

Course Description

Course in General Engineering Course code ENGR (259)

ENGR103 (259103) Engineering Materials 3(3-0-6)

Prerequisite : None

Background and classification of engineering materials: metals, plastics, ceramic, asphalt, wood and concrete. Production processes for product using engineering materials. Macro and microstructures of engineering materials. Imperfections in solids; Phase equilibrium. Properties of material. Mechanical testing. Hardening and heat treatment processes. Corrosion reactions and corrosion control.

ENGR104 (259104) Engineering Drawing 3(2-3-4)

Prerequisite : None

Introduction to engineering drawing, drawing instruments and lettering. Theory of Orthographic projection and drawing. Dimensioning and to lerancing. Sections and conventions. Auxiliary views and development. 3D: Isometric. 3D: Oblique. 3D: Perspective. Freehand sketches. Drawing Applications.

ENGR106 (259106) Workshop Technology 1(0-3-0)

Prerequisite : None

Introduction to workshop, occupational health, safety and environment. Folding and welding. Lathe and milling. Handcraft with hand tools. Introduction to automation. Basic computer programming for microcontroller. Sensors, actuators, and instrumentation. 2D rapid prototyping. 3 rapid prototyping.

ENGR107 (259107) Engineering Mechanics 1 3(3-0-6)

Prerequisite : MATH 161 (206161) and PHYS 105 (207105)

Principle of statics and dynamics. Force systems. Free body diagram. Equilibrium. Simple structures. Distributed force. Moment of inertia of an area. Friction. Principle of virtual work and stability.

ENGR108 (259108) Electricity in Everyday Life 3(3-0-6)

Prerequisite : None

Electrical safety, Electrical equipments in daily life, Electrical equipments maintenance, Electrical appliances safety, Help and First-aids for electrical hazards, Basic electricity saving, Electrical appliances electricity saving, Electric light energy saving, Air conditioning electricity saving, Electricity saving policy, Electricity cost calculation, Electricity cost rate, Fuel Adjustment Charge (at the given time : Ft), Electricity organizations in Thailand, Electricity generation nowadays and in the future, Electrical power plants, Nuclear power plant, Electricity distribution system.

ENGR109 (259109) Telecommunication in Thailand 3(3-0-6)

Prerequisite : None

Telecommunication evolution in Thailand, telecommunication policies and related laws, telecommunication economics, basic telephone and mobile telephone, radio broadcasting, television broadcasting, fiber optic communication, submarine cable network in Thailand, wireless communication network microwave communication, satellite

communication, internet protocol communication and next generation telecommunication.

ENGR191 (259191) Principle of Being Professional 1(0-3-1)

(เปลี่ยนชื่อวิชาจาก Learning through Activities 1) มีผลบังคับใช้ตั้งแต่ภาคเรียนที่ 1/2563

Prerequisite : None

Student preparation to be a well-disciplined student, with physical well-being, positive mental health, morality, ethics and social consciousness. Student will be able to live a sufficient and safety life, as well as be loyal to faculty and university and to be professional. Grading will be on given on Satisfactory or unsatisfactory basis.

ENGR192 (259192) Skills for Professionalism and 1(0-3-1)

Entrepreneurship

(เปลี่ยนชื่อวิชาจาก Learning through Activities 2) มีผลบังคับใช้ตั้งแต่ภาคเรียนที่ 1/2563

Prerequisite : None

Preparing students for graduation in professional practice and entrepreneurship, a well-disciplinary with physical well-being, positive mental health, morality, ethics and social consciousness. Preparing students to be able to live a sufficient and safety life. Grading will be on given on Satisfactory or unsatisfactory basis.

ENGR193 (259193) Morality and Intelligence for 1(0-3-1)

Being a Professional

(เปลี่ยนชื่อวิชาจาก Learning through Activities 3) มีผลบังคับใช้ตั้งแต่ภาคเรียนที่ 1/2563

Prerequisite : None

The truth of life, meaning of life, living in society by adhering to the principles of morality. Applying the auspicious principles of life in self-development, increasing the potential, developing wisdom, quality of life and society for a happy life, peace from inside, to create a society that is stable and sustainable. Grading will be on given on Satisfactory or unsatisfactory basis.

ENGR194 (259194) Characteristics and Values for 1(0-3-1)

Being a Professional Entrepreneur

(เปลี่ยนชื่อวิชาจาก Learning through Activities 4) มีผลบังคับใช้ตั้งแต่ภาคเรียนที่ 1/2563

Prerequisite : None

Principles for creating good work values, preparation for being a good professional practitioner, assessing self-potential as a professional entrepreneur, internal capacity building, behavior development, having character, good values, and being a potential professional entrepreneur. Grading will be on given on Satisfactory or unsatisfactory basis.

ENGR195 (259195) Managing Activities for Development 1(0-3-1)

(เปลี่ยนชื่อวิชาจาก Learning through Activities 5) มีผลบังคับใช้ตั้งแต่ภาคเรียนที่ 1/2563

Prerequisite : None

Principles and concepts of social and environmental development. Applying theoretical knowledge in planning, management, monitoring, evaluation and lessons learned. Managing activities for social and environmental development. Grading will be on given on Satisfactory or unsatisfactory basis.

ENGR201 (259201) Computer Programming for Engineers 3(2-3-4)	ENGR499 (259499) Project 3(0-9-0)
<p>Prerequisite : None</p> <p>Introduction to computers for engineers. Principles of computer hardware and software. Hardware and software interaction. Computer components. Computer systems EDP concepts. Engineering problem solving concepts and planning. Engineering problem solving by using computers. Software design and development methodology. Principles of high-level computer programming languages. Computer programming language selection for engineering applications. Software applications for engineering problem solving.</p>	<p>Prerequisite : Consent of the department</p> <p>Special investigation or studies of any topic in engineering is carried out by an individual student or a group of students under the supervision of an advisor. A written report must be submitted at completion of the course and an oral examination will be examined by a committee.</p>
ENGR203 (259203) Engineering Mechanics II 2(2-0-4)	<p>Course in Civil Engineering Course code CE (251) CE100 (251100) Introduction to Civil Engineering 1(0-3-0)</p>
<p>Prerequisite : ENGR107 (259107)</p> <p>Review of force systems. Kinematics of particles; rectilinear motion, curvilinear motion. Kinetics of particles. Kinematics and kinetics of rigid bodies.</p>	<p>Prerequisite : PHYS105 (207105)</p> <p>Introduction to civil engineering study. Introduction to structural and materials engineering, geotechnical engineering, hydraulic engineering and water resource management, transportation and traffic engineering, survey engineering, construction engineering and management. Applications of knowledge in physics (statics dynamics and fluid) and mathematics to various civil engineering areas.</p>
ENGR301 (259301) Innovation to Market 3(3-0-6)	CE211 (251211) Strength of Materials 1 3(3-0-6)
<p>Prerequisite : None</p> <p>Introduction to innovation to market; structure rapid-prototyping tools; logic rapid-prototyping tools; designing innovations that fulfill market needs; intellectual property management; types and registration of businesses; funding sources and fundraising.</p>	<p>Prerequisite : ENGR107 (259107)</p> <p>Simple stresses and strains. Stress-strain relation, torsion, shear force and bending moment in beams, stresses in beams, combined stresses, Mohr's circle, deflection of beam by double integration method, buckling of columns, failure criteria.</p>
ENGR401 (259401) Power Plant Operation and Maintenance 3(3-0-6)	CE213 (251213) Theory of Structures 3(3-0-6)
<p>Prerequisite : Consent of the department</p> <p>Main components and transmission system in power plant. Transmission system and power development plan. Supervisory Control and Data Acquisition (SCADA). Protection of transmission system in power plant. Modern safety management in power plant. Power Purchase Agreement (PPA) and Grid Code. Power plant performance and efficiency. Power plant operation. Power plant maintenance.</p>	<p>Prerequisite : CE211 (251211)</p> <p>Analysis of determinate structures. Stability and determinacy of structures. Shearing force and bending moment diagrams. Analysis of simple trusses and compound trusses. Influence lines for determinate beams and trusses. Deflections of determinate frames and trusses. Continuous beams and restrained beams.</p>
ENGR401 (259402) Engineering Professional Practice 3(3-0-6)	CE216 (251216) Structural Materials and Testing 4(3-3-6)
<p>Prerequisite : Consent of the department</p> <p>Duties and responsibilities of engineering profession. Hard skills and fundamental knowledge required for engineering profession. Design process in engineering profession. Attributes and attitudes required for engineering profession. Ethical and safety awareness in engineering profession. Grading will be given on satisfactory or unsatisfactory basis.</p>	<p>Prerequisite : CE211 (251211) and ENGR103 (259103)</p> <p>Concrete technology; materials for concrete; mixture proportioning and testing of concrete; mechanical properties of concrete; application of statistics in concrete proportion; production technology of structural steel; mechanical properties of reinforcing steel and testing of structural steel; mechanical properties of timber; properties of brick; materials testing methods..</p>
ENGR491 (259491) Project Survey 1(0-3-0)	CE242 (251242) Surveying Engineering 1 3(2-3-4)
<p>Prerequisite : Consent of the department</p> <p>This course is for the students who will enroll the course 259499 "Project" in the next semester. The students have to survey and research to select topics for projects and methods to do projects. The students have to report the plan and time schedule for the approval of project in the next semester. The report evaluation result is S or U.</p>	<p>Prerequisite : MATH162 (206162)</p> <p>Introduction to surveying work, errors and adjustments, distance measurements, leveling, angle and direction measurements, theodolites, traverses, stadia, area and volume.</p>
	CE261 (251261) Hydraulics 3(3-0-6)
	<p>Prerequisite : ENGR107 (259107)</p> <p>Fluid properties. Hydrostatics. Basic concepts of fluid flow. Forces developed by moving fluid. Flow in pipes. Flow in open channels. Fluid measurements. Dimensional analysis and hydraulic similitude.</p>

CE281 (251281) Elementary Survey for Non-Civil Engineering Majors 3(2-3-4)	specifications and methods of testing; types of surfacing materials and design methods; stabilization for highway engineering purposes.
Prerequisite : For Non-Civil Engineering Majors Introduction to surveying; measurement of distance; chain surveying; leveling; measurement of angle; traversing; area and volume computation; topographic surveying; application of surveying to non-engineering field.	CE343 (251343) Survey for Civil Engineering 4(3-3-6) Prerequisite : MATH162 (206162) and STAT263 (208263)
CE292 (251292) Mathematical Application and Differential Equation for Civil Engineers 3(3-0-6)	Introduction to surveying work. Errors and adjustments. Distance measurements. Leveling. Angle and direction measurements. Theodolites. Traverses. Stadia. Area and volume. Topographic survey and mapping. Triangulation. Construction surveys. Surveying with modern technology. Eighty hours of field practice at surveying camp at the end of semester to complete topographic maps.
Prerequisite : MATH261 (206261) Civil engineering problems and differential equations. Linear algebra, Solution of algebraic and transcendental equation, Solution of linear systems, Vector Calculus, Numerical Method in Interpolation, Integral and Differential equation, Linear regression, Homogeneous first and second order linear/non-linear differential equation and solution, Fourier transforms and Laplace transforms, Application of ordinary linear differential equations to fluid flow through orifice, sedimentation of soil particles in clear water, deflection of beam, buckling of column, vibration of structure and foundation. Application of partial differential equations to vibration of bar and flow of water through soil. Numerical solution of differential equations.	CE361 (251361) Hydraulics Laboratory 1(0-3-0) Prerequisite : CE261 (251261)
CE312 (251312) Structural Analysis 3(3-0-6) Prerequisite : CE213 (251213)	Laboratory practice and demonstration in hydraulic engineering; measurement of fluid properties; center of pressure and fluid subjected to acceleration; flow through orifices and weirs; flow through pipe lines; flow in an open channel; surge tank; wind tunnel; centrifugal pump and impulse momentum relationship; demonstration on selected topics.
Influence lines for indeterminate structures. Analysis of indeterminate structures by the slope-deflection method, moment distribution method and matrix displacement method. Approximate analysis. Introduction to plastic analysis.	CE363 (251363) Engineering Hydrology 3(3-0-6) Prerequisite : STAT263 (208263) and CE261 (251261)
CE313 (251313) Reinforced Concrete Design 4(3-3-6) Prerequisite : CE 216 (251216) and CE 312 (251312); or concurrence	Hydrologic cycle; hydrometeorology; origin and analysis of precipitation; evaporation and transpiration; infiltration and loss rate; streamflow measurements; streamflow hydrograph; flood routing; flood frequency analysis; groundwater hydrology.
มีผลบังคับใช้ภาคการศึกษา 1/2564 Design of reinforced concrete structures by working stress and strength design concepts, bonding and anchorage between concrete and reinforcing bars, theory and design of reinforced concrete beams, slabs, columns, and footings, reinforcement detailing, design practices.	CE371 (251371) Soil Mechanics 3(3-0-6) Prerequisite : CE211 (251211) and CE261(251261) and GEOL275 (205275)
CE333 (251333) Highway Engineering 3(3-0-6) Prerequisite : CE342 (251342) or CE343 (251343) or concurrence; and CE371 (251371)	Formation of soil. Physical properties of soils. Engineering soil classification. Permeability of soils. Stress distribution in soil mass. Consolidation theory and settlement analysis. Stress-strain and shear strength of soils. Bearing capacity theory. Soil compaction.
Highway system and organization network; forecast of traffic volume for highway and urban transportation planning; highway project evaluation; basic traffic characteristics for highway design; capacity and geometric design of open highway and intersection; highway traffic control techniques; highway lighting; surface and subsurface drainage for highway; types, properties, and specification for highway materials; design highway pavement design; highway construction, maintenance, and rehabilitation.	CE372 (251372) Engineering Soil Tests 1(0-3-6) Prerequisite : CE371 (251371) or concurrence
CE334 (251334) Highway Engineering Laboratory 1(0-3-0) Prerequisite : CE333 (251333) or concurrence; and CE372 (251372)	Field testing and laboratory experiments in soil mechanics; standard tests to determine various engineering properties of soils; uses of equipments; report writing, analysis, and discussion of test results.
Laboratory tests of road building materials; origin, physical, and mechanical properties of soils, aggregate, and bituminous materials; standard	CE374 (251374) Foundation Engineering and Practices 3(2-3-4) Prerequisite : CE371 (251371) and CE372 (251372)
	Engineering properties of soils for foundation design; subsurface investigation; design of shallow foundation; design of deep foundations; foundation settlement analysis; slope stability analysis; applications of earth pressure theory; earth retaining structure and sheet pile wall design; elementary of soil improvement; practices in foundation engineering and detailing.

CE400 (251400) Training in Civil Engineering	3(0-18-0)	information technology for freight transport systems. Green Logistics: Sustainable freight transport.
Prerequisite : Consent of the Department		
Training with government organizations or private companies involving in design and construction of civil engineering works under supervisions of training engineers and/or academic advisor. Students are required to submit training reports which will be reviewed and approved by a training by committee.		
CE401 (251401) Cooperative Education	6 Credit	CE436 (251436) Transportation Engineering
Prerequisite : CE313 (251313) and CE333 (251333) and CE343 (251343) and CE363 (251363) and CE347 (251374) and Consent of the Department		3(3-0-6)
Training with government organizations or private companies involving in design and construction of civil engineering virtually as a staff. The trainee must works continuously at least 16 weeks (480 hours) under supervisions of the academic advisory staff and training engineers.		Prerequisite : Consent of the department
		Components and characteristics of transportation systems; regional and urban transportation planning; multimodal transportation planning in a region; layout and design of land and air transportation with some attention to waterways and pipelines.
CE411 (251411) Timber and Steel Design	4(3-3-6)	CE437 (251437) Fundamentals of Traffic Engineering
Prerequisite : CE312 (251312)		3(2-3-4)
Design of timber and steel structures; axially loaded members; built-up members; flexural members; beam-columns; plate girders; connections using Allowable Stress Design (ASD) and Load Resistance Factor Design (LRFD) methods. Practice in timber and steel design.		Prerequisite : Fourth year standing
CE412 (251412) Bridge Design	3(2-3-4)	Nature of highway traffic; basic traffic flow theory; field studies and analysis of field survey data; methods and equipment used in operation, regulation, and control traffic, traffic lighting; some attention to environmental considerations in traffic engineering.
Prerequisite : CE313 (251313)		
Bridge design concept and practice. Loads, load combinations and distributions. Design of simple R.C. and steel bridges. Design of bridge piers, abutments and bearings.		CE438 (251438) Rail Engineering
CE417 (251417) Building Design	3(2-3-4)	3(3-0-6)
Prerequisite : CE313 (251313)		Prerequisite : Consent of the department
Architectural and engineering approach to design of reinforced concrete structures of various types.		Transit characteristics. Rail system planning. Passenger and freight transportation. Track layout and train operation diagram. Motion and performance of track structure. Railway structural design. Rail system operation and service. Rail system operation analysis. Intelligent transportation system (ITS) and its applications in rail system. Transit oriented development (TOD) . Economics and financial analysis of rail system. Organization and implementation of rail system.
CE418 (251418) Prestressed Concrete Design	3(2-3-4)	CE439 (251439) Selected Topics in Transportation Engineering
Prerequisite : CE313 (251313)		3(3-0-6)
Materials and methods of prestressing; losses of prestress; elastic analysis and design of determinate beams; flexural and shear capacity; end effects; composite members.		Prerequisite : Consent of the department
CE419 (251419) Selected Topics in Structural Engineering	3(3-0-6)	Selected topics in transportation engineering which are of current interest in this field. Special problems or topics are to be presented and discussed. The content of the course will be proposed by the Transportation Engineering Division and approved by the Department of Civil Engineering and will be announced prior to the commencement of each semester.
Prerequisite : consent of the department		
Selected topics in current interesting and new development in structural engineering.		CE441 (251441) Elementary Photogrammetry and Remote Sensing
CE 434 (251434) Freight Transport and Logistics Systems	3(3-0-6)	3(2-3-4)
Prerequisite : Consent of the department		Prerequisite : CE241 (251241) or CE242 (251242) or CE281 (251281)
Introduction to freight transport, logistics and supply chain systems. Soft and hard freight transport infrastructures. Freight transport infrastructures: Freight transport agents and freight transport modes. Construction logistics. City logistics. Introduction to freight transport modeling. Globalisation and		Introduction; aerial photography; stereoscopic plotting instrument and orientation; aerial triangulation; remote sensing.
		CE442 (251442) Photogrammetry
		3(2-3-6)
		Prerequisite : CE341 (251341) or CE342 (251342)
		Basic concepts of photogrammetry, cameras and photogramphy, flight planning, geometry of photographs, methods, mosaic, rectification, stereoscopic plotting, orthophotography.

<p>CE443 (251443) Introductory Geospatial Technology for Civil Engineers 3(2-3-6)</p> <p>Prerequisite : CE341 (251341) or CE342 (251342)</p> <p>The interdisciplinary concept of geospatial information science: the Global Positioning System, Geographic Information Systems, and remote sensing, spatial data infrastructure, geodesy and map projections, spatial data quality, light detection and ranging, application examples to engineering.</p>	<p>improving the building information modeling and the information modeling for city design and management. The course is encompassed with the application of building information modeling for project scheduling, project bill of quantity preparation, and project quality control.</p>
<p>CE449 (251449) Selected Topics in Survey Engineering 3(3-0-6)</p> <p>Prerequisite : CE 341 (251341) or Consent of the Department</p> <p>Selected topics in current interesting and new development in survey engineering.</p>	<p>CE459 (251459) Selected Topics in Construction Management Engineering 3(3-0-6)</p> <p>Prerequisite : Consent of the Department</p> <p>Selected topics current interesting and new development in construction management engineering.</p>
<p>CE451 (251451) Construction Techniques and Management 3(3-0-6)</p> <p>Prerequisite : CE313 (251313); and CE431 (251431) or CE333 (251333) or concurrence</p> <p>Introduction to the principles of construction; project organization; project delivery systems; construction equipment; site layout; project planning; progress measurement; critical path method (CPM); resource management; construction safety; quality systems; modern construction technology.</p>	<p>CE461 (251461) Hydraulic Engineering 3(3-0-6)</p> <p>Prerequisite : CE363 (251363)</p> <p>Planning for development of water resources; role of hydrology in hydraulic engineering; reservoir; dams and related structures; analysis and design of pipe line system; design of open channel flow; fluid machinery; hydraulic structure; hydraulic models; erosion and sediment; drainage.</p>
<p>CE452 (251452) Construction Estimation and Specification 3(3-0-6)</p> <p>Prerequisite : CE313 (251313) and CE411 (251411); and CE333 (251333) or CE431 (251431)</p> <p>Basic concepts of estimations; construction contracts; construction drawings; specification for material; specification for workmanships; related legal matters in construction.</p>	<p>CE465 (251465) Natural Disasters 3(3-0-6)</p> <p>Prerequisite : CE 363 (251363) or consent of the Department</p> <p>Introduction – various types of natural disasters, anatomy of the earth, various groups of natural disasters, natural disasters statistics, glossary of terms, interesting photos and details of some natural disasters.</p>
<p>CE 455 (251455) Information Technology in Construction Engineering and Management 3(3-0-6)</p> <p>Prerequisite : Consent of the department</p> <p>Data and information system in construction project, concept and application of innovation and information technology in construction engineering and management, computer-aided design in 2D and 3D, geographic information system, construction project management software, cloud technology in construction, BIM technology in construction.</p>	<p>CE466 (251466) Irrigation 3(3-0-6)</p> <p>Prerequisite : CE363 (251363)</p> <p>Irrigation need and benefits; irrigation and drainage; field management of irrigation; surface irrigation; subsurface irrigation; overhead irrigation; trickle or drip irrigation; surface and sprinkler field system design; canals and canal structures; irrigation development problems.</p>
<p>CE456 (251456) Architecture and Engineering Systems for Buildings 3(3-0-6)</p> <p>Prerequisite : CE313 (251313) or concurrence</p> <p>Basic concepts in architectural design. Engineers' role and duty in designing of a building with architects. Design concept of structural systems for buildings. Electrical, water supply, sanitary and mechanical systems for buildings. Principles of green architecture.</p>	<p>CE467 (251467) Drainage 3(3-0-6)</p> <p>Prerequisite : CE363 (251363)</p> <p>The measurement and manipulation of drainage data; theory of surface drainage; design of surface drainage; theory of subsurface drainage; design of subsurface drainage; drainage system layouts; manipulation of field system design; drainage development problems.</p>
<p>CE457 (251457) Application of Building Information Modeling for Construction Management 3(2-3-4)</p> <p>Prerequisite : Consent of the department</p> <p>Understanding the working system of building information modeling for construction management, which are the building information modeling for building footings, columns, beams, floors, walls, stairs, roofs, steel reinforcement, and others, including the computer programming for</p>	<p>CE468 (251468) Urban Storm Drainage System 3(3-0-6)</p> <p>Prerequisite : CE363 (251363)</p> <p>Introduction to Urban storm drainage, hydraulic of drainage system, storm water runoff rate, storm sewer design, sewer appurtenances, pumps, design of pumping system, pump station system</p>
	<p>CE469 (251469) Selected Topics in Water Resources Engineering 3(3-0-6)</p> <p>Prerequisite : consent of the department</p> <p>Selected topics in current interesting and new development in water resources engineering.</p>

CE473 (251473) Tunneling and Underground Construction 3(3-0-6)

Prerequisite : Consent of the Department

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Fundamental theory of geotechnical engineering for tunneling and underground construction, Subsoil investigation interpretation for design and construction, Design and analysis of underground structure, Underground construction technics, Design and analysis of tunneling in different ground condition, Tunneling construction technology.

