Course Description

General Education Courses **38 Credits**
General Education Core Courses **12 Credits**

202107 Use of Computer and Information **3 (2-2-5)**

Prerequisite : None

Introduction to computer and computer organization, operating systems and utility programs, application software, computer network systems and internet, computer system security and related legal issues, information and organization systems, information services for searching, report writing, citations and reference writing

202211 Thinking for Development **3 (3-0-6)**

Prerequisite : None

Process of logical- analytical thinking, deductive and inductive logic for argument analysis, soundness of argument, conceptions in sufficiency economics for sustainable development, religions and ethics for development in quality of living

202212 Man and Culture **3 (3-0-6)**

Prerequisite : None

Social and cultural body of knowledge, evolution of arts and civilization and their social phenomena, being human and human community in a system of plural cultures, significance of arts/culture and wisdom for new generations

202213 Globalization **3 (3-0-6)**

Prerequisite : None

Comparative Studies on international relations both before and after the advent of globalization in terms of state/country status, international laws, international organizations both at the regional and global levels, international economics under the influence of powerful countries, emerging economic countries and multinational enterprises, development and its impact, civil society and globalization trends, as well as changing trends towards globalization in the 21st century

English Courses **15 Credits**

203101 English I **3 (3-0-6)**

Prerequisite : None

Developing students' ability for effective communication in social and academic settings, course content reflecting students' interests using integrated skills with primary emphasis on listening and speaking, improving communication and language learning strategies, and introducing autonomous learning using various resources

203102 English II **3 (3-0-6)**

Prerequisite : 203101 English I

Enhancing students' proficiency in social communication, developing students' ability to accomplish learning tasks, using integrated skills and task-based learning with emphasis on contemporary themes and current issues, reading semi-academic texts from avariety of authentic sources such as newspapers, magazines and online resources

203203 English III **3 (3-0-6)**

Prerequisite : 203102 English II

Course content dealing with science and technology for effective communication in an academic field of study, text-based activities involving integrated language skills with an emphasis on reading, exposure to both authentic and semi-authentic materials from both printed and audiovisual materials, as well as online resources

203204 English IV **3 (3-0-6)**

Prerequisite : 203203 English III

Further enhancement of student's language learning skills and ability in science and technology content developed from English III; exposure to authentic language in science and technology from both printed and audiovisual materials, as well as on-line resources; focus on text-based tasks involving integrated skills with the emphasis on writing

203305 English V **3 (3-0-6)**

Prerequisite : 203204 English IV

English needed for employment preparation, effective communication skills in the workplace, and career advancement, covering topics such as job search, resumes, employment letters and documents, job interviews, academic applications, some essential correspondence, reports, meetings, discussion, and short informal occasional speeches

General Mathematics and Social Science Courses **9 Credits**

103113 Mathematics in Daily Life **3 (3-0-6)**

Prerequisite : None

Applications of basic mathematics in daily life problems such as problems related to graphs, area and volume, financial problems such as computing interests, annuities and taxes, resource allocation problems such as break-even point, finding the optimal value by graph and the simplex method, and other problems of interest

104113 Man and Environment **3 (3-0-6)**

Prerequisite : None

Evolution of man, human populations and dynamics, physical and biological environments of human populations, present and future design for survival, natural resources and conservation, environmental problems, environmental planning and management, human resource management, ecotourism for sustainable development

105113 Man and Technology **3 (3-0-6)**

Prerequisite : None

History, concepts and principles of physical science, energy and matter, importance of energy resources and energy crisis, atom, nuclear and nanotechnology, water management, gas and oil drilling, air pollution, satellite communication, geo-informatics and development, chemistry in everyday life, chemistry and advancement of science, impacts of science and technology on environment, economics, society and future of mankind

General Education Elective Courses **2 Credits**

114100 Sport and Recreation **2 (1-2-4)**

Prerequisite : None

Introduction and definition of sport and recreation, rules, culture social sports, principle for exercise, leadership of sport and recreation, skill of sports e.g. team sports, racket sports, aquatic sports, dance sports, Muay Thai, Jogging and Physical Fitness

202111 Thai for Communication **2 (2-0-4)**

Prerequisite : None

The Thai grammar, skill of using Thai in speaking, listening, reading, and writing, composition in Thai for communication and work presentation

202241 Law in Daily Life **2 (2-0-4)**

Prerequisite : None

Basic principle of law, hierachy of law, population registry law, useful law in daily life e.g. law concerning person, property, legal act and contract, loan agreement, service contract, made-to-order contract, contract of sale, property rental contract, hire-purchase contract, suretyship agreement, mortgage contract, basic law of family and inheritance, consumer protection law, and basic law of intellectual property

