

01205217** Electromagnetic Fields and Waves 3(3-0-6)
Vector analysis. Electrostatic fields. Potential and energy. Conductors and dielectric. Capacitance. Convection and conduction currents. Resistance. Solution of Laplace's and Poisson's equations. Magneto static fields. Magnetic materials. Inductance. Displacement current. Time-varying electromagnetic fields. Maxwell's equations.

01205218** Electrical Measurements and Instruments 3(3-0-6)
Prerequisite : 01205211

Units and standards of electrical measurements. Instrument classifications and characteristics. Measurement analysis. Measurement of DC and AC current and voltage using analog and digital instruments. Power, power factor and energy measurements. Measurements of resistance, inductance, and capacitance. Frequency and period/time-interval measurements. Noises. Transducers. Calibration.

01205241** Digital Circuits and Logic Design 3(3-0-6)
Number systems and codes. Logic gate. CMOS circuit. Boolean algebra. Combinational logic design principles and practices. Latch and flip-flop. Sequential logic design principles and practices. Computer-aided design (CAD) for digital circuit design.

01205242** Electronic Circuits and Systems I 3(3-0-6)
Prerequisite : 01205211
Semiconductor devices. Current-voltage and frequency characteristics of electronic devices. Analysis and design of basic electronic circuits including diodes and power supply circuit. Bipolar junction transistors (BJT) and field-effect transistors including MOS, CMOS, and BiCMOS. Transistor bias circuits and transistor small signal analysis. Basic amplifiers. Operational amplifiers and its applications in linear and nonlinear circuits. Multistage transistor amplifiers.

01205251** Electromechanical Energy Conversion I 3(3-0-6)
Prerequisite : 01205211

** Revised

Magnetic circuits. Principles of electromechanical energy conversion. Energy and co-energy in magnetic circuits. Principles of rotating machines. DC machines. Starting method of DC motors. Speed control methods of DC motors.

01205311** Microprocessor 3(3-0-6)

Prerequisite : 01205241

Introduction to microprocessors. Structure of microprocessors. Assembly programming. Interface techniques. Memories. Input-output interfaces. Applications of microprocessors in instrumentation systems. Applications of microprocessors in automation systems.

01205312** Linear Control Systems 3(3-0-6)

Prerequisite : 01205211

Mathematical models of system. Transfer function and state-space representations. System models on time domain and frequency domain. Block diagram and signal flow graphs. Dynamic models and dynamic responses of systems. First and second order systems. Open-loop and closed-loop control. Feedback control and sensitivity. Steady-state error. Types of feedback control. Concepts and conditions of system stability. Methods of stability test. Root locus. Time domain analysis and design of control systems. Bode plots. Nyquist plots. Frequency domain analysis and design of control systems.

01205348** Electrical Engineering Materials 3(3-0-6)

Structure of materials. Electrical properties of materials. Magnetic properties of materials. Optical properties of materials. Electrical conductors. Introduction to semiconductor devices. Superconductivity. Solid, liquid and gas dielectrics. Applications of materials in electrical power devices.

01205351** Electromechanical Energy Conversion II 3(3-0-6)

Prerequisite : 01205251

Single phase and three phase transformers. AC machine structure. Synchronous machines. Single phase and three phase induction machines. Steady state performance

01205359** Power Electronics 3(3-0-6)

Prerequisite : 01205242

Characteristics of power electronics devices. Principles of power converters. AC to DC converter. DC to DC converter. AC to AC converter. DC to AC converter.

01205371** Process Sensors and Transducers 3(3-0-6)

Introduction to measurement and control devices. Analog and digital transducers. Distance, velocity and acceleration sensors. Pressure measurement techniques. Differential pressure transmitter. Fluid flow measurement includes primary meters, secondary meters and special method. Measurement of temperature includes nonelectric methods, electric method and radiation method. Types of liquid level measurement, direct liquid level measurement, indirect liquid level measurement includes hydrostatic pressure methods, electrical methods and special methods. pH Sensor. Conventional controller.

01205373** Embedded Control Systems 3(3-0-6)

Prerequisite : 01205311

Introduction to embedded control systems. Programming language. Real-time operating systems. Interfaces between sensors, actuators, and embedded controllers. Applied control theory. Algorithms and implementations in embedded control systems.

01205374** Industrial Automation and Control 3(3-0-6)

Logical sensors and actuators. Relay and relay circuits. Timer and counter in relay circuits. Programmable logic controllers. Basic programmable logic controller instructions. Timer and counter programmable logic controller instructions. Control programmable logic controller instructions. Design techniques and programmable logic controller programming for industrial automation controls. Analog sensors and actuators. Introduction of Analog controls, programmable logic controller networks, human-machine interfaces.