CE474 (251474) Fundamentals of Geotechnical Earthquake Engineering 3(3-0-6)

Prerequisite : CE374 (251374) or concurrence

Earthquake phenomena. Impact on earthquakes on buildings and earth structures. Earthquake-induced soil liquefaction. Basic design concepts for resisting or mitigating earthquake-induced damages of building foundations. Soil slope and earth retaining structures.

CE475 (251475) Temporary Structures and Underground Work 3(3-0-6)

Prerequisite : Consent of the Department

Analysis and design of temporary structures. Formwork design of footing, column, beam and slab. Temporary structures selection. Temporary structures management of project. Underground works preparation. Temporary and permanent retaining structures. Underground work management of project.

CE476 (251476) Road and Track Foundation Design 3(3-0-6)

Prerequisite : CE371 (251371) and Consent of the Department

Road and track foundations overview. Road and track foundations based on fundamental knowledge of soil mechanics. Analysis and design of road and track foundations using basic knowledge of related soil mechanics including stress and strain analysis. Material characterizations and construction of road and track foundations. Practical concern on road and track foundation.

CE477 (251477) Designing with Geosynthetics 3(3-0-6)

Prerequisite : Consent of the Department

Overview of geosynthetics material. Design and using of geotextiles, geogrid, geonet, geomembrane, geosynthetics clay liner, geopipe and geocomposite. Geosynthetics application in civil engineering work.

CE478 (251478) Fundamentals of Geoenvironmental Engineering 3(3-0-6)

Prerequisite : Consent of the Department

Scope of geoenvironmental engineering; Soil and groundwater contamination; Subsurface pollutant transport; Site investigation to assess geoenvironmental problems; Geotechnical aspects of waste disposal; Geotechnical engineering in landfill technology; Application of geotechnical principles for environmental protection; Remediation of contaminated soil.

CE479 (251479) Selected Topics in Geotechnical Engineering 3(3-0-6)

Prerequisite : Consent of the Department

Selected topics in geotechnical engineering which are of current interest in this field. Special problems or topics are to be presented and discussed. The

content of the course will be proposed by the Geotechnical Engineering Division and approved by the Department of Civil Engineering and will be announced prior to the commencement of each semester.

CE499 (251499) Civil Engineering Project 3(0-9-0)

Prerequisite : CE399 (251399) or concurrence; or consent of the department

Special investigation or studies of any topics of civil engineering, to be carried out by individual student or a group of students under supervision of instructor (s) appointed by the department. A written report must be submitted at completion of the course and an oral examination will be given by a committee appointed by the department. The course must be completed within two semesters.

Course in Electrical Engineering Course code EE (252)

EE201 (252201) Electrical Measurements and Instruments 3(3-0-6)

Prerequisite : PHYS106 (207106)

Units and standards in electrical measurement. Characteristics and types of electrical instrument. Measurement analysis. Measurement of DC and AC current and voltage using analog and digital instruments. Power, power factor and energy measurement. Measurement of resistance, inductance and capacitance. Frequency and period/ time-interval measurement. Noises. Transducers. Calibration.

EE210 (252210) Basic Electrical Engineering Laboratory 1(0-3-0)

Prerequisite : None

Basic meter laboratory, cathode ray oscilloscope, basic network theorem, RLC properties, resonance and Q-factor, power and energy measurements, DC power supply.

EE211 (252211) Electric Circuits 1 3(3-0-6)

Prerequisite : None

Circuit elements, resistance, inductance, capacitance, resistive circuits, Kirchhoff's laws, source transformation, node and mesh analysis, circuit theorems, superposition principles, Thevenin and Norton equivalent circuits, maximum power transfer, AC sinusoidal steady-state responses, phasor diagrams, AC power circuits, resonance phenomena, real and reactive power, power factors, three-phase systems, wye-delta connection, analysis of three-phase circuits, three-phase power.

EE212 (252212) Electric Circuits 2 3(3-0-6)

Prerequisite : EE211 (252211)

Circuit equations. Introduction to graph theory. Modified nodal analysis. State variables. Formulation of state equations. First order and second order circuits. Laplace's transformation method of circuit analysis. Forced response and complete response of linear time-invariant circuits. Convolution. Network functions. Characteristic roots and s-plane. Stability. Two-port networks. Two-port parameters. Connection of two-port networks. Filters. Introduction to nonlinear circuit. Static and dynamic nonlinear circuit analysis.

EE222 (252222) Electrical Machines	3(3-0-6)	EE286 (252286) Fundamentals of Electrical Engineering	1(0-3-0)
Prerequisite : EE211 (252211)		Laboratory for Mechanical Engineers	
Magnetic circuits, principles of electromechanical energy conversion, energy and co-energy, single phase transformers, principles of rotating machines, DC machines, Ac machines construction, principles of synchronous machines, principles of induction machines.		Prerequisite : EE285 (252285) or concurrence	
		Introduction to basic electrical engineering laboratory. Introduction to electronic devices. Basic meters and oscilloscopes. DC circuit measurements and basic network theorems. Transformers and power measurement. Motor controls. Principles of DC machines and basic controls. Principles of AC machines and basic controls.	
EE232 (252232) Electronic Devices	3(3-0-6)	EE301 (252301) Engineering Stochastic Processes	3(3-0-6)
Prerequisite : PHYS106 (207106)		Prerequisite : MATH261 (206261)	
Atomic structure, Energy band theory, Types of semiconductors. Transport phenomena in semiconductor: mobility and conductivity, electrons and holes, generation and recombination of carrier in semiconductor. Junction: P-N junction, M-S junction, biasing, characteristics and operations of various types of diodes. Transistor: transistor structure and construction, characteristics, operations and applications of various types of transistors. Thyristor and other semiconductor devices.		Introduction to probability theory. Random variables and random vectors. Engineering stochastic processes. Samples of engineering stochastic processes. Detection and estimation in engineering stochastic processes.	
EE235 (252235) Engineering Electronic Circuits	3(3-0-6)	EE302 (252302) Orientation to Computational Intelligence	3(3-0-6)
Prerequisite : EE232 (252232)		Prerequisite : ENGR201 (259201)	
Semiconductor devices. Current-voltage and frequency characteristics. Analysis and design of diode circuits. Analysis and design of BJT and MOS, CMOS, BiCMOS transistor circuits. Operational amplifier and its applications. Power supply module.		This course is designed to give students an overview in subjects related to computational intelligence, e. g. , neural networks, fuzzy logic, genetic algorithms, evolutionary computation, hybrid algorithms parallel processing, etc.	
EE281 (252281) Fundamentals of Electronic Circuits for Information Systems and Network Engineering	3(3-0-6)	EE311 (252311) Electromagnetic Fields and Waves	3(3-0-6)
Prerequisite : None		Prerequisite : PHYS106 (207106) and MATH261 (206261)	
Basic concepts of electricity. DC circuit analysis. AC circuit analysis. Electronic devices and integrated circuits. Amplifiers. Filters. Oscillators. Modulators. Switching circuits.		Vector analysis. Electrostatic field: Coulomb's law, Gauss's law, convection and conduction currents, conductors and dielectrics, capacitance. Magnetostatic field: inductance. Time-varying field: Maxwell's equations. Plane wave: wave equations. Transmission lines. Smith Chart.	
EE282 (252282) Fundamentals of Electrical Engineering	3(3-0-6)	EE317 (252317) Signal Analysis	3(3-0-6)
Prerequisite : PHYS106 (207106) or PHYS (207123)		Prerequisite : MATH162 (206162)	
Definitions and laws. Basic DC and AC circuit analysis. Transformers. Basic electric machines. Three-phase electrical system. Some basic electrical instruments. Basic electronic devices and applications.		Signal classification: continuous-time, discrete-time signal and noise; analysis of continuous-time signal; analysis of discrete-time signal; random signal analysis; probability, random process, noise; signal processing: filtering, optimal detection; introduction to digital signal processing.	
EE283 (252283) Basic Electrical Engineering Laboratory	1(0-3-0)	EE320 (252320) Electrical Machines Laboratory	1(0-3-0)
Prerequisite : EE282 (252282) or concurrence		Prerequisite : EE222 (252222) or EE223 (252223)	
Basic Meters; Cathode-Ray Oscilloscope; RLC Properties; Basic Network Theorems; Resonance; Transformer; Measurement of Electrical Power; Experiments on Some Basic Electronic Devices; DC Power Supply.		Electrical machine structures and rating. EMF generation in electrical machines. Open-circuit characteristics of DC machines. Separate and shunt DC generators. Series and compound DC generators. Shunt DC motors. Series and compound DC motors. Transformers. Winding factor. Synchronous generators. Synchronous motors. Induction motors. Single phase motors. Motor controls.	
EE285 (252285) Fundamentals of Electrical Engineering for Mechanical Engineers	3(3-0-6)	EE322 (252322) Electrical Machines Analysis	3(3-0-6)
Prerequisite : PHYS106 (207106)		Prerequisite : EE222 (252222)	
Definitions and laws. DC circuit analysis. Basic electrical instruments. Basic electronic devices. AC circuit analysis. Power transmission and three-phase systems. Principles of electromechanical energy conversion and transformers. Principles of DC machines and basic controls. Principles of AC machines and basic controls.		Per-unit system, three-phase transformers and their winding connections, DC machine analysis, synchronous machine analysis, three-phase induction machine analysis, single phase induction machines, protection of electrical machines.	

<p>EE325 (252325) Power Generation, Transmission and Distribution 3(3-0-6)</p> <p>Prerequisite : EE222 (252222) or EE321 (252321)</p> <p>Sources of energy. Conventional power system, decentralized power system and micro-grid system. Power system characteristics and modeling. Transmission line parameters and modeling. Transmission line network modeling. Power flow calculation and power flow control.</p>	<p>communication. Binary baseband modulation. Nyquist's sampling theory and quantization. Pulse analog modulation, PCM, DM. Multiplexing techniques. Introduction to transmission lines, radio wave propagation, microwave components and communication, satellite communications, optical communication.</p>
<p>EE326 (252326) Electrical Energy Laboratory 1(0-3-0)</p> <p>Prerequisite : Concurrent to EE325 (252325)</p> <p>Power plant control; Generator power factor control; Real power control; Reactive power compensation; Electrical power and energy measurement; Peak demand control; Load management; Electrical energy conservation and efficiency.</p>	<p>EE353 (252353) Control Systems 3(3-0-6)</p> <p>Prerequisite : EE212 (252212)</p> <p>Mathematical models of systems. Transfer function. System models on time domain and frequency domain. Dynamic models and dynamic responses of systems; first and second order systems. Open-loop and closed-loop control. Feedback control and sensitivity; types of feedback control. Concepts and conditions of system stability; methods of stability test. System compensation.</p>
<p>EE327 (252327) Solar Electricity 3(3-0-6)</p> <p>Prerequisite: EE321 (252321) or EE322 (252322)</p> <p>Solar radiation; Solar cell characteristics; Solar cell modules; Battery technology; Power conditioning and control; Sizing photovoltaic system; Application of solar electricity; Photovoltaic impacts on environment; Photovoltaic as parts of hybrid renewable energy system; Grid-connected photovoltaic system.</p>	<p>EE365 (252365) Microcontroller for Electrical Engineering 3(3-0-6)</p> <p>Prerequisite : EE331 (252331)</p> <p>Finite state machines. Specific and general propose processors. Memory. Microcontroller architecture. On-chip peripheral devices. Serial communications. Assembly and higher-level languages. Development platforms. Task scheduling and RTOS.</p>
<p>EE328 (252328) Solar Electricity Laboratory 1(0-3-0)</p> <p>Prerequisite : Concurrent to EE327 (252327)</p> <p>Experiments on sun position and solar radiation measurement; Characterization of solar cell and solar cell modules; Hot spot problems of solar cell modules; Photovoltaic battery charging system; Photovoltaic water pumping system; Photovoltaic lighting system; Photovoltaic under concentrated light; Grid connected photovoltaic system.</p>	<p>EE399 (252399) Cooperative Education in Electrical Engineering 3(3-0-6)</p> <p>Prerequisite : Consent of the department</p> <p>Work-based learning as the full time temporary employees or doing the special projects related to electrical engineering at public or private organizations for a period of at least 16 weeks, continuously, under supervision of engineer(s) or trainer(s) and/or instructor(s); a report is required and has to be approved by the cooperative education committee. Grading will be given on satisfactory or unsatisfactory basis.</p>
<p>EE330 (252330) Electronic Engineering Laboratory 1(0-3-0)</p> <p>Prerequisite : EE235 (252235)</p> <p>Experimental studies of electronic circuits using transistors and other semiconductor devices. The emphasis is upon understanding circuit properties and the applications of electronic circuits in analog and digital systems, as well as developing skills in measurement techniques and operations of measurement instruments.</p>	<p>EE400 (252400) Electrical Engineering Training 3(0-18-0)</p> <p>Prerequisite : Consent of the Department</p> <p>Training in electrical engineering with consulting engineer(s) or industry or equivalent job under supervision of engineer(s) or trainer(s) and/or instructor(s); a training report is required to be approved by the training committee.</p>
<p>EE331 (252331) Digital Electronic Circuits and Systems 3(3-0-6)</p> <p>Prerequisite : EE232 (252232)</p> <p>Digital signal and logic value, digital codes, logic gates, boolean algebra, logic circuit synthesis and simplification, combinational circuits, sequential circuits, TTL and CMOS logic families, logic gate performance, programmable logic devices, interfacing circuits, clock generator, DAC and ADC, introduction to digital system design.</p>	<p>EE401 (252401) Optical Communication 3(3-0-6)</p> <p>Prerequisite : EE311 (252311)</p> <p>Cylindrical dielectric waveguides and propagating conditions. Structure and types of optical fiber. Optical fiber parameters. Optical fiber production. Optical cable types. Optical transmitters. Optical receivers. Signal degradations, attenuation and dispersion in fiber link. Optical repeaters and amplifiers. Link budget calculation. Multiplexing in optical link system. Introduction to FTTX.</p>
<p>EE342 (252342) Principles of Communication Systems 3(3-0-6)</p> <p>Prerequisite : EE317 (252317)</p> <p>Communication models: wire/cable and wireless/radio. Introduction to signal and system. Spectrum of signal and applications of Fourier series and transform. Analog modulation: AM, DSB, SSB, FM, NBFM, PM. Noises in analog</p>	<p>EE402 (252402) Data Communications and Networks 3(3-0-6)</p> <p>Prerequisite : EE342 (252342)</p> <p>Introduction to data communications and networks. Layered network architecture. Point-to-Point protocols and links. Delay models in data networks. Medium-access control protocols. Flow and error control. Local</p>

area network. Switching network. Routing in data networks. Network security. Cloud network, architecture and system and standards.

EE403 (252403) Communication Network and Transmission Lines 3(3-0-6)

Prerequisite : Concurrent to EE 342 (252342)

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Wire and wireless communication. Wire communication network: Y, Z, F, G, H matrix and relation. Connection and basic circuits, network transformation, transmission quantities, signal transmission circuit techniques, wave filters, attenuator, and impedance matching. Transmission line theory, equation, solution for low, medium, high frequencies, primary and secondary constant. Incident and reflected waves, standing wave ratio, line characteristics for open, short, terminated load, lossless, and lossy lines. Reflections in time domain, bounce diagrams, near-end and far-end crosstalk, differential signaling, composite line, types of cable, unshielded twisted pair, and coaxial cable. Current cable standards.

EE404 (252404) Digital Communication 3(3-0-6)

Prerequisite : EE342 (252342)

Review of probability and random process. Signal space. Minimum Nyquist bandwidth. Signal detections. AWGN, digital modulation techniques, sigma-delta, and performance analysis. Synchronization. Equalization. Introduction of information theory. Source coding. Channel coding. Multichannel and multicarrier systems. Spread spectrum techniques. Multipath fading channels.

EE405 (252405) Mobile Communication 3(3-0-6)

Prerequisite : EE342 (252342)

Wireless communication system. Theory and principles of mobile communication system. Characteristics and impacts of radio propagation. Modulation techniques, speech coding, diversity channel coding and multiplexing technique. Interconnection components for mobile communication system. Standards of current mobile communication, 3G, 4G, 5G and beyond. Cellular systems. Multiple access and interference management. Capacity of wireless channels and multiuser capacity. Multi-input multi-output (MIMO) system.

EE406 (252406) Broadband Communication 3(3-0-6)

Prerequisite : EE342 (252342)

Principles of broadband communication networks for switching telephone system. Voice over IP (VoIP) telephone. Wide area network (WAN) infrastructure. Asynchronous transfer mode (ATM), virtual private network (VPN), fiber distributed data interface (FDDI), digital subscriber line (DSL) and current techniques. Internet and intranet. Synchronous digital hierarchy (SDH). Traffic engineering and quality of service (QoS). Fiber to the home (FTTH), wireless local area network (WLAN), passive optical network (PON), dense wavelength division multiplexing (DWDM) network. Theory of power line communications (PLC) for narrowband and broadband communications. Standards of PLC-based networking.

EE407 (252407) Electrical Safety Engineering 3(3-0-6)

Prerequisite : Consent of the department

Electrical hazards and safety measures. Causes of electrical accidents and injuries. Electric shock. Step and touch potentials. Electrostatic discharge (EDS). Electrical arc flash and protection. Electrical isolation. Practical grounding, bonding and shielding. Electrical safety testing. Circuit protection devices. Electrical safety guidance for low-voltage and high-voltage systems. Electrical safety in workplaces.

EE408 (252408) Electrical Energy Management and Conservation 3(3-0-6)

Prerequisite : Consent of the department

Fundamental of energy efficiency. Principles of energy efficiency in building and industry. Load management. Laws and regulations of energy conservation. Energy management and analysis in building and industry. Electrical tariff. Electrical demand and energy management. Technical aspects to use energy efficiently in transformers, lighting systems, heating, ventilating and air-conditioning (HVAC) systems. Industrial motor. Co-generation. Energy conservations and economic analysis.

EE409 (252409) Advanced Topics in General Electrical Engineering 3(3-0-6)

Prerequisite : Fourth year standing and consent of the department

Advanced topics in general electrical engineering that are of current interest in this field. Special problems and/or advanced topics are to be presented and discussed. The contents of the course are to be proposed by the instructor(s), approved by the department of electrical engineering and then announced prior to the commencement of each semester.

EE412 (252412) Network Synthesis 3(3-0-6)

Prerequisite : EE212 (252212)

Circuit analysis and network synthesis. Conditions for the realisability of driving-point and transfer functions. Synthesis of LC and RC 1-port networks. 2-port network. Approximation theory, Butterworth and Chebyshev responses. Singly and doubly R-terminated 2-port networks. Frequency transformation. LC filter design.

EE413 (252413) Digital Signal Processing 3(3-0-6)

Prerequisite : EE317 (252317)

Introduction to Digital Signal Processing; Relation between continuous-time and discrete-time signals; Discrete-time description of signals & systems; Transformation methods of discrete-time signal; Digital filter structures and design.

EE414 (252414) Applications of Digital Signal Processing Techniques 3(3-0-6)

Prerequisite : EE317 (252317)

Continuous-time and discrete-time signals. Spectral analysis. Decimation and interpolation. Sampling rate conversion. Discrete Fourier transform. Probabilistic methods in digital signal processing. Design of digital filters. Multirate systems and filter banks. Discrete wavelet transform. Introduction to some digital signal processing applications.

