-6)
03609332	Cyber Physical System and Cyber Security	3(3-0-6)
03609341	Digital Technology Applied in Manufacturing	3(2-2-5)
03609344	Production Control System	3(3-0-6)
03609351	Database Design and Data Mining	3(3-0-6)
03609352	Industrial Data Analysis and Visualization	3(3-0-6)
03609353	Industrial Measurement and Quality Management	3(2-3-6)
03609399	Digital Manufacturing System Engineering Project II	2(0-6-3)
03609426	Industrial System Analysis and Design	3(3-0-6)

2.2.2) Approved Electives *minimum* *12 credits*

Select minimum 12 credits from any courses offered in the following list

03600390	Cooperative Education Preparation	3(3-0-6)
03600490	Co-operative Education	6
03602417	Innovative Product Design and Manufacturing	3(3-0-6)
03602442	Energy Management	3(3-0-6)
03602473	Strategies for Managing Supply Chains	3(3-0-6)
03609433	Digital Reality in Industry	3(3-0-6)
03609451	Enterprise Information System	3(3-0-6)
03609461	Smart Logistics and Transportations	3(3-0-6)
03609462	Smart Warehouse	3(3-0-6)
03609496	Selected Topics in Digital Manufacturing System Engineering	1-3
03609498	Special Problems	1-3

(3) Free Electives　　　　　　　　　minimum　　6　credits

(4) Internship　　　　　　　　　minimum 240 hours (no credits)

Excluding the students applied in
Co-operative Education

Course Code

A course code includes 8 digits that the use and meaning of character "position" in a course code are as the followings:

Position 1 – 2 (03)   Sriracha Campus

Position 3 – 5 (609)   Digital Manufacturing System Engineering Program

Position 6   Year Offerred

Position 7   Area of Specialization

          1   Manufacturing Engineering

          2   Industrial System Engineering

          3   Digital Technology

          4   Automation Engineering

          5   Data Sciences

          6   Applied Digital Technology

          7   Applied Computation

          9   Selected Topics, Special Problems, and Engineering Project

Position 8   Order of the course in each area of specialization

Example of Study Plan

for the students applied in Co-operative Education

Bachelor of Engineering Program in Digital Manufacturing System Engineering

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Year 1 Semester 1		Credits (Lecture-Lab-Self Study)
01417167	Engineering Mathematics I	3(3-0-6)
01420111	General Physics I	3(3-0-6)
01420113	Laboratory in Physics I	1(0-3-2)
01999111	Knowledge of the Land	2(2-0-4)
03603103	Basic Digital Circuit Design	3(3-0-6)
03609161	Digital Manufacturing System Engineering Exploration	1(0-3-2)
01355xxx	English	3(– –)
	General Education: Entrepreneurship	3(– –)
	Total	**19(– –)**

Year 1 Semester 2		Credits (Lecture-Lab-Self Study)
01417168	Engineering Mathematics II	3(3-0-6)
03601101	Introduction to Industrial Electronics Engineering	3(3-0-6)
03601102	Introduction to Industrial Electrical Engineering	3(3-0-6)
03603101	Introduction to Computer Programming	3(2-3-6)
03609111	Basic Digital Modelling and Applications	3(2-3-6)
	Information/Computer	1(– –)
	General Education: Wellness	2(– –)
	Total	**18(– –)**

Year 2 Semester 1   Credits (Lecture-Lab-Self Study)

03601206	Introduction to Industrial Electronics Engineering Laboratory	1(0-3-2)
03601207	Introduction to Industrial Electrical Engineering Laboratory	1(0-3-2)
03602201	Introduction to Materials and Manufacturing Processes	3(3-0-6)
03602221	Applied Probability and Statistics for Engineers	3(3-0-6)
03609231	Industrial Data Communication and Internet of Things	3(3-0-6)
03609271	Fundamentals of Computation for Digital Manufacturing System Engineering	3(3-0-6)
01175xxx	Physical Education Activity	1(0-2-1)
01355xxx	English	3(- -)
	Total	**18(- -)**