202261 Religion for Life **2 (2-0-4)**

Prerequisite : None

Teachings from various religions on human living between private and work life, as well as living with others in society

202262 Buddhadhamma **2 (2-0-4)**

Prerequisite : None

Essential dhammas from Theravada and Mahayana Buddhism for understanding the world, life, and the right path, e.g. the Highest Blessings, the Noble Truth, Dependent Origination, Law of Karma, Threefold Training, the Middle Way, Emptiness, and Emancipation

202291 Modern Management **2 (2-0-4)**

Prerequisite : None

Components, importance and behavior of organization, external environment trends and effects, trends of modern organizations, process of organizational management for effectiveness and efficiency, planning, problem solving and decision making, organizing, leading, leadership and control

202292 Technopreneur **2 (2-0-4)**

Prerequisite : None

The study of entrepreneurship and technology business, analysis and feasibility studies of projects including simple business plan development e.g., business idea grooming for concept/ product value creation, research and development of product for commercialization, marketing analysis, organization analysis and management, production analysis, financial and tax analysis, business start-up and the development of technopreneur for sustainable growth

202324 Pluri-Cultural Thai Studies **2 (2-0-4)**

Prerequisite : None

Knowledge management and understanding of the system of Thai society and culture, plurality in Thai economic and political development, significance of plural folk wisdom, concept of sufficiency economy in worldwide

202354 Philosophy of Education and Working **2 (2-0-4)**

Prerequisite : None

Philosophical perspectives on education and working, meaning of work and working, working as the end of education, the nature of study in educational institutions and work-learning from actual performance, education and further opportunity in occupation, working and well-being, working ethics

MAJOR COURSES **138 Credits**

Science and Mathematic Foundation Courses **30 Credits**

102111 Fundamental Chemistry I **4 (4-0-8)**

Prerequisite : None

Atomic theory and electronic structure of atoms, periodic properties of atoms, representative elements and transition metals, chemical bonding, stoichiometry, gases, liquids, solids, chemical equilibrium, general properties of acids and bases, chemical kinetics

102112 Fundamental Chemistry I **1 (0-3-0)**

Prerequisite : 102111 Fundamental Chemistry I or Co-requisite

Experimental works in the laboratory which include the basic techniques in experimental chemistry, properties of gases and liquids, metallic models, chemical equilibrium, acid - base titrations, chemical kinetics and various types of chemical reactions

103101 Calculus I **4 (4-0-8)**

Prerequisite : None

Limits, continuity, the derivative, applications of the derivative, inverse functions, the definite integral and the fundamental theorem of calculus

103102 Calculus II **4 (4-0-8)**

Prerequisite : 103101 Calculus I

Techniques of integration (of functions of a single variable), numerical integration, sequences and series, vectors and geometry, vector valued functions, functions of several variables

103103 Probability and Statistics **3 (3-0-6)**

Prerequisite : 103102 Calculus II

Elementary probability theory, random variables, and distributions, moments, moment generating functions and characteristic functions, limit theorems, random samples and sampling distributions estimations, tests of hypothesis

103105 Calculus III **4 (4-0-8)**

Prerequisite : 103102 Calculus II

Multiple integration, vector calculus, first order ordinary differential equations, second order linear ordinary differential equations, power series method

105101 Physics I **4 (4-0-8)**

Prerequisite : None

Linear motion, circular motion, conservations of momentum, angular momentum, and energy, elasticity, simple harmonic motion, damped oscillation and resonance, wave propagation, sound wave, fluid dynamics, heat and thermodynamics, kinetic theory of gases

105102 Physics II **4 (4-0-8)**

Prerequisite : 105101 Physics I

Electric field and potential, electrical current and resistance, magnetic field and induction, superconductivity, light wave, waveguide for microwave, optical fiber and fiber-optic communication, atom, molecule, nucleus, quark, lepton and the big-bang theory

105191 Physics Laboratory I **1 (0-3-0)**

Prerequisite : 105101 Physics I or taken concurrently

Experiments in physics which relate to topics in Physics I. To gain experience in experimental physics, students must perform 8 experiments in topics of mechanics, wave and fluid dynamics

105192 Physics Laboratory II **1 (0-3-0)**

Prerequisite : 105191 Physics Laboratory I AND 105102 Physics II or 105191 Physics Laboratory I AND enrolling with 105102 Physics II

Experiments in physics which relate to topics in Physics II. To gain experience in experimental physics, students must perform experiments in topics of optics, electronic circuits, photoelectric effect, and radioactivity

