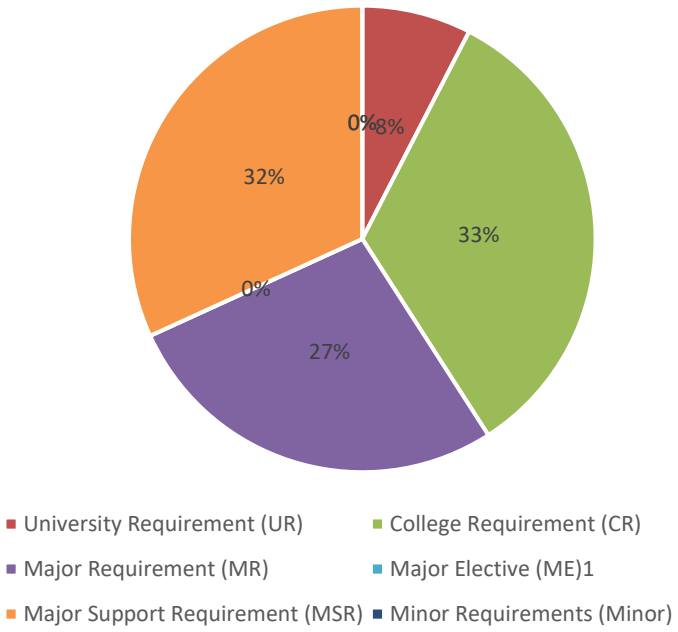
Diploma in Instrumentation and Control Engineering 2025

The Instrumentation and Control Engineering 2022/2025 Exit Diploma Program for Batch 2022 Onwards

Program Components



Course Type	CRD
University Requirement (UR)	05
College Requirement (CR)	19
Major Requirement (MR)	15
Major Elective (ME)[1]	------
Major Support Requirement (MSR)	21
Minor Requirements (Minor)	------
Total Credits (CRD)	60

Detailed Study Plan

Year 1 - Semester 1

Course Code	Course Title	Course Hours			Course Type	Prerequisite	Major GPA
		LEC	PRAC	CRD			
CHEMY 101	General Chemistry I	3	2	4	CR	------	NO
ITCS 110	Computer Programming for Engineers	3	2	4	MSR	------	NO
ENGL 101	Communication Skills I	3	0	3	CR	------	NO
MATHS 101	Calculus I	3	0	3	CR	------	NO
PHYCS 101	General Physics I	3	2	4	MSR	------	NO
Total		15	6	18			

Year 1 - Semester 2

Course Code	Course Title	Course Hours			Course Type	Pre requisite	Major GPA
		LEC	PRAC	CRD			
EENG 100	Circuit Theory I	2	2	3	MSR	MATHS 101	NO
ENGL 242	Report Writing and Presentation	3	0	3	CR	ENGL 101	NO
HRLC 107	Human Rights	2	0	2	UR	------	NO
ICENG 111	Introduction to Instrumentation and Control Engineering	2	2	3	MR	MATHS 101, PHYCS 101	YES
MATHS 102	Calculus II	3	0	3	CR	MATHS 101	NO
PHYCS 102	General Physics II	3	2	4	MSR	PHYCS 101	NO
Total		15	6	18			

Year 2 - Semester 3

Course Code	Course Title	Course Hours			Course Type	Pre requisite	Major GPA
		LEC	PRAC	CRD			
ARAB 110 HIST 122 ISLM 101	Arabic Language Skills Modern History of Bahrain and Citizenship Islamic Culture	3	0	3	UR	----------	NO

EENG 251	Digital Systems I	2	2	3	MSR	EENG 100	YES
EENG 261	Electronic Devices and Circuits	2	2	3	MSR	EENG 100	NO
MATHS 205	Differential Equations	3	0	3	CR	MATHS 102	NO
Total		10	04	12			

Year 2 - Semester 4

Course Code	Course Title	Course Hours			Course Type	Pre requisite	Major GPA
		LEC	PRAC	CRD			
ICENG 318	Microprocessors in Process Automation	3	2	3	MR	ITCS 110, EENG 251	YES
ICENG 208	Computer Applications for Instrumentation and Control Engineering	0	6	3	MR	MATHS 205 ITCS 110	YES
ICENG 324	Signal Conditioning and Electronic Instruments	2	2	3	MR	ICENG 220	YES
ICENG 220	Measurement Systems I	2	2	3	MR	ICENG 111, EENG 261, PHYCS 102	YES
Total		07	12	12			