EE420 (252420) High Voltage Engineering Laboratory	1(0-3-0)	EE427 (252427) Power System Protection	3(3-0-6)
Prerequisite : EE428 (252428)		Prerequisite : EE325 (252325)	
Experiments on high voltage engineering and overvoltages in electric power system: introduction to safety in high voltage operations, generation and measurement of high voltage, electric field and insulation techniques, breakdown characteristics of gas, liquid and solid dielectrics, test of high voltage material and equipment, overvoltages in electric power system.		Fundamental of protection practices. Instrument transformer and transducers. Protection devices and protection systems. Overcurrent and earth fault protection. Differential protection. Transmission line protection by distance relaying. Transmission line protection by pilot relaying. Motor protection. Transformer protection. Generator protection. Bus zone protection. Introduction to digital protection devices.	
EE421 (252421) Power Plant and Substation	3(3-0-6)	EE428 (252428) High Voltage Engineering	3(3-0-6)
Prerequisite : EE325 (252325)		Prerequisite : EE311 (252311)	
Energy conversion system. Load calculation. Electricity generation sources. Steam turbine power plant. Gas turbine power plant. Combined cycle power plant. Diesel power plant. Hydro power plant. Nuclear power plant. Economic operation of power plant. Substation type and design. Lightning protection and grounding.		Uses of High Voltage and Overvoltages in Power Systems, Generation of High Voltage for Testing, High Voltage Measurement Techniques, Electric Field Stress and Insulation Techniques, Breakdown of Gas, Breakdown of Liquid and Solid Dielectrics, High Voltage Testing Techniques, Insulation Coordination of High Voltage Systems and Overvoltages Protections, Lightning Discharges and Protections.	
EE422 (252422) Illumination Engineering	3(3-0-6)	EE429 (252429) Electrical System Design	3(3-0-6)
Prerequisite : EE212 (252212)		Prerequisite : EE321 (252321) or EE322 (252322)	
Physics of Illumination, Properties of Light Sources; Light Control and Luminaire Design; Properties of Reflecting Surfaces; Room Geometry; Lighting Calculations for Interior and Exterior Applications.		Basic design concept; codes and standards; power distribution schemes; electrical wires cables; raceway; electrical equipment and apparatus; load calculation; power factor improvement and capacitor bank circuit design; lighting and appliances circuit design; motor circuit design; load, feeder, and main schedule; emergency power system; short circuit calculation; grounding system for electrical installation.	
EE423 (252423) Electrical Power System Analysis	3(3-0-6)	EE433 (252433) Pulse, Digital and Switching Circuits	3(3-0-6)
Prerequisite : EE325 (252325)		Prerequisite : EE331 (252331)	
Review of electrical network calculation; power flow; automatic generation control; symmetrical fault analysis; symmetrical components; unsymmetrical fault analysis; transient stability; economic dispatch.		Linear Wave Shaping; Wideband Amplifiers; Switching Characteristics of Electronic Devices; Clipping and Comparator Circuits; Multivibrators; Waveform Generators; Sampling Gates; Counting and Timing; synchronization and Frequency Division.	
EE424 (252424) Advanced Electrical Machinery	3(3-0-6)	EE435 (252435) Power Electronics	3(3-0-6)
Prerequisite : EE321 (252321) or EE322 (252322)		Prerequisite : EE212 (252212)	
Modeling and simulation of electrical drives systems. Elements of modern electrical drives. Dynamics of motor-load system. Components of load torque. Load and motor torque-speed characteristics. Operating region of drives. Braking methods of motors. Power transmission and sizing. Modeling of DC motor drives. DC motor dynamic performance. Modeling of AC motor drives. Power converter in electrical drives. Servo drives systems. Applications of drives in industrial.		Characteristics of power electronics devices: power diode, SCR, GTO, power bipolar, power MOSFET, IGBT. Characteristics of magnetic material: power transformer core, ferrite core, iron powder core. Converters: ac-to-dc converter, dc-to-dc converter, ac-to-ac converters, inverter, dc-to-ac converters, frequency changer. Solid state motor drive: direct current motor control, induction motor control, synchronous motor control.	
EE425 (252425) DC Power Transmission	3(3-0-6)	EE436 (252436) Power Electronics Laboratory	1(0-3-0)
Prerequisite : EE325 (252325)		Prerequisite : EE325 (252325)	
Transmission system characteristics; converter theory; harmonics and filters; transient over-voltages; insulation coordination; AC and DC power flow analysis; high voltage direct current (HVDC) scheme and control; HVDC transmission design.		Power switch characteristics of power electronics. Single-phase diode rectifiers. Three-phase diode rectifiers. Single-phase phase-controlled rectifiers. Three-phase phase-controlled rectifiers. AC converters. DC converters. Single-phase voltage source inverters. Three-phase voltage source inverters. DC motor controls. AC motor controls.	
EE426 (252426) Power System Stability	3(3-0-6)		
Prerequisite : EE325 (252325)			
Review of network modeling; principles of real and reactive power controls; the swing equation; stability criteria; multi-machine problems; small-signal stability; angle stability; voltage stability; methods of improving stability.			

EE439 (252439) Advanced Topics in Electronic Engineering	3(3-0-6)	EE448 (252448) Satellite Communications	3(3-0-6)
Prerequisite : Fourth year standing and consent of the department		Prerequisite : EE342 (252342)	
Advanced topics in electronic engineering which are of current interest in this field. Special problems and/or advanced topics are to be presented and discussed. The contents of the course are to be proposed by the instructor(s), approved by the department of electrical engineering and then announced prior to the commencement of each semester.		Introduction to Satellite Communications, Satellite Link Models and Link Power Budget Calculations, Various Techniques in Satellite Communications.	
EE440 (252440) Communication Engineering Laboratory	1(0-3-0)	EE449 (252449) Advanced Topics in Telecommunication Engineering	3(3-0-6)
Prerequisite : EE342 (252342)		Prerequisite : Fourth year standing and consent of the department	
Experiments on analog and digital communication systems: AM, FM, spectrum analyzer, transmission line, analog to digital conversion, introduction to digital communications, PCM encoding, noise on a digital link, error detection and correction, bit error rate, ASK, FSK, PSK, microwave simulation, computer network configurations, fiber optic cabling and system.		Advanced topics in telecommunication engineering which are of current interest in this field. Special problems and/or advanced topics are to be presented and discussed. The contents of the course are to be proposed by the instructor(s), approved by the department of electrical engineering and then announced prior to the commencement of each semester.	
EE442 (252442) Radio Systems	3(3-0-6)	EE450 (252450) Control System Laboratory	1(0-3-0)
Prerequisite : EE311 (252311)		Prerequisite : EE353 (252353)	
Ground wave propagation. Ionosphere and wave propagation effects. Sky wave propagation. Space wave propagation in the troposphere. Narrow band fast fading. Wide band fast fading. Cellular propagation. Radio systems example.		Experiments in linear and nonlinear control systems: open loop and closed loop systems behavior. PID controller and setting recommendations. Temperature control systems. Speed and voltage control systems. Fuzzy control systems. Programmable logic control. Control system based on programmable logic control.	
EE443 (252443) Antenna Theory	3(3-0-6)	EE455 (252455) Modern Control System	3(3-0-6)
Prerequisite : EE311 (252311)		Prerequisite : EE353 (252353)	
Basic definitions and theory. Isotropic point source. Power and field patterns. Directivity and gain. Efficiency. Polarization. Input impedance and bandwidth. Friis transmission equation. Radiation from current elements. Ground effects. Radiation properties of wire antenna. Array antenna. Yagi-Uda antenna and log-periodic antenna, aperture antenna, and microstrip antenna. Modern antenna for current applications. Antenna characteristics measurement.		Concepts of linear spaces. Mathematical model of linear systems. Modeling in the time domain. Analysis and design of a system using state variables. Linear operators and matrix calculus. The relation between system transfer functions and state variable descriptions. Phase variable form representation. Eigenvalues. Time domain solution of state equations. System transformations. Diagonalizing a system matrix. Stability test. Controllability. Observability.	
EE444 (252444) Microwave	3(3-0-6)	EE456 (252456) Fundamental Mechatronics for Electrical Engineering	3(3-0-6)
Prerequisite : EE311 (252311)		Prerequisite : Third year standing	
Review of Maxwell's equations, and plane waves. Microwave transmission lines and waveguides. Microwave network analysis. Impedance and equivalent voltage and current. The S-matrix and signal flow graphs. Impedance matching and tuning. Microwave resonators. Power dividers and directional couplers. Microwave filters. Point-to-point microwave link. Radar system. Microwave propagation. Basic of microwave measurement, and applications.		Components of mechatronics systems. Energy generation and transportation. Pneumatic, hydraulic and electrical drive. Sensor technology and control systems. Programming and documentation. Safety technology and regulations. Systematic commissioning and error diagnosis.	
EE447 (252447) Communication Electronics	3(3-0-6)	EE459 (252459) Advanced Topics in Control System Engineering	3(3-0-6)
Prerequisite : EE331 (252331)		Prerequisite : Fourth year standing and consent of the department	
Review of small signal amplifiers. Network noise and intermodulation distortion. Frequency selective network and transformers. High frequency amplifier and automatic gain control. Power amplifiers. Hybrid and transmission line transformers. Oscillators, phase-locked loops, frequency synthesizers. Modulators and demodulators.		Advanced topics in control system engineering which are of current interest in this field. Special problems and/or advanced topics are to be presented and discussed. The contents of the course are to be proposed by the instructor(s), approved by the department of electrical engineering and then announced prior to the commencement of each semester.	

<p>EE498 (252498) Special Topics in Electrical Engineering 4 3(3-0-6) Prerequisite : Consent of the Department Special topics in electrical engineering profession which are of current interest in this field. Special problems and/ or topics are to be presented and discussed. The contents of the course are to be proposed by the instructor(s), approved by the department of electrical engineering and then announced prior to the commencement of each semester.</p>	<p>ENV318 (253318) Water Engineering and Design 4(3-3-6) Prerequisite : CE 261 (251261) and ENV314 (253314) or CE 261 (251261) and ENV 216 (253216) Raw water sources for water supply. Raw water quality. Population estimation. Water consumption, Intake system. Transmission system. Water treatment processes: aeration, coagulation and flocculation. Sedimentation, filtration and disinfection. Water storage and distribution. Design of water treatment plant. Waterworks management and Advance waterworks. Practice water treatment plant design.</p>
<p><u>Course in Environmental Engineering Course code ENV (253)</u></p>	
<p>ENV101 (253101) Elementary Environmental Engineering 1(1-0-2) Prerequisite : None Overview of environmental engineering. Introduction to water supply. Introduction to wastewater management. Introduction to solid waste management. Introduction to building sanitation. Introduction to air pollution control. Working field in environmental engineering. License for Professional Practice in environmental engineering. Case study in environmental engineering practice.</p>	<p>ENV321 (253321) Wastewater Engineering and Design 4(3-3-6) Prerequisite : CE 261 (251261) and ENV314 (253314) and ENV315 ;or CE251 (251261) and ENV216 (253216) Wastewater measurement and runoff prediction. Physical, chemical and biological characteristics of wastewater. Theories of physical, chemical and biological wastewater treatment systems. Sludge treatment and disposal. Design of sewer systems. Pump and pumping station. Other parts of wastewater treatment process.</p>
<p>ENV215 (253215) Chemistry for Environmental Engineering 3(2-3-4) Prerequisite : CHEM104 (203104) and CHEM108 (203108) ;or CHEM162 (203162) and CHEM167 (203167) Basic concepts of chemistry as related to water and wastewater treatment; chemical and physical characteristics of water and wastewater in general considerations; sample collection and preservation; determination methods of DO, BOD, COD, solids, nitrogen, etc. ; instrumentation for analysis; interpretation of analysed data to environmental engineering practice; laboratory practice for water and wastewater analysis.</p>	<p>ENV332 (253332) Air Pollution and Meteorology 3(3-0-6) Prerequisite : Third year standing Atmospheric composition. Atmospheric motion and stability. Primary and secondary air pollutants. Air pollution chemistry. Air pollution modeling. Geographic information system and meteorology. Air pollution control: particulate and gaseous.</p>
<p>ENV216 (253216) Environmental Engineering Unit Processes and Operations 3(3-0-6) Prerequisite : ENV215 (253215) or concurrent Fundamental principles of unit processes and operations in environmental engineering, hydraulic flow in reactors, screening, mixing, coagulation and flocculation, sedimentation, flotation, filtration, mass balance, mass transfer and aeration, adsorption, absorption, ion-exchange and equalization, biological kinetics, mathematic model in reactors, neutralization, ion precipitation, redox, disinfection</p>	<p>ENV352 (253352) Energy and Environment for Sustainability 3(3-0-6) Prerequisite : Consent of the department Interconnection of Energy and Environment, Principle of Environment and Energy Management for Sustainability, Energy from waste cycling, Biomass residue and biogas energy production, Environmental Impact from energy production and management.</p>
<p>ENV261 (253261) Fundamental Microorganisms for Environmental Engineering 3(3-0-6) Prerequisite : None Introduction, Principles of biology, Diversity of life and ecology, Principles of biochemistry, Microorganisms and growth condition, Fundamental role of microorganisms in related environmental engineering, Basic microorganism role in environmental engineering and its important metabolisms, Microbiology and biochemistry related fundamental analytical technique for environmental engineering, Technique for monitoring microbial population change in related environmental engineering process.</p>	<p>ENV400 (253400) Environmental Engineering Training 3(0-18-0) Prerequisite : Consent of the Department Training in environmental engineering with consulting engineer(s) or industry or equivalent job under supervision of engineer(s) or trainer(s) and/ or instructor(s); a training report is required to be approved by the training committee.</p>
<p>ENV411 (253411) Design Practice for Environmental Engineering with Related Engineering Disciplines 1(1-0-2) Prerequisite : ENV318 (253318) and ENV321 (253321) and ENV441 (253441) Introduction to construction project, Civil work and structure for treatment system, Electrical system in treatment system Mechanical equipment in treatment system, Drawing and specifications understanding and materials take-off, Resource management in construction, Construction management and planning, Reporting and progressive monitoring, Fundamental of master plan and landscape design, Fundamental of cost estimate, Law regulation and safety in construction, Training of design software for environmental</p>	<p>ENV411 (253411) Design Practice for Environmental Engineering with Related Engineering Disciplines 1(1-0-2) Prerequisite : ENV318 (253318) and ENV321 (253321) and ENV441 (253441) Introduction to construction project, Civil work and structure for treatment system, Electrical system in treatment system Mechanical equipment in treatment system, Drawing and specifications understanding and materials take-off, Resource management in construction, Construction management and planning, Reporting and progressive monitoring, Fundamental of master plan and landscape design, Fundamental of cost estimate, Law regulation and safety in construction, Training of design software for environmental</p>

engineering ie; Sketch up and AutoCaD, Training of design software for cost estimate.

ENV413 (253413) Capstone Design Project in Environmental Engineering 3(0-9-0)

Prerequisite : ENV318 (253318) and ENV321 (253321) and ENV441 (253441)

Training and practicing in environmental engineering project work including planning, gathering data, designing, determining size of components, selection of equipment based on update and appropriate technology and presentation of the project to be a remarkable work.

ENV415 (253415) Water and Wastewater Treatment Plant Operation 3(3-0-6)

Prerequisite : ENV312 (253312) and ENV316 (253316) ; or ENV318 (253318) and ENV321 (253321)

Practical day-to-day operational techniques for water and wastewater treatment facilities, maintenance schedule setting, remedy for troubleshooting, equipment failure reducing, safety practices and cost saving.

ENV416 (253416) Industrial Water Pollution Control 3(3-0-6)

Prerequisite : ENV 316 (253316) or ENV 321 (253321) or concurrence

Types of industrial wastewater characteristics; Impacts of wastewater; Regulations and control; Physical-chemical treatment; Biological treatment; Green productivity; Technical, environmental and economic assessment; Case studies of industrial wastewater management.

ENV417 (253417) Building Sanitation 3(3-0-6)

Prerequisite : ENV312 (253312) or ENV318 (253318)

Fundamentals of building sanitation. Laws and regulations. Cold water supply. Hot water supply. Soil drainage system. Waste and Vent system. Fire protection system. Building drainage system. Wastewater treatment system. Solid waste for individual building.

ENV418 (253418) Performance Test of Water Supply and Wastewater Treatment Systems 3(3-0-6)

Prerequisite : ENV318 (253318) and ENV321 (253321)

Start up of biological aerobic and anaerobic wastewater treatment reactors. Effects of operating conditions on performances of aerobic and anaerobic reactors. Determination of required chemical doses for suspended solids removal for water supply production. Performance of ceramic membrane in water contaminant removal. Performance of adsorption process for water supply production. Report writing; analysis and discussion of test results.

ENV422 (253422) Design of Anaerobic Wastewater Treatment Systems 3(3-0-6)

Prerequisite : ENV316 (253316) or ENV321 (253321)

Theory of organic matter stabilization by anaerobic process; anaerobic wastewater treatment systems and design, Selection and application of anaerobic wastewater treatment systems, operation and maintenance.

ENV423 (253423) Natural Wastewater Treatment Systems 3(3-0-6)

Prerequisite : ENV316 (253316) or ENV321 (253321) or concurrence

Pre-treatment of wastewater; Constructed wetland system for wastewater treatment; Design, operation and maintenance of constructed wetland system; Land treatment system; Design, operation and maintenance of land treatment system; Stabilization pond system; Design, operation and maintenance of stabilization pond system; Re-use of treated wastewater; Case studies.

ENV432 (253432) Noise and Vibration Control 3(3-0-6)

Prerequisite : None

Theories of sound and vibration, noise and vibration measurement; noise and vibration scales, effect of noise and vibration; sound absorbing materials; design of noise and vibration control systems; reducing noise and vibration from various sources; related laws and regulations and case studies.

ENV433 (253433) Air Pollution Control and System Design 4(3-3-6)

Prerequisite : Fourth year standing

Air pollution problems, air pollutants, Photochemical air pollution, Meteorology related to air pollution, plume rise and dispersion, Design of air pollution control devices for mobile and stationary sources, air sampling and analysis, air pollution control regulations and standards.

ENV441 (253441) Solid Waste Management 3(3-0-6)

Prerequisite : ENV215 (253215)

Principle of solid waste management. Source/composition/ properties of solid waste. Solid waste generation/ collection rate and handling at source. Collection of solid waste. Transfer/ transport. Separation/ processing/ transformation of solid waste. Composting. Combustion, landfill.

ENV442 (253442) Landfill System Design 3(3-0-6)

Prerequisite : ENV441 (253441)

Basic understanding of landfill system design and construction, performance monitoring landfill system operation.

ENV443 (253443) Hazardous Waste Management 3(3-0-6)

Prerequisite : Consent of the department

Hazardous waste characteristics, toxicology, fate and transport of contaminants, waste minimisation and resource recovery, onsite management and transportation of hazardous waste, treatment processes; physico-chemical, biological, stabilization and solidification thermal, secure landfill and site remediation.

ENV451 (253451) Environmental Impact Assessment 3(3-0-6)

Prerequisite : ENV215 (253215)

Concepts of impact assessment, methodology of environmental impact assessment; assessments of impact on physical resources, ecological resources, human use values and quality of life values, prevention and mitigation measures, monitoring plan.

<p>ENV452 (253452) Environmental Systems and Management 3(3-0-6)</p> <p>Prerequisite : consent of the department</p> <p>Concepts of environmental systems and management. Prioritizing environmental impact. Safety management and fundamental public health. Law, standards and criteria setting. Indication and indices. Law enforcement and economic aspects of environmental control. Environmental Management System (EMS) and ISO 14001; audit and monitoring. Pollution prevention and cleaner technology. Life cycle assessment and environmental management. Information system for environment. Case studies.</p>	<p>Students are required to work in the organizations related to environmental engineering major for a minimum period of 16 weeks continuously as a staff under the supervision of in-charge trainer(s) of the organizations and instructor(s) of the university. Grading will be given on satisfactory or unsatisfactory basis.</p>
<p>ENV453 (253453) Urban Engineering and Sustainable Infrastructure Planning 3(3-0-6)</p> <p>Prerequisite : consent of the department</p> <p>Concept of sustainable infrastructure and city management. Sustainable urban landscape planning. Sustainable transportation technology. Green building design. Circular economy and smart city. Integrated sustainable urban water management. Integrated sustainable urban waste management. Integrated sustainable urban energy management. Computer software aid in master plan and infrastructure design.</p>	<p>Course in Mechanical Engineering Course code ME (254)</p> <p>ME182 (254182) Introduction to Energy 3(3-0-6)</p> <p>Prerequisite : None</p> <p>None; for non-engineering students only Definitions of energy; Sources of energy; Energy situation and its problems; Development of alternative energy; Energy conservation; Climate change from the energy development; Energy laws; Case studies on energy; Royal projects related to energy.</p>
<p>ENV454 (253454) Environmental Health Engineering 3(3-0-6)</p> <p>Prerequisite : Consent of the department</p> <p>Principles of environmental health engineering. Health aspects in environmental engineering. Engineering and infectious diseases. Environmental health standards. Health risk assessment. Health hazards of waste and wastewater reuses. Application of engineering principles in environmental health protection. Occupational health engineering. Safety and emergency response. Environmental health policy.</p>	<p>ME200 (254200) Mechanical Engineering Design Process 1(0-2-1)</p> <p>Prerequisite : ENGR107 (259107) and concurrent to ME205 (254205) or consent of the department</p> <p>An introduction to engineering design principles and procedures, in the context of mechanical engineering: problem identification, pertinent information gathering, preliminary ideas, idea refinement, design analysis, decision and implementation. Students work in teams under the direction of a department advisor to solve engineering design problem through problem examples.</p>
<p>ENV456 (253456) Fundamental of Material Flow Analysis and Life Cycle Assessment 3(3-0-6)</p> <p>Prerequisite : Consent of department</p> <p>Substance flow in natural and anthropogenic system. Mass and energy balance principle. Methodology of substance and material flow analysis. Application of material flow analysis on waste management, wastewater management, environmental impact assessment and resources management. Material flow cost accounting. Importance of life cycle assessment. Methodology of life cycle assessment. Case study of life cycle assessment. Software for life cycle assessment. Carbon footprint assessment. Case study of Carbon footprint assessment.</p>	<p>ME205 (254205) Mechanical Drawing 2(1-3-2)</p> <p>Prerequisite : ME102 (254102) or ENGR104 (259104) or consent of the department</p> <p>Principles of mechanical drawing. Precision and tolerance. Limits and dimensioning standards. Principles of limits and dimensioning defining. Drawing of thread fasteners, keys, rivets, springs, gears, and cams. Piping drawing. Computer-aided drawing: parts drawing, assembly, working drawing, and rendering.</p>
<p>ENV491 (253491) Environmental Engineering Research Project 3(0-9-0)</p> <p>(เปลี่ยนชื่อวิชาจาก Environmental Engineering Project) มีผลบังคับใช้ตั้งแต่ภาคเรียนที่ 1/2563</p> <p>Prerequisite : Consent of the Department</p> <p>Special investigation or studies of a topic in environmental engineering to be carried out by individual student or a group of students under the faculty direction.</p>	<p>ME206 (254206) Engineering Dynamics 1 3(3-0-6)</p> <p>Prerequisite : ENGR107 (259107)</p> <p>Kinematics and kinetics of particles; kinematics and kinetics of rigid bodies in plane; mass moment of inertia.</p>
<p>ENV492 (253492) Cooperative Education 9 credits</p> <p>Prerequisite : fourth year standing and consent of the Department</p>	<p>ME207 (254207) Modeling and Graphics for Mechanical Engineering Design 3(2-3-4)</p> <p>Prerequisite : ENGR104 (259104) and ENGR107 (259107)</p> <p>Mechanical engineering design process. Modeling and visualization of mechanical parts for creating engineering drawings and using them within the mechanical engineering design process using computers as a tool. Basis of manufacturing process, the freehand sketching, mechanical drawing standard, working drawing and concepts of dimensioning, limits and cylindrical fits, geometric dimensioning and tolerancing, surface roughness symbols, functionality and representation methods for thread fasteners, removable fasteners, springs, gears, bearings and cams. Use of computer for design and analysis of mechanical engineering problems; Physical modeling and simulations of mechanical engineering problems and related applications.</p>