Year 2 Semester 2   Credits (Lecture-Lab-Self Study)

03601208	Automation System in Manufacturing	3(3-0-6)
03603102	Basic Computer Architecture and Embedded System	3(3-0-6)
03609221	Production and Project Management	3(3-0-6)
03609223	Digital Work Analysis and Design	3(3-0-6)
03609299	Digital Manufacturing System Engineering Project I	1(0-3-2)
	General Education: Aesthetics	3(- -)
	Free Elective	3(- -)
	Total	**19(- -)**

Year 3 Semester 1　　　　　　　　　　　　　　　　　**Credits (Lecture-Lab-Self Study)**

03601304	Automation System in Manufacturing Laboratory	1(0-3-2)
03607331	Machine Vision and Applications in Automation System	3(3-0-6)
03609324	Preventive and Predictive Maintenance	3(3-0-6)
03609332	Cyber Physical System and Cyber Security	3(3-0-6)
03609341	Digital Technology Applied in Manufacturing	3(2-2-5)
03609351	Database Design and Data Mining	3(3-0-6)
01355xxx	English	<u>3(- -)</u>
	Total	**<u>19(- -)</u>**

Year 3 Semester 2　　　　　　　　　　　　　　　　　**Credits (Lecture-Lab-Self Study)**

03607332	Artificial Intelligence for Robot and Machinery	3(3-0-6)
03609322	Virtual Factory	3(2-2-5)
03609344	Production Control System	3(3-0-6)
03609352	Industrial Data Analysis and Visualization	3(3-0-6)
03609353	Industrial Measurement and Quality Management	3(2-3-6)
03609399	Digital Manufacturing System Engineering Project II	2(0-6-3)
	General Education: Thai Citizen and Global Citizen	<u>3(- -)</u>
	Total	**<u>20(- -)</u>**

Year 4 Semester 1   **Credits (Lecture-Lab-Self Study)**

03602401	Financial and Economic Analysis	3(3-0-6)
03609426	Industrial System Analysis and Design	3(3-0-6)
	Area of Concentration: Approved Electives	6(- -)
	General Education: Entrepreneurship	3(- -)
	Thai Language	3(- -)
	Free Elective	3(- -)
	Total	**21(- -)**

Year 4 Semester 2   **Credits (Lecture-Lab-Self Study)**

| 03600490 | Co-operative Education | 6 |
| | **Total** | **6** |

Example of Study Plan for the DMSE students applied in Co-operative Education
Faculty of Engineering at Sriracha, Kasetsart University (Sriracha Campus)

Name …………………………………………… Family Name ………………………………………… Student ID ………………………………

Academic Advisor …………………………………………………………………………………………..

Year (AD)	1 (20….)		2 (20….)			3 (20….)			4 (20….)		
Semester	1	2	Summer	1	2	Summer	1	2	Summer	1	2
Credits Registered											
GPA on each Semester											
Total Credits											
GPAX											
Credits on each Semester	19	18	18	19	19	20	21			6	