Basic Engineering Courses **33 Credits**

523101 Computer Programming I **2 (1-2-4)**

Prerequisite : None

Computer concepts and components, hardware and software interaction, Electronic Data Processing (EDP) concepts, program design and development methodology, programming with C language, variable type declaration, expressions, control statements, programming practice

523201 Computer Programming II **2 (1-2-4)**

Prerequisite : 523101 Computer Programming I

Programming with C language, function and parameter passing, array, pointer, sorting and searching, data structure, data file

525101 Engineering Graphics I **2 (1-3-5)**

Prerequisite : None

Practice to lettering, orthographic projection, dimensioning, drawing the section view and symbols, practice to sketch by free-hand.

525206 Engineering Graphics II **2 (1-3-5)**

Prerequisite : 525101 Engineering Graphics I

Practice to lettering, line and plane, geometric applications. Reading and drawing on orthographic projection, fundamental of dimensioning and tolerance, section view, standards and symbols. Practice to sketch by free-hand.

526416 Quality Control **4 (4-0-8)**

Prerequisite : 103103 Probability and Statistic

Principle of industrial quality management. Application of statistics for quality control system. Evaluation of process capability and variation in production. Design of different control methods and sampling plan for monitoring control charts. Application of sampling plan from standard tables. Evaluation of reliability in product quality. Organization structure of quality control unit. Modern concept in quality control techniques. International standard concerning quality. Management of quality assurance systems such as ISO9000, ISO14000 and TIS18000.

529292 Electrical Engineering **4 (4-0-8)**

Prerequisite : 105102 Physics II

General principles of electrical engineering: DC and AC circuits, magnetic circuits and transformers, electrical machines, electronic devices and circuits, logic gates and digital ICs, control systems

529294 Electrical Engineering Laboratory **1 (0-3-0)**

Prerequisite : 529292 Electrical Engineering

Experimental works on electric circuits and electrical machines to reinforce the topics in Electrical Engineering I

530201 Engineering Statics **4 (4-0-8)**

Prerequisite : 105101 Physics I

Force systems, Resultant forces and moments, Equilibrium, Friction, Virtual work, Stability

530211 Mechanics of Materials I **4 (4-0-8)**

Prerequisite : 530201 Engineering Statics

Forces and stresses, Stress-strain relations, Stresses in beams, Shear diagram and moment diagram, Deflection of beams, Torsion, Buckling of columns, Mohr's circle and combined stresses, Failure criteria

531101 Engineering Materials **4 (4-0-8)**

Prerequisite : None

General properties of engineering materials, e.g., metals and alloys, asphalt, wood, concrete, plastic, resin and rubber; Mechanical properties and mechanical testing; Phase diagrams and their interpretations; Macro- and microstructures; Metal processing; Heat treatment of metals; Corrosion in metals and preventions; Introduction to ceramics; Structure of ceramics; Engineering ceramic, e.g., glass, cement, advanced ceramics and ceramic composite materials; Ceramic processing; General properties and applications; Polymers in daily life, Monomers and polymers; Molecular weights of polymers; Polymer synthesis; Physical properties of polymers; Polymer processing; Polymer blends, polymer composites and their engineering applications

533221 Engineering Economy **4 (4-0-8)**

Prerequisite : none

Brief principles of engineering economy focusing on interest and time value of money; analysis and comparison of industrial projects investment such as break-even analysis; depreciation; replacement analysis; risk and uncertainty; after-tax analysis.

Major Engineering Courses 69 **Credits**

531201 Physical Metallurgy I **3 (3-0-6)**

Prerequisite : None

Crystal structures; Crystal defects; Crystal interface; Grain and microstructure; Solidification of metals and alloys; Elastic and plastic deformation; Strengthening mechanisms and microstructural control; Solid solution and compounds; Phase diagrams

531202 Physical Metallurgy Laboratory I **1 (0-3-0)**

Prerequisite : 531201 Physical Metallurgy I or Co-requisite

Preparation of metallographic specimens for macrostructural and microstructural observations; Hardness measurements; Determination of grain size; Cooling curve of metals and alloys; Microstructure of carbon steel

531203 Physical Metallurgy II **3 (3-0-6)**

Prerequisite : 531201 Physical Metallurgy I

Solidification of metals and alloys; Recovery, recrystallization and grain growth; Time-Temperature-Transformation (TTT) diagrams; Diffusion; Principles of solid-state phase transformation;

Relationship between microstructure and mechanical property of metals and alloys; Heat treatment of metals