ME215 (254215) Mechanics of Solids1 3(3-0-6) Prerequisite : ENGR107 (259107) Basic concept of stresses in axial loaded members and thin-walled pressure vessels; Basic concept of strains, stress-strain relationship, thermal stress and strain; Torsion of circular shafts; Shear and bending moment in beam, stresses in beams; Deflection of beams; Buckling of column; Welding and rivet connections.	ME271 (254271) Material Property Laboratory for Machine Design Application 1(0-3-0) Prerequisite : ENGR103 (259103) and concurrent to ME215 (254215) or consent of the department Material property laboratory for machine design application; relation between stress and strain, modulus of elastic, shear modulus, hardness, fatigue, resistance to fracture, conductivity, and specific heat.
ME216 (254216) Mechanics of Solids 2 3(3-0-6) Prerequisite : ME215 (254215) Deflections of beams and shafts; buckling of columns; external work and strain energy; impact loadings; principle of virtual works; Castiglano' s theorem; welding and rivet connections; curved beams; introduction to flat plates; thick-wall cylinder; contact stresses; plane problems and stress concentration.	ME282 (254282) Fundamentals of Mechanical Engineering 3(3-0-6) Prerequisite : MATH162 (206162) and PHYS104 (207104) or PHYS106 (207106) Reviews of basic thermodynamics; principles and operation of various kinds of heat engine and auxiliary equipments; internal combustion engines and compressors; pulleys, shafts, gears; principle of refrigeration and air-conditioning; automotive equipment; basic principles and performance factors; study of various kinds of mechanical equipment for engineering construction work.
ME222 (254222) Mechanics of Machinery 1 3(3-0-6) Prerequisite : ME 206 (254206) ; for Mechanical Engineering students only Linkages and mechanisms. Velocity and acceleration analysis. Gear trains. Static and dynamics force analysis. Balancing of machinery.	ME302 (254302) Computational Methods for Engineers 4(3-3-6) (เปลี่ยนชื่อวิชาจาก Mechanical Engineering Computational Methods) มีผลบังคับใช้ตั้งแต่ภาคเรียนที่ 1/2563 Prerequisite : MATH 261 (206261) and ENGR 201 (259201) Basic numerical methods for interpolation, differentiation, integration, finding roots of nonlinear functions, and solving ordinary differential equations. Error analysis. Solution of simultaneous linear equations. Least square curve fitting. Numerical computing for solving engineering problems.
ME231 (254231) Engineering Thermodynamics 1 3(3-0-6) Prerequisite : MATH162 (206162) and PHYS106 (207106) and PHYS116 (207116) Definition and basic concepts in thermodynamics; thermodynamic properties of a pure substances; work and heat; the first and the second laws of thermodynamics; entropy; steam power cycles.	ME325 (254325) Machine Design 1 3(3-0-6) Prerequisite : ME214 (254214) or ME215 (254215) Fundamentals of mechanical design. Properties of materials. Theories of failure. Impact. Fatigue. Design of simple machine elements; rivets, screw fasteners, keys and pins, shafts, springs, power screws, coupling, etc. Design project.
ME232 (254232) Engineering Thermodynamics 2 3(3-0-6) Prerequisite : ME231 (254231) Analysis of internal combustion engine cycles, gas power cycle, refrigeration cycles, heat pump cycles and air compressor systems; thermodynamic relations; gas/ vapor mixtures; fuel properties and combustion; chemical reactions; irreversibility and availability (exergy).	ME333 (254333) Fluid Mechanics 3(3-0-6) Prerequisite : ENGR203 (259203) or ME206 (254206) or consent of the department Properties of fluid; fluid statics; fluid dynamics; laminar and turbulent flows; compressible and incompressible flows, Euler and Bernoulli continuity and momentum equations; Dimensionless analysis and similitude; pipe flow and flow around immersed objects, basic turbomachinery.
ME252 (254252) Automotive Technology 2(1-3-2) Prerequisite : Consent of the Department Basic principles and operation of spark ignition and compression ignition engines. Study of various automotive components and auxiliary systems. Training in automotive shop work such as safety, care, correct use of shop tools and equipment, engine overhaul, maintenance and performance testing.	ME334 (254334) Heat Transfer 3(3-0-6) Prerequisite : ME231 (254231) and ME333 (254333) Fundamental laws of heat transfer: conduction, convection and radiation; simple analysis and application of heat transfer in conduction, convection, radiation and combined systems; heat exchangers; boiling and condensation; heat transfer enhancement.
ME254 (254254) Internal Combustion Engine Laboratory 1(0-3-0) Prerequisite : None Operation principles of spark ignition and compression ignition engines. Parts, mechanisms, and operations of various systems in engines. Uses of hand tools and equipments for engines. Removing and assembling engines and various systems in engines. Condition inspections and maintenances on engines. Technologies used in modern engines.	

ME352 (254352) Internal Combustion Engines	3(3-0-6)	ME411 (254411) Advanced Mechanics of Solids	3(3-0-6)
Prerequisite : ME231 (254231)		Prerequisite : ME212 (254212) or ME214 (254214) or ME216 (254216)	
Fundamental principles of internal combustion engine, design and applications; thermodynamics of various engine processes, cycle analysis, gas-analysis, combustion; theories and efficiencies of spark ignition, compression ignition and gas turbine units; fuels; lubricants pollution controls; maintenance and performance testing, etc.		Review of fundamental theories. Stress and strain; in three dimensions. Introduction to elasticity and plasticity. Application to advanced problems.	
ME362 (254362) Manufacturing Process for Mechanical Engineering	3(3-0-6)	ME412 (254412) Introduction to Fibre Reinforced Materials	3(3-0-6)
Prerequisite : ME 214 (254214) or ME 215 (254215)		Prerequisite : ME212 (254212) or ME214 (254214) or ME216 (254216)	
Behavior and manufacturing properties of materials, Forming and shaping processes and equipment, Machining processes and machine tools, Joining processes and equipment, Surface technology, Automation in manufacturing processes.		Introduction, Unidirectional Composites, Laminated Composites, Micromechanics of Composites, Strength of Fibre Reinforced Materials, Analysis of Composite Structures and Design of Fibre Reinforced Materials.	
ME371 (254371) Mechanical Engineering Laboratory 1	1(0-3-0)	ME413 (254413) Introduction to Contact Mechanics	3(3-0-6)
Prerequisite : ME231 (254231); and ME214 (254214) or ME216 (254216)		Prerequisite : ME214 (254214) or ME216 (254216) and ME325 (254325) or consent of the department	
Basic experiments on thermodynamics, fluid and solid mechanics.		Mechanical properties of materials. Linear elastic fractures mechanics. Delayed fracture in brittle solids. Statistics of brittle fractures. Elastic indentation stress fields. Elastic contact. Hertzian fractures. Elastic-plastic indentation stress fields.	
ME372 (254372) Computer-Based Instrumentation	3(2-3-4)	ME414 (254414) Mechanics of Granular Materials	3(3-0-6)
(เปลี่ยนชื่อวิชาจาก Instrumentation) มีผลบังคับใช้ตั้งแต่ภาคเรียนที่ 1/2562		Prerequisite : ME214 (254214) or ME216 (254216) or consent of the department	
Prerequisite : EE285 (252285)		Introduction to granular materials; geometrical representation of granular assemblies; discrete mechanics; stress and strain; micro and macro behavior; friction behavior; discrete element approaches; molecular dynamics, non smooth contact dynamics.	
Introduction to engineering measurement and related instruments in mechanical engineering applications. Design of instrumentation systems. Measurement uncertainty analysis. Use of computer software for design, analysis, and simulation of process instrumentation in mechanical engineering.		ME415 (254415) Mechanics of Wood	3(3-0-6)
ME373 (254373) System Analysis and Control	3(3-0-6)	Prerequisite : ME214 (254214) or ME216 (254216)	
Prerequisite : MATH362 (206362)		Wood structure, physical properties and moisture relations, linear elasticity, orthotropic elasticity and wood, experimental determination of elastic compliance, linear viscoelasticity, viscoelastic deformation of wood.	
Control principles. Analysis and modeling of linear control elements. Control system design concepts. Feedback systems. Stability of linear feedback systems, time domain analysis and design. Frequency response and frequency domain analysis.		ME421 (254421) Mechanical Vibration	3(3-0-6)
ME390 (254390) Preliminary Study for Mechanical Engineering Project	1(0-3-0)	Prerequisite : MATH 362 (206362) and ME 206 (254206)	
Prerequisite : consent of the department		มีผลบังคับใช้ตั้งแต่ภาคเรียนที่ 1/2564	
Preliminary study of a mechanical engineering problem for formulating an engineering project which will be carried out under the supervision of a project advisor. Special training and seminar for project planning and proposal report writing. Grading will be given on satisfactory (S) or unsatisfactory (U) basis.		Definitions. System with one degree of freedom. Simple harmonic motion. Torsional vibration. Method of equivalent systems by energy method; Rayleigh method. Vibration with damping; Coulomb damping, viscous damping. Force vibration. System having several degree of freedom. Dynamic vibration absorber.	
ME398 (254398) Special Study for Cooperative Education	3(0-18-0)	ME422 (254422) Introduction to Finite Element Method	3(2-3-4)
Prerequisite : Consent of the Department		Prerequisite : ME212 (254212) or ME214 (254214) or ME216 (254216) and ME334 (254334)	
Preparation for cooperative education in the organization, training in the organization. Students will conduct their own senior project proposal. Grading will be given on satisfactory (S) or unsatisfactory (U) basis.		Finite element method, interpolation functions, formulation of characteristic element matrices and vectors, Using of commercial software.	

ME423 (254423) Fracture Mechanics	3(3-0-6)	ME435 (254435) Combustion	3(3-0-6)
Prerequisite : ME325 (254325)		Prerequisite : ME232(254232)	
Fracture mechanics; crack analysis; fracture control; fracture toughness; environment-assisted cracking; cyclic stress and strain fatigue; fatigue crack propagation; analyses of engineering failures.		Combustion process analysis; flame propagation; chemical reaction & fuel characteristics; comparison between fuels	
ME424 (254424) Machine Design 2	3(3-0-6)	ME436 (254436) Tribology	3(3-0-6)
Prerequisite : ME325 (254325)		Prerequisite : ME333 (254333)	
Design of rolling-element bearings. Journal bearings. Spur gears. Clutches and brakes. Miscellaneous power transmission components. Case studies.		Property of lubricants under various conditions, various types of bearings, wear characteristics & maintenance process.	
ME425 (254425) Modeling of Mechanical Systems	3(3-0-6)	ME438 (254438) Computational Fluid Dynamics and Heat Transfer	3(3-0-6)
Prerequisite : MATH362 (206362)		Prerequisite : ME302 (254302) or MATH355 (206355) and MATH362 (206362); and ME334 (254334) or AE334 (260334)	
System modeling. Modeling of mechanical systems. Dynamic system analysis. Response of dynamics system. Nonlinear dynamics.		This course is designed to emphasize the essence of the methods by starting from the basic governing equations of fluid dynamics and heat transfers and their corresponding characteristics to involving numerical methods. Relevant case studies are also well presented.	
ME426 (254426) Mechanics of Machinery 2	3(3-0-6)	ME439 (254439) Flight Mechanics	3(3-0-6)
Prerequisite : ME222 (254222)		Prerequisite : ME 206 (254206)	
Motion and force analysis of machines and mechanisms; balancing of rotating and reciprocating machines; basic vibration analysis.		The standard atmosphere. Basic aerodynamics. The drag polar, equations of motion and thrust required for level flight. Thrust available, maximum velocity, power required and power available. Rate of climb, gliding flight, absolute service ceiling and time to climb. Range and endurance and relations between parasite drag and induce drag coefficients. Takeoff, landing performance and turning flight. Accelerated rate of climb, supersonic airplane, stability and control. Moments on the airplane, angle of attack and stability. Longitudinal static stability, neutral point, static margin and longitudinal control. Elevator angle to trim, stick fix and stick free elevator hinge moment and stick free longitudinal static stability. Directional and lateral static stability. Glider and competition.	
ME427 (254427) Mechanism Analysis and Synthesis	3(3-0-6)	ME441 (254441) Refrigeration	3(3-0-6)
Prerequisite : ME222 (254222)		Prerequisite : ME232 (254232) and ME334 (254334)	
Mechanism analysis. Centrodes. Curvature. Spherical four-bar mechanism. Boolean algebra. Graph theory. Mechanism synthesis.		Principle of refrigeration; refrigeration systems; equipments; applications.	
ME428 (254428) Design of Mechanical Systems	3(3-0-6)	ME442 (254442) Air Conditioning	3(3-0-6)
Prerequisite : ME213 (254213) or ME325 (254325); and ME222 (254222)		Prerequisite :ME333 (254333) and ME334 (254334)	
Methodology of system design; Design process; Economics in designing; Drives and Actuators; Application of machinery and machine elements; Control, sensor and power supply; Engineering documentation; Case studies.		Nature of air; human comfort; cooling load estimation; applied psychrometrics; air duct design; piping design; air conditioning systems; equipment; applications.	
ME429 (254429) Engineering Dynamics 2	3(3-0-6)	ME443 (254443) Solar Energy Thermal Processes	3(3-0-6)
Prerequisite : MATH362 (206362) and ME206 (254206)		Prerequisite : ME232 (254232) and AE334 (254334)	
Dynamics of rigid bodies. Dynamics of multi-body systems. Derivation of equations of motion. Dynamic simulations.		Nature of solar radiation; solar energy measurements; collections and storages; applications on heating, cooling, power, and etc.	
ME431 (254431) Gas Dynamics	3(3-0-6)		
Prerequisite : ME232 (254232) and ME333 (254333)			
Basic concepts of gas dynamics; wave phenomena; subsonic, sonic and supersonic flows; related theories of gas dynamics & applications.			
ME433 (254433) Advanced Mechanics of Fluids	3(3-0-6)		
Prerequisite : ME333 (254333)			
Review of principles and concepts in mechanics of fluid; advanced theories & applications.			
ME434 (254434) Advanced Heat Transfer	3(3-0-6)		
Prerequisite : ME334 (254334)			
Advanced theories in conduction, convection and radiation heat transfer with applications.			

ME444 (254444) Design of Thermal Systems	3(3-0-6)	ME455 (254455) Nuclear Engineering	3(3-0-6)
Prerequisite : ME333 (254333); and ME302 (254302) or AE355 (206355); and ME334 (254334) or AE334 (260334)		Prerequisite : ME232 (254232)	
System design; workable and optimum; economics; equation fitting and mathematical modeling; system simulation; methods of optimization.		Review of atomic and nuclear structures, nuclear fission; fusion and chain reaction; radiation detection and protection; nuclear heat transfer; components and operation of a nuclear reactor.	
ME445 (254445) Basic Aerodynamics	3(3-0-6)	ME456 (254456) Energy Conservation	3(3-0-6)
Prerequisite : ME232 (254232) and ME333 (254333)		Prerequisite : ME232 (254232) and EE285 (252285)	
History and development of aircraft; units and dimensions; air flow; aerofoil and highlift devices; aerodynamics force; aircraft propulsion, flight performance, aircraft stability and control, introduction to compressible.		Energy promotion and conservation acts; fuel and combustion processes; boiler, steam and condensate systems; energy conservation in systems using thermal and electrical energy; energy auditing techniques.	
ME446 (254446) Thermal Equipment in Industries	3(3-0-6)	ME457 (254457) Rocket and Propulsion Engineering	3(3-0-6)
Prerequisite : ME334 (254334)		Prerequisite : ME 231 (254231) and ME 333 (254333)	
Heat transfer processes. Heat and mass transfer. Selection and design of heat exchangers; evaporators, condensers and cooling towers, boilers, refractories and furnaces, drying equipment. Heat losses from insulated piping and jacketing.		Rocket engineering and basic propulsion principles. Design, Specification, and operation of spacecraft systems. Theories and practical applications from current and past spacecraft and rocket propulsion systems.	
ME451 (254451) Power Plant Engineering	3(3-0-6)	ME 458 (254458) Efficiency Improvement in Thermal Energy Systems	3(3-0-6)
Prerequisite : ME232 (254232)		Prerequisite : ME 334 (254334) or AE 334 (260334)	
Load calculation; power plant economics; fuel and combustion; steam power plant; internal combustion engine power plant; gas turbine and hydroelectric power plant; instrumentation and control.		Energy conversion into heat and electricity. Source of waste heat and heat recovery. Heat transfer enhancement. Process integration. Energy storage. Energy in buildings. Cooling combined heat and power. Availability of renewable energy resources.	
ME452 (254452) Automotive Engineering	3(3-0-6)	ME 459 (254459) Sustainable Energy	3(3-0-6)
Prerequisite : ME252 (254252) or ME254 (254254)		Prerequisite: ME 231 (254231)	
Definitions and development history of automobiles. Classification of automobiles. Automotive specifications. Dimensions, weight, wheel and tire, and center of gravity. Statics of automobiles. Engine' s cycles and performances. Transmission system. Wheel torque, drag forces, net driving force and acceleration. Dynamics of automobiles during accelerating, braking and cornering. Brake system. Deceleration and braking energies. Steering system, Steering angles and steering radii. Fundamentals of suspension systems. Wheel angles.		Historical context of global energy growth. Energy sources for a more sustainable future, energy efficiency and sustainability. Pollution, global warming and energy footprint. Energy economics and world energy reserves. Population and consumption growth, and energy supply demand and storage. Smart grid and nuclear energy. Wind power and solar thermal power. Geothermal power and biomass systems.	
ME453 (254453) Gas Turbines	3(3-0-6)	ME461 (254461) Robotics Engineering	3(3-0-6)
Prerequisite : ME232 (254232)		Prerequisite : ME206 (254206)	
Principles and performance of gas turbine power plants for power generation and aircraft propulsion.		Introduction to history and technology of robots and manipulators. Industrial robots. Spatial descriptions and characteristics. Transformations in three-dimension. Manipulator Forward and Inverse kinematics. Mechanics of robot motion. Trajectory planning. Basic robot controls.	
ME454 (254454) Steam Power Plant	3(3-0-6)	ME462 (254462) Soft Computing Techniques	3(3-0-6)
Prerequisite : ME232 (254232)		Prerequisite : MATH362 (206362)	
Steam power plant equipments; steam engines; steam turbines; heat transfer; condensers; feed water heater and evaporator; feed water treatment; combustion equipment; steam generating units; duct work and piping systems; draft; equipment selection; plant operation; heat balance and plant economics.		Soft-computing techniques. Neural networks. Fuzzy Systems. Fuzzy logic. Genetic algorithms.	