Area of Concentration: Approved Electives

1.Code…………………….Grade…………

	Year 1 Sem 1	Year 1 Sem 2	Year 2 Summer	Year 2 Sem 1	Year 2 Sem 2	Year 3 Summer	Year 3 Sem 1	Year 3 Sem 2	Year 4 Sem 1	Year 4 Sem 2
name	Math I	Math II	Inro.Electro.Lab	Auto.Manu	Auto.Manu.Lab	AI.Robot.Mach	Fin.Econ.Ana			COOP
	3 01417167	3 01417168	1 03601206	3 03601208	1 03601304	3 03607332	3 03602401			6 03600490
name	Gen.Phys I	Inro.Electro	Intro.Electri.Lab	Basic.Com.Arch.Embed.Sys	Mach.Vis.App.Auto	Vir.Fac	Ind.Sys.Ana.Des			
	3 01420111	3 03601101	1 03601207	3 03603102	3 03607331	3 03609322	3 03609426			
name	Lab.Phys I	Intro.Electri	Intro.Mat.Manu	Prod.Proj.Man	Prev.Pred.Maint	Prod.Contr	AE			
	1 01420113	3 03601102	3 03602201	3 03609221	3 03609324	3 03609344	3			
name	Basic.Digi.Cir.Des	Intro.Com.Pro	App.Prob.Eng	Digi.Work.Ana.Des	Cyber.Phys.Cyber.Secur	Ind.Data.Ana.Des	AE			
	3 03609161	3 03603101	3 03602221	3 03609223	3 03609332	3 03609352	3			
name	DMSE Explo	Basic.Digi.Mod.App	Ind.Data.Com.IOT	DMSE Proj I	Digi.App.Manu	Ind.Mea.QM				
	1 03609161	3 03609111	3 03609231	1 03609299	3 03609341	3 03609353				
name			Fund.Compu.DMSE		Database.Des.Data.Min	DMSE Proj II				
			3 03609271		3 03609351	2 03609399				

Free Electives

1.Code…………………….Grade…………

Course Name………………

2.Code…………………….Grade…………

Course Name………………

Extracurricular Courses

1.Code…………………….Grade…………

	Year 1 Sem 1	Year 1 Sem 2	Year 2 Summer	Year 2 Sem 1	Year 3 Summer	Year 3 Sem 1	Year 4 Sem 1
name	Knowledge of the Land	L/C (I.Com.)	W	A	English	T/G	EN
2.Code	2 01999111	1	1 01175___	3	3 01355___	3	3
name	English	W	English	FE			L/C (Thai)
3.Code	3 01355___	2	3 01355___	3			3
name	En						FE
4.Code	3						3

5.Code…………………….Grade…………

Course Name………………

6.Code…………………….Grade…………

Course Name………………

Extracurricular Courses	Extracurricular Courses	Extracurricular Courses	Extracurricular Courses	Extracurricular Courses	Extracurricular Courses	Extracurricular Courses

Abbreviation

W = Wellness

En = Entrepreneurship

T/G = Thai Citizen and Global Citizen

A = Aesthetics

L/C = Language and Communication

AE = Approved Electives

FE = Free Electives

Example of Study Plan

for the students <u>not</u> applied in Co-operative Education

Bachelor of Engineering Program in Digital Manufacturing System Engineering

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Year 1 Semester 1		Credits (Lecture-Lab-Self Study)
01417167	Engineering Mathematics I	3(3-0-6)
01420111	General Physics I	3(3-0-6)
01420113	Laboratory in Physics I	1(0-3-2)
01999111	Knowledge of the Land	2(2-0-4)
03603103	Basic Digital Circuit Design	3(3-0-6)
03609161	Digital Manufacturing System Engineering Exploration	1(0-3-2)
01355xxx	English	3(– –)
	General Education: Entrepreneurship	<u>3(– –)</u>
	Total	**<u>19(– –)</u>**

Year 1 Semester 2		Credits (Lecture-Lab-Self Study)
01417168	Engineering Mathematics II	3(3-0-6)
03601101	Introduction to Industrial Electronics Engineering	3(3-0-6)
03601102	Introduction to Industrial Electrical Engineering	3(3-0-6)
03603101	Introduction to Computer Programming	3(2-3-6)
03609111	Basic Digital Modelling and Applications	3(2-3-6)
	Information/Computer	1(– –)
	General Education: Wellness	<u>2(– –)</u>
	Total	**<u>18(– –)</u>**

Year 2 Semester 1 **Credits (Lecture-Lab-Self Study)**

03601206	Introduction to Industrial Electronics Engineering Laboratory	1(0-3-2)
03601207	Introduction to Industrial Electrical Engineering Laboratory	1(0-3-2)
03602201	Introduction to Materials and Manufacturing Processes	3(3-0-6)
03602221	Applied Probability and Statistics for Engineers	3(3-0-6)
03609231	Industrial Data Communication and Internet of Things	3(3-0-6)
03609271	Fundamentals of Computation for Digital Manufacturing System Engineering	3(3-0-6)
01175xxx	Physical Education Activity	1(0-2-1)
01355xxx	English	3(- -)
	Total	**18(- -)**