01205375	Machine Vision in Robotics	3(3-0-6)
	Homogeneous transformation. Kinematics. Sensors related to machine vision. Homography. Image warping. Kinematic relationships between cameras and robots / objects / sensors. Machine vision programming.	
01205376	Introduction to 3D Design and Prototyping	3(3-0-6)
	Introduction to rapid prototype technologies. Concepts of material forming. CAD and CAM. 3D product design, 3D prototyping. Hardware and software of 3D rapid prototype machine.	
01205377	Artificial Intelligence in Robotics	3(3-0-6)
	Introduction to robot system. Sensor. Image Sound and Signal processing. Machine learning. Machine vision. Neural Networks Design and Training. Application of Artificial Intelligent in Industrial Robots and Service Robots.	
01205387**	Microprocessor Laboratory	1(0-3-2)
	Prerequisite : 01205311 or in the same semester Laboratory experiments on topics covered in Microprocessor.	
01205388**	Control and Measurement Laboratory	1(0-3-2)
	Prerequisite : 01205312 or in the same semester Laboratory for Electrical Measurements and Instruments, and Linear Control Systems.	
01205389**	Industrial Automation and Control Laboratory	1(0-3-2)
	Prerequisite : 01205374 or in the same semester Laboratory for Industrial Automation and Control.	
01205399	Internship	1
	Internship for Electrical Engineering in private enterprises, government agencies, government enterprises or academic places at least 240 hours and at least 30 workdays in order to get experiences from the assignment.	

** Revised

01205451** Energy Conservation and Management 3(3-0-6)

Fundamental of energy efficiency. Principle of energy efficiency in building and industry. Load management. Laws and regulations of energy conservation. Energy Management and analysis in building and industrial. Technical aspects to use energy efficiently in lighting system, heating ventilating and air-conditioning (HVAC) systems. Industrial motor. Cogeneration. Energy Conservations and management measures and economics analysis.

01205471** Introduction to Robotic Systems 3(3-0-6)

Design, analysis, control, and operation of robotic mechanisms. Use of homogeneous coordinates for kinematics and dynamics. Camera orientation. Sensors and actuators. Control. Task planning. Vision and intelligence.

01205478 Human Robot Interface 3(3-0-6)

Human-Robot Collaboration System is a multidisciplinary area concerned with the controller design, natural language understandings, human-robot interaction and mechatronics. This course is intended to study advanced topics in force control systems. The first part of the course will focus on force measurement and estimation, observer design and model-based development. The second portion of the course will focus on control of robot to interact with an unknown environments and human operators, driven by a number of real-world examples.

01205479 Internet of Things for Electrical Engineering 3(3-0-6)

Basic Data Communication, Computer Network, Short-Range Wireless Communication, Personal Area Network, and Cloud Computing. Internet of Things Architecture , Protocol and Reference Model, Application of Internet of Things in Electrical Engineering.

01205491 Electrical Engineering Project I 1(0-3-2)

Select and prepare interesting project in electrical engineering.

01205497 Seminar 1

Presentation and discussion on current interesting topics in electrical engineering at the bachelor's degree level.

01205498**	Special Problems	1-3
	Study and research in electrical engineering at the bachelor's degree levels and compiled into a written report.	
01205499**	Electrical Engineering Project II Prerequisite : 01205491	3(0-9-5)
	Continuing the same project as in electrical engineering project I.	
01204111	Computers and Programming	3(2-3-6)
	Basic structure of modern computer systems. Data representation in computer. Algorithmic problem solving. Program design and development methodology. Introductory programming using a high-level program language. Programming practice in computer laboratory.	
01208111	Engineering Drawing	3(2-3-6)
	Lettering techniques. Applied geometry drawing. Orthographic drawing. Pictorial drawing. Dimensioning and tolerancing. Sectional view drawing. Auxiliary views. Development. Sketching techniques. Detail and assembly drawing. Introduction to computer-aided drawing.	
01208221	Engineering Mechanics I Prerequisite : 01417167	3(3-0-6)
	Force analysis. Equilibrium. Application of equilibrium equation to frames and machines. Centroid. Theorem of Pappus. Beams. Shear and bending moment diagrams. Cable. Dry friction. Wedges, screws and belts. Virtual work. Stability of equilibrium. Area moment of inertia.	
01213211	Materials Science for Engineers	3(3-0-6)
	Relationships between structures, properties. Processes and performances of engineering materials. Phase equilibrium diagrams and their interpretation. Micro and macrostructures related to properties of engineering materials. Investigation of material structures. Material properties testing and analysis. Corrosion and degradation of materials. Production processes of engineering materials. Composite and construction materials.	

01403114	Laboratory in Fundamentals of General Chemistry Prerequisite : 01403117 or in the same semester Laboratory work for 01403117 Fundamentals of General Chemistry.	1(0-3-2)
01403117	Fundamentals of General Chemistry Atomic structure. Periodic table and periodic properties. Chemical bonds. Stoichiometry. Gases. Liquids. Solids. Solutions. Chemical kinetics. Chemical equilibrium. Acids and bases. Ionic equilibrium. Representative elements. Metals. Nonmetals and metalloids. Transition metals.	3(3-0-6)
01417167	Engineering Mathematics I Limits and continuity of functions. Derivatives and applications. Differentials. Integration and applications. Polar coordinates. Improper integrals. Sequences and series. Mathematical induction.	3(3-0-6)
01417168	Engineering Mathematics II Prerequisite : 01417167 Vectors and solid analytic geometry. Calculus of multivariable functions. Calculus of vector valued functions.	3(3-0-6)
01417267	Engineering Mathematics III Prerequisite : 01417168 First order linear differential equations. Linear differential equations with constant coefficients. Laplace transforms and inverse transforms. Power series solutions. System of linear differential equations.	3(3-0-6)
01420111	General Physics I Mechanics. Harmonic motion. Waves, Fluid mechanics. Thermodynamics.	3(3-0-6)
01420112	General Physics II Electromagnetism. Electromagnetic waves. Optics. Introduction to modern physics and nuclear physics.	3(3-0-6)
01420113	Laboratory in Physics I	1(0-3-2)