<p>ME463 (254463) Computer Aided Design and Computer Aided Manufacturing for Mechanical Engineers 3(2-2-5)</p> <p>Prerequisite : ME205 (254205) or ME207 (254207) ; and ME301 (254301) or ME302 (254302)</p>	<p>power circuits; Fluid circuit design; Component selection and design; Transmission medium; System maintenance; Automatic Control.</p>
<p>Mathematical representation of curves. Representation of surfaces and solids. Curve drawing, surfaces, and solid modeling. Computer Aided Design and Computer Aided Manufacturing data exchange. Computer Numerical Controls part programming and Computer Numerical Controls practice.</p>	<p>ME476 (254476) Turbomachines 3(3-0-6)</p> <p>Prerequisite : ME333 (254333)</p> <p>Hydraulic pumps; hydraulic turbines; centrifugal compressors and fans; axial flow compressors and fans; axial flow steam and gas turbines; radial flow gas turbines.</p>
<p>ME464 (254464) Flow in Plastic Injection Process 3(3-0-6)</p> <p>Prerequisite : Fourth year standing</p> <p>Fundamental principles of plastic injection molding process and mold, Principles of rheology and continuum mechanics involved in the flow of plastic injection molding process and mold.</p>	<p>ME477 (254477) Conveying Systems 3(2-3-4)</p> <p>Prerequisite : ME222 (254222)</p> <p>Theories and techniques for material conveying; principles of various types of conveying systems; selection of conveying system; design of conveying systems.</p>
<p>ME465 (254465) Plastic Part Design for Mechanical Engineering 3(3-0-6)</p> <p>Prerequisite : Fourth year standing</p> <p>Theoretical principles and sound engineering practices involved in the design of mechanical parts made from plastics, Applying the balance-knowledge approach between mechanical product design, choice of materials, and process technique, in the design process as they affect competitive choice for commercial success.</p>	<p>ME478 (254478) Engineering Piping Systems 3(3-0-6)</p> <p>Prerequisite : ME333 (254333)</p> <p>Sizing and design of piping systems in buildings; steam piping design; gas piping design.</p>
<p>ME466 (254466) Mechatronics for Mechanical Engineering Students 3(3-0-6)</p> <p>Prerequisite : consent of the department</p> <p>Introduction to mechanic systems, applied electronics, drive and sensor technology, electro-mechanical systems, microprocessor and microcontroller, computer interfacing, programmable logic controller, mechanical engineering design project.</p>	<p>ME489 (254489) Cooperative Education for Mechanical Engineering Students 6 หน่วยกิต</p> <p>Prerequisite : consent of the department</p> <p>Students are required to continuously work in a company or an organization conducting engineering activities for a minimum period of 16 weeks under the supervision of a nominated trainer for professional practice and an engineering project.</p>
<p>ME467 (254467) Digital Control and Signal Processing for Mechanical Engineering 3(3-0-6)</p> <p>Prerequisite : consent of the department</p> <p>Modern dynamic control and signal processing methods focusing on fundamental theory in mechanical and mechatronic engineering. Discrete time systems; Dynamic response, Discrete-time Fourier transform, Signal sampling; Z-transform, Filter design, Controller design methods, Microprocessor platforms and programming.</p>	<p>ME490 (254490) Special Study for Project 1(0-3-0)</p> <p>Prerequisite : Fourth year standing or Consent of the department</p> <p>Special study, technical searching or literature survey for a topic in mechanical engineering to be carried out by individual or a group of students under faculty supervision. A proposal of the project topic must be prepared and well-written and should be technically and practically reasonable. The proposal has to be approved by the departmental committee.</p>
<p>ME468 (254468) Advanced Manufacturing Processes 3(3-0-6)</p> <p>Prerequisite : ME362 (254362)</p> <p>Forming from liquid and powder. Basic theory of plasticity. Stress-Strain relations for plastic flow. Theories applied in large and small-scale metal forming processes. Theories applied in hot and cold rolling process. Machining theories. Fabrication processes.</p>	<p>ME491 (254491) Capstone Design Project in Mechanical Engineering 3(0-9-0)</p> <p>(เปลี่ยนชื่อวิชาจาก Project in Mechanical Engineering) มีผลบังคับใช้ตั้งแต่ภาคเรียนที่ 1/2563</p> <p>Prerequisite : ME390 (254390) or ME490 (254490)</p> <p>Preparing students for engineering practice through culminating major design experience based on knowledge and skills applied for designing elements, systems, or processes with realistic constraints.</p>
<p>ME473 (254473) Fluid Power Systems 3(3-0-6)</p> <p>Prerequisite : ME333 (254333)</p> <p>Introduction; Fundamental fluid mechanics concepts; Fluid power source, reservoir and distribution systems; Fluid motors and components; Basic Fluid</p>	<p>ME492 (254492) Seminar in Mechanical Engineering 3(3-0-6)</p> <p>Prerequisite : Consent of the department</p> <p>Special problems in mechanical engineering are to be discussed and reported.</p>

ME493 (254493) Industrial Internship	3(0-18-0)	IE210 (255210) Industrial Metallurgy	3(2-3-4)
Prerequisite : Consent of the department		Prerequisite : ENGR103 (259103) or IE101 (255101)	
Training in mechanical engineering with consulting engineer(s) or industry or equivalent job under supervision of engineer(s) or trainer(s) and/ or instructor(s); training report is needed to be approved by the department-committee.		Production of steels, ternary equilibrium diagrams, alloy steels, tool steels, cast iron, nonferrous metals and metallographic examination.	
ME494 (254494) Special Topic in Mechanical Engineering 1	3(3-0-6)	IE215 (255215) Manufacturing Processes	3(3-0-6)
Prerequisite : Consent of the department		Prerequisite : ENGR106 (259106)	
New technologies or existing technologies applied to specific areas. The topic must be approved by the departmental committee.		Theory and concepts of manufacturing processes in the following areas: casting, forming, machining forming, welding, rolling, pressing, cutting, shearing, grinding and surface finishing, joint and assembling, materials and manufacturing relationships, fundamentals of manufacturing costs.	
ME495 (254495) Special Topic in Mechanical Engineering 2	3(3-0-6)	IE217 (255217) Production Supporting Systems in Factories	3(3-0-6)
Prerequisite : Consent of the department		Prerequisite : Concurrent to IE 215 (255215)	
New technologies or existing technologies applied to specific areas. The topic must be approved by the departmental committee.		Hydraulic system. Pneumatic system. Power system in factories. Refrigerating and air-conditioning systems. Boiler system. Transporting system in factories. Smart sensors.	
ME496 (254496) Special Topic in Mechanical Engineering 3	3(3-0-6)	IE230 (255230) Industrial Organization and Management	3(3-0-6)
Prerequisite : Consent of the department		Prerequisite : None	
New technologies or existing technologies applied to specific areas. The topic must be approved by the departmental committee.		Organization theory. Planning and strategic planning. Organizing. Staffing, leading and controlling. Motivating and leadership. Modern concept and theories in management. Innovation and creativities. Ethics, business code of conduct and social responsibility. Principle of logistics and supply chain management. Logistics and supply chain activities. Principle of supply, operation, and demand management. Supply chain management model and strategy. Supply chain management in Modern Industry. Sustainable supply chain management.	
ME497 (254497) Special Topic in Mechanical Engineering 4	3(3-0-6)	IE251 (255251) Motion and Time Study	3(3-0-6)
Prerequisite : Consent of the department		Prerequisite : none	
New technologies or existing technologies applied to specific areas. The topic must be approved by the departmental committee.		Productivity rate and productivity rate improvement, definition and history of motion and time study, process design for new product, plant layout and material handling system, production process analysis, activity analysis, operations analysis and micromotion study, fundamentals of hand motion and principles of motion economy, time study and direct time study, work sampling, standard data system, predetermined time system, Motion Time Measurement (MTM) time system and ergonomics.	
ME498 (254498) Co-Operative Education	6 credits	IE290 (255290) Industrial Engineering Laboratory 1	1(0-3-0)
Prerequisite : ME398 (254398)		Prerequisite : concurrent to IE215 (255215) and IE251 (255251)	
Students are required to continuously work in the related organizations for a minimum period of 16 weeks as a staff in the organization under the supervision of in-charge trainer(s) at the organization and instructor(s) of the university. Students will conduct their own senior project. Grading will be given on satisfactory (S) or unsatisfactory (U) basis.		Manufacturing process chart and flow diagram, left and right hand chart, fundamental of hand motion and motion economy, standard time determining using direct time study, standard time determining using standard data system, standard time determining in MTM and PMTS time system, fundamental of manufacturing process, casting process, forming process, turning and milling process, shaping and drilling process, abrasive and grinding process and joining process.	
ME499 (254499) Cooperative Education in Mechanical Engineering	8 credits		
Prerequisite : consent of the department			
Preparation and continuous working in the related organizations for a minimum period of 16 weeks as a staff in the organization under the supervision of in-charge trainer(s) at the organization and instructor(s) of the university. Proposal and senior project conducting are also included.			
Course in Industrial Engineering Course code IE (255)			
IE201 (255201) Quantitative Analysis in Industrial Engineering	3(3-0-6)		
Prerequisite : None			
Statistical quantitative analysis used in industrial engineering including probability, random variables, probability distribution, point estimation and hypothesis testing, analysis of variance, simple linear regression and multiple regression. Computer packaging in industrial engineering applications such as decision making, quality engineering, operation research, and production planning.			

<p>IE300 (255300) Introduction to Fluid Mechanics and Thermodynamics for Industrial Engineers</p> <p>Prerequisite : ENGR 107 (259107)</p> <p>Introduction to the fundamental concepts in fluid mechanics and thermodynamics and properties of fluid. Pressure and fluid statics and fluid kinematics. Mass and Bernoulli's equation. Conservation of energy equation. Momentum analysis of flow system. Flow analysis and modeling. Flow in pipe. Flow over bodies. Energy, energy transfer and general energy analysis. Properties of pure substance. Energy analysis in closed system. Mass and energy analysis in control volume system. Second law of thermodynamics and entropy. Reciprocating air compressor test and refrigerator system test.</p>	<p>3(3-0-6)</p>	<p>IE322 (255322) Industrial Data Analysis</p> <p>Prerequisite : IE201 (255201)</p> <p>Evolution of industrial data. Manufacturing data life cycle. Framework of data-driven smart manufacturing. Industrial database. Basic of using spreadsheet to analyze industrial data. Pivot table. Statistical data analysis. Modern technology in gathering and storing data. Modern technology in analyzing data. Constructing dashboard. Introduction to industrial data mining.</p>	<p>3(3-0-6)</p>
<p>IE301 (255301) Manufacturing Technology</p> <p>Prerequisite : IE212 (255212) or IE215 (255215)</p> <p>Components of manufacturing technology, computer aided design and manufacturing technology, numerical control language, applications of numerical control language for part productions, applications of computer aid design and manufacturing, fundamental of CNC system and their components, operation on CNC machining center, advanced manufacturing process, automation system, components of automation system and applications of automation system</p>	<p>3(2-3-4)</p>	<p>IE330 (255330) Engineering Economy</p> <p>Prerequisite : None</p> <p>An overview of engineering economy concept, time value of money, tools for project evaluation, replacement analysis, depreciation methods, after-tax economic analysis, sensitivity analysis, decision under risk and uncertainty.</p>	<p>3(3-0-6)</p>
<p>IE317 (255317) Industrial and Commercial Laws</p> <p>Prerequisite : None</p> <p>Relationship between laws and business establishments. Laws regarding commerce and industry including establishments, construction regulations, industrial factory statutes, environmental statutes, investment promotion laws, customs duty laws, production and production standards laws, insurance management and engineering occupation laws. Also included are social security statutes and labor protection laws.</p>	<p>3(3-0-6)</p>	<p>IE332 (255332) Industrial Cost Analysis and Budgeting</p> <p>Prerequisite : None</p> <p>Fundamental of accounting. Fundamental of economics. Industrial cost concepts and determinants. Direct material, labour, and factory overhead cost. Job order costing analysis. Process cost system analysis. Standard cost analysis. Financial report and financial analysis. Break even and profit analysis. Incremental analysis.</p>	<p>3(3-0-6)</p>
<p>IE320 (255320) Engineering Operation Research</p> <p>Prerequisite : IE201 (255201)</p> <p>An introduction to the methodology of operation research in modern industrial engineering problem solving using mathematical models, linear programming and application, transportation models, assignment models, network programming, shortest-route, game theory, queuing theory, simulation in decision making processes and related areas and computer applications.</p>	<p>3(3-0-6)</p>	<p>IE337 (255337) Safety Engineering</p> <p>Prerequisite : Third year standing</p> <p>Introduction to safety engineering, accident evaluation and control, industrial psychology and safety management, industrial pollution control and personal protection equipment, safety law, factory law, civil and commercial law, safety use for boilers, safety use for industrial electrical system and safety use for air conditioning system.</p>	<p>3(3-0-6)</p>
<p>IE321 (255321) Industrial Engineering Quality Control</p> <p>Prerequisite : IE201 (255201) or STAT263 (208263)</p> <p>Introduction to the concept of quality control and industrial applications. Administrative and engineering aspects of quality program. The application of statistic in quality control, quality assurance and product reliability.</p>	<p>3(3-0-6)</p>	<p>IE340 (255340) Production Planning and Control</p> <p>Prerequisite : IE 320 (255320) or STAT380 (208380)</p> <p>Studying the role of production planning and control, production control information flow, techniques in controlling production and inventories, including forecasting demand, production planning, material requirement planning, determination of economic order quantities, production scheduling, quantity production control, and project management.</p>	<p>3(3-0-6)</p>
<p>IE359 (255359) Industrial Pollution and Control</p> <p>Prerequisite : CHEM162 (203162) or CHEM 151 (203151)</p> <p>Environment overview. Sources of waste water. Laws and standards about industrial waste water. Physical and chemical treatments of waste water. Biological treatments of waste water. Laws and control of industrial hazard wastes. Control of sludge and air pollutant from industry. Sources of air pollution, laws and standards about industrial air pollution. Control of particulate matter, toxic vapor and odors from industry. Pollution prevention and cleaner production techniques.</p>	<p>3(3-0-6)</p>		

collection, analysis of variance in product design, taguchi design methodology and robust design.

IE422 (255422) Quality Assurance 3(3-0-6)

Prerequisite : IE321 (255321)

Quality assurance systems and technologies. Statistic process control concepts, reliability system, maintainability, safety system and quality assurance.

IE423 (255423) Engineering Operations Research 2 3(3-0-6)

Prerequisite : IE320 (255320)

Engineering operations research 2, including introduction to problem solving with mathematical models, linear programming models for large-size problems, integer programming models, multi-objective programming models, queuing theory applications and principle of simulation.

IE424 (255424) Applications of Simulation Techniques 3(3-0-6)

Prerequisite : IE320 (255320) or STAT380 (208380)

System structure; logic and methodologies; random generation of numbers and deviates; system simulation languages, models and analysis, discrete and continuous applications to industrial situations.

IE425 (255425) Quantitative Quality Improvement in Engineering 3(3-0-6)

Prerequisite : IE201 (255201)

Quality philosophy and art of discovery, strategy of experimentation, treatment comparison, factorial experiments, experiments with defects, defectives and sample variance as the response, dealing with missing observations, sequential experimentation, Taguchi's parameter designs, and response surfaces.

IE426 (255426) Network Theory 3(3-0-6)

Prerequisite : IE323 (255323)

Introduction to the Application of Network, Scheduling, Construction of FUMT, CPK, Shortest-Path, Maximum Flow, Flowgraphs and Decision Trees. Introduction to Stochastic Networks by Using GMAT, GMNTS III and their Application.

IE427 (255427) Value Engineering 3(3-0-6)

Prerequisite : Consent of the department

Introduction and history of value engineering. Job plan, basic fundamentals, meaning of value, value analysis, data collection, function analysis, idea creation evaluation of alternatives and recommendation for action, application of value engineering and case study.

IE428 (255428) Queuing Theory 3(3-0-6)

Prerequisite : IE320 (255320)

Development of mathematical models of queuing with application to industrial problems, such as inventory policy and machine interference.

IE429 (255429) Inventory Theory and Control 3(3-0-6)

Prerequisite : IE320 (255320) or STAT380 (208380)

Introduction to inventory management, cost considerations, demand evaluation and forecasting technique, buffer stock determination, lot-size and reorder point consideration. The study of inventory policy and model: deterministic, stochastic. Application of inventory management and Japanese's inventory management style.

IE430 (255430) Small and Medium Industry Management 3(3-0-6)

Prerequisite : IE230 (255230)

Definition and principle of small and medium industry, industry business selection and evaluation, marketing study, production and engineering study, financial study, industrial management study, government law related to industrial business, industrial business plan preparation, financial management of bank loan, organization and institute related to industrial business.

IE431 (255431) Industrial Hygiene 3(3-0-6)

Prerequisite : None

Laws and regulations on hygiene. Workplace hygiene and work environment; chemical environment, physical environment, biological environment, ergonomic environment. Occupational diseases. Environmental assessment and evaluation. Occupational hazard prevention and control. First aid procedures and equipments. Development of monitoring and promotional systems.

IE432 (255432) Industrial Cost Analysis and Budgeting 3(3-0-6)

Prerequisite : IE330 (255330)

Fundamentals of accounting cost concepts and determinants, standard cost and factory overhead, direct costing, cost analysis for planning purposes, capital expenditure, capital rationing and decision making for investment in challenging projects.

IE433 (255433) System Analysis for Quality and Productivity Improvement 3(3-0-6)

Prerequisite : None

Basic concepts and fundamental principles for process improvement, quality improvement and problem solving using fundamental principles and methods of quality management such as teamwork, Deming's fourteen points, seven basic tools for improving quality and statistic process control.

IE434 (255434) Logistic Engineering and Management 3(3-0-6)

Prerequisite : IE230 (255230)

Exploration of the technological and managerial issues involved in the design and operation of distributions and physical logistics facilities and associated information technology in an enterprise supply chain. Analysis of tradeoffs between transportation and inventory cost. Design of carrier integration and shipper perspectives in system models. Evaluations of logistics system performance metrics and the impact of logistics activities on an enterprise's financial performance.

<p>IE436 (255436) Industrial Human Resource Management 3(3-0-6) Prerequisite : Consent of the department Industrial evolution and principle of human resource management. Industrial human resource planning. Engineering job design and analysis. Industrial career management. Industrial recruitment and selection. Application interview and test. Orientation and training, industrial performance evaluation. Industrial compensate management. Industrial quality of life and labor relationship. Human resource laws.</p>	<p>IE 442 (255442) Data Mining for Industrial Engineers 3(3-0-6) Prerequisite : IE230 (255230) (เปลี่ยนชื่อวิชาจาก Modern Techniques for Industrial Data Analysis) มีผลบังคับใช้ ตั้งแต่ภาคเรียนที่ 1/2563 Data related to industrial engineers. Industrial data analysis procedure. Data preparation. Association rules. Cluster analysis. Classification. Prediction. Application of data analysis techniques with industrial data.</p>
<p>IE437 (255437) Introduction to Supply Chain Management 3(3-0-6) Prerequisite : IE230 (255230) Supply chain management model, procurement and outsourcing strategies, manufacturing strategies, inventory and warehouse management, enterprise resource planning, market distribution strategies, transportation management in supply chain, customer accommodation strategies, management of information technology in supply chain, strategic alliance in supply chain.</p>	<p>IE 443 (255443) Industrial Engineering and Enterprise 3(3-0-6) Resource Planning Prerequisite : IE230 (255230) Evolution and technology of enterprise resource planning system. Overview of organization information. Business process reengineering. Software for enterprise resource planning with modules. Logistics and production management module, Inventory and warehouse management module. Sales and distribution module. Financial and accounting module. Enterprise resource planning software life cycle. Presentation and opportunities in enterprise resource planning.</p>
<p>IE438 (255438) Quantitative Analysis for Marketing 3(3-0-6) Management Prerequisite : IE201 (255201) or IE330 (255330) The role of scientific marketing analysis, decision models, test marketing, decision of pricing, advertising and promotional activities</p>	<p>IE444 (255444) Computer Applications in IE 3(2-3-4) Prerequisite : ENGR 201 (259201) or CPE210 (261210) Principles of good programming style. The applications of computer in the fields of operation research, production planning and control, work study, data management system, engineering statistics, quality control, financial analysis and other topics of industrial engineering.</p>
<p>IE439 (255439) Decision Making for Engineers 3(3-0-6) (เปลี่ยนชื่อวิชาจาก Principles of Management Science) มีผลบังคับใช้ตั้งแต่ภาคเรียนที่ 1/2563 Prerequisite : IE230 (255230) Introduction to management science and decision making. Foundation of multiple criteria decision making. The classification of multiple criteria decision making. Attribute generation, data and weight. Technique of multiple attributes decision making. Fuzzy multiple attribute decision making. Technique of multiple objective decision making. Risk management. Case studies.</p>	<p>IE445 (255445) Advanced Computer Application for 3(2-3-4) Industrial Engineering Prerequisite : Consent of the department Manufacturing operation using computer numerical control machine (CNC), designing engineering component by a computer-aided design (CAD) software, designing manufacturing operation by a computer-aided manufacturing (CAM) software, basic computer-aided engineering (CAE), designing engineering components in 2D, designing engineering components in 3D, designing free-form engineering components, computer numerical control programming and engineering analysis.</p>
<p>IE440 (255440) Principle of Product Design 3(3-0-6) Prerequisite : IE212 (255212) or IE215 (255215) Development process and organization structure, identifying customer needs and establishing product specification, concept generation and concept selection, industrial design, design for manufacturing. Economic product development project.</p>	<p>IE446 (255446) Computer Integrated Manufacturing 3(2-3-4) Prerequisite : IE301 (255301) Components of computer integrated manufacturing, computer aided design software for designing parts, computer aided manufacturing software for making parts, numerical control language generation, computer numerical control machine preparation, computer numerical control operation, cnc's direct commands operation, cnc's operation using connected computer.</p>
<p>IE441 (255441) Information Technology for Industrial 3(3-0-6) Engineers Prerequisite : ENGR201 (259201) Information, information technology, computer technology, communication technology, database management, manufacturing information system, artificial intelligence and knowledge-based system, information system development for industrial organization.</p>	<p>IE447 (255447) Industrial Robotics 3(3-0-6) Prerequisite : ENGR201 (259201) Characteristics of industrial robotic, components of industrial robotic, industrial robotic motion and operation, mathematical for industrial robotic motion and operation, computer simulation for industrial robotic design, industrial robotic control system, application of computer control</p>

for industrial robotic and application of internet based remote control for industrial robotic.

IE448 (255448) Industrial Plant Layout and Design 3(3-0-6)

Prerequisite : IE251 (255251) and IE320 (255320)

Introduction to plant design, preliminary analysis of plant design, plant layout and facilities planning, material handling system, nature of plant design problems, plant location, product analysis, basic types of layout services and auxiliary functions, the systematic layout planning (SLP), the SLP processes, flow of materials, managing plant layout project, Thai factory laws related to plant layout.

IE449 (255449) Design of Production System 3(3-0-6)

Prerequisite : IE230 (2552300)

Advanced topics related to evolution and new development technology in industrial engineering. The contents are philosophy and systems leading to design of production and continuous quality system of product and process. Lean and Just-in-time (JIT) manufacturing system. Integration of concepts of production management, operations research, quality management and resource management.

IE451 (255451) Metallurgical Process 3(3-0-6)

Prerequisite : IE210 (255210)

General characteristics of metallurgical process. Ore extraction. Compound formation. Metal production. Powder metallurgy for hot and cold system. Post processing. Microstructure analysis. Mechanical properties analysis. Economic value analysis of process. Application and future trends.

IE452 (255452) Tool Engineering 3(2-3-4)

Prerequisite : IE212 (255212) or IE215 (255215)

Principles and application of tool engineering, including cutting tools, jig and fixture, forming tools, as well as measuring device for metrology and modern manufacturing for tool engineering. Workshop on engineering tools.

IE453 (255453) Ventilation in Industrial Factory 3(2-3-4)

Prerequisite : Consent of the department

เปิดใหม่ มีผลบังคับใช้ภาคการศึกษาที่ 1/2563

Ventilation and cleaning system of air pollutants principles in industrial factory, natural ventilation, general ventilation, local exhaust ventilation, ventilation system components, design principles of ventilation system, control, monitor and maintenance principle of ventilation system, Laws, standard and related parties in air pollution control.

IE454 (255454) Manufacturing Automation System 3(3-0-6)

Prerequisite : Third year standing

The overview of the manufacturing automation system. Strategies and control hierarchy of manufacturing automation system, basic of pneumatics and hydraulics, principles of pneumatics diagram design, basic of pneumatics diagram, electropneumatics and electropneumatics

diagram, basic of sensor devices and system and basic of Programmable Logical Controller (PLC) program.

IE455 (255455) Energy System and Management 3(3-0-6)

Prerequisite : Fourth year standing

Overview of primary sources (oil, natural gas, coal, uranium) derivative sources (gasoline, coal gas, plutonium), renewable energy, energy conversions, processing, transportation and storage. Energy management, cost/benefit analysis and environmental impact of alternative modes of energy, National and International energy strategies and policies.

IE456 (255456) Project Feasibility Study 3(3-0-6)

Prerequisite : IE330 (255330) or IE332 (255332)

Basic concepts of project feasibility studies, marketing studies, engineering studies, management studies, financial studies, economics studies, social studies and environmental impact. Case studies are also discussed.