Course Description

Description of Major Courses

Course Code: ICENG 111 **Course Title:** Introduction to Instrumentation and Control Engineering
Concept of control systems through daily life examples. Basic terminology and symbols in control systems. Benefits of control systems: social, economic, environmental, and safety impacts. Basic components of an Instrumentation and Control System. Physical systems classification: mechanical, chemical, electrical, biomedical, etc. Units and standards. Signals classification: analog and digital. Sensing element classification. Signal conditioning. Final control element types. Controller: electronic and digital. Examples of modern control-systems applications. Hierarchy of instrumentation and control system activities. Tasks and responsibilities of control and instrumentation engineers, and career opportunities.

Course Code: ICENG 203 **Course Title:** Computer Applications for Instrumentation and Control Engineering
Classification of engineering software. MATLAB: programming environment, array and matrix operations, graphing, variables and text string manipulation, files and I/O statements, control flow and looping, functions, script files, symbolic processing. Simulink and MATLAB M-files, S-function. Selected toolboxes. Instrumentation and control applications using available software. Tools: programming environment for calculation and simulation (e.g., MATLAB®/Simulink).

Course Code: ICENG 220 **Course Title:** Measurement Systems I
Importance of measurement in process control and monitoring. Components of a measurement system. Static and dynamic characteristics of measurement systems. Error analysis and data representation. Sensors: resistive, inductive and capacitive sensors. Resistance strain gauge, piezoelectric/piezoresistive sensors, and miscellaneous sensors. Calibration of measurement systems. Tools: spreadsheet software (e.g., Microsoft® Excel).

Course Code: ICENG 318 **Course Title:** Microprocessors in Process Automation

Introduction to microcontroller architecture: CPU, RAM, ROM and flash memory. Microcontroller programming (Assembly and C languages). Interrupts, analog to digital conversion, digital to analog conversion. Universal asynchronous receiver transmitter. Tools: programming environment for calculation and simulation (e.g., Assembly and C language).

Course Code: ICENG 324 **Course Title:** Signal Conditioning and Electronic Instruments
Signal conditioning elements and schemes: amplifiers, AC/DC bridges, grounding, shielding, current loop, opto-isolator, V/I, F/V converters, etc. Data acquisition and telemetry systems: multiplexing, telemetry signals, transmission modes, modulation, analog to digital and digital to analog converters. Electronic Instrument (e.g., voltmeter, ohmmeter, ammeter, power meter, frequency meter, etc.): principles of operation, applications, etc. Related laboratory experiments.

College Requirement Courses Descriptions

Description of Major Support Requirement Courses

Course Code: ITCS 110 **Course Title:** Computer Programming for Engineers

Introduction to computers, their uses, development, components, hardware, and software. Internal representation and numbering systems. Algorithmic problem-solving principles. Introduction to a modern programming language (e.g. C++). Input/Output, conditional statements, iteration, files, strings, functions, and arrays. Lab assignments to practice programming.

Course Code: EENG 100 **Course Title:** Circuit Theory I

Basic quantities of electricity: Charge, Current, Voltage, Power, Energy and Resistance. Basic laws of electricity: Ohm's Law, Kirchhoff's Laws (KVL & KCL). Apply circuit theorems: mesh, nodal, superposition, Thevenin's, Norton's, and maximum power transfer. Capacitors and inductors in DC circuits. Phasors & complex numbers for AC circuits. Sinusoidal steady-state analysis. Power in AC circuits: Complex, Apparent, Real & Reactive Powers and Power Factor.

Course Code: EENG 251 **Course Title:** Digital Systems I

Number systems; Basic logic gates; Boolean algebra; Simplification of logic functions: Karnaugh maps, QuineMcCluskey method, NAND and NOR gates networks; Multiple output networks; MSI combinational logic circuits: Multiplexers, Decoders, Adders, Comparators; Tri-State logic; combinational logic circuits design with programmable logic devices: memories, PLA, PAL; FlipFlops; Design and analysis of counters and registers.