531204 Physical Metallurgy Laboratory II **1 (0-3-0)**

Prerequisite : 531203 Physical Metallurgy II or Co-requisite

Annealing; Normalizing; Stress relief; Quenching and tempering; Case hardening by carburizing; Diffusion; Hardenability of metals; Age hardening; Recovery, recrystallization, and grain growth; Martensite transformation

531205 Physical Metallurgy III **3 (3-0-6)**

Prerequisite : 531203 Physical Metallurgy II

Manufacturing processes and physical metallurgy of important ferrous metals, e.g., carbon steels, alloy steels, tool steels, white cast irons, gray cast irons, malleable cast iron and ductile cast irons; Mechanical property improvement by heat treatment processes

531206 Physical Metallurgy Laboratory III **1 (0-3-0)**

Prerequisite : 531205 Physical Metallurgy III or Co-requisite

Microstructure of primary forming of as cast or as rolled ferrous metals, e.g., carbon steels, alloy steels, tool steels, white cast irons, gray cast irons, malleable cast irons and ductile cast irons; Heat treatment processes of important alloys; Post-heat treated microstructure

531207 Principles of Metallurgical Engineering **3 (3-0-6)**

Prerequisite : 102111 Fundamental Chemistry I

Raw materials for metal industries; Metallurgical systems and fundamentals of material balances; Stoichiometric principles and stoichiometric calculations; Thermochemistry of reactions; Fundamentals of heat balances; Combustion of fuels and heat utilization

531208 Methods of Defferential Equations in Metallurgical Engineering **3 (3-0-6)**

Prerequisite : 103105 Calculus III

Initial value problem; Boundary value problem; Higher order linear ordinary differential equations with constant coefficients; Partial differential equations and methods of finding solutions; Application of methods of differential equations in metallurgical engineering

531209 Thermodynamics of Materials I **3 (3-0-6)**

Prerequisite : 102111 Fundamental Chemistry I and 105101 Physics I

Fundamental principles of thermodynamics; Term and definition of thermodynamics; First law and second law of thermodynamics; Function and relationship among properties in thermodynamics, free energy as a function of temperature, pressure and chemical potential; Heat capacity, enthalpy entropy and the third law of thermodynamics; Calculation of free energies from available thermodynamics data; Basic principles of phase diagrams

531301 Thermodynamics of Materials II **3 (3-0-6)**

Prerequisite : 531209 Thermodynamics of Materials I

Chemical equilibrium; Thermodynamics equilibrium; Criteria for equilibria in constant pressure processes; Equilibrium in gas mixtures; Equilibrium between condensed phases and gas phases; Free energy diagram; Behavior of solutions, Phase rule; phase equilibria; Phase diagram; Electrochemistry, electrochemical concepts and thermodynamics, electrochemical cell, aqueus solution

531302 Mechanical Metallurgy **4 (4-0-8)**

Prerequisite : 530211 Mechanics of Materials I

Statics of materials under external loading; Elastic behaviors; Plastic deformation; Stress analysis in two and three dimensions; Yield criteria; Effects of temperature, strain rate, residual stresses, metallurgical factors and defects on mechanical behaviors of metals; Strengthening mechanisms in metals; Introduction to fracture mechanics, fracture modes, fracture analysis in metals; Mechanical properties and mechanical testing, e.g., hardness, tension, torsion, creep, impact toughness, fracture toughness and fatigue; Analysis of mechanical properties for engineering design and applications

531303 Mechanical Metallurgy Laboratory **1 (0-3-0)**

Prerequisite : 531302 Mechanical Metallurgy or Co-requisite

Introduction to mechanical testing for metals in engineering applications; Assessment and analytical techniques of experimental data; Engineering measurements; Hardness testing; Measurement of stress and strain; Tensile testing; Torsion testing; Creep testing; Impact testing; Bend testing; Fatigue testing; Fractography

531304 Metal Forming **4 (4-0-8)**

Prerequisite : 531302 Mechanical Metallurgy

Classification of metal forming processes; Fundamental of metal forming; Principle and operational techniques of metal forming; Operational and metallurgical factors in metal forming processes; Theory and metal operations, e.g., forging, rolling, extrusion, drawing of rod and tubes, sheet metal forming, machining; Advanced metal forming; Defects in formed parts and preventions

531305 Metal Forming Laboratory **1 (0-3-0)**

Prerequisite : 531304 Metal Forming or Co-requisite

Introduction to metal forming laboratory and equipments; Conventional metal forming, e.g., turning, planning, cutting, drilling, and taping; Autocad programming; Advanced metal machining, e.g., CNC, EDM and Wire cutting