Year 2 Semester 2 **Credits (Lecture-Lab-Self Study)**

03601208	Automation System in Manufacturing	3(3-0-6)
03603102	Basic Computer Architecture and Embedded System	3(3-0-6)
03609221	Production and Project Management	3(3-0-6)
03609223	Digital Work Analysis and Design	3(3-0-6)
03609299	Digital Manufacturing System Engineering Project I	1(0-3-2)
	General Education: Aesthetics	3(- -)
	Free Elective	3(- -)
	Total	**19(- -)**

Year 3 Semester 1   **Credits (Lecture-Lab-Self Study)**

03601304	Automation System in Manufacturing Laboratory	1(0-3-2)
03607331	Machine Vision and Applications in Automation System	3(3-0-6)
03609324	Preventive and Predictive Maintenance	3(3-0-6)
03609332	Cyber Physical System and Cyber Security	3(3-0-6)
03609341	Digital Technology Applied in Manufacturing	3(2-2-5)
03609351	Database Design and Data Mining	3(3-0-6)
01355xxx	English	<u>3(- -)</u>
	Total	**<u>19(- -)</u>**

Year 3 Semester 2   **Credits (Lecture-Lab-Self Study)**

03607332	Artificial Intelligence for Robot and Machinery	3(3-0-6)
03609322	Virtual Factory	3(2-2-5)
03609344	Production Control System	3(3-0-6)
03609352	Industrial Data Analysis and Visualization	3(3-0-6)
03609353	Industrial Measurement and Quality Management	3(2-3-6)
03609399	Digital Manufacturing System Engineering Project II	2(0-6-3)
	General Education: Thai Citizen and Global Citizen	<u>3(- -)</u>
	Total	**<u>20(- -)</u>**

Year 4 Semester 1   **Credits (Lecture-Lab-Self Study)**

03602401	Financial and Economic Analysis	3(3-0-6)
03609426	Industrial System Analysis and Design	3(3-0-6)
	Area of Concentration: Approved Electives	6(- -)
	General Education: Entrepreneurship	3(- -)
	Thai Language	3(- -)
	Total	**18(- -)**

Year 4 Semester 2   **Credits (Lecture-Lab-Self Study)**

	Area of Concentration: Approved Electives	6(- -)
	Free Elective	3(- -)
	Total	**9(- -)**

Example of Study Plan for the DMSE students not applied in Co-operative Education

Faculty of Engineering at Sriracha, Kasetsart University (Sriracha Campus)

Name ……………………………………… Family Name ………………………………………… Student ID ………………………………

Academic Advisor ………………………………………………………………………………………..

Year (AD)	1 (20….)		2 (20….)			3 (20….)			4 (20….)	
Semester	1	2	Summer 1		2	Summer 1		2	Summer 1	2
Credits Registered										
GPA on each Semester										
Total Credits										
GPAX										
Credits on each Semester	19	18	18		19	19		20	18	9

Area of Concentration: Approved Electives

1.Code…………………….Grade…………

	Math I	Math II	Inro.Electro.Lab	Auto.Manu	Auto.Manu.Lab	AI.Robot.Mach	Fin.Econ.Ana	AE
Course Name……………………	3 01417167	3 01417168	1 03601206	3 03601208	1 03601304	3 03607332	3 03602401	3

2.Code…………………….Grade…………

	Gen.Phys I	Inro.Electro	Intro.Electri.Lab	Basic.Com.Arch.Embed.Sys	Mach.Vis.App.Auto	Vir.Fac	Ind.Sys.Ana.Des	AE
Course Name……………………	3 01420111	3 03601101	1 03601207	3 03603102	3 03607331	3 03609322	3 03609426	3

3.Code…………………….Grade…………

	Lab.Phys I	Intro.Electri	Intro.Mat.Manu	Prod.Proj.Man	Prev.Pred.Maint	Prod.Contr	AE
Course Name……………………	1 01420113	3 03601102	3 03602201	3 03609221	3 03609324	3 03609344	3

