3.1.5 course description

course code

01234397*	Seminar Presentation and discussion on current interesting topics in digital manufacturing and robotics integration engineering at the bachelor's degree level.	1
01234490*	Co-operative Education On the job training as a temporary employee in order to get experiences from the assignment for digital manufacturing and robotics integration engineering.	9
01234494*	Body of knowledge from Oversea University Knowledge in digital manufacturing and robotics integration engineering the bachelor's degree level taken in oversea university. Credit equivalent according to Kasetsart University regulation.	1-12
01234495*	Digital Manufacturing and Robotics Integration Engineering Projects Preparation Research methods in digital manufacturing and robotics integration engineering. Project proposal writing. Literature review. Research report writing. Utilization of instrumentation for research. Application of software in instrumental control and data analysis. Media creation for research presentation.	1(0-3-2)

01234496*	Selected Topics in Digital Manufacturing and Robotics Integration Engineering Selected topics in digital manufacturing and robotics integration engineering at the bachelor's degree level. Topics are subject to change each semester	1-3
01234498*	Special Problems Study and research in digital manufacturing and robotics integration engineering at the bachelor's degree level and complied into a written report.	1-3
01234499*	Digital Manufacturing and Robotics Integration Engineering Project Pre course: 01234495 Project of practical interest in various fields of digital manufacturing and robotics integration engineering.	2(0-6-3)

Courses that are extracurricular codes

01204111	Computers and Programming Basic structure of modern computer systems. Data representation in computer. Algorithmic problem solving. Program design and development methodology. Introductory programming using a high-level program language. Programming practice in computer laboratory.	3(2-3-6)
01205201	Introduction to Electrical Engineering Direct current and alternating current circuit analysis. Generators and their uses. Motors and their uses. Transformers. Three-phase systems. Power transmission system. Electrical instruments.	3(3-0-6)

01205202	Electrical Engineering Laboratory I Pre course: 01205201 Laboratory experiments on topics covered in introduction to Electrical Engineering.	1(0-3-2)
01205301	Digital Circuits and Microcontrollers Number systems and codes. Boolean algebra. Combinational and sequential logic circuit design. Karnaugh map. State machine. Synchronous and asynchronous sequential logic circuit design. Hardware and software development tools for microcontroller. Microcontroller architectures and peripherals. Compilers and debuggers. Timer and interrupt systems. Interfacing of devices. Data communication and networks.	3(3-0-6)
01205302	Digital Circuits and Microcontrollers Laboratory Pre course: 01205301 Laboratory for digital circuit and microcontrollers.	1(0-3-2)
01208112	Mechanical Engineering Drawing 2D and 3D drawing.Mechanical engineering drawing.Working drawing. Technology of drawing and design by using computer.	3(2-3-6)
01208271	Applied Mathematics in Mechanical Engineering Mathematical models and numerical solutions for mechanical engineering. Systems of linear equations. Curve fitting. First- order differential equations. Systems of linear differential equations. Laplace transform. Fourier-series methods and partial differential equations.	3(2-3-6)

01208281 Workshop Practice 1(0-3-2)

Practices in the use of measurement devices. Hand tools. Power tools. Materials and accessories in mechanical works. Welding. Machining. Wood works. Piping system. Electrical and electronics works, and safety.

01208381 Mechanical Engineering Laboratory I 1(0-3-2)

Pre course: 01208201 or 01208221

Experimental works in the areas of engineering mechanics, solid mechanics, thermodynamics, engineering materials and fluid mechanics.

01211151 Statics and Strength of Materials 3(3-0-6)

Force systems. Resultant. Equilibrium. Friction. Principle of virtual work and stability. Introduction to dynamics. Stresses and strains relationship. Stresses in beams. Shear force and bending moment diagrams. Deflection of beams. Torsion. Buckling of columns. Mohr's circle and combined stresses. Failure criterion.

01211211 Design Engineering and Design Technology 3(2-3-6)

Solid modeling for mechanical part. Reverse engineering and surface modeling. Sheet metal design. Pneumatics and hydraulics drawing. Motion simulation. Mechanical parts structure analysis. Computer-aided engineering. Mechanical and electrical drafting. Wire harness design and electrical routing.

01211221 Hydraulics and Pneumatics Systems 3(2-3-6)

Components of pneumatic and hydraulic systems. Design of pneumatic and hydraulic circuits. Design of electro pneumatic circuits. Electro pneumatics system control using PLC. Applications of pneumatic and hydraulic system in mechatronics.

01211222 Mechatronics Engineering 3(2-3-6)

Electric motor. Hydraulics system and pneumatics system. Mechanical drives. Transducers. Sensors. Microcontroller. Fundamental PLC. Control system. Implementations of sensor and actuator systems. Mechanical devices and electrical circuits interface. Navigational sensors.

01211232 Production Systems Management

Introduction to manufacturing planning and control system. Just-in-time/Lean manufacturing. Demand management. Forecasting. Inventory control. Master production scheduling. Final assembly scheduling. Capacity management. Rough-cut capacity planning. Material requirements planning. Capacity requirements planning. Manufacturing resource planning. Production activity control. Scheduling and sequencing. System monitoring and data analytics.

01211261 Fundamentals of Thermodynamics and Fluid Mechanics 3(3-0-6)

Introduction to thermodynamics. Basic principles and definitions. Properties and states of pure substances. Work and heat. First Law of Thermodynamics. Closed Systems. Open Systems. Introduction to Fluid Mechanics. Fluid properties. Fluid statics. Law of conservation of mass. Momentum and energy. Bernoulli's equation. Flux field. Static and incompressible flow.