IE460 (255460) Performance Measurement System for 3(3-0-6)

Industries

Prerequisite : IE230 (255230)

The crucial roles of performance management for industries in the digital economy. Identify a shift paradigm of performance measurement system from industrial based economy to the digital one. Enhance concepts that performance measurement system allows firms to align business processes with vision and strategy to strengthen their competitiveness immediately.

IE462 (255462) System Engineering 3(3-0-6)

Prerequisite : IE230 (255230)

Exploration of the conceptual and practical issues in system engineering with particular emphasis on application in industrial management. Element, procedure, and problem solving techniques in system engineering.

IE463 (255463) Ergonomics 3(3-0-6)

Prerequisite : none

Introduction to ergonomics, introduction to anatomy and physiology, man-machine interaction, information input and process, man-machine interaction: human output and control, analysis of human body movement, energy consumption, measurement of static strength, physical work capacity, electromyography, anthropometry and engineering application, biomechanics, workstation, workplace and equipment design, hand tools design, manual materials handling, working environment, ergonomics application in industrial work.

IE464 (255464) Cleaner Production Engineering 3(3-0-6)

Prerequisite : IE359 (255359)

Global environment issues, an introduction to cleaner production, materials balance, process assessment, organization and management for cleaner production, material yield and unit consumption

management, equipment maintenance for cleaner production, case study.

IE471 (255471) Introduction to Innovation Management 3(3-0-6)

Prerequisite : Fourth year standing

Theory and case study of innovation and fundamental of innovation management. Definition of innovation, understanding about innovation, types of innovation, innovation through the perspective of economic and market, managing innovation in organization, innovation and operation management, strategic alliance and network., managing organizational knowledge, managing intellectual properties, management of research and development, and open innovation and technology transfer.

IE490 (255490) Advance Topics in Industrial Engineering 1 3(0-18-0)

Prerequisite : Consent of the department

Study of current interesting and new developments in the field of Industrial Engineering.

IE491 (255491) Industrial Engineering Project 3(0-9-0)

Prerequisite : Fourth year standing

Practical interesting project or problems in various fields of industrial engineering assigned by the instructor. The project must be completed within one semester. A Complete written report is required and final oral examination must be taken.

IE492 (255492) Special Topics in Industrial Engineering 1 3(3-0-6)

Prerequisite : Consent of the department

The department may offer courses as special topics or nominate topics of other departments as special topics for each semester. Special topics are usually technical subjects which are considered beneficial to student carrier. Only in special circumstances, can special topics be non-technical subjects.

IE497 (255497) Advance Topics in Industrial Engineering 2 3(3-0-6)

Prerequisite : Fourth year standing and Consent of the department

Advanced topics in Industrial Engineering which are of current interest in this field. Special problems and/or topics are to be presented and discussed. The contents of the course are to be proposed by the instructor(s), approved by the department of industrial engineering and then announced prior to the commencement of each semester

IE498 (255498) CO-Operative Education for Industrial Engineer 8(0-48-0)

Prerequisite : IE393 (255393)

Working in industrial engineering with industry as temporary employees who have certain responsibility and works full time during the period of work 16 weeks under supervision of engineer(s) or head of department at the organization and instructor(s) from the University.

IE499 (255499) Special Topics in Industrial Engineering 2 3(3-0-6)

Prerequisite :Fourth year standing and Consent of the department

Special topics in Industrial Engineering which are of current interest in this field. Special problems and/or topics are to be presented and discussed. The contents of the course are to be proposed by the instructor(s), approved by the department of industrial engineering and then announced prior to the commencement of each semester.

Course in Mining Engineering Course code MN (256)

MN100 (256100) Sustainable Use of Mineral Resources 3(3-0-6)

Prerequisite : None

Concept of sustainable development. Benefits of using mineral. Relationships between mineral resources and society. Economy and environment. Principles of sustainable use of mineral resources.

MN131 (256131) Urban Mining 3(2-2-5)

Prerequisite : None

Concept of urban mining. Principles of artificial resources management. Principles of waste collection and classification. Basic principles of mineral processing and recycling. Applications of mineral processing methods in recycle processes and case studies.

MN271 (256271) Rock Mechanics 3(2-3-4)

Prerequisite : ENGR107 (259107) or consent of the department

Engineering properties of intact rock and testing, rock mass classification, stress, strain, elastic theory, stress distribution in elastic material; rock failure, in-situ stress and measurement, stress around underground opening, rock slope stability.

MN281 (256281) Reservoir Rock Properties 3(2-3-4)

Prerequisite : ENGR107 (259107) or Consent of the department

Basic reservoir rock properties and their measurements: porosity, saturations and volumetric equations. Land descriptions. Trapping mechanism. Pressure and temperature gradients, and abnormally pressured reservoirs. Darcy's law for linear horizontal and tilted flow. Radial flow for single phase liquids and gases. Multiphase flow (relative permeability). Capillary pressure and formation compressibility.

MN301 (256301) Introduction to Particle Technology 3(3-0-6)

Prerequisite : None

Basic knowledge of particle technology: introduction; characterization; size reduction; separation; particle-fluid dynamics; flow, storage and handling of particles; agglomeration and sintering; production of fine particle; and particulate emission controls.

MN316 (256316) Surface Mining and Design 3(2-3-4)

Prerequisite : GEOL103 (205103)

Surface prospecting, exploration, reserve estimation, mine feasibility study, environmental assessment; surface mine development, optimum pit design and slope stability; unit operation for surface mining, drilling, blasting, loading,

and hauling; open pit mining methods and equipment for metal, non-metal, and bedded deposits; alluvial mining; dredging; non-entry mining methods.

MN317 (256317) Underground Mining and Design 3(2-3-4)

Prerequisite : GEOL103 (205103)

Underground prospecting, exploration, reserve estimation, feasibility study, environmental assessment; underground mine development, shaft sinking and tunneling; unit operation for underground mining: hoisting, blasting, mucking, and handling, rock mechanics application; underground mining methods including unsupported, supported, caving, shortwall and longwall methods; mine ventilation and safety.

MN318 (256318) Drilling and Blasting 3(3-0-6)

Prerequisite : Consent of the department

Composition and properties of explosives, blasting theory and applications of explosives in mining, principles of operation and selection of rock drills, blasting design, controlled blasting, drilling and blasting economics, blasting and environment, and blasting regulations and safety.

MN333 (256333) Mineral Processing 1 4(3-3-6)

Prerequisite : CHEM104 (203104) and PHYS106 (207106)

Theory and practice of physics methods of mineral processing; fundamental of mineral processing including sampling, communication and liberation, screening, size determination, gravity concentration, magnetic and electrostatic separation, and construction of simple flowsheets for mineral processing plants.

MN334 (256334) Mineral Processing 2 4(3-3-6)

Prerequisite : MN333 (256333)

Theory and practice of flotation; flocculation and coagulation; solid-liquid separation including thickening, filtration and drying; chemical processing of minerals; and construction of complex for mineral processing plants.

MN373 (256373) Geotechniques for Mining Engineering 3(3-0-6)

Prerequisite : MN271(256271) or consent of the department

Soil and rockmass classification. Engineering properties of soil and rock. Site investigation. Lab and field tests. Elasticity theory and failure criteria. Geotechniques applications in open-pit and underground mines. Numerical methods for solving soil and rock mechanics problems in mining engineering.

MN381 (256381) Reservoir Fluid Properties 3(3-0-6)

Prerequisite : ME 282 (254282) and MN 281 (256281); or consent of the department

Properties of fluids encountered in petroleum engineering. Phase behavior, density, viscosity. Interfacial tension and composition of oil, gas and brine systems. Interpreting lab data for engineering applications. Flash calculations with k-values and equation of state. Use of reservoir simulation software.

MN382 (256382) Well Log Analysis and Formation Evaluation 3(2-3-4)

Prerequisite : MN 281 (256281) or consent of the department

Introduction to well logging methods for petroleum engineering. Relationship between measured properties and reservoir properties. Analysis of log suites

for reservoir size and contents. Graphical and analytical development methods for visualizing the reservoir, its contents, and its potential for production. Computer application for creating graphs and log traces. Computations of reservoir parameters.

MN383 (256383) Drilling Engineering 3(3-0-6)

Prerequisite : MN382 (256382) or consent of the department

Introduction to drilling engineering. Drilling rig. Drilling fluids and circulation system. Drilling hydraulics. Drilling bits and string. Formation pore pressure and fracture resistance. Casting and cementing. Directional drilling. Well control.

MN384 (256384) Mechanics of Petroleum Production 3(3-0-6)

Prerequisite : MN 381 (256381) and concurrent to MN 383 (256383); or consent of the department

Nadal analysis for pipe and formation deliverability. Single and multiphase flow. Natural flow. Designing artificial lift for enhancing production efficiency by using gas lift, sucker rod pumps, electrical submersible pumps and hydraulic pumps.

MN400 (256400) Training in Mining Engineering 3(0-9-0)

Prerequisite : MN316 (256316); and MN331 (256331) or MN333 (256333)

Training with government organizations or private Companies involving of mining engineering works under supervisions of training engineers and/ or academic advisor. Students are required to submit training reports which will be reviewed and approved by training by committee in actual working environment.

MN412 (256412) Computer Applications in Mining Engineering 3(2-3-4)

Prerequisite : ENGR201 (259201)

Applications of computers in mine surveying, orebody modeling and geologic database management, ore reserve estimation, surface and underground mine planning and design, mineral processing, and mine feasibility study.

MN414 (256414) Coal Mining Technology 3(3-0-6)

Prerequisite : MN 316 (256316) or consent of the department

Techniques of Modern coal Mining, exploration, Physical and Chemical properties, Utilization, environmental prevention, accident prevention and administration.

MN415 (256415) Explosives for Engineering 3(3-0-6)

Prerequisite : Consent of the department

Chemistry and chemical reactions of explosives, explosive energy, shock waves, detonation, blasting vibration, engineering applications

MN416 (256416) Design of Quarry and Stone Crushing Plant 3(3-0-6)

Prerequisite : Third year standing and consent of the department

Properties and uses of crushed stone. Geology and exploration of stone deposits. Investment analysis of quarry projects. Extraction methods and design of quarries. Selection of mining and hauling equipment for quarrying. Application of explosives in quarrying. Design of a stone crushing plant. Selection of stone crushing and sizing equipment. Maintenance of quarrying

equipment and the crushing plant. Safety management and pollution control in quarrying. Laws and regulations in quarrying.

MN418 (256418) Geological Information for Mining Engineers 3(2-3-4)

Prerequisite : Consent of the department

Basic geological prospecting in mine. Analysis and application of geological structure in mining. Basic principles of the topographic map and geologic map. Other geological information in mining.

MN419 (256419) Geological Information System and Remote Sensing for Mining Engineering 3(2-3-4)

(เปลี่ยนชื่อวิชาจาก Mine Reclamation and Monitoring) มีผลบังคับใช้ตั้งแต่ภาคการศึกษาที่ 2/2562

Prerequisite : Consent of the department

Principles of Geographic Information System (GIS). Data management and spatial analysis in mining. Application of GIS in mine monitoring. Principles of remote sensing. Application of remote sensing in mine monitoring.

MN422 (256422) General Metallurgy 3(3-0-6)

Prerequisite : ME282 (254282)

Principles in the extraction and refining of metals by hydro, pyro, and electro metallurgical techniques. The production of ferrous, non ferrous and rare metals from ores, concentrates, or other raw materials. Refractory materials, the manufacturing and use in metallurgical construction. Applications of chemical and instrumental methods to determine the elemental constituent of ores, concentrates, slags and metal products. Design of smelting furnaces.

MN423 (256423) Applied Chemistry in Aqueous Processing 3(3-0-6)

Prerequisite : CHEM103 (203103) or equivalent

Applications of chemical and engineering principles to metal processing in aqueous systems: metallurgical extraction, engineering material synthesis from extracted metals, and treatment of the metal/material waste.

MN433 (256433) Mineral Processing Technology 3(3-0-6)

Prerequisite : MN332 (256332) or MN334 (256334)

Application of mineral processing technology in resource recovery and recycling. Using techniques of size reduction, screening, physical separation, physic-chemical separation, and chemical separation and recovery.

MN434 (256434) Assaying 3(2-3-4)

Prerequisite : CHEM102 (203102) or CHEM104 (203104)

Basic theory and technics for mineral analysis in chemical analysis. Application of classical chemical methods to the determination of waste ore in Thailand. Theories, modern instrumental chemical analysis. Treatment of experimental data in analysis techniques and tools of qualitative and quantitative analysis.

MN441 (256441) Mine Economics and Project Evaluation 3(3-0-6)

Prerequisite : Fourth year standing or consent of the department

Concepts of mineral economics: mineral demand and supply, mineral production, optimal production, cost of production in mining, mine cost estimation, mineral consumption, and project evaluation. Acquisition of mineral property and valuation. Investment decision techniques: time value

of money, depreciation, depletion, tax regulation, cash flow analysis, and risk analysis. Mine organization and project financing. Government policy related to mining industry.

MN442 (256442) Mine Valuation 3(3-0-6)

Prerequisite : MN316 (256316)

Theory of sampling and statistical analysis applied to the evaluation of ore reserves. Financial analysis of mineral deposits, and economic factors related to mining and marketing.

MN443 (256443) Geostatistics 3(3-0-6)

Prerequisite : Consent of the department

Introduction to Geostatistics. Applications of statistics and mathematics of random functions to a study of spatial correlation of geological and geographical parameters, and to a more efficient estimation of these variables with meaningful statistical result.

MN444 (256444) Mine System Engineering 3(3-0-6)

Prerequisite : MN316 (256316) and MN317 (256317); or consent of the department

Applications of operations research techniques in mining, mine design, and short-range and long-range mine planning. Development and formulation of analysis techniques, including uses of softwares to solve mining problems. The techniques applied include simulation, linear programming, and network theory.

MN445 (256445) Mine Management 3(3-0-6)

Prerequisite : Fourth year standing

Mine management fundamental. Decision making process, strategic planning, and organization for a mining and fuel mineral firm.

MN453 (256453) Mine Ventilation 3(3-0-6)

Prerequisite : MN317 (256317)

Mine atmosphere and ventilation control. Solution of air flow networks by numerical techniques. Ventilation of deep mines. Design of mine ventilation systems.

MN454 (256454) Mine Equipment 2 3(3-0-6)

Prerequisite : MN456 (256456) or consent of the department

Theory and engineering principle of Surface and Underground mine-equipment. A unified method of approach to the analysis of the characteristics of mine equipment, including, thermodynamics, Power measurement, traction, fluid system, transmission system, tire and track, steering system, suspension, terramechanics, equipment performance, machine management, human response to mine equipment.

MN455 (256455) Bulk Material Handling 3(3-0-6)

Prerequisite : Fourth year standing

Selection and design of transporting and handling methods for bulk materials including belt conveying, bucket lifting, screw conveying, apron conveying, drag conveying, vibrating conveying and feeding, crushing and screening, hoisting, bin and hopper storage, ventilation and dust collection.

<p>MN456 (256456) Mine Equipment Selection 3(2-3-4)</p> <p>Prerequisite : MN316 (256316) and Fourth year standing</p> <p>The economics and mechanics of mine equipment selection; fundamental theory and characteristics of equipment of surface and underground mining including rock drill, drill rig, excavator, bulldozer, loader, hauler, belt conveyor, locomotive, tunnel boring machine, etc.</p>	<p>MN475 (256475) Rock Cutting Technology 3(3-0-6)</p> <p>Prerequisite : MN271 (256271)</p> <p>Mechanics of rock cutting by picks, discs, toothed roller cutters and button cutters. Rock properties and cuttability assessment. Water-jet assisted rock cutting and drilling. Rock cutting machine design and applications for competent and non-competent rocks. Dimension stone quarrying and processing of granite and marble. Selection of appropriate rock cutting technology.</p>
<p>MN457 (256457) Mine Plant and Accessories Design 3(2-3-4)</p> <p>Prerequisite : MN334 (256334)</p> <p>Structural analysis of roof trusses, columns, footing; indeterminate structural analysis; design of headframe, mine hoist, ore bin, ore skip and man cage; pumping and handling of mine slurry; power generator; mine ventilation; air compressor and drilling equipment</p>	<p>MN477 (256477) Applied Groundwater Engineering for Mining Engineering 3(2-3-4)</p> <p>Prerequisite : Consent of the department</p> <p>Advanced topics in theory of groundwater occurrence and flow in porous media and fractured rocks. Properties of aquifers, well hydraulics and estimation of aquifer parameters using pumping and tracer tests. Groundwater well design and development. Analytical and numerical solutions to problems encountered in mining and civil engineering. Introduction to groundwater modeling. Design of dewatering systems in open-pit and underground mines. Laboratory practices accompany lecture topics and utilizes real field data.</p>
<p>MN462 (256462) Mine Environment 3(3-0-6)</p> <p>Prerequisite : Consent of the department</p> <p>Mining, environment and the importance of environmental problems, visual impact, air pollution and control of dust in mine, mine ventilation, water in mine and control, noise pollution and control, ground vibrations from blasting and air blast, transport, environmental problems of floatation reagents in tailing water from mineral processing plant, reclamation, waste utilization from mining, framework and scope of environmental impact assessment.</p>	<p>MN481 (256481) Petroleum Reservoir Engineering 1 3(3-0-6)</p> <p>Prerequisite : MN 381 (256381) or MN 382 (256382) or consent of the department</p> <p>Data requirements for reservoir engineering studies. Material balance calculations for normal gas, retrograde gas condensate, solution-gas and gas-cap in reservoirs with and without water drive. Primary reservoir performance. Forecasting future recoveries by incremental material balance.</p>
<p>MN463 (256463) Mine Safety Engineering 3(3-0-6)</p> <p>Prerequisite : Fourth year standing</p> <p>Fundamental principles of accident analysis and prevention; mine safety management, accident, injuries and severity rate, modern safety concept, safety program organization, controlling physical condition, personal protection control, performance measurement and motivation, psychological aspect of accident prevention, cost analysis.</p>	<p>MN482 (256482) Petroleum Reservoir Engineering 2 3(3-0-6)</p> <p>Prerequisite : MN481 (256481)</p> <p>Reservoir engineering aspects of supplemental recovery processes. Liquid-liquid displacement processes and gas-liquid displacement processes. Thermal recovery processes. Numerical reservoir simulation. History matching and forecasting.</p>
<p>MN472 (256472) Rock Mechanics 2 3(3-0-6)</p> <p>Prerequisite : MN271 (256271)</p> <p>Theoretical and applied rock mechanics, beam theory applied to roof failure in tabular structures, slope stability, surface subsidence, and construction of mine openings.</p>	<p>MN483 (256483) Well Test Analysis and Design 3(3-0-6)</p> <p>Prerequisite : MN 382 (256382) and MATH 261 (206261); or consent of the department</p> <p>Solution with the diffusivity equation. Transient well testing: build-up, drawdown. Multi-rate test analysis for oil and gas. Flow tests and well deliverabilities. Type curve analysis. Superposition. Active and interference tests. Well test design.</p>
<p>MN473 (256473) Tunnelling 3(3-0-6)</p> <p>Prerequisite : MN271 (256271)</p> <p>Types and uses of tunnels; Rock mass classifications; geological and geotechnical investigations; analysis of loads on tunnel; strength of rock mass and failure mechanism; tunnelling support design; excavation methods; ventilation in tunnel.</p>	<p>MN484 (256484) Enhanced Oil Recovery 3(3-0-6)</p> <p>Prerequisite : MN 481 (256481) or concurrence or consent of the department</p> <p>เปิดใหม่ มีผลบังคับใช้ตั้งแต่ภาคการศึกษา 2/2563</p> <p>Fundamentals of Enhanced Oil Recovery (EOR). Thermal flooding. Chemical flooding. Microbial EOR. Current technology in EOR.</p>
<p>MN474 (256474) Rock Slope Engineering 3(3-0-6)</p> <p>Prerequisite : MN271 (256271)</p> <p>Fundamental mechanics and analysis of slope failure including plane, wedge, circular, and toppling failure. Design of slope and reinforcement to prevent sliding.</p>	

<p>MN485 (256485) Carbon Capture and Storage 3(3-0-6) Prerequisite : MN481 (256481) or concurrence or consent of the department เปิดใหม่ มีผลบังคับใช้ตั้งแต่ภาคการศึกษา 2/2563 Introduction to Carbon Capture and Storage (CCS) . Carbon capture technology. Storage assessment and capacity. Carbon storage in petroleum reservoirs and Enhanced Oil Recovery. Current technology in CCS.</p>	<p>AE402 (260402) Agricultural Waste Engineering 3(3-0-6) Prerequisite : None Basic knowledge of waste in farm and agricultural practice. Waste materials. Waste handling and storing. Waste management and disposal. Waste management system in Thailand.</p>
<p>MN491 (256491) Mining Engineering Project 3(0-9-0) Prerequisite : fourth year standing and consent of the department A special topic or problem in mining engineering is assigned to the student for thorough investigation. Opportunity is afforded the student for original thinking and the application of mining research techniques.</p>	<p>AE413 (260413) Fundamental Design of Agricultural Machinery 3(3-0-6) Prerequisite : ME214 (254214) or ME215 (254215) Concept of design and procedure. Review of Stress and strain. Theory of failure of materials. Design of agricultural machine elements such as joining parts, keys spring, couplings. journal bearing, roller bearing and shaft design. Power transmissions i.e. belt drives, chain drives and spur gear. Case study and design project in farm machine.</p>
<p>MN494 (256494) Cooperative Education 6 credits Prerequisite : fourth year standing and consent of the department Students are required to work in the organizations related to mining engineering major for a minimum period of 16 weeks continuously as a staff under the supervision of in-charge trainer(s) of the organizations and instructor(s) of the university. Grading will be given on satisfactory or unsatisfactory basis.</p>	<p>AE416 (260416) Pump for Agricultural Engineering 3(3-0-6) Prerequisite : ME333 (254333) Classification and properties of pump. Pump laws. Calculation of friction loss in pipe. Calculation of power requirement and size of pump. Selection of pump for agricultural engineering work. Pipe design for pump. Pump and equipment installation. Sump design. Pump maintenance.</p>
<p><u>Course in Agricultural Engineering Course code AE (260)</u> AE313 (260313) Fluid Power Control System in Agricultural Engineering 3(3-0-6) Prerequisite : ME333 (254333) Review of fluid mechanics. Fluid power systems. Fluid power circuit layout design. Functional design and automatic operations. Logic control of operation systems. Maintenance and safety.</p>	<p>AE421 (260421) Principle of Drying Process for Agricultural Products 3(3-0-6) Prerequisite : ME231 (254231) and ME333 (254333) Review of Thermodynamics, Heat and Mass Transfer. Theory of drying and storage. Principle of air in motions. Drying grain and food by hot air. Moisture determinations. Properties of moist air. Moisture equilibrium. Parameters for drying analysis. Solar drying.</p>
<p>AE334 (260334) Heat and Mass Transfer for Agricultural Process Engineering 3(3-0-6) Prerequisite : ME231 (254231) and ME333 (254333) Fundamental laws of heat and mass transfer, analysis of heat transfer characteristic. Combine systems of heat transmission modules. Heat exchanger design and analysis. Boiling and condensation diffusion and convection mass transfer.</p>	<p>AE424 (260424) Refrigeration and Cold Storage System 3(3-0-6) Prerequisite : ME333 (254333) and AE334 (260334) Principles of refrigeration and types of refrigeration systems, such as, gas compression system, absorption system and other refrigeration systems. Cooling load calculation for cold storage. Refrigerants. Components of gas compression system. Performance and efficiency analysis of refrigeration system. Psychrometric of air. Refrigerant piping system design. Air circulation inside cold storage. Preservation of agricultural products and food in cold storage. Freezing process.</p>
<p>AE401 (260401) Land, Pavement and Agricultural Farmhouse 3(3-0-6) Prerequisite : Consent of the department Topology of the developing land. Obstacles removal by mechanical and explosive devices. Grading for elevations, excavation and compacting. Construction of bare soil, asphalt and concrete pavements. Bearing load of the pavements and reinforcements. Foundation, footing and piles. Columns and beams of farm structures. Loads and safety strength of farm structures. Design and analysis of farm structures. Modification, maintenance and safety strength of the farm structures.</p>	<p>AE432 (260432) Introduction to Postharvest Engineering 3(3-0-6) Prerequisite : consent of the department Physical and biological characteristics of the grains, fruits and vegetables after harvest. Harvesting of fruits and vegetables. Factors affecting the quality of agricultural produce after harvest psychrometric Engineering harvest for grain, vegetable and fruit preparation products to market, keeping fruits and vegetables. Engineers in the design of cold storage and controlled atmosphere.</p>

AE434 (260434) Agricultural Process Engineering	3(3-0-6)	in object-oriented programming. Project development using object-oriented programming.
Prerequisite : Fourth year standing		
Fluid mechanics, fluid-flow measurements, water pumps and air compressor system, size reduction, cleaning and sorting, agricultural material handling, principles of heat transfer for drying and refrigeration, air-vapour mixture properties for drying and refrigeration, heat transfer analysis in drying and refrigeration.		
AE461 (260461) Ground Vehicles for Agriculture	3(3-0-6)	CPE205 (261205) Data Structures and Algorithms 3(3-0-6)
Prerequisite : Fourth year standing		Prerequisite: CPE102 (261102) or CPE203 (261203) or CPE200 (261200)
Types of heavy equipment and earth mover machines, Operations systems of the machines. Operation and maintenance.		Concept of data structure. Complexity analysis. Pointer. Objects and classes. Arrays and vectors. Linked List. Stacks, queues and priority queues. Recursion. Sorting algorithms. Hashing. Memory management. String comparison.
AE462 (260462) Principles of Agricultural Irrigation	3(3-0-6)	CPE207 (261207) Basic Computer Engineering Laboratory 2(0-6-0)
Prerequisite : None		Prerequisite: CPE103 (261103)
Soil-water relations. Water sources. Irrigation methods. Water measurement. Farm irrigation system. Water requirement of crops. Water pumps.		Unix file system. Basic commands on Unix system. Shell script programming. Basic Unix administration. Basic database systems. Basic web application.
AE494 (260494) Special Topic in Agricultural Engineering	3(3-0-6)	CPE208 (261208) Numerical Computation for Engineers 3(3-0-6)
Prerequisite : Consent of the department		Prerequisite: MATH161 (206261) or consent of the department
A modern knowledge in engineering applied to and caused direct benefit to various branches in agro-industry as well as food industry. The topic is compulsory approved by the department.		Linear algebra for computer engineering. Accuracy and error propagation. Algorithms for systems of linear algebraic equations. Root finding. Interpolation. Least square approximation. Numerical integration. Numerical computation for ordinary differential equations. Numerical computation for partial differential equations. Numerical computation for eigenvalue problems.
<u>Course in Computer Engineering Course code CPE (261)</u>		CPE210 (261210) Logic and Digital Circuits 3(3-0-6)
CPE102 (261102) Computer Programming	3(1-6-2)	Prerequisite : PHYS106 (207106)
Prerequisite : None		Numeral system and coding. Basic switching circuit theory. Principles of digital logic circuit. Logic gate and Boolean algebra. Logic function reduction. Analysis and design of combination logic circuit. Latch and flip-flop devices. Principles of sequential logic circuit. Analysis and design of sequential logic circuit. Concept of applying digital logic circuit in computer architecture.
Introduction to computer programming. Variables and data types, Operators. Flow of control. File input/output. Subroutines. Arrays. Objects and classes. Command line arguments. Basic algorithms.		CPE212 (261212) Logic and Digital Circuits Laboratory 1(0-3-0)
CPE103 (261103) Basic Computer Engineering	3(1-6-2)	Prerequisite : concurrent to CPE210 (261210)
Prerequisite : None		Principles of semiconductor devices. Logic gate and Boolean algebra. Logic function reduction techniques. Circuit development using digital logic ICs. Design of combination logic circuits. Digital logic circuit development using Hardware Description Language (HDL). Latches and flip-flops. Design and development of sequential logic circuit. Design and development of Application Specific IC (ASIC) using digital logic circuits. Applying digital logic circuit in computer architecture design.
Basic of design and problem solving for computer engineering problems. Basic programming principles. Solving computer engineering problems using programming. Basic automated computer control systems. Solving computer engineering problems using computer control systems.		CPE214 (261214) Microprocessor and Interfacing 3(3-0-6)
CPE111 (261111) Internet and Online Community	3(3-0-6)	Prerequisite : CPE210 (261210) and EE281 (252281); or consent of the department
Prerequisite : None		Microprocessor-Based System. Memory and Input/ Output connecting. Assembly programming. Microprocessor instruction-set and programming techniques. Stack and sub-procedures. The interrupt system. Programmable timers. Serial and parallel ports and data communications. Trends in Microprocessor technology.
Introduction to the Internet and online community. Computer technology and modern world. Selecting of online tools and services. Impact of the Internet in daily life. The Internet and cloud computing. Online businesses. Ethics in social networking. Analyzing of social networking data. Online investment. Legal aspects of the Internet and online community. Security and privacy in social networking. Case studies.		
CPE200 (261200) Object-Oriented Programming	3(2-3-4)	
Prerequisite : CPE102 (261102) or ISNE102 (269102)		
Object-oriented concepts. Classes and objects. Function overloading. Operator overloading. Inheritance. Override. Polymorphism. Advanced topics		

CPE215 (261215) Embedded Systems Laboratory	1(0-3-0)	computer engineering stochastic processes. Detection algorithm based on probability theory. Prediction algorithm based on probability theory. Statistics and probability theory applications in computer engineering.
Prerequisite : Concurrent to CPE214 (261214)		
Embedded system development tools. Basic embedded system circuit construction and control programming. Using analog to digital converters. Output tools controls. Connecting to embedded system expansion devices. Using interrupt system. Printed circuit board design.		
CPE 216 (261216) Discrete Mathematics for Computer Engineers	3(3-0-6)	
Prerequisite : None		
Mathematical models. Mathematical reasoning. Sets and applications in computer engineering. Binary relations. Functions and applications in computer engineering. Counting and algorithm analysis. Infinite sets. Graphs and applications in computer engineering.		
CPE 217 (261217) Data Structures for Computer Engineers	3(3-0-6)	
Prerequisite : CPE102 (261102)		
Arrays, Linked lists, Abstract data type, and recursion. Analysis tools with computer engineering applications. Stack and queue with computer engineering applications. Lists with computer engineering applications. Trees with computer engineering applications. Priority queue. Map and dictionary with computer engineering applications. Search trees with computer engineering applications. Graphs with computer engineering applications.		
CPE 218 (261218) Algorithms for Computer Engineers	3(3-0-6)	
Prerequisite : CPE216 (261216) and CPE217 (261217)		
Growth function and asymptotic notation. Bounding of summations and recurrences in computer engineering. Comparison-based sorting. Linear-time sorting. Medians, maximum, minimum values and order statistics. Greedy algorithm design in computer engineering. Dynamic programming in computer engineering. Hash tables. NP-complete problems and reduction in computer engineering. Approximation algorithms.		
CPE304 (261304) Computer Architecture	3(3-0-6)	
Prerequisite : CPE210 (261210) or consent of the department		
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Introduction to computer architecture. The role of performance. Machine arithmetic. Datapath design. Control design. Pipelining. Memory organization.		
CPE305 (261305) Operating Systems	3(3-0-6)	
Prerequisite : CPE304 (261304) or ISNE210 (269210)		
Review of computer architecture structure and introduction to Operating Systems. Process management. Central processing unit management. Process synchronization. Process deadlock. Memory management: paging, segmentation. Virtual memory system. File and device management. Security and protection of operating systems. System programming.		
CPE 306 (261306) Computer Engineering Probability and Statistic	3(3-0-6)	
Prerequisite : MATH 261 (206261)		
Introduction to statistics and probability theory, random variables and random vectors. Computer engineering stochastic processes. Samples of		
CPE332 (261332) Data and Computer Communications	3(3-0-6)	
Prerequisite : PHYS106 (207106)		
Introduction to data and computer communications. Signal processing and signal analysis. Modulation. Multiplexing and multiple access protocols. Transmission medium. Data compression. Error detection and error control. Information security. Multimedia Data.		
CPE335 (261335) Computer Networks	3(3-0-6)	
Prerequisite : CPE332 (261332) or ISNE130 (269130)		
Introduction to computer network. Network access. Network layer and routing. Transport layer. Application layer. Basic network security. Basic network design and management.		
CPE336 (261336) Computer Networks Laboratory	1(0-3-0)	
Prerequisite : concurrent to CPE335 (261335)		
Introduction to computer networks laboratory. Transmission media. Network equipment. Network simulation and monitoring tools. Network access layer. Network layer and routing. Transport layer. Application layer. Wireless computer networks. Basic network security.		
CPE342 (261342) Fundamentals of Database Systems	3(3-0-6)	
Prerequisite : CPE205 (261205) or CPE218 (261218)		
Database concepts. Data modeling. Database design and engineering. Data model improvement. Query language. Physical database design. Efficient data retrieval and indexing. Query optimization. Basic concept of transaction, concurrency and recovery techniques. Trends in database systems technology.		
CPE343 (261343) Database System Laboratory	1(0-3-0)	
Prerequisite : Concurrent to CPE342 (261342)		
Database management system software installation. Database design. Query language. Database administration. Database application development.		
CPE361 (261361) Software Engineering	3(3-0-6)	
Prerequisite : CPE200 (261200)		
Basic principles of software engineering. Software development processes. Requirements engineering. Software design. Software construction and software testing. Software operation and maintenance, Software quality. Advanced topics in software engineering.		
CPE400 (261400) Computer Engineering Training	3(0-18-0)	
Prerequisite : CPE335 (261335) and CPE342 (261342); or consent of the department		
Training in information system and network engineering with consulting engineers or industrial. Students enrolled in this course must work in an information system and network related organization under the supervising of engineers, trainers and/or teachers. The students have to submit the complete report at the end of the course.		

CPE404 (261404) Advanced Computer Engineering Laboratory 2(0-6-0)

Prerequisite : CPE200 (261200)

Introduction to advanced computer engineering technologies. Platforms of advanced computer engineering technologies. Tools used in advanced computer engineering technologies. Applications of advanced computer engineering technologies. Laws and ethics related to computer engineering.

CPE405 (261405) Advanced Computer Engineering Technology 3(3-0-6)

Prerequisite : CPE261 (261361)

Introduction to advanced computer engineering technologies. Platforms of advanced computer engineering technologies. Tools used in advanced computer engineering technologies. Applications of advanced computer engineering technologies. Laws and ethics related to computer engineering.

CPE406 (261406) Basic Compiler Design 3(3-0-6)

Prerequisite : CPE102 (261102)

Introduction to theory of computation and compiler design. Processes and structures of compilers. Expression and syntax. Finite automata. Lexical analysis. Syntax analysis. Instruction set implementation. Language used for compiler design.

CPE407 (261407) Fundamentals of Computation for Computer Engineering 3(3-0-6)

Prerequisite : CPE218 (261218)

Computers, complexity and intractability. Theory of NP-completeness. Proving NP-completeness results. Using NP-completeness to analyze problems. NP-hardness. Coping with NP-complete problems.

CPE408 (261408) Quantum Computation 3(3-0-6)

Prerequisite : consent of the department

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Introduction to quantum circuit model. Quantum mathematics basics. The power of entanglement. Grover's algorithm. Quantum query complexity. Boolean Fourier analysis and Simon's Algorithm. Quantum Fourier transform over Z_n . Period finding : Simon's problem over Z_n . Shor's algorithm. Quantum complexity.

CPE411 (261411) Parallel Processing and Distributed Systems 3(3-0-6)

Prerequisite : Consent of the department

Introduction to parallel processing. Parallel architectures. Problems suited for parallel processing. Parallel algorithms. Parallel programming environments. Introduction to distributed systems. Models of distributed systems. Distributed algorithms. Distributed programming environments.

CPE414 (261414) Digital System Design 3(3-0-6)

Prerequisite : CPE210 (261210)

Introduction to integrated circuit technology and digital systems. Integrated circuit design and applications. Digital system design criteria. Characteristics of Integrated Circuits (IC) in digital systems. Input/output connecting. Using computer program to design and simulate digital systems. Hardware Description Language (HDL) for digital system design. Using HDL for sequential

and combinational digital circuits design. IC implementation on Field Programmable Gate Arrays (FPGA). Digital system applications.

CPE421 (261421) Computer Hardware Design 3(3-0-6)

Prerequisite : CPE214 (261214) or CPE304 (261304)

Computer hardware design environments. Basic concept and system simulation. Design methodology. Modeling transfer and related language structures. Design management. Defining parameters and simulation execution. Logic circuit design examples. Central processing unit simulation. Design and synthesis using the HDL language.

CPE 424 (261424) Remote Monitoring and Control Systems 3(3-0-6)

Prerequisite : consent of the department

Introduction to remote monitoring and control systems. Wireless Sensor Network (WSN) design fundamental. Sensor device technology. Embedded systems. Communication for WSN. Routing protocol for WSN. Deployment techniques. Data process and analysis. Data management in the base station. Remote monitoring and control system applications.

CPE430 (261430) Wireless Networks 3(3-0-6)

Prerequisite : CPE 335 (261335)

Introduction to radio communications. Wireless networks technologies (WPAN, WLAN, WMAN, WWAN). Wireless network architecture. Network topology. Routing protocol. Localization. Energy optimization. Network simulation. Wireless network advantages and applications.

CPE433 (261433) Network Programming 3(3-0-6)

Prerequisite : CPE 335 (261335)

Introduction to network programming. Open system interconnectivity reference model: programming point of view. Client-server working model and implementation. Transmission Control protocol transmission control protocol sockets. Input/ Output multiplexing. User Datagram Protocol sockets. Raw sockets. Name and addressing conversion. Daemon process and superserver. Threading. Advanced issues in networking programming.

CPE434 (261434) Computer Network Design and Management 3(3-0-6)

Prerequisite : CPE 335 (261335)

Computer network review. Principles and architecture of enterprise network design. Small and large backbone design. Network management. Case studies of network design and management.

CPE435 (261435) Broadband Communication Networks 3(3-0-6)

Prerequisite : CPE 335 (261335)

Computer network review. Protocol architecture and design. High speed Local Area Networks (LANs) and Wide Area Networks (WANs). Network congestion and traffic management. Network and traffic modeling. Fast switching architecture and analysis. Optical networks. Wireless networks.

<p>CPE437 (261437) Fundamentals of Queueing Theory for Computer Engineers 3(3-0-6)</p> <p>Prerequisite : CPE306 (261306) and CPE 335 (261335)</p> <p>Introduction to queueing systems. Discrete and continuous Markov processes. Single-queue Markovian systems. Semi- Markovian queueing systems. Priority queueing systems. Open queueing networks. Closed queueing networks. Flow and congestion control analysis. Applications in computer engineering.</p>	<p>CPE447 (261447) Network and Information Security 3(3-0-6)</p> <p>Prerequisite : CPE 335 (261335)</p> <p>Introduction to network and information security. Security policy specifications and evaluation. Firewalls. Hardening of Operating Systems. Authentication and authorization. Monitoring, audit and review. Secret-key and public-key encryption. Digital signature and certification. World-Wide-Web security. E-mail security. General network transportation security. Social and non-technical issues.</p>
<p>CPE438 (261438) Fundamentals of Multiprotocol Label Switching 3(3-0-6)</p> <p>Prerequisite : CPE 335 (261335)</p> <p>Fundamentals of computer network. Architecture of Multiprotocol Label Switching. Packet forwarding of Multiprotocol Label Switching. Fundamentals of virtual private network. Multiprotocol Label Switching application in virtual private network. Fundamentals of traffic engineering. Multiprotocol Label Switching application in traffic engineering.</p>	<p>CPE448 (261448) Data Mining for Computer Engineering 3(3-0-6)</p> <p>Prerequisite : consent of the department</p> <p>Introduction to data mining. Data preprocessing. Association rule mining. Classification and prediction. Clustering analysis. Advanced topics in data mining.</p>
<p>CPE439 (261439) Wireless Communications for Computer Engineering 3(3-0-6)</p> <p>Prerequisite : consent of the department</p> <p>Introduction to wireless communication for computer engineering. Spectrum and bandwidth. Digital signal modulation. Wireless channel. Channel coding. Wireless network. Antennas. Wireless network design. Wireless network system management.</p>	<p>CPE449 (261449) Software Testing for computer Engineering 3(3-0-6)</p> <p>Prerequisite : CPE 361 (261361)</p> <p>Basic principles of software testing. Test case design. Test levels, Black-box and White-box testing. Other types of testing. Supporting tools for software testing. Testing process. Test planning. Writing test report.</p>
<p>CPE441 (261441) Internet of Things and Big Data 3(3-0-6)</p> <p>Prerequisite : Consent of the department</p> <p>Introduction to Internet of things and big data. Basic electronics circuits. Basic digital design. Basic microcontrollers. Sensors and physical measurement. Bus systems and data communication. Remote communication. Basic data management. Basic data analysis. Visualization techniques.</p>	<p>CPE453 (261453) Digital Image Processing 3(3-0-6)</p> <p>Prerequisite : Consent of the department</p> <p>Fundamental concepts of digital image. Image enhancement in the spatial domain. Image enhancement in frequency domain. Image restoration. Discrete image transform. Wavelet and multiresolution processing. Image segmentation.</p>
<p>CPE444 (261444) Advanced Database Systems 3(3-0-6)</p> <p>Prerequisite : CPE 342 (261342)</p> <p>Concepts of physical database design. Querying techniques. Transactions. Concurrency controls. Recovery systems. Database system architectures. Parallel database. Distributed databases. Trends in database technologies and developments of database applications.</p>	<p>CPE456 (261456) Introduction to Computational Intelligence for Computer Engineering 3(3-0-6)</p> <p>Prerequisite : Consent of the department</p> <p>Introduction to computational intelligence. Introduction to artificial neural networks. Introduction to fuzzy systems. Introduction to evolutionary computing. Introduction to swarm intelligence.</p>
<p>CPE446 (261446) Information Systems 3(3-0-6)</p> <p>Prerequisite : CPE205 (261205) or CPE217 (261217)</p> <p>Introduction to information systems and roles of information systems in organizations. Characteristics of organizations. Ethical and social impact of information systems. Computer and information processing. Telecommunications. Organizations planning and designing with information systems. Management information systems. Executive information systems. Decision support systems. Expert systems. Interorganizational and international information systems.</p>	<p>CPE457 (261457) Digital Image and Video Compression 3(3-0-6)</p> <p>Prerequisite : Consent of the department</p> <p>Introduction to image and video coding. Lossless image compression. Lossy image compression. Video compression. Isochronous information and applications.</p>
	<p>CPE458 (261458) Machine Vision 3(3-0-6)</p> <p>Prerequisite : Consent of the department</p> <p>Images and fundamentals of image processing. Image feature extraction. Image recognition and classification. Object detection. Grouping and segmentation. Moving object tracking. Applications of machine vision technologies.</p>

CPE461 (261461) Visual and Interactive Programming	3(3-0-6)	CPE473 (261473) Computer-Aided Manufacturing	3(3-0-6)
Prerequisite: CPE 102 (261102) or ISNE102 (269102)		Prerequisite : Consent of the department	
Visual and interactive programming language and environment. Variables, conditionals, and loops. Functions and objects. Arrays, debugging, and libraries. Applying mathematics. Translation, and rotation (in 3D). Images. Text and data input. Data visualization.		Introduction to manufacturing and engineering process. Decision support systems. Optimization model for production planning. Graph in production planning. Algorithms in production planning. Sensitivity analysis. Tools for optimization in production planning. Automation control in manufacturing. Problem solving by using network modeling. Multi-objective problem solving. Artificial intelligence in manufacturing. Basic queuing theory and simulation. Game theory for strategy planning.	
CPE465 (261465) Computer Graphics	3(3-0-6)	CPE475 (261475) Modeling and Optimization for Big Data Analytics	3(3-0-6)
Prerequisite : ENGR104 (259104) or consent of the department		Prerequisite : Consent of the department	
Mathematics for computer graphics. Two and three-dimensional geometric shapes. Transformation and viewing. Lighting and shadow. Texture mapping. Alpha blending. Keyframe and physics-based animation. Computer graphics for visualization applications. Game programming.		Introduction to modeling and optimization for big data analytics. Optimization models. Graph techniques in optimization. Graph for production planning. Algorithms in optimization. Change analysis. Tools for optimization in production planning. Problem solving by using network modeling. Multi-objective problem solving. Artificial intelligence in manufacturing. Development of modeling in data analytics.	
CPE468 (261468) System Analysis and Design for Computer Engineering	3(3-0-6)	CPE476 (261476) Biomedical Instruments	3(3-0-6)
Prerequisite : Consent of the department		Prerequisite : EE211 (252211) or EE281 (252281)	
Introduction to systems analysis and design. Analysis of business case studies. Requirements models. Data models and processes. Development strategies. User interface and output design. Data design. System architecture. System development. System operation and security.		Introduction to biomedical instruments. Basic principles of transducer and materials. Sources of bioelectric potentials. Electrodes. Cardiovascular instruments. Virtual hospital and telemedicine systems. Patient-care and monitoring systems. Biotelemetry and computed tomography (CT) systems. Digital computers in biomedical instrumentation. Electrical safety of medical equipment.	
CPE469 (261469) Software Project Management for Computer Engineering	3(3-0-6)	CPE478 (261478) Principles of Control Systems	3(3-0-6)
Prerequisite : Consent of the department		Prerequisite : Consent of the department	
Concepts of project management. Fundamentals of project management. Ethics in software engineering. Business concepts and software business. Software project initiation. Software project definition. Software project planning. Software project implementation. Software project decommissioning. Quality management in Software project.		Introduction to control engineering. Models of physical systems. Laplace transform. Block diagram and transfer function. Signal flow graph. State variable model. System time response. Stability analysis. Design and analysis of root locus. Design and analysis of frequency response. Computer control systems.	
CPE470 (261470) Signals and Systems	3(3-0-6)	CPE479 (261479) Bioinformatics Programming	3(3-0-6)
Prerequisite : Consent of the department		Prerequisite : Consent of the department	
Introduction to signals and systems. Sinusoids. Spectrum representation. Sampling and aliasing. Linear time invariant systems. Z-transform. Finite-duration impulse response (FIR) filters. Infinite-duration impulse response (IIR) filters.		Introduction to bioinformatics and molecular data. Algorithms and complexity. Algorithms and techniques in Motif finding. Algorithms and techniques in DNA sequence comparison and gene prediction. Algorithms and techniques in DNA and protein sequencing. Algorithms and techniques in combinatorial pattern matching. Gene expression analysis using clustering and tree algorithms. Special topics in bioinformatics.	
CPE471 (261471) Advanced Digital Signal Processing	3(3-0-6)	CPE491 (261491) Project Survey	1(0-3-0)
Prerequisite : Consent of the department		Prerequisite : Consent of the department	
Digital signal and fundamentals of digital signal processing. Advanced frequency analysis techniques. Filter banks. Noise reduction techniques. Autoregressive model. Machine learning for signal processing. Speech and audio signal processing. Advanced applications of digital signal processing.		This is a preparation course for students intending to enroll in the course CPE 492 PROJECT in the next semester. The student will carry out literature survey of preliminary studies and/ or experiments in order to arrive at a feasible topic to be pursued as his chosen senior project. The students are	
CPE472 (261472) Robotics	3(3-0-6)		
Prerequisite : Consent of the department			
Introduction to Robotics. Homogeneous transformations. Kinematic equations. Solving kinematic equations. Differential relationships. Robot arms. Dynamics of robot arms. Static forces in robot arms. Robotic control.			

required to submit a written report outlining the topics they have studied and giving details of the work-plan and time-schedule of the intended project. The report will be evaluated (S or U).

CPE492 (261492) Project 3(0-9-0)

Prerequisite : CPE491 (261491)

Special investigation or studies of any topic in computer engineering to be carried out by an individual student or a group of students under the supervision of an advisor. A written report must be submitted at completion of the course and an oral examination will be given by a committee.

CPE493 (261493) Seminar 3(3-0-6)

Prerequisite : Consent of the department

Theoretical studies in computer engineering under supervision of faculty members. An elementary research problem. A written report and oral examination.

CPE494 (261494) Selected Topics in Computer Engineering 3(3-0-6)

Prerequisite : Consent of the department

Selected topics of current interests and new developments in various fields of computer engineering.

CPE495 (261495) Cooperative Education 6 credits

Prerequisite : Consent of the department

Working in a computer engineering related organization. The positions taken must have the certain responsibility as an employee under supervision of both the mentor employee and advisor. The period of the practice must be at least 16 weeks continuously. Grading will be given on satisfactory (S) or unsatisfactory (U) basis.

CPE497 (261497) Selected Topics in Computer Software 3(3-0-6)

Prerequisite : Consent of the department

Selected topics of current interests and new developments in various fields of computer software.

CPE498 (261498) Selected Topics in Computer Networks 3(3-0-6)

Prerequisite : Consent of the department

Selected topics of current interest and new developments in various fields of computer networking.

CPE499 (261499) Selected Topics in Computational Intelligence 3(3-0-6)

Prerequisite : Consent of the department

Selected topics of current interests and new developments in various fields of computer engineering in computational intelligence.

Course in Information Systems and Network Engineering Course code ISNE (269)

ISNE101 (269101) Introduction to Information Systems and Network Engineering 3(3-0-6)

Prerequisite : none

Introduction to information systems for information systems and network engineering, Introduction to computer hardware for

information systems and network engineering, Introduction to computer software for information systems and network engineering, Introduction to computer networks for information systems and network engineering, Introduction to database systems for information systems and network engineering.

ISNE102 (269102) Basic Computer Programming for Information Systems and Network Engineering 3(1-6-2)

Prerequisite: None

Introduction to computers and programming for information systems and network engineering. Structural programming Control structures. Functions. Arrays. Pointers.

ISNE103 (269103) Programming for Information Systems and Network Engineering 3(3-0-6)

Prerequisite : CPE 102 (261102) or ISNE102 (269102)

Modular program design approach, Large-scale application development for information processing, Network application development, Team development, Source code repository, Program unit test.

ISNE105 (269105) Information Systems and Network Engineering Laboratory 1 1(0-3-0)

Prerequisite : none

High-level software description. Software development using integrated development environment. Software unit testing. Versioning systems. Documentation. Software development best-practice.

ISNE130 (269130) Fundamentals of Data and Computer Communications for Information Systems and Network Engineering 3(3-0-6)

Prerequisite : ISNE 101 (269101)

Introduction to data communication and computer network. Mathematical fundamentals for data communication. Basic signal processing and signal analysis. Fundamentals of modulation techniques. Multiplexing and multiple access protocols. Transmission medium. Data compression. Error detection and error control. Information security. Multimedia data.

ISNE200 (269200) Web Programming Language 3(2-3-4)

Prerequisite : CPE102 (261102) or ISNE102 (269102)

Principle of web application, Web application workflow, Languages for web programming, Database-driven website, Authentication and session, Testing and debugging

ISNE201 (269201) Information Systems and Network Engineering Laboratory 2 1(0-3-0)

Prerequisite : ISNE105 (269105)

Singly linked list. Doubly linked list. Queue simulation. Binary search trees. Binary tree application. Graph introduction. Shortest path. Minimal spanning trees. Algorithms application.

<p>ISNE202 (269202) Algorithms for Information Systems and Network Engineering 3(3-0-6)</p> <p>Prerequisite : CPE205 (261205)</p> <p>Data structure and algorithm review. Binary trees. Multiway trees. Graphs. Problem solving using search. Inform search. Adversarial search. Data compression. Synchronization.</p>	<p>ISNE370 (269370) Project Management for Information Systems and Network Engineering 3(3-0-6)</p> <p>Prerequisite : CPE205 (261205)</p> <p>Concepts of project management, Ethics in information system and network engineering, Business concepts in information system and network industry, Project initiation for information system and network engineering, Project definition for information system and network engineering, Project planning for information system and network engineering, Project implementation for information system and network engineering, Project deployment for information system and network engineering, Project service and maintenance for information system and network engineering, Project decommissioning for information system and network engineering</p>
<p>ISNE210 (269210) Computer Architecture for Information Systems and Network Engineering 3(3-0-6)</p> <p>Prerequisite : none</p> <p>Overview of computer organization and architecture. Computer evaluation and performance measurement. Number systems and computer arithmetic. Digital logic. Computer function and interconnection. Cache memory. Internal memory. External memory. Virtual memory. Instruction sets: Characteristics and functions. Instruction sets: addressing modes and formats. Processor structure and function. Advanced technology in computer architecture.</p>	<p>ISNE400 (269400) Advanced Information Systems and Network Technology 3(3-0-6)</p> <p>Prerequisite : ISNE 360 (269360)</p> <p>Advanced development process for information systems and network systems, Advanced information systems, Advanced network systems, Advanced information systems trends, Advanced network systems trends.</p>
<p>ISNE340 (269340) Data Centric Application Development 3(3-0-6)</p> <p>Prerequisite : CPE342 (261342) and CPE343 (261343)</p> <p>Introduction to data centric application development, data centric application development processes, naming and directory service, data centric application resource management, schema mapping between front-end applications and back-end applications, concurrency control, XML data for data centric application development, data centric application development in web environment, data centric application development in web service environment</p>	<p>ISNE401 (269401) Information System and Network Engineering Training 3 credits</p> <p>Prerequisite : CPE335 (261335) and CPE342 (261342); or consent of the department</p> <p>Training in information system and network engineering with consulting engineers or industrial. Students enrolled in this course must work in an information system and network related organization under the supervising of engineers, trainers and/or teachers. The students have to submit the complete report at the end of the course. Grading will be given on satisfactory or unsatisfactory basis.</p>
<p>ISNE341 (269341) Data Warehousing and Business Intelligence for Information Systems and Network Engineering 3(3-0-6)</p> <p>Prerequisite : ISNE 340 (269340)</p> <p>Introduction to data warehousing for information systems and network engineering, Business intelligence and key performance indicators, Granularity management, Data modeling for data warehousing, Data warehousing and business intelligence system design, Data extraction, Data transformation, Data loading, Data warehousing and business intelligence deployment and administration, Reporting in business intelligence, Performance tuning for data warehousing and business intelligence, Case studies in data warehousing and business intelligence for information systems and network engineering</p>	<p>ISNE421 (269421) Computer Network Traffic Analysis 3(3-0-6)</p> <p>Prerequisite : CPE335 (261335)</p> <p>Probability, Random processes, Markov chains, Markov chains at equilibrium, Queuing analysis, Modeling traffic flow control protocols, Modeling error control protocols, Modeling medium access control protocols, Modeling network traffic.</p>
<p>ISNE360 (269360) Platform Programming 3(3-0-6)</p> <p>Prerequisite : CPE 200 (261200)</p> <p>Introduction to platform programming, Review of object-oriented design and analysis, Components and middleware, Modules and interfacing, Events and connections, Properties and introspection, Concurrency, Decentralization and serialization, Component frameworks, Model-driven architecture, Service-oriented architecture</p>	<p>ISNE430 (269430) Wireless and Broadband Computer Networks 3(3-0-6)</p> <p>Prerequisite : CPE335 (261335)</p> <p>Computer network architecture, Wireless computer network standards, Wireless computer network connection, Design of wireless computer networks, Broadband computer network architecture, Broadband computer network design, Quality of service of broadband computer networks.</p>

<p>ISNE431 (269431) Wireless Sensor Network 3(3-0-6) Prerequisite : CPE 335 (261335) Introduction to wireless sensor network, Radio propagation model, Medium access layer model, Network layer model, Wireless sensor platform and simulator, Energy management, Synchronization and localization, Clustering and data aggregation</p>	<p>ISNE470 (269470) Information Technology Service Management 3(3-0-6) Prerequisite : ISNE370 (269370) and CPE446 (261446) Concepts of information technology service management. Information technology service strategy. Information technology service design. Information technology service transition. Information technology service operation. Continual improvement of information technology service.</p>
<p>ISNE432 (269432) Peer-to-Peer Systems 3(3-0-6) Prerequisite : CPE 335 (261335) Architecture of peer-to-peer systems, Overlay network, Routing, Distributed hash table, Indexing, Security, Current trend of peer-to-peer systems.</p>	<p>ISNE471 (269471) Advanced Project Management for Information System and Network Engineering 3(3-0-6) Prerequisite : ISNE 370 (269370) Project integration management for information system and network engineering, Project scope management for information system and network engineering, Project time management for information system and network engineering, Project cost management for information system and network engineering, Project quality management for information system and network engineering, Project human resource management for information system and network engineering, Project communication management for information system and network engineering, Project risk management for information system and network engineering, Project procurement management for information system and network engineering, Project management evaluation and evolution for information system and network engineering.</p>
<p>ISNE451 (269451) Introduction to Neuro-Fuzzy Systems 3(3-0-6) Prerequisite : CPE 205 (261205) Architecture of neuro-fuzzy systems, Artificial neural networks, Perceptron learning rule, Generalized delta learning rule, Effectiveness of neural networks, Fuzzy logic and operations of fuzzy sets, Linguistic variables, Membership function, Integration of fuzzy logic and neural networks, Tuning neuro-fuzzy parameters, Neuro-fuzzy classifiers, Application of neuro-fuzzy system.</p>	<p>ISNE472 (269472) Risk Management in Software Project 3(3-0-6) Prerequisite : ISNE 370 (269370) Introduction to risk management in software projects, Principles of project risk management, Elements of project risk management, Software project risk factors, Software project risk identification, Software project risk assessment, Contingency planning, Software project risk monitoring, Software project risk mitigation, Risk management tools.</p>
<p>ISNE452 (269452) Mobile Application Development 3(3-0-6) Prerequisite : Consent of the department Introduction to mobile application development, Application programming interfaces (APIs) and toolkits to build mobile applications, User interface development, Basic application development steps, Notifications and services, Database system on mobile devices, Multimedia application development, Graphics application development, Advanced topics in mobile application development</p>	<p>ISNE491 (269491) Project Survey 1(0-3-0) Prerequisite : Consent of the department This course is for the students who will enroll the course 269492 “ Project” in the next semester. The students have to survey and research to select topics for projects and methods to do projects. The students have to report the plan and time schedule for the approval of project in the next semester. The report evaluation result is S or U.</p>
<p>ISNE 461 (269461) Personal Software Process Improvement 3(3-0-6) Prerequisite : Consent of the department Quality perspective in software engineering. Software process improvement. Software engineering processes. Measurement in software engineering. Quality in software engineering process. Software design. Software quality. Quality measuring in software engineering. Organizational quality. Personal process improvement.</p>	<p>ISNE492 (269492) Project 3(0-9-0) Prerequisite : ISNE 491 (269491) This course is study or research for the topic by student under supervision from the project advisor. The students have to submit the complete report at the end of the semester. In addition, the project committees evaluate the project by student project presentation.</p>
<p>ISNE462 (269462) Introduction to Human-Computer Interaction 3(3-0-6) Prerequisite : CPE361 (261361) Psychology and science of human-computer interaction. Human and computers. Human-computer interaction. Design for a good user experience. Model. Evaluation. Using experiment. Interaction design technology. Case study.</p>	

ISNE493 (269493) Seminar	3(3-0-6)	<u>Course in Robotics Engineering and Artificial Intelligence Course code REAI (271)</u>
Prerequisite : Consent of the department		
Study of information systems and network under supervision of instructor. Students must submit the report and give the presentation on the topic.		
ISNE494 (269494) Selected Topics in Information Systems and Network Engineering	3(3-0-6)	REAI 101 (271101) Robotics Laboratory 1
Prerequisite : Consent of the department		2(1-3-0)
Selected topics of current interest and new developments in information systems and network engineering.		Prerequisite : None
		เปิดใหม่ มีผลบังคับใช้ตั้งแต่ภาคการศึกษา 1/2564
		Engineering design process. Computer-aided design. 3 D modeling. Rapid prototyping technology. Learning through hand-on experience.
ISNE495 (269495) Cooperative Education	6 credits	REAI 201 (271201) Robotics Laboratory 2
Prerequisite : Consent of the department		1(0-3-0)
The students enrolled in this course must work in an information systems and network related organization. The positions taken must have the certain responsible as an employee under supervision of both the mentor employee and the faculty member. The period of the practice must be at least 480 hours continuously. Grading will be given on satisfactory or unsatisfactory basis.		Prerequisite : REAI 101 (271101)
		เปิดใหม่ มีผลบังคับใช้ตั้งแต่ภาคการศึกษา 1/2564
		Hands-on laboratory to enhance experience on simple robotic system and robot components.
ISNE 496 (269496) Selected Topics in Information System 1	3(3-0-6)	REAI 301 (271301) Robotics Laboratory 3
Prerequisite : Consent of the department		1(0-3-0)
Selected topics of current interest and new developments in information systems.		Prerequisite : REAI 101 (271101)
		เปิดใหม่ มีผลบังคับใช้ตั้งแต่ภาคการศึกษา 1/2564
		Experiments on robotic components: basic sensory system, motor control system, robot manipulator, robot simulation.
ISNE 497 (269497) Selected Topics in Information Systems 2	3(3-0-6)	REAI 302 (271302) Robotic Design Essentials
Prerequisite : Consent of the department		3(3-0-6)
Selected topics of current interest and new developments in information systems.		Prerequisite : third year standing
		เปิดใหม่ มีผลบังคับใช้ตั้งแต่ภาคการศึกษา 1/2564
		Introduction to robotic system. Robot motion. Actuator and power train. Sensors. Digital communication. Electric motors and drives. Control of motors.
ISNE 498 (269498) Selected Topics in Network Engineering 1	3(3-0-6)	REAI 371 (271371) Online Self-Learning 1
Prerequisite : Consent of the department		3(3-0-6)
Selected topics of current interest and new developments in network engineering.		Prerequisite : consent of the department
		เปิดใหม่ มีผลบังคับใช้ตั้งแต่ภาคการศึกษา 1/2564
		This course allows student to learn subject of his/her interest through legitimate online course such as Coursera, UDEMY, MIT OpenCourseware, Stanford SEA etc. Student must present the details of the chosen online course to the Program Administrative Committee for approval before enrolling. Student must formally register the course that has certain schedule with no less than 30 lecture hours and must obtain certificate after taking the course. Student will then be assigned project work related to the subject. The course taken must be related to robotic technologies and/or artificial intelligence which are not offered by the program or not available during the course of study. Grading will be given on satisfactory or unsatisfactory basis.
ISNE 499 (269499) Selected Topics in Network Engineering 2	3(3-0-6)	REAI 372 (271372) Online Self-Learning 2
Prerequisite : Consent of the department		3(3-0-6)
Selected topics of current interest and new developments in network engineering.		Prerequisite : consent of the department
		เปิดใหม่ มีผลบังคับใช้ตั้งแต่ภาคการศึกษา 1/2564
		This course allows student to learn subject of his/her interest through legitimate online course such as Coursera, UDEMY, MIT OpenCourseware, Stanford SEA etc. Student must present the details

of the chosen online course to the Program Administrative Committee for approval before enrolling. Student must formally register the course that has certain schedule with no less than 30 lecture hours and must obtain certificate after taking the course. Student will then be assigned project work related to the subject. The course taken must be related to robotic technologies and/or artificial intelligence which are not offered by the program or not available during the course of study. Grading will be given on satisfactory or unsatisfactory basis.

REAI 391 (271391) Robotics Engineering Project 1 2(0-6-0)

Prerequisite : third year standing

เปิดใหม่ มีผลบังคับใช้ตั้งแต่ภาคการศึกษา 1/2564

Project on programming design using microcontroller and/or industrial control system under the supervision of an advisor. Students are required to submit a report and make an oral presentation on completion of the project.

REAI 392 (271392) Robotics Engineering Project 2 2(0-6-0)

Prerequisite : REAI 391 (271391)

เปิดใหม่ มีผลบังคับใช้ตั้งแต่ภาคการศึกษา 1/2564

Project on circuit design and electrical devices in robotic system leading to construction of a printed circuit board (PCB) under the supervision of an advisor. Students are required to submit a report and make an oral presentation on completion of the project.

REAI 400 (271400) Training in Robotic Engineering 3(0-18-0)

Prerequisite : third year standing

เปิดใหม่ มีผลบังคับใช้ตั้งแต่ภาคการศึกษา 1/2564

Industrial Training in robotic engineering or related areas under supervision of experienced engineers in private sectors or government agencies. Grading will be given on satisfactory or unsatisfactory basis.

REAI 401 (271401) Artificial Intelligence for Robotics 3(3-0-6)

Prerequisite : consent of the department

เปิดใหม่ มีผลบังคับใช้ตั้งแต่ภาคการศึกษา 1/2564

Basic concepts in artificial intelligence with an emphasis on statistical and decision-theoretic models to design an intelligent system. The topics include intelligent agents, problem-solving agents, informed search such as A* search, game playing, Constraint Satisfaction Problem, planning algorithms such as sampling-based motion planning algorithms, probabilistic reasoning, Bayesian Networks, Markov decision processes, Reinforcement learning, and so on.

REAI 411 (271411) Autonomous Robotic System 3(3-0-6)

Prerequisite : consent of the department

เปิดใหม่ มีผลบังคับใช้ตั้งแต่ภาคการศึกษา 1/2564

Introduction to autonomous systems. Autonomy. Planning algorithms. Robot navigation. Simultaneous Localization and Mapping (SLAM). Robot Operating System (ROS).

REAI 491 (271491) Robotics Engineering Project 3 2(0-6-0)

Prerequisite : MN392 (271392)

เปิดใหม่ มีผลบังคับใช้ตั้งแต่ภาคการศึกษา 1/2564

Project on engineering design of robot structure, mechanical components and driving system under the supervision of an advisor. Students are required to submit a report and make an oral presentation on completion of the project.

REAI 492 (271492) Robotics Engineering Project 4 3(0-9-0)

Prerequisite : MN491 (271491)

เปิดใหม่ มีผลบังคับใช้ตั้งแต่ภาคการศึกษา 1/2564

Project on robotic engineering that involves design of mechanical, electronics, programming and artificial subsystems and their integration that leads to effective smart robotic system under the supervision of an advisor. Students are required to submit a project report and make an oral presentation on completion of the project.