Course Code: EENG 261 **Course Title:** Electronic Devices and Circuits

Semiconductor fundamentals: carrier transport and recombination, doped materials, physics and applications of pn junction diode, Zener diode characteristics and applications, special purpose diodes, fundamentals of BJTs and FETs, DC analysis of transistors circuits, Transistors as a switch, Transistor as an amplifier, small signal equivalent circuits, Biasing techniques, Basic single stage amplifiers.

Course Code: PHYCS 101 **Course Title:** General Physics I

Units and measurements; brief review of vectors; Newton's laws of motion; projectile motion; work and energy; impulse and momentum; rotational dynamics; equilibrium of a rigid body; periodic motion.

Course Code: PHYCS 102 **Course Title:** General Physics II

Electric charges and fields; Coulomb's and Gauss's laws; electric potential; capacitors and dielectrics; direct current circuits; Kirchoff's rules; magnetic field and flux; ampere's law; induced emf; Lenz's law; mutual and self inductance; AC circuits; RLC circuit.

College Requirement Courses Descriptions

Course Code: CHEMY 101 **Course Title:** General Chemistry I
Significant figures, chemical formulas and equations; mass relations, limiting reactions and theoretical yield; Physical behavior of gases; electronic structure, periodic table, covalent bonding; Lewis structures, Molecular structures, hybridization; molecular orbitals, solutions; colligative properties. Related practical work.

Course Code: ENGL 101 **Course Title:** Communication Skills I
This course focuses on reading skills and strategies and language development. The reading section concentrates on high-interest contemporary topics and encourages students to increase speed and efficiency. The writing component, integrated to the reading materials, reviews grammatical structures, develops language accuracy and introduces paragraph writing. Students are required to upgrade their grammar, reading, and listening skills on the internet.

Course Code: ENGL 242 **Course Title:** Report Writing and Presentation
This course offers theoretical and practical experience in technical report writing. It also introduces the steps involved in writing a report and in presenting its findings. The emphasis throughout is upon practical tasks and assignments, the most important of which is the production of a full-length formal report.

Course Code: MATHS 101 **Course Title:** Calculus I
Algebra. Functions and graphs. Trigonometry. Conic sections. Limits and continuity. Derivatives and integrals. Applications of derivatives which include mean value theorem, extrema of functions and optimization. Definite integrals and the Fundamental Theorem of Calculus.

Course Code: MATHS 102 **Course Title:** Calculus II
Applications of definite integrals, including areas, volumes and surface areas of solids of revolution, arc length and centroids. Transcendental functions, indeterminate form and L'Hopital's Rule. Techniques of integration and improper integrals. Infinite series, power series. Maclaurin and Taylor Theorem.

Course Code: MATHS 205 **Course Title:** Differential Equations
Differential equations of first order and their solution. Separable and exact equations. Equations convertible to separable type. Higher order linear equations with constant coefficients (homogeneous and non-homogeneous). Power series method for second order linear equations. Variation of parameters. Laplace transform technique. Applications of differential equations.

University Requirements Courses Descriptions

Course Code: ARAB 110 **Course Title:** Arabic Language Skills
This course focuses on basic Arabic skills including form, function, and meaning. It also helps the student to appreciate and understand structures and approach them from a critical point of view, through various genres in literature.

Course Code: HIST 122 **Course Title:** Modern History of Bahrain and Citizenship
Spatial identity of Bahrain: Brief history of Bahrain until the 18th century; the historical roots of the formation of the national identity of Bahrain since the 18th century; the modern state and evolution of constitutional life in Bahrain; the Arabic and Islamic dimensions of the identity of Bahrain; the core values of Bahrain's society and citizenship rights (legal, political, civil and economic); duties; responsibilities and community participation; economic change and development in Bahrain; Bahrain's Gulf, Arab and international relations.

Course Code: HRLC 107 **Course Title:** Human Rights
This course deals with the principles of human rights in terms of the definition of human rights, scope, sources with a focus on the International Bill of Human Rights; The Charter of the United Nations; Universal Declaration of Human Rights; The International Covenant on Economics, Social and Culture rights; Convention against Torture and other Cruel, Inhuman or Degrading Treatment or Punishment; Mechanics and the Constitutional Protection of Rights and Public Freedoms in Kingdom of Bahrain.

Course Code: ISLM 101 **Course Title:** Islamic Culture
An introduction to the general outline and principles of Islamic culture, its general characteristics, its relationships with other cultures, general principles of Islam in beliefs, worship, legislation and ethics.