01211271 lndustrial Artificial Intelligence and IoT 3(2-3-6)

Introduction to artificial intelligence and IoT. Design and development approaches. Hardware and software. Programming and algorithm development. Communication protocol. Cloud system connection. Device monitoring and control. Data collection and analysis. Probabilistic models. Integration and applications of artificial intelligence and IoT in manufacturing industry.

01211313 Automatic Machine Design 3(3-0-6)

Mechanical, electrical, and fluid power elements in automatic machine. Integrated design of mechanical, electrical, and fluid power systems. Assembly and disassembly design. Comparisons and considerations for purchasing.

01211315 Manufacturing Facility Design 3(3-0-6)

Facilities planning and design. Problems, factors, and methods of location selection. Types of plant layout. Process and workstation design. Analysis of requirement for machines, equipment and manpower. Material handling. Material handling equipment. Time and motion study. Flow and activity relationship analysis. Material flow and area requirement analysis. Features of mass production and assembly line layout. Line balancing techniques. Computerized layout.

01211323 Industrial Automation Control System 3(2-3-6)

Basic principle of automation system for electrical-mechanical manufacturing engineering. Programmable logic controller. Basic PLC programming. Basic PLC instructions. Timer and counter instructions. Program control instructions. Process controller design. Analog sensors and actuators. Analog control. PLC network. Human-machine interface. Analysis and design of automation system.

01211324 Robotics Integration and Automation System 3(2-3-6)

Principles of industrial automation system. Principles of SCADA systems. SCADA programming to monitor and control the PLC-based industrial processes. Principles of industrial robot. Robotics integration and automation system for modern manufacturing. Smart factory. Guidance for safety system design for robot work cell.

01211325 Vibration Analysis and Condition Based Maintenance 3(2-3-6)

Basic theory of mechanical vibration. Systems with one degree of freedom. Free and forced vibration. Method of equivalent system. Multi-degree of freedom system. Effects of vibration on mechanical equipment. Vibration measuring instrument. Vibration diagnostic. Vibration analysis and control. Realtime data monitoring and vibration analysis. Condition based maintenance.

01211334 Robotics Engineering and Information System 3(2-3-6)

Introduction to robotics. Industrial robot operating system (ROS). Architectural components of the ROS. Computer programming for ROS to control robot. Commands and instruction sets. Display and simulation. Calling tools and libraries. Creating packets. Interfacing between ROS and sensors/actuators. Algorithm for data processing. Kinematics analysis. Manipulator kinematics. Joints and links. Homogeneous transformations. Forward and inverse kinematics. Position analysis. Dynamic analysis. Velocity and Acceleration analysis. Force and torque relationships. Force and moment balance. Trajectory planning.

01211371 Industrial Dynamics System and Control 3(2-3-6)

Dynamics modelling of mechanical and electromechanical systems. Classical control theory. Classical control practice. Controller design. Introduction to digital control and modern control. Control principles and practical design of microcontroller-based control systems, CPLD and FPGA, PLC, and industrial motion control cards.

01211373 Machine Learning and Programming for Industry 3(2-3-6)

Machine Learning in industrial. Neural network. Hardware and software. Perceptron. Supervised and unsupervised learning. Reinforcement learning. Loss functions. Back propagation. Binary and multiclass classification. Hyperparameters tuning. Convolutional neural networks. Transfer learning. Data pipelining. Recurrent neural networks. Sequence models. Natural language processing. Embedded device deployment.

01211472 Deep Learning for Manufacturing Industry 3(2-3-6)

Introduction to deep learning and neural networks for manufacturing industry. Deep sequence modelling. Deep computer vision. Deep generative modelling. Deep reinforcement learning. Limitations and new frontiers. Evidential deep learning. Bias and fairness. Case studies of deep learning in electrical-mechanical manufacturing engineering fields.

01213201 Materials and Manufacturing Processes 3(3-0-6)

Relationships between structures, properties, processes and performances of engineering materials. Phase equilibrium diagrams and their interpretation. Micro and macrostructures related to properties of engineering materials. Material properties testing and analysis. Corrosion and degradation of materials. Fundamental of manufacturing processes: foundry, forming, welding, powder metallurgy, hot and cold forming, machining and surface finishing. Measurement and inspection.

01403114 Laboratory in Fundamental of General Chemistry 1(0-3-2)

Pre course: 01403117 or simultaneously with 01403117 Fundamental of General Chemistry

Laboratory work for 01403117 Fundamentals of General Chemistry.

01403117 Fundamental of General Chemistry 3(3-0-6)

Atomic structure. Periodic table and periodic properties. Chemical bonds. Stoichiometry. Gases. Liquids. Solids. Solutions. Chemical kinetics. Chemical equilibrium. Acids and bases. Ionic equilibrium. Representative elements. Metals. Nonmetals and metalloids. Transition metals.

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

Limits and continuity of functions. Derivatives and applications. Differentials. Integration and applications. Polar coordinates. Improper integrals. Sequences and series. Mathematical induction.

01417168 Engineering Mathematics II 3(3-0-6)

Vectors and solid analytic geometry. Calculus of multivariable 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)

Pre course: 01420111 or simultaneously 01420117

Or simultaneously Laboratory for General Physics I or Basic Physics I.