Form: Study Plan- Bachelors	Form Number	EXC-01-03-02A
	Issue Number and Date	2963/2022/24/3/2 5/12/2022
	Number and Date of Revision or Modification	2/(10/12/2023)
	Deans Council Approval Decision Number	50/2023
	The Date of the Deans Council Approval Decision	26/12/2023
	Number of Pages	08

1.	School	Engineering
2.	Department	Mechatronics
3.	Program title (Arabic)	بكالوريوس في هندسة الميكاترونكس
4.	Program title (English)	B.Sc. in Mechatronics Engineering

5. Components of Curriculum:

The curriculum for the bachelor's degree in Mechatronics Engineering consists of (165) credit hours distributed as follows

Number	Type of requirement	credit hours
First	University Requirements	27
Second	Faculty Requirements	26
Third	Department Requirements	112
Total		165

6. Numbering System:

A- Department number

Number	Department
1	Civil Engineering
2	Architectural Engineering
3	Electrical Engineering
4	Mechanical Engineering
5	Chemical Engineering
6	Industrial Engineering
7	Computer Engineering
8	Mechatronics Engineering

B- Course number

Domain number	Domain title
0	General Topics
1	Mathematics and Numerical Analysis
2	Electrical Engineering
3	Programming and computer Engineering
4	Mechanical Engineering
5	Special Topics in Mechatronics
6	Industrial Engineering
7	Mechatronics Engineering
8	Modeling and Control
9	Graduation Project

C- Course number consists of 7 digits

School		Department		Level	Domain (Specialty)	Serial
0	**9**	**0**	**8**			

Study Plan- Bachelors

First: University Requirements 27 Credit Hours:

Preparation Program Requirements				
All students admitted to the university must apply for a degree examination in Arabic, English, and computer, which is prepared or approved by the university to determine their level. Based on the results of the examinations, the student will study either one or more of the requirements of the preparatory program. (0 - 15 Credit Hours)				
No.	Course Title	Course No.	Credit Hours	Prerequisites	Notes
1	Basics of Arabic	3201099	3	3201099	Pass/Fail
2	Arabic Languages Skills	3201100	3	3201100	Pass/Fail
3	Basics of English	3202099	3	3202099	Pass/Fail
4	English Language Skills	3202100	3	3202100	Pass/Fail
5	Basics of Computing	1932099	3	1932099	Pass/Fail

Compulsory Requirements (18 Credit Hours)					
No.	Course Title	Course No.	Credit Hours	Prerequisites	Notes
1	Military Science	2220100	3		
2	National Culture	3400100	3		
3	Learning & Research Skills	3400101	3	3202099 3201099 1932099	
4	Communication Skills	3400102	3	3400101	
5	Introduction to Philosophy and Critical Thinking	3400103	3	3400101	
6	Human Civilization	3400104	3		
7	Campus Life and Ethics	3400105	(Zero credit; one-hour weekly meeting)		

Study Plan- Bachelors

			Electives			
			(9 Credit Hours)			
Elective courses: (9) credit hours to be chosen from the first, second and third groups mentioned below. The student has to choose one course from each of the groups.					

Electives

(9 Credit Hours)

Elective courses: (9) credit hours to be chosen from the first, second and third groups mentioned below. The student has to choose one course from each of the groups.

(First Group)

No.	Course Title	Course No.	Credit Hours	Prerequisites	Notes
1	Great Books	3400107	3		
2	Islam and Current Issues	0400101	3		
3	Arab-Islamic Civilization	2300101	3		
4	Jordan: History and Civilization	2300102	3		
5	Jerusalem	3400108	3		

(Second Group)

No.	Course Title	Course No.	Credit Hours	Prerequisites	Notes
1	Legal Culture	1000102	3		
2	Environmental Culture	0300102	3		
3	Physical Fitness Culture	1100100	3		
4	Islamic Culture	0400102	3		
5	Health Culture	0720100	3		

(Third Group)

No.	Course Title	Course No.	Credit Hours	Prerequisites	Notes
1	Entrepreneurship & Creativity	3400109	3		
2	Foreign Language	2200103	3		
3	Electronic Commerce	1600100	3		
4	Social Media	1900101	3		
5	Appreciation of Arts	2000100	3		
6	Special Subject	3400106	3		
7	Administrative skills	1601105	3		

Study Plan- Bachelors

Second: School courses: distributed as follows:

    A. Obligatory school courses: (26) credit hours

    B. Elective school courses: (Zero) credit hours

    A. Obligatory school courses: (26) credit hours:

Course No.	Course Title	Contact Hours		Credit Hours	Pre-Requisite
		Theoretical	Practical		
0301101	Calculus (1)	3	-	3	-
0301102	Calculus (2)	3	-	3	0301101
0301201	Calculus (3)	3	-	3	0301102
0302101	General Physics (1)	3	-	3	-
0302111	Practical Physics (1)	-	3	1	0302101 or co-requisite
0302102	General Physics (2)	3	-	3	0302101
0302112	Practical Physics (2)	-	3	1	0302102 or co-requisite
0921420	Engineering Economy	2	-	2	90 Cr. Hours
0904131	Engineering Drawing	2	2 Drawing 2 Computer	3	-
0906111	Engineering Workshops	-	3	1	-
0907101	Computer Skills for Engineers	3	-	3	1932099

    B. Elective school courses: (Zero) credit hours

Third: Specialty courses: (112) credit hours distributed as follows:

    A. Obligatory specialty courses: (103) credit hours

    B. Elective specialty courses: (9) credit hours

    A. Obligatory specialty courses: (103) credit hours:

Course Number	Course Title	Contact Hours		Credit Hours	Pre-Requisite
		Theoretical	Practical		
0301202	Engineering Mathematics-I	3	-	3	0301201
0301241	Linear Algebra -1	3	-	3	0301101
0303101	General Chemistry (1)	3	-	3	-
0903211	Electrical Circuits (1)	3	-	3	0302102
0903212	Electrical Circuits (2)	3	-	3	0903211
0908241	Statics and Strength of Materials	3	-	3	0302101

Course Number	Course Title	Contact Hours		Credit Hours	Pre-Requisite
		Theoretical	Practical		
0904222	Dynamics	3	-	3	0908241
0904233	Machine Drawing	-	3	1	0904131
0904331	Mechanics of Machinery	3	-	3	0904222
0908211	Statistics and Probability	2	-	2	0301102
0907231	Digital Logic	3	-	3	0907101
0907342	Object-Oriented Problem Solving	2	1	3	0907101
0918101	Mechatronics Engineering Skills and Ethics	1	0	1	-
0908232	Computer Skills for Mechatronics	-	3	1	0907101
0908243	Engineering Materials and Manufacturing Technology	3	-	3	0303101 + 0918101 + 0906111
0908310	Engineering Numerical Methods	3	-	3	0301241+ 0301202
0908320	Electronics	3	-	3	0903211
0908322	Electronics Lab for Mechatronics	-	3	1	0908320 or co-requisite + 0908232
0908325	Power Systems and Electrical Machines	3	-	3	0903212
0908326	Electrical Actuators Lab	-	3	1	0908325
0908333	Industrial Communications Systems & Networks	3	-	3	0907231
0908344	Thermal Sciences for Mechatronics	3	-	3	0904222
0908371	Engineering Measurements and Signal Processing	3	-	3	0908320+0908381
0908381	System Modelling and Vibrations	3	-	3	0301202 + 0903211 + 0904222
0908382	Control Systems	3	-	3	0908381
0908425	Power Electronics and Drive	3	-	3	0908326 + 0908320
0908426	Power Electronics and Drive Lab	-	3	1	0908425 or co-requisite
0908434	Microprocessors and Microcontrollers Applications	3	-	3	0907342 + 0908333
0908435	Microprocessors and Microcontrollers Applications Lab	-	3	1	0908322 + 0908434 or co-requisite
0908446	Design and Control of Hydraulic and Pneumatic systems	3	-	3	0908344
0908447	Hydraulic and Pneumatic systems Lab	-	3	1	0908446 or co-requisite

Course Number	Course Title	Contact Hours		Credit Hours	Pre-Requisite
		Theoretical	Practical		
0908472	Transducers and Sensors	2	-	2	0908371
0908473	Transducers and Sensors Lab	-	3	1	0908472 or co-requisite
0908474	Robotic Systems	3	-	3	0908310 + 0904233+0904331
0908483	Digital Signals and System Analysis	3	-	3	0908382+0908371
0908484	Control Systems Lab	-	3	1	0908483 or co-requisite
0908485	Artificial Intelligence	3	-	3	908483
0908536	Industrial Automation	2	-	2	0908434 + 0908446
0908538	Automation and Industrial Process Control Lab	-	3	1	0908536 or co-requisite
0908576	Mechatronics Systems Design	2	-	2	0908434 +0908472 + 0908483
0908577	Mechatronics Systems Design Lab	-	3	1	0908435 + 0908484 + 0908576 co-requisite
0958500	Employability Readiness and Field Training	-	-	5	Student must pass 120 Cr. Hr
0908598	Project (1)*	-	-	1	0958500
0908599	Project (2)*	-	-	2	0908598

* Project duration for Project (1) and Project (2) is two regular semesters. Project mark is registered once at the end of project 2. Students are allowed to register in project 1 after completion of 120 credit hours.

B. Elective specialty courses: (9) credit hours:

Course Number	Course Title	Contact Hours		Credit Hours	Pre-Requisite
		Theoretical	Practical		
0934445	Air Conditioning (1)	3	-	3	0908344
0904554	Solar Energy	3	-	3	0908344
0907520	Information Security and Networks	3	-	3	0908333
0917521	Internet of Things	3	-	3	0908333+0908434
0908444	Design of Machine Elements	3	-	3	0904331
0908445	Autotronics	3	-	3	0908344
0908527	Advanced Power Electronics and Drive Systems	3	-	3	0908425
0908552	Mobile Robots	3	-	3	0908474
0908586	Industrial Process Control	3	-	3	0908483
0908587	Modern Control	3	-	3	0908483
0908559	Special Topics In Mechatronics Engineering	3	-	3	0958500

Fourth: Courses offered by other faculties and departments

A. Courses offered by other faculties departments

Course No.	Course Title	Contact Hours		Credit Hours	Pre-Requisite
		Theoretical	Practical		
0301101	Calculus (1)	3	-	3	-
0301102	Calculus (2)	3	-	3	0301101
0301201	Calculus (3)	3	-	3	0301102
0302101	General Physics (1)	3	-	3	-
0302111	Practical Physics (1)	-	3	1	0302101 or co-requisite
0302102	General Physics (2)	3	-	3	0302101
0302112	Practical Physics (2)	-	3	1	0302102 or co-requisite
0301202	Engineering Mathematics-I	3	-	3	0301201
0303101	General Chemistry (1)	3	-	3	-
0301241	Linear Algebra -1	3	-	3	0301101