531306 Chemical Metallurgy I **3 (3-0-6)**

Prerequisite : 531301 Thermodynamics of Materials II

Principles of mineral processing, sampling, comminution and liberation, screening, classification, size determination, gravity concentration, magnetic and electrostatic separation, froth flotation; Principles of pyrometallurgy, thermodynamic applications, calcination, roasting, metal reduction and refining; Principles of hydrometallurgy, leaching and precipitation, solvent extraction and ion exchange; Electrochemistry of aqueous solution, electrowinning and electrorefining

531307 Chemical Metallurgy Laboratory 1 (0-3-0)

Prerequisite : 531306 Chemical Metallurgy I or Co-requisite

Experiment in extractive metallurgy, pyrometallurgy, hydrometallurgy; Recycling of metals from waste; Electrochemistry, electrowining, electrorefining; Corrosion testing

531308 Chemical Metallurgy II 3 (3-0-6)

Prerequisite : 531306 Chemical Metallurgy I

Gerneral overview of iron and steel manufacture; Physical chemistry of iron and steel making; Ironmaking process, blast furnace; Smelting and direct reduction process; Steel making process, basic oxygen furnace (BOF) and electric arc furnace (EAF) steel making; Secondary steel making, ladle metallurgy, vaccum metallurgy; Metallurgical slag of iron and steel making; Chemical reaction in steel making process, reaction of carbon, silicon, chromium; Removal of sulfur and phosphorus; Deoxidation and vacuum degassing of steel; Clean steel technology, metallurgy of inclusion removal; Continuous casting

531309 Foundry Engineering 4 (4-0-8)

Prerequisite : 531205 Physical Metallurgy III

Introduction to metal casting; History of foundry; Types and properties of molding sand; Molding processes and equipments; Pattern design; Melting Furnaces; Charge calculation; Melting operations and quality control; Melt treatments; Cooling curve analyses; Other metal casting processes; Principle of solidification science; Microstructural evolution during solidification; Shrinkage; Fluid dynamic during mold filling; Directional solidification; Feeding system and design; Gating system and design; Casting design; Secondary operations; Inspection and quality control; Casting defects and analyses; Casting Technology, status of metal casting industry and new development; Occupational health and safety

531310 Foundry Engineering Laboratory 1 (0-3-0)

Prerequisite : 531309 Foundry Engineering or Co-requisite

Foundry laboratories, e.g., molding sand testing, pattern design, molding, core making; Melting techniques, melt chemistry control; Casting processes; Analysis of casting defects; Casting simulation; Metallurgical quality control

531311 Nonferrous Metallurgy 3 (3-0-6)

Prerequisite : 531203 Physical Metallurgy II

Metallurgy of commercial nonferrous metals, e.g., aluminium, magnesium, copper, zinc, titanium, nickel; Alloying, melting and forming into engineering components; Phase diagrams of alloys; Correlations among microstructures and physical, mechanical and corrosion properties affecting their utilizations in engineering services; Mechanical property improvement of nonferrous alloys; Heat treatments in aluminium alloys, copper alloys and titanium alloys; Metallurgy and engineering significance of other nonferrous alloys, e.g., tin, lead, gold, and silver

531312 Transport Phenomena in Metallurgical Engineering 4 (4-0-8)

Prerequisite : 531207 Principles of Metallurgical Engineering and 531208 Methods of Differential Equation in Metallurgical Engineering

Fluid properties; Laminar flow and turbulent flow; Newton's law of viscosity; Mass balance and momentum balance; Similitude and dimensional analysis; Flow in pipe; Application of energy balance in

fluid flow; Fourier's law; Conduction of heat in solid; Introduction to convection and radiation heat transfer; Fick' s first law and mass transfer by diffusion; Diffusion in solids; Surface modification by diffusion; Homogenization of alloy

531313 Corrosion of Metals **4 (4-0-8)**

Prerequisite : 531101 Engineering Materials

Principles of corrosion; Forms of corrosion; Pourbaix diagrams; Corrosion prevention by design; Materials selection, e.g., stainless steels, copper and its alloys, nickel and its alloys, aluminium and its alloys, titanium and its alloys; Corrosion protection, cathodic protection and anodic protection, role of inhibitors; Corrosion testing

531401 Metallurgy of Metal Joining **4 (4-0-8)**

Prerequisite : 531205 Physical Metallurgy III

Principles of metal joining; Evolution of various metal joining processes; Heat and mass transfer in metal joining; Weld fusion zone solidification; Weld microstructure; Analysis of metal joining problems, e.g., residual stress, distortion; Prevention and correction of metal welding problems, pre- and post weld heat treatment; Weldability of various metals and alloys; Weld testing; Weld quality control and weld quality assurance

531402 Materials Characterization **4 (4-0-8)**

Prerequisite : 531205 Physical Metallurgy III

Physics of light and electron; Physics of atom and molecules; Principle of chemical analysis and spectroscopy; Phase and crystal structure analysis by X- ray diffraction technique; Microstructural characterization using electron microscopy; Chemical microanalysis

531403 Analysis of Metallurgical Failures **4 (4-0-8)**

Prerequisite : 531101 Engineering Materials and 531302 Mechanical Metallurgy

Introduction to analysis of metallurgical failures; Procedure of failure analysis; Failure modes of metallic components, e.g., ductile, brittle failures; Introduction to fracture mechanics; Fatigue failures in engineering services; Failures due to creep, corrosion, stress-corrosion cracking; Failures in weldments; Failures and defects in metallic components due to heat treatments, metal forming and casting; Case studies of analysis of metallurgical failures

Engineering Electives Courses **6 Credits**

528403 Safety Engineering **4 (4-0-8)**

Prerequisite : Consent of the school

Principles of heath, safety and environmental protection, mechanical hazards and safeguarding, electrical hazards and safety, fire and explosion hazards and protection, toxic substances and explosive hazards and safety, heat and temperature hazards at work, safety laws, principle of safety management , element of industrial safety psychology

531321 Heat Treatment Technology **3 (3-0-6)**

Prerequisite : 531203 Physical Metallurgy II

Heat treatment processes; Furnace atmosphere control; Quenching medium and quenching technology; Distortion and cracking; Industrial furnace; Quality test of heat treated parts

531322 Surface Technology **3 (3-0-6)**

Prerequisite : Consent of the school

Wear mechanisms; Surface technology; Wear resistance; Corrosion resistance; Wear testing; Physical vapor deposition (PVD); Chemical vapor deposition (CVD); Thermal spraying; Hard facing; Electroplating

531323 Non-Destructive Testing **4 (4-0-8)**

Prerequisite : 105102 Physics II

Fundamental and basics of non-destructive testing; Non-destructive testing in metallic materials; Visual inspection; Die penetration test; Radioactive test; Ultrasonic test; Magnetic penetration test; Eddy current test

531324 Corrosion Testing **3 (3-0-6)**

Prerequisite : 531313 Corrosion of Metals or Co-requisite

Corrosion of metals; Electrochemical reaction; Equilibrium electrode; Construction of Pourbaix diagram; Application of electrode mechanism; Tafel slope; Definition of polarization curve, determination of polarization curve by potentiostat analyzer, interpretation of polarization curve; Corrosion testing, e.g., sensitization test, stress corrosion cracking test, and high temperature oxidation test

531325 Materials Selection for Engineering Applications **3 (3-0-6)**

Prerequisite : 531101 Engineering Materials

Roles of materials on design and engineering applications; Designing processes for engineering applications and case studies; Important engineering materials and properties; Materials indices; Materials property diagrams; Construction of materials property diagrams from electronic database; Theory of materials selection; Case studies of materials selection for structural applications, thermal applications, electronic applications; Materials selection and manufacturing processes; Case studies of materials selection with consideration of manufacturability and cost; Materials selection with multiple constraints; Selection of materials by shapes; Selection of composite materials; New developments of materials and challenging of materials selection

531326 Stainless Steel **3 (3-0-6)**

Prerequisite : 531205 Physical Metallurgy III

Types of stainless steels; Metallurgy of stainless steels; Mechanical property, Chemical property, Physical property; Heat treatment and forming process of stainless steels; Application of stainless steels

531327 Powder Metallurgy **3 (3-0-6)**

Prerequisite : 531101 Engineering Materials

Introduction and history of powder metallurgy; Powder fabrication with chemical and physical methods; Powder types; Powder characterization and interpretation; Powder mixing; Additives; Lubricants;

Binders; Principles of powder compaction technology; Tool design and production; Thermodynamics and kinetics of sintering; Sintering technology; Sintering defects; Characterization and mechanical testing of sintered parts; Secondary processes; Powder metallurgy of steels; New development in powder metallurgy; Future and trends of powder metallurgy industry; Occupational health and safety in powder metallurgy processes

531328 Metal Matrix Composite **3 (3-0-6)**

Prerequisite : 531101 Engineering Materials

Introduction to composite materials; Metal matrix and reinforcing materials; Mechanics of composite materials; Interfacial bonding of metal matrix and reinforcing materials; Fabrications of metal matrix composites; Properties and engineering applications of commercially important metal matrix composites, e.g., aluminium, magnesium, titanium and steel matrix composites; Failures and degradation of metal matrix composites; Engineering design of metal matrix composites

531329 Computer Aided Engineering in Metallurgical Processing **3 (3-0-6)**

Prerequisite : 530211 Mechanics of Materials and 531312 Transport Phenomena in Metallurgical Engineering

Numerical calculation in computer system; Basic of finite element analysis; Application of finite element analysis software for engineering problems solving

531330 Laser in Materials Processing **3 (3-0-6)**

Prerequisite : 105102 Physics II

Characteristics of laser; Principle of laser generator; Types of laser; Interaction of laser and materials; Transport phenomena in laser processing; Laser welding, Laser cutting; Laser engraving; Laser soldering; Laser application in materials processing

531421 Cast Iron Technology **3 (3-0-6)**

Prerequisite : 531205 Physical Metallurgy III

Classification; Basic metallurgy and solidification characteristics of cast irons; Metallurgy and properties of gray cast irons, ductile cast irons, compacted graphite cast irons, malleable cast irons, high-alloy white cast irons, and high-alloy graphitic cast irons; Casting processes and foundry practice for cast irons; Heat treatment of gray cast irons, ductile cast irons, and malleable cast irons; Casting defects and failure analysis of cast irons; Special assignment of selected topics on cast iron technology

531422 Casting Technology **3 (3-0-6)**

Prerequisite : 531309 Foundry Engineering

Foundry raw materials and molding processes for metal casting; Melt preparation, reaction of melts with environment; Energy and material balance in Cupola; Fluid mechanics and gating design; Heat transfer and solidification of metals and alloys; Die casting; Squeeze casting; Semi-solid casting; Lost wax casting, lost foam casting; Analysis of casting defects; Special assignment of selected topics on casting technology

531423 Casting Simulation **3 (3-0-6)**

Prerequisite : 531309 Foundry Engineering

Review of casting fundamentals; Review of transport phenomena in metallurgical Engineering; Principles of solidification; Analysis of casting defect; Applications using commercial casting-simulation software; Cast study of application using commercial casting-simulation software for design and analysis to solve a problem of casting defects

531424 Advanced Metal Forming **3 (3-0-6)**

Prerequisite : 531304 Metal Forming

Advanced mechanical metallurgy for metal forming; Plastic deformation in crystalline; Ideal work and actual work in metal forming; Friction in metal forming; Analysis of metal behavior during metal forming process; Problem analysis on metal forming and its solutions; Development of new metal forming technology

531425 Physical Metallurgy of Steels **3 (3-0-6)**

Prerequisite : 531205 Physical Metallurgy III

Classification and application of steels, manufacturing of steels, property of irons and steels: chemical, physical and mechanical properties, steel design; Effects of alloying and forming parameters on steel properties; Thermomechanical treatment; Engineering steels, plain carbon steels, high-strength low-alloy steels, high alloy steels, stainless steels, electrical steels, tool steels, refractory steels

531426 Gas-Metal Reactions for Heat Treatment **3 (3-0-6)**

Prerequisite : 531301 Thermodynamics of Materials II

Metallurgical thermodynamics; Reviews of the calculations of some basic thermodynamic functions, chemical potential and chemical equilibrium; Furnace atmospheres; Gas reactions in the furnace atmosphere, classifications of prepared atmospheres, composition of atmospheres inert to heated steels; Furnace atmosphere control; Surface hardening of steels by gas-metal reactions; Control of surface carbon content in heat-treated steels and process control in gas carburizing

531427 Kinetics in Metallurgical Processes **3 (3-0-6)**

Prerequisite : 531308 Chemical Metallurgy II

Measurement of chemical reaction rate; Effect of concentration and temperature; Collision mechanism; rate determining steps; Diffusion controlled reaction; Chemical controlled reaction; Reaction kinetics in liquid/solid; liquid/liquid, and gas/solid systems

531428 Melting and Recycling of Metals **3 (3-0-6)**

Prerequisite : Consent of the school

Thermodynamics and extractive metallurgy reviews; treatment of wastes in metal industry; Process studies with respect to raw materials, chemical reaction, energy consumption, process intensity yield; Recycling and refining processes of irons and steels, aluminium, copper, lead, zinc, tin and precious metals; Environmental impact by metallurgical plants; Management of metallurgical wastes

531481 Special Studies I **3 (3-0-6)**

Prerequisite : Consent of the school

Analytical study and problem solving in industrial related topics of metal processing under supervision of faculty in charge of the program

531482 Special Studies II **3 (3-0-6)**

Prerequisite : Consent of the school

Analytical study and problem solving in industrial related topics of metal processing under supervision of faculty in charge of the program

531483 Selected Topics in Metallurgical Engineering I **3 (3-0-6)**

Prerequisite : Consent of the school

Study of topics in selected fields of current or new development in metallurgical engineering under supervision of faculty in charge of the program

531484 Selected Topics in Metallurgical Engineering II **3 (3-0-6)**

Prerequisite : Consent of the school

Study of topics in selected fields of current or new development in metallurgical engineering under supervision of faculty in charge of the program

531485 Advanced Topics in Metallurgical Engineering I **3 (3-0-6)**

Prerequisite : Consent of the school

Study of advanced topics or new technology development in various fields of metallurgical engineering under supervision of faculty in charge of the program

531486 Advanced Topics in Metallurgical Engineering II **3 (3-0-6)**

Prerequisite : Consent of the school

Study of advanced topics or new technology development in various fields of metallurgical engineering under supervision of faculty in charge of the program

531487 Undergraduate Metallurgical Engineering Project **4 (0-8-4)**

Prerequisite : Consent of the school

Study of topic of interest concerning with metallurgical engineering; Literature survey; Proposal of research topic; Experimental; Report and presentation; Grading evaluation by S/U under consideration of faculty in charge of the program

531488 Project Supporting Metal Industry **4 (0-8-4)**

Prerequisite : Consent of the school

Integration of basic or applied metallurgy research and study in industrial work; Grading evaluation by S/U under consideration of faculty in charge of the program

533021 Industrial Management **4 (4-0-8)**

Prerequisite : None

Functioning of management in industry; planning, production and operations strategies; forecasting; locations analysis; plants layout; product and service design; project analysis; safety and industrial law

533041 Quality Management **4 (4-0-8)**

Prerequisite : None

Quality management and quality assurance in industry; principles of quality cost; statistical process control (SPC); concept of Taguchi's method and quality loss function

534208 Mineralogy **4 (3-3-9)**

Prerequisite : None

Introduction to crystallography, classification, properties and uses of minerals

Cooperative Education **9 Credits**

531490 Pre-cooperative Education **1 (1-0-2)**

Prerequisite : None

Principals and concepts relating to Cooperative Education; Process and steps of undertaking Cooperative Education; Protocols relating to Cooperative Education; Basic knowledge on and techniques for job application such as workplace selection, job application letter writing, job interviews and communication skills; Basic knowledge necessary for undertaking Cooperative Education at workplace; Building up self-confidence; Entrepreneurial potential development; Occupational health and safety in workplace; Organizational culture, Quality management systems at workplace such as 5S, ISO 9000 and ISO 14000; Report writing and presentation techniques; Personality development

531491 Cooperative Education I **8 Credits**

Prerequisite : Courses specified by the School and Pre-cooperative Education

The student has to perform full-time academic or professional work as a temporary staff member at a workplace for 1 entire Cooperative Education trimester according to the School's specifications. Once completed the work, the student has to submit an operational report and present his/her performance results to the School faculties for the assessment, Evaluation by the supervising faculties and job supervisor(s) based on the student's performance on the assigned work and the operational reports as well as his/her performance at the post-placement interview and seminar activities will determine the assessment result of the student to be either pass or fail

531492 Cooperative Education II **8 Credits**

Prerequisite : 531491 Cooperative Education I

The student has to perform full-time academic or professional work as a temporary staff member at a workplace for 1 entire Cooperative Education trimester according to the School's specifications. Once completed the work, the student has to submit an operational report and present his/her performance results to the School faculties for the assessment, Evaluation by the supervising faculties and job

supervisor(s) based on the student's performance on the assigned work and the operational reports as well as his/ her performance at the post- placement interview and seminar activities will determine the assessment result of the student to be either pass or fail

531493 Cooperative Education III **8 Credits**

Prerequisite : 531492 Cooperative Education II

The student has to perform full-time academic or professional work as a temporary staff member at a workplace for 1 entire Cooperative Education trimester according to the School's specifications. Once completed the work, the student has to submit an operational report and present his/her performance results to the School faculties for the assessment, Evaluation by the supervising faculties and job supervisor(s) based on the student's performance on the assigned work and the operational reports as well as his/ her performance at the post- placement interview and seminar activities will determine the assessment result of the student to be either pass or fail

531494 Metallurgical Engineering Study Project **9 Credits**

Prerequisite : Consent of the school

This study project must be in Metallurgical Engineering field.

Project should be in research or development of the new knowledge in Metallurgical Engineering. Final report and oral presentation exam are required