4.Code…………………….Grade…………

	Basic.Digi.Cir.Des	Intro.Com.Pro	App.Prob.Eng	Digi.Work.Ana.Des	Cyber.Phys.Cyber.Secur	Ind.Data.Ana.Des	AE
Course Name……………………	3 03609161	3 03603101	3 03602221	3 03609223	3 03609332	3 03609352	3

	DMSE Explo	Basic.Digi.Mod.App	Ind.Data.Com.IOT	DMSE Proj I	Digi.App.Manu	Ind.Mea.QM	
	1 03609161	3 03609111	3 03609231	1 03609299	3 03609341	3 03609353	

Free Electives

1.Code…………………….Grade…………

			Fund.Compu.DMSE		Database.Des.Data.Min	DMSE Proj II	
Course Name……………………			3 03609271		3 03609351	2 03609399	

2.Code…………………….Grade…………

Course Name……………………

Extracurricular Courses

1.Code…………………….Grade…………

	Knowledge of the Land	L/C (I.Com)	W	A	English	T/G	EN	FE
Course Name……………………	2 01999111	1	1 01175___	3	3 01355___	3	3	3

2.Code…………………….Grade…………

	English	W	English	FE			L/C (Thai)	
Course Name……………………	3 01355___	2	3 01355___	3			3	

3.Code…………………….Grade…………

	En							
Course Name……………………	3							

4.Code…………………….Grade…………

Course Name……………………

5.Code…………………….Grade…………

	Extracurricular Courses	Extracurricular Courses	Extracurricular Courses	Extracurricular Courses	Extracurricular Courses	Extracurricular Courses	Extracurricular Courses
Course Aesthetics……………………							

6.Code…………………….Grade…………

Course Name……………………

Abbreviation

W = Wellness

En = Entrepreneurship

T/G = Thai Citizen and Global Citizen

A = Aesthetics

L/C = Language and Communication

AE = Approved Electives

FE = Free Electives

Course Description

Course with 03609xxx

03609111   Basic Digital Modelling and Applications   3(2-3-6)

         Principles of engineering drawing. Principles of computer-aided design, computer-aided manufacturing and computer-aided engineering. Basic 3D part modeling, assemblies and drawings. Machining theory. Automated CNC machining. Additive manufacturing technology. Basic structural analysis with software. CAD/CAM/CAE integration.

03609161   Digital Manufacturing System Engineering Exploration   1(0-3-2)

         Introduction to digital technologies in manufacturing processes. Basic smart factory components. SCADA. Internet of things system. RFID and GPS tracking systems. ERP system. Automatic storage and retrieval systems. AGV and smart conveyor system. Industrial robot arm. Machine vision. Coordinate measuring machine. Career planning. Ethics. Industry site visits.

03609221   Production and Project Management   3(3-0-6)

         Introduction to production planning and control. Forecasting. Aggregate production planning. Capacity planning. Master plan schedule. Job scheduling. Just-in-time, lean manufacturing and toyota production system. Fundamental of project management process and framework. Management of time, cost, quality, human resources, risk management. Procurement. Project life cycle management. Applications of PERT and CPM for project management. Project planning and control.

03609223   Digital Work Analysis and Design   3(3-0-6)

     Prerequisite: 03602221

         Productivity and work study. Method study. Work measurement. Ergonomics. Anthropometry. Work posture. Workstation and workspace design. Digital technologies in work analysis and design.

03609231   Industrial Data Communication and Internet of Things   3(3-0-6)

        Basic of data communication. Network protocols. TCP/IP network. Sensors and network devices. Wireless sensor networks. IoT applications.

03609271   Fundamentals of Computation for Digital Manufacturing System Engineering   3(3-0-6)
Prerequisite: 01417168

        First order and second order ordinary differential equations. Laplace transforms and the applications. Basic linear algebra; matrices and determinants, vector spaces, linear transform, eigenvalues and eigenvectors. Matrix decomposition, principal component analysis and singular value decomposition.

03609299   Digital Manufacturing System Engineering Project I   1(0-3-2)

        Interesting projects in various disciplines of digital manufacturing system engineering. Applying digital technologies for improving a small-scale manufacturing process.

03609322   Virtual Factory   3(2-2-5)
Prerequisite: 03602221

        Virtual factory overview and concepts. Probability and statistic for simulation. Layout planning simulation. Material flow simulation. Process simulation. Manufacturing data analytics. Virtual reality and Augmented reality analysis and validation. Manufacturing execution system.

03609324   Preventive and Predictive Maintenance   3(3-0-6)

        Concepts of preventative and predictive maintenance. Preventive and predictive maintenance techniques. Preventative and Predictive maintenance systems and Technology. Root cause analysis. Machine failure. Machine reliability. Maintenance schedule and plan. Condition-based maintenance techniques. Machine condition monitoring techniques. Reliability, productivity and cost analysis techniques. Overall equipment and effectiveness. Computerized maintenance management system.

03609332   Cyber Physical System and Cyber Security   3(3-0-6)

Prerequisite: 03609231

Introduction to cyber-physical systems and cyber security. Overview of cyber-physical systems. Fundamental of networking security. Control systems. Industrial networks. Introduction to industrial control systems. Ladder logic. Industrial network design and architecture. Industrial network protocols. Smart grid. Hacking. Securing industrial control systems. Privacy in cyber-physical systems and cyber security.

03609341   Digital Technology Applied in Manufacturing   3(2-2-5)

Introduction to computer integrated manufacturing. Flexible manufacturing systems. Digital technology in manufacturing System. Lean automation in manufacturing system. Just in time system. Quality control and automated inspection. Application of digital technology for material handling and storage system. Computer network for manufacturing. Manufacturing productivity and implementation.

03609344   Production Control System   3(3-0-6)

Prerequisite: 03601208

Introduction to production control systems. Principles of SCADA and industrial network security. SCADA architecture. Fundamentals of SCADA communication. System components; MTU and RTU Devices. SCADA visualization. Design and implementation of SCADA system. Basic concepts of DCS. DCS Classification. DCS hardware and software. DCS accessories.

03609351   Database Design and Data Mining   3(3-0-6)

Data models. Relational models. ER modeling. Database management systems. Structured query language. Association rule. Tools for data mining. Classification, clustering, and pattern mining approaches. Techniques in machine learning.

03609352 Industrial Data Analysis and Visualization   3(3-0-6)

Prerequisite: 03609351

   Introduction to industrial data. Statistical data analysis. Learning from data. Forecasting. Regression. Pattern classification. Anomaly detection. Recommendation systems. Types of data visualization. Visualizing time series. Interactive data visualization.

03609353 Industrial Measurement and Quality Management   3(2-3-6)

   Introduction to industrial measurement technology. Specification on the drawing. Guaging. Coordinate measurement. Surface metrology. Form and position measurement. Laser measuring technology. Industrial sensors. Measuring uncertainty and traceability. Quality management methods and systems.

03609399 Digital Manufacturing System Engineering Project II   2(0-6-3)

   Interesting projects in various disciplines of digital manufacturing system engineering. Applying digital technologies for improving full-scale manufacturing processes.

03609426 Industrial System Analysis and Design   3(3-0-6)

   Introduction to manufacturing system. Concept of integrated production line design. Design and development of digital factory. Human machine interface design. Manufacturing execution system. Lean automation system. Integration of digital technology and automation system for smart factory.

03609433 Digital Reality in Industry   3(3-0-6)

   Introduction to digital reality; virtual reality, augmented reality, mixed reality, immersive technologies, 360 degree video. Hardware and software for digital reality. Applications of digital reality in industry.

03609451   Enterprise Information System   3(3-0-6)

        Introduction to enterprise information systems. Systems architecture of enterprise information systems. Business functions analysis. Enterprise Information System analysis and planning. Enterprise resource planning modules. Enterprise information systems integration. Enterprise Information System design and implementation. Project monitoring and control; system testing, enterprise system risks and controls, people and technology management, success and failure factors. Automatic identification and data capture systems and technology.

03609461   Smart Logistics and Transportations   3(3-0-6)

        Intelligent transport systems and logistics; data integration, logistics, multimodal transport, on-demand transport services. Transport information broker. Digital technologies in logistics and transportations; digitally-enabled ride, electric and autonomous vehicles.

03609462   Smart Warehouse   3(3-0-6)

        Introduction to smart warehouse. Automated picking tools. Automatic guided vehicles. Automated inventory control platforms. Warehouse management systems. IoT in warehouse. Collaborative robots. Automated storage and retrieval systems.

03609496   Selected Topics in Digital Manufacturing System Engineering   1-3

        Selected topics in digital manufacturing system engineering at the bachelor's degree level. Topics are subject to change each semester.

03609498   Special Problems   1-3

        Study and research in digital manufacturing system engineering at the bachelor's degree level and compile into written reports.

Course with extracurricular codes

01417167   Engineering Mathematics I   3(3-0-6)

         Limits and continuity of functions. Derivatives and applications. Different integration and applications. Polar coordinates. Improper integrals, sequences an Mathematical induction.

01417168   Engineering Mathematics II   3(3-0-6)
Prerequisite: 01417167

         Vector and solid analytic geometry. Calculus of multivariables functions. Calculus of vector – valued functions.

01420111   General Physics I   3(3-0-6)

         Mechanics. Harmonic motion. Waves. Fluid mechanics. Thermodynamics.

01420113   Laboratory in Physics I   1(0-3-2)
Prerequisite or Corequisite: 01420111, 01420117

         Laboratory for General Physics I or Basic Physics I.

03600390   Cooperative Education Preparation   3(3-0-6)

         Principles. Concepts and processes of cooperative education. Related rules and regulations. Basic knowledge and techniques in job application. Basic knowledge and techniques in working. Communication and human relations. Personality development. Quality management system in workplace. Presentations techniques. Report writing.

03600490   Co-operative Education   6

         On the job training as a temporary employee according to the assigned project including report and presentation.

03601101   Introduction to Industrial Electronics Engineering   3(3-0-6)

        Base number systems and codes. Basic logic gate and logic circuit design. Analog and digital conversion principles. Semiconductor devices. Industrial control. Input and output devices for industrial control. Power electronics basics and converters. Driving direct current motor and alternating current motor. Programmable logic controller (PLC) and interfaces. Basic applications of PLC in automation systems.

03601102   Introduction to Industrial Electrical Engineering   3(3-0-6)

        Direct current and alternating current circuit analysis. Three phase systems. Basic electrical and electronic equipment. Basic electrical machine. Electrical measuring instruments. Basic electrical system installation in buildings and factories. Safety in electrical engineering.

03601206   Introduction to Industrial Electronics Engineering Laboratory   1(0-3-2)
        Prerequisite: 03601101

        Laboratory experiments on topics covered in Introduction to Industrial Electronics Engineering.

03601207   Introduction to Industrial Electrical Engineering Laboratory   1(0-3-2)
        Prerequisite: 03601102

        Laboratory experiments on topics covered in Introduction to Industrial Electrical Engineering.

03601208   Automation System in Manufacturing   3(3-0-6)
        Prerequisite: 03601101

        Fundamental elements for automation in manufacturing process. Industrial controllers. Analog and digital signal conditioning. Process and motion control. Industrial sensors and actuators Sequential control and programmable logic controllers. PLC interfaces. PLC programming. Human-machine Interface. Overview of Industrial robots. Robot programming and simulation software. Robot programming hardware.

03601304   Automation System in Manufacturing Laboratory   1(0-3-2)
             Prerequisite: 03601208
                  Laboratory experiments on topics covered in Automation System in
             Manufacturing.

03602201   Introduction to Materials and Manufacturing Processes   3(3-0-6)
                  Relationship between structures, properties, manufacturing processes
             and applications of engineering materials. Metals. Polymers. Ceramics.
             Composites. Mechanical properties and material degradation. Fundamental of
             manufacturing processes; foundry, forming, welding, powder metallurgy, hot
             and cold forming, cutting, turning, shaping, drilling, milling, and surface finishing.

03602221   Applied Probability and Statistics for Engineers   3(3-0-6)
             Prerequisite: 01417168
                  Descriptive statistics in basic engineering. Probability. Random
             variables. Discrete probability distributions. Continuous probability distributions.
             Joint probability distributions. Sampling distributions. Statistical inference for
             one and two populations. Engineering applications.

03602401   Financial and Economic Analysis   3(3-0-6)
                  Profitability analysis: cost estimation, financial estimation, rate of return
             estimation, and financial evaluation. Resource-ability analysis: value-added,
             effects of income taxes and inflation, and economic rate of return.

03602417   Innovative Product Design and Manufacturing   3(3-0-6)
                  Introduction to ages of industry. Product design processes. Creative and
             innovative thinking. Conceptual design. Feasibility analysis. System-level design.
             Detail design. Design for manufacturing and assembly. Additive manufacturing.
             Product evaluation and improvement. Product life cycle management. Startup
             entrepreneurship. Patents.

03602442   Energy Management   3(3-0-6)

Energy conservation in industrial plants. Audit and analysis of energy consumptions of lighting. Air-conditioned. Heat energy. Air compression and electrical systems. Materials and products balance chart. Techniques for energy conservation. Economy engineering applications in energy management. Energy measuring devices and technology. Modern techniques and technology in energy conservation.

03602473   Strategies for Managing Supply Chains   3(3-0-6)

Supply chain strategy and corporate strategy interface. Porter's value chain. Logistics costs. Supply chain performance. Matching supply and demand. Bullwhip effect. Collaborative planning forecasting and replenishment. Sales and operations planning. Supply chain strategy design. Lean concepts in supply chain. Agile concepts in supply chain. Responsive supply chain. Hybrid supply chain. Managing risk in supply chain. Era of network competition. Creating sustainable supply chain.

03603101   Introduction to Computer Programming   3(2-3-6)

Computer concepts. Computer components. Hardware and software interaction. EDP concepts. Program design and development methodology. High-level language programming.

03603102   Basic Computer Architecture and Embedded System   3(3-0-6)

Basics of computer architecture. Computer arithmetic. Memory system organization and architecture. Interface and communication. Assembly language. Device subsystems. Processor design and organization of CPU. Performance and enhancements. Distributed system models. Embedded systems technologies, architecture, and design. Embedded systems peripherals. Digital and analog inputs/outputs. Interrupts, timer, and watchdog. Storage. Sensors and transducers. Wired communications. State machines. Wireless sensors networks and smart systems. Model-based programming.

03603103   Basic Digital Circuit Design   3(3-0-6)

Basic digital system design. Boolean algebra. Digital design techniques. Logic gates. Logic minimization. Standard combinational circuits, sequential circuits. Flip-flops. Synchronous and asynchronous sequential circuits. PLA, ROM, and RAM. Arithmetic circuits. Computer-aided logic design.

03607331   Machine Vision and Applications in Automation System   3(3-0-6)

Fundamental of digital image. Intensity transformation and spatial filtering. Color image processing. Edge and corner detection. Feature extraction. Image segmentation. Using of computer vision library. Image formation and camera model. Imaging with one camera. Camera calibration. Stereo imaging. Object recognition and tracking. Robot vision.

03607332   Artificial Intelligence for Robot and Machinery   3(3-0-6)

Introduction to artificial intelligence for robot and machinery. Mathematics for artificial intelligence. Knowledge representation and logic. Fuzzy logic. Agent. Search strategies. Planning. Genetic algorithm. Decision tree. Bayesian learning. Artificial neural networks. Reinforcement learning. Applications of artificial intelligence for robot and machinery.

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Knowledge of the Land

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