Study Plan- Bachelors

B. Courses offered by other departments in School of Engineering

Course Number	Course Title	Contact Hours		Credit Hours	Pre-Requisite
		Theoretical	Practical		
0921420	Engineering Economy	2	-	2	90 Cr. Hours
0903211	Electrical Circuits (1)	3	-	3	0302102
0903212	Electrical Circuits (2)	3	-	3	0903211
0904131	Engineering Drawing	2	2 Drawing 2 Computer	3	-
0904222	Dynamics	3	-	3	0908240
0904233	Machine Drawing	-	3	1	0904131
0904331	Mechanics of Machinery	3	-	3	0904222
0934445	Air Conditioning (1)	3	-	3	0908344
0904554	Solar Energy	3	-	3	0908344
0906111	Engineering Workshops	-	3	1	-
0907101	Computer Skills for Engineers	3	-	3	1932099
0907231	Digital Logic	3	-	3	0907101
0907342	Object-Oriented Problem Solving	3	-	3	0907101
0907520	Information Security and Networks	3	-	3	0908333
0917521	Internet of Things	3	-	3	0908333+0908434

Fifth: Advisory Study Plan

First Year

First Semester			Second Semester		
Course Number	Course Title	Credit Hours	Course Number	Course Title	Credit Hours
0301101	Calculus (1)	3	0301102	Calculus (2)	3
0302101	General Physics (1)	3	0301131	General Physics (2)	3
0302111	Practical Physics (1)	1	0302102	Practical Physics (2)	1
0303101	General Chemistry (1)	3	0904131	Engineering Drawing	3
0918101	Mechatronics Engineering Skills and Ethics	1	0907101	Computer Skills for Engineers	3
	University Requirement	3	0906111	Engineering Workshops	1
				University Requirement	3
Total		**15**	**Total**		**17**

Second Year

First Semester			Second Semester		
Course Number	Course Title	Credit Hours	Course Number	Course Title	Credit Hours
0301201	Calculus (3)	3	0301241	Linear Algebra -1	3
0907231	Digital Logic	3	0903212	Electrical Circuits (2)	3
0908232	Computer Skills for Mechatronics	1	0301202	Engineering Mathematics-I	3
0903211	Electrical Circuits (1)	3	0908211	Statistics and Probability	2
0908241	Statics and Strength of Materials	3	0904222	Dynamics	3
0904233	Machine Drawing	1	0908243	Engineering Materials and Manufacturing Technology	3
	University Requirement	3			
Total		**17**	**Total**		**17**

Study Plan- Bachelors

Third Year

<table>
<tr><th colspan="3">First Semester</th><th colspan="3">Second Semester</th></tr>
<tr><th>Course Number</th><th>Course Title</th><th>Credit Hours</th><th>Course Number</th><th>Course Title</th><th>Credit Hours</th></tr>
<tr><td>0904331</td><td>Mechanics of Machinery</td><td>3</td><td>0908310</td><td>Engineering Numerical Methods</td><td>3</td></tr>
<tr><td>0907342</td><td>Object-Oriented Problem Solving</td><td>3</td><td>0908326</td><td>Electrical Actuators Lab</td><td>1</td></tr>
<tr><td>0908320</td><td>Electronics</td><td>3</td><td>0908333</td><td>Industrial Communication Systems & Networks</td><td>3</td></tr>
<tr><td>0908322</td><td>Electronics Lab for Mechatronics</td><td>1</td><td>0908344</td><td>Thermal Sciences for Mechatronics</td><td>3</td></tr>
<tr><td>0908325</td><td>Power Systems and Electrical Machines</td><td>3</td><td>0908371</td><td>Engineering Measurements and Signal Processing</td><td>3</td></tr>
<tr><td>0908381</td><td>System Modeling and Vibrations</td><td>3</td><td>0908382</td><td>Control Systems</td><td>3</td></tr>
<tr><td colspan="2">Total</td><td>16</td><td colspan="2">Total</td><td>16</td></tr>
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Fourth Year

<table>
<tr><th colspan="3">First Semester</th><th colspan="3">Second Semester</th></tr>
<tr><th>Course Number</th><th>Course Title</th><th>Credit Hours</th><th>Course Number</th><th>Course Title</th><th>Credit Hours</th></tr>
<tr><td>0921420</td><td>Engineering Economy</td><td>2</td><td>0908426</td><td>Power Electronics and Drive Lab</td><td>1</td></tr>
<tr><td>0908425</td><td>Power Electronics and Drive</td><td>3</td><td>0908446</td><td>Design and Control of Hydraulic and Pneumatic systems</td><td>3</td></tr>
<tr><td>0908434</td><td>Microprocessors and Microcontrollers Applications</td><td>3</td><td>0908447</td><td>Hydraulic and Pneumatic systems Lab</td><td>1</td></tr>
<tr><td>0908435</td><td>Microprocessors and Microcontrollers Applications Lab</td><td>1</td><td>0908474</td><td>Robotic Systems</td><td>3</td></tr>
<tr><td>0908472</td><td>Transducers and Sensors</td><td>2</td><td>0908485</td><td>Artificial Intelligence</td><td>3</td></tr>
<tr><td>0908473</td><td>Transducers and Sensors Lab</td><td>1</td><td></td><td>Elective Requirement / Department</td><td>3</td></tr>
<tr><td>0908483</td><td>Digital Signals and System Analysis</td><td>3</td><td></td><td>University Requirement</td><td>3</td></tr>
<tr><td>0908484</td><td>Control Systems Lab</td><td>1</td><td></td><td></td><td></td></tr>
<tr><td colspan="2">Total</td><td>17</td><td colspan="2">Total</td><td>17</td></tr>
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Fifth Year

First Semester			Second Semester		
Course Number	**Course Title**	**Credit Hours**	**Course Number**	**Course Title**	**Credit Hours**
0908536	Industrial Automation	2		University Requirement	3
0908538	Automation and Industrial Process Control Lab	1		University Requirement	3
0908576	Mechatronics Systems Design	2		University Requirement	3
0908577	Mechatronics Systems Design Lab	1		Elective Requirement / Department	3
0908598	Project (1)	1	0908599	Project (2)	2
	University Requirement	3			
	Elective Requirement / Department	3			
	University Requirement	3			
Total		**16**	**Total**		**14**

Study Plan- Bachelors

0301101   **Calculus (1)**   **(3 Credit Hours)**
Prerequisite: (None)
Functions: domain, operations on functions, graphs of functions; trigonometric functions; limits: meaning of a limit; computational techniques, limits at infinity, infinite limits; continuity; limits and continuity of trigonometric functions; the derivative: techniques of differentiation, derivatives of trigonometric functions; the chain rules; implicit differentiation; differentials; Roll's Theorem; the mean value theorem; the extended mean value theorem; L'Hopital's rule; increasing and decreasing functions; concavity; maximum and minimum values of a function; graphs of functions including rational functions (asymptotes) and functions with vertical tangents (cusps); antiderivatives; the indefinite integral; the definite integral; the fundamental theorem of calculus; the area under a curve; the area between two curves; transcendental functions: inverse functions, logarithmic and exponential functions; derivatives and integrals; limits (the indeterminate forms); hyperbolic functions and their inverses; inverse trigonometric functions.

0301102   **Calculus (2)**   **(3 Credit Hours)**
Prerequisite: 0301101
Techniques of integration: integration by substitution; integration by parts, integrating powers of trigonometric functions, trigonometric substitutions, integrating rational functions, partial fractions, rationalization, miscellaneous substitution; improper integrals; application of definite integral: volumes, length of a plane curve, area of a surface of revolution polar coordinates and parametric equations: polar coordinates, graphs in polar coordinates, area in polar coordinates; infinite series: sequences, infinite series, convergence tests, absolute convergence, conditional convergence; alternating series; power series: Taylor and Maclurin series, differentiation and integration of power series.

0301201   **Calculus (3)**   **(3 Credit Hours)**
Prerequisite: 0301102
Three-dimensional space and vectors rectangular coordinates in 3-space; spheres, cylindrical surfaces; quadric surfaces; vectors: dot product, projections, cross product, parametric equations of lines. Planes in 3-spaces; vector-valued functions: calculus of vector valued functions, change of parameters, arc length, unit tangent and normal vectors, curvature, functions of two or more variable: domain, limits, and continuity; partial derivatives; differentiability; total differentials; the chain rule; the gradient; directional derivatives; tangent planes; normal lines; maxima and minima of functions of two variables; Lagrange multipliers; multiple integrals: double integral, double integrals in polar coordinates; triple integrals; triple integrals in cylindrical and spherical coordinates; change of variables in multiple integrals; Jacobian.

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0302101   **General Physics (1)**   **(3 Credit Hours)**
   Prerequisite: None
   Motion in one dimension; motion in two dimensions; the laws of motion; circular motion; conservation of energy; linear momentum and collisions; rotation of a rigid object about a fixed axis; angular momentum; static equilibrium; universal gravitation; fluid mechanics; oscillatory motion.

0302111   **Practical Physics (1)**   **(1 Credit Hour)**
   Prerequisite: 0302101 or co-requisite
   11 experiments each of 3 hrs/week duration: collection and analysis of data; measurements and uncertainties; vectors: force table; kinematics of rectilinear motion; force and motion; collision in two dimensions; rotational motion; simple harmonic motion: simple pendulum; gas's Laws; ballistic pendulum; specific heat capacity of metals.

0302102   **General Physics (2)**   **(3 Credit Hours)**
   Prerequisite: 0302101
   Electric field; Gauss's law; electric potential; capacitance and dielectrics, current and resistance; direct current circuits; magnetic field; sources of the magnetic field; Faraday's law, inductance; alternating current circuits; the nature of light and the principles of ray optics; image formation.

0302112   **Practical Physics (2)**   **(1 Credit Hour)**
   Prerequisite: 0302102 or co-requisite
   12 experiments each of 3 hrs/week duration: electric field mapping; specific charge of copper ions; power transfer; potentiometer; capacitors: RC time constant; Kirchoff's laws; magnetic field of a current; lenses; Young's double slit experiments; electromagnetic induction; Ohm's law; Wheatstone bridge.

0921420   **Engineering Economy**   **(2 Credit Hours)**
   Prerequisite: (Passing 90 Cr. Hrs.)
   Major elements of feasibility studies. Principles of engineering economy. Equivalence and compound interest formulas. Single payment model. Uniform payment model. Gradient payment model. Exponential payment model. Decision criteria for single and multiple alternatives: present worth, annual worth, future worth, internal rate of return, benefit cost ratio and payback methods. Income-tax effect on decision making.

0904131   **Engineering Drawing**   **(3 Credit Hours)**
   Prerequisite: None
   Drawing equipment and use of instruments. Lettering, Geometric construction, Sketching and shape description. Basic descriptive geometry, Developments and intersections. Axonometric, oblique and perspective drawings, Multiview projection, Principal views, Conventional practice, and sectional views. Auxiliary views. Dimensioning techniques. Parallel: Introduction to computer drawing, drawing aids, Geometrical construction, and the appropriate commands of text, editing, plotting, sections, layers, pictorial views, and dimensioning. Auxiliary views.

0906111 Engineering Workshops (1 Credit Hour)
Prerequisite: None
General safety, materials and their classifications, measuring devices and their accuracy, fits and tolerances, theoretical background for the practical exercises including fitting, forging, carpentry, casting, welding, mechanical saws, shearers, drills, lathes, milling machines, shapers and grinders.

0907101 Computer Skills for Engineers (3 Credit Hours)
Prerequisite: 1932099
fundamental concepts of programming using one high level programming language like C++, Java, or Python. basic structures of the programming language such as variables; data types; control structures; arrays; functions; and introduction to records (struct) and object-oriented programming (classes and objects). practical programming skills.

0301202 Engineering Mathematics-I (3 Credit Hours)
Prerequisite: 0301201
Ordinary differential equations, linear differential equations of second and higher order, systems of differential equations, phase plane, stability, series solutions of differential equations, orthogonal functions, Laplace transforms, linear systems of equations, matrices and determinants.

0301241 Linear Algebra -1 (3 Credit Hours)
Prerequisite: 0301101
Systems of linear equations; matrices and matrix operations; homogeneous and nonhomogeneous systems; Gaussian elimination; elementary matrices and a method for finding; determinants; Euclidean vector spaces; linear transformations from to and their properties; general vector spaces; subspaces; basis; dimension; row space; column space; null space of a matrix; rank and nullity; inner product spaces; eigenvalues and diagonalization; linear transformations.

0303101 General Chemistry (1) (3 Credit Hours)
Prerequisite: None
Measurements and significant figures, chemical reactions; stoichiometry; the gaseous state; thermochemistry; electronic structure and periodicity; chemical bonding; molecular shapes; states of matter and intermolecular forces.

0903211 Electrical Circuits (1) (3 Credit Hours)
Prerequisite: 0302102
Units, definitions, and simple circuits. Circuit analysis techniques. Inductance and capacitance. Source-free RL and RC circuits. The application of unit-step forcing functions. The RLC circuits. The sinusoidal forcing functions. The phasor concepts. The phasor relationships for R, L, and C. Impedance/admittance. The sinusoidal steady state response. Circuit analysis using MATLAB and SPICE.

0903212 Electrical Circuits (2) (3 Credit Hours)
Prerequisite: 0903211
Average power and rms values. Polyphase circuits. Three phase Y- and Delta- connectic Complex frequency. The damped sinusoidal forcing function. Frequency response. Parallel and series resonance. Magnetically coupled circuits. General two port networks Impedance, admittance, hybrid and transmission parameters. Principles of basic filterin Basic passive and active filters.

0908241   Statics and Strength of Materials   (3 Credit Hour)

Prerequisite: 0302101

Force vectors, force system and resultants, equilibrium, structural analysis, geometric properties and distributed Loadings, internal Loadings, stress and strain, mechanical properties of materials, axial load, torsion, bending, transverse shear, combined loadings, stress and strain transformations, design of beams, buckling of Columns.

0904222   Dynamics   (3 Credit Hours)
Prerequisite: 0908241

Kinematics of particles; Rectilinear and curvilinear motion in various coordinate systems. Kinetics of particles; Newton's second law, Central force motion, Work-energy equation, Principle of impulse and momentum, Impact, Conservation of energy and momentum, Application to a system of particles. Kinematics of rigid bodies; Relative velocity and acceleration, Instantaneous centre, Analysis in terms of a parameter. Plane kinetics of rigid bodies with application of Newton's second law, Energy and impulse-momentum.

0904233   Machine Drawing   (1 Credit Hours)
Prerequisite: 0904131

Prerequisite: Mechanical engineering drawing conventions and abbreviations, various systems of size description, including precision dimensioning, fastening elements, standard organization and preparation of engineering drawings, assembly and detailed drawings, design applications.

0904331   Mechanics of Machinery   (3 Credit Hours)
Prerequisite: 0904222

Mechanisms and applications, mobility and linkages. Cams, gears and gear trains. Velocity and acceleration analysis in mechanisms. Inertia forces. Principles of balance in rotating & reciprocating masses.

0908211   Statistics and Probability   (2 Credit Hours)
Prerequisite: 0301102

Basic concepts of statistics, data analysis, visualization, confidence intervals, regression, as well as descriptive and inferential statistics. Fundamentals of probability, random variables, probability distributions, conditional distributions, and expected value. Other topics covered include Availability, Reliability, and Maintainability.

0907231   Digital Logic   (3 Credit Hours)
Prerequisite: None

Number Systems and digital waveforms. Basic gates and logic functions. Boolean algebra, Boolean expressions. Logic minimization techniques. VHDL basics. Design, simulation and synthesis tools for programmable logic devices. Combinational logic building blocks including decoders, encoders, multiplexers, demultiplexers, magnitude comparators. VHDL for combinational circuits. Digital arithmetic, adders, subtractors. VHDL for arithmetic circuits. Basics of sequential circuits. Basic latches and flip-flops. Timing parameters and diagrams. Counters, shift registers. Basic PLDs, CPLDs and FPGAs architectures. VHDL for binary counters and shift registers. State machines. System design with state machines using VHDL. Memory devices and systems including RAM, ROM, FIFO, LIFO and dynamic RAM.

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0907342   Object-Oriented Problem Solving   (3 Credit Hours)
Prerequisite: (0907101)
object-oriented programming concepts, classes, objects, properties, indexers, attribute encapsulation, data abstraction, inheritance, polymorphism, generalization, specialization, exception handling, aggregation, and associations. laboratory experiments for hands-on experience. project for solving engineering problem.

0918101   Mechatronics Engineering Skills and Ethics   (1 Credit Hour)
Prerequisite: None
history of engineering, Mechatronics engineering evolution and relationship with other disciplines. planning and management, types of engineering, engineering design, engineering ethics such as codes of ethics and honour, responsibilities to employers and society. The proper use of engineering tools including computers and computer simulations, as well as tools for inventive problem solving, creative and critical thinking including mind mapping, teamwork skills, an introduction to project management. technical writing such as structure of technical reports, writing process, writing style, grammar, punctuation, and usage. Requirements of effective presentations.

0908232   Computer Skills for Mechatronics   (1 Credit Hour)
Prerequisite: (0907101)
Computer packages for mathematical and symbolic manipulation; graphics and user interface; data processing and analysis. Both MATLAB and LABVIEW are used as software packages for teaching students programming concepts, techniques, features and functions. Plotting (two dimensional and three dimensional); Inputs and outputs, test and measurements, data acquisition, instruments control and data logging. user interfaces, program structure and implementation details.

0908243   Engineering Materials and Manufacturing Technology   (3 Credit Hour)
Prerequisite: (0303101 + 0918101 + 0906111)
Fundamental of mechanical behaviour of material, Structure and manufacturing properties of Metal-Phase diagrams and heat treatment, casting processes, Bulk deformation processes: forging, drawing, rolling, and extrusion. Sheet metal forming processes: blanking, piercing. Metal removal processes: Turning, drilling, milling, shaping, broaching.

0908310   Engineering Numerical Methods   (3 Credit Hours)
Prerequisite: (0301241 + 0301202)
Mathematical preliminaries, classifications and motivation of numerical algorithms, numerical errors (round-off and truncation), significant figures, condition number, error propagation, integer and floating-point representation. Root finding techniques for single and multidimensional nonlinear equations, Numerical solutions of systems of linear equations (direct and iterative methods). Curve fitting (regression, polynomial Interpolation, spline Interpolation, and linearization). Numerical differentiation and integration. Numerical solution of ordinary differential equations. Eigen value problems.

0908320   Electronics   (3 Credit Hours)
Prerequisite: (0903211)
Solid-state theory, semiconductors, PN junctions; basic diode circuits. Basic power supplies; Half wave and full-wave basic rectifier circuits; Filters; Regulator. Zener diodes and basic Zener circuit. Clippers and Clambers circuits. Other types of diodes; LEDs, Photodiodes, Solar cell, Schottky diode. Basic Bipolar Junction Transistor

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(BJT), types of BJTs, BJT biasing; Single stage and multistage amplifiers. Basic Metal Oxide Field Effect Transistor (MOSFET), types of MOSFETs, MOSFETs biasing; Single stage and multistage amplifiers. Frequency response of the amplifiers.

0908322   Electronics Lab for Mechatronics   (1 Credit Hour)
Prerequisite: (0908232 + 0908320 or co-requisite))
DC circuits. KVL. Network theorems. RC circuit DC and AC; Transient analysis RC; Power and P.F. Diode characteristics and Diode applications; Rectifiers; clipping circuit; clambers. Zener Diode and voltage regulators. BJT characteristics. BJT biasing and large-signal amplification. BJT as an amplifier. MOSFET characteristics. MOSFET biasing. MOSFET as an amplifier. Cascaded amplifiers. Frequency response of amplifiers

0908325   Power Systems and Electrical Machines   (3 Credit Hours)
Prerequisite: (0903212)
Introduction to sources of electrical energy and power system: Basic concepts; Per unit quantities; Per unit calculations applied to power systems. Magnetic circuits; single-phase and three-phase transformers: Principles, analysis, performance characteristics and testing; electromechanical energy conversion; principles and classification of DC generators; DC motors: analysis, performance characteristics, starting,   testing   and speed   control;   synchronous   motors: analysis, performance characteristics, applications, starting, and testing; three-phase induction motors: analysis, performance characteristics, testing, starting and speed control;   single-phase induction motors; special types of motors: stepper motors, universal motors, reluctance motors, brushless DC motors.

0908326   Electrical Actuators Lab   (1 Credit Hours)
Prerequisite: (0908325)
Transformer characteristics. Testing and operational characteristics of DC motors. Testing and operational characteristics of alternators.   Testing and operational characteristics of induction motors.

0908333   Industrial Communications Systems & Networks   (3 Credit Hours)
Prerequisite: (0907231)
Data Communication basics (sampling and quantization, coding, modulation...), OSI reference model. The standards and techniques needed to design and maintain a communications system in an industrial environment. Introduction to Industrial Communication Protocols, Industrial Network Architectures, Fieldbuses (Modbus, Fieldbus, OPC communications...). Design of Supervisory Control And Data Acquisition (SCADA) applications. New Trends in Industrial communication and networks..

0908344   Thermal Sciences for Mechatronics   (3 Credit Hours)
Prerequisite: (0904222)
Introduction to fluid power systems. Basics of hydraulics systems including basic theory, energy, power, losses, and flow types. Theory and applications of engineering thermodynamics and heat transfer fluid mechanics. Basic principles of fluid mechanics. Fluid statics. Conservation laws. Energy equations. Flow in pipes. Fundamental concepts of thermal sciences such as temperature, pressure, internal energy, work, heat, enthalpy, properties of a pure substance. Applied thermal sciences, first and second laws of thermodynamics, internal and external combustion heat engine cycles, heat pump cycles, mixtures, fuels and combustion, and their associated engineering components and subsystems. Heat transfer and its essential mechanisms by conduction, convection, and radiation.

0908371   **Engineering Measurements and Signal Processing**   **(3 Credit Hours)**
Prerequisite: (0908320 + 0908381)
Introduction to process-control concepts and the elements of a process-control system. Block diagram of a simple process-control loop and its elements. analogue and digital control systems. Overview of metrology and measurement. Errors & error analysis; Uncertainty analysis; Statistical methods. Mechanical and Electrical Engineering units. Instrumentation: Characteristics (statics and dynamics); Operational modes; Measurement accuracy; Measurement standards. Analog signal conditioning methods used in process-control systems; Passive methods and active methods; Operational amplifiers; Filters. Basic principles of digital signal processing: Digital-to-analogy converters (DAC); Analog-to-digital converters (ADC); Characteristics of digital data.

0908381   **System Modeling and Vibration**   **(3 Credit Hour)**
Prerequisite: (0301202 + 0903211 + 0904222)
Introduction to system dynamics, nonlinearities and linearization, Laplace transform, solution of linear differential equations using Laplace transform, transfer function of linear systems, dominant poles, block diagram and signal-flow graph, state diagrams, state-space representation of linear systems, time response analysis of first-order and second-order, mathematical modelling of electrical networks, translational mechanical systems, and electromechanical systems, undamped one-degree-of-freedom vibration of a rigid body using the equation of motion and energy methods, analysis of undamped forced vibration and viscous damped forced vibration.

0908382   **Control Systems**   **(3 Credit Hours)**
Prerequisite: (0908381)
Introduction to control systems, stability of LTI control systems, stability analysis using Routh Hurwitz criterion, steady state error analysis for unity and non-unity feedback control systems, root locus technique, effect of adding poles and zeros, design of lead, lag controllers using root locus technique, frequency domain analysis using bode plots, design of lead, lag controllers using bode plots, introduction to PID controllers, tuning methods for PID controllers in open loop and closed loop configurations.

0908425   **Power Electronics and Drive**   **(3 Credit Hours)**
Prerequisite: (0908326 + 0908320)
Principle of operation of: power semiconductor devices; single-phase and three-phase uncontrolled and controlled rectifiers feeding resistive and inductive loads; step-down (buck) and step-up (boost) DC-DC converters; Other types of DC-DC converters; AC voltage controllers; half-bridge and full-bridge single-phase and three-phase inverters feeding inductive loads; Power electronics in renewable (solar and wind) energy sources; DC motor drives; AC motor drives.

0908426   **Power Electronics and Drive Lab**   **(1 Credit Hours)**
Prerequisite: (0908425 or co-requisite)
Introduction to the power electronic components (SCR, Diode, IGBT). Controlled and uncontrolled rectifiers: single phase and three phases. AC to AC converter. DC-DC Converters: Buck; Boost. Speed and torque control of a DC motor with a load. Inverter control of an induction motor.

0908434   **Microprocessors and Microcontrollers Applications**   **(3 Credit Hours)**
Prerequisite: (0907342 + 0908333)
Introduction to embedded systems including hardware and software architectures. embedded systems hardware components and platforms, interfacing with external

environments using sensors and actuators, embedded software organization including real-time operating systems, an overview of communication protocols, and emerging application domains such as biomedical devices, home appliances and electronics.

0908435 **Microprocessors and Microcontrollers Applications Lab** **(1 Credit Hour)**
Prerequisite: (0908322 +0908434 or co-requisite)
Introduction to embedded systems and their applications through experimental exercises. HDL codes. basic combinational and sequential logic circuits including simulation, automatic placement and routing, timing analysis and testing. hands-on experience in programming using off-the-shelf embedded system development kits. a comprehensive project that include design, implementation, and evaluation of a prototype embedded system.

0908446 **Design and Control of Hydraulic and Pneumatic systems** **(3 Credit Hours)**
Prerequisite: (0908344)
This course provides the student with the basic knowledge concerned with structure, modelling, and principles of the performance, function, and applications of all hydraulic and pneumatic components (valves; pumps; motors and cylinders). Design and control of hydraulic, electro-hydraulic, pneumatic, and electro- pneumatic circuits. Design of electro-hydraulic and electro- pneumatic systems, and application of digital logic and PLC to fluid power systems.

0908447 **Hydraulic and Pneumatic systems Lab** **(1 Credit Hours)**
Prerequisite: (0908446 or co-requisite)
Applications of all hydraulic and pneumatic components (valves, pumps, motors, cylinders). Introduced to symbols, circuits, the principle of design and construction. Modelling and design of hydraulic, electro-hydraulic, and pneumatic control circuits.

0908472 **Transducers and Sensors** **(2 Credit Hour)**
Prerequisite: (0908371)
concepts for converting a physical non-electrical quantity into an electrical quantity. conventional and modern transducing systems, such as resistive, capacitive, magnetic, photovoltaic, piezoelectric, hall effect, micro-electro-mechanical systems (MEMS), and others. instrumentation systems for displacement, strain, force, toque, pressure, flow, acceleration, vibration, temperature, and humidity measurement. measurement systems are categorized and explained with examples of actual transducers and sensors used in measurement and mechatronics systems. The selection criteria of the transducers and sensors, and the signal conditioning elements. design and build projects for an actual and functional measurement system with contemporary issues and applications.

0908473 **Transducers and Sensors Lab** **(1 Credit Hour)**
Prerequisite: (0908472 or co-requisite)
hands-on experience on the following measurement systems: displacement, strain, force, toque, pressure, flow, acceleration, vibration, temperature, and humidity measurement. hands-on experience on various measurement devices such as signals display equipment and function generators. the selection of signal conditioning elements.

0908474 **Robotic Systems** **(3 Credit Hours)**
Prerequisite: (0908310 + 0904233)
Introduction and an overview of robot types, basic components of industrial manipulators, coordinate frames, homogeneous transformations, forward and inverse kinematic of industrial manipulators, differential kinematics, Jacobian and singularity, manipulator dynamics, force and torque transformation, trajectory planning, and MATLAB Programming..

0908483   **Digital Signals and Systems Analysis**   **(3 Credit Hour)**
Prerequisite: (0908382)
Sampling and signal reconstruction, signal analysis and data filtering, z-transform, practical aspects of system identification and digital control, discretization of systems, response and stability analysis of discrete systems, State space representation of discrete systems, controller design methods (digital pole placement, digital PID, etc.), Realization of digital controllers, introduction to system identification, System Identification Principles, Recursive Identification Methods (Recursive Least Squares, Extended Least Squares, Recursive Maximum Likelihood, Output Error with Extended Prediction Model, Generalized Least Squares, etc), Applications to real life control systems.

0908484   **Control Systems Lab**   **(1 Credit Hours)**
Prerequisite: (0908483 or co-requisite)
analysis of first and second order systems in open-loop and closed-loop configurations, stability of dynamical systems, system identification, design and tuning of different types of controllers, software packages for computer simulation and design validation.

0908485   **Artificial Intelligence**   **(3 Credit Hours)**
Prerequisite: (0908483)
Introduction to artificial intelligence, artificial neural networks; the perceptron and multilayer neural networks, application of neural networks to modelling, estimation, and control, fuzzy expert systems, fuzzy inference, fuzzy control, genetic algorithms, application of genetic algorithms to modelling, estimation, and control, hybrid artificial intelligent systems (neuro-fuzzy, neuro-genetic, and fuzzy-genetic) and their application to control system design and real life applications.

0908536   **Industrial Automation**   **(2 Credit Hours)**
Prerequisite: (0908434 + 0908446)
introduction to Industrial Automation. programming mechanisms for modern industrial control systems. Integration of sensors and actuators with programmable logic controllers (PLCs) to automate industrial processes. Supervisory Control And Data Acquisition (SCADA), main challenges and prospects on human-machine-interaction in complex automation systems. Computer Numeric Control (CNC) machine their structure and programming, engineering applications in selected industry in Jordan.

0908538   **Automation and Industrial Process Control Lab**   **(1 Credit Hours)**
Prerequisite: (0908536 or co-requisite)
Introduction to industrial automation and their applications through experimental exercises. Writing codes to deal with different types of programmable logic controllers (PLCs) and the Computer Numeric Control (CNC). Hands-on experience with different machines that contains a PLC as main controller.

0908576   **Mechatronics Systems Design**   **(2 Credit Hours)**
Prerequisite: (0908434 + 0908472)
A general overview of the design of full mechatronics systems, mechatronics systems in a variety of applications in many fields. Analysis, design, synthesis, and selection of systems that combine mechanical, electrical, electronic, and computer systems. Interdisciplinary experience that encompasses key elements which include physical controllers, control algorithms, measurement theory and sensors, electronic and electrical circuitry, computer interfacing, and actuators. Case studies of mechatronics system in multiple applications such as automation, robotics, servo-mechanics, hybrid and electrical vehicles, and advanced automotive systems.

0908577 **Mechatronics Systems Design Lab**   **(1 Credit Hours)**
Prerequisite: (0908484 + 0908435 + 0908576 or co-requisite)
Hands-on experience of mechatronics system design and their applications in real-life as well as in industries through practical projects. Introduction to the basic concepts of project and project stages, building simple systems. Design and build sensor-based control systems as part of projects.

0908559 **Special Topics in Mechatronics Engineering**   **(3 Credit Hours)**
Prerequisite: (0958500)
Special topics of current interest in mechatronics engineering.

0934445 **Air Conditioning (1)**   **(3 Credit Hours)**
Prerequisite: (0908344)
Review of psychrometry; thermal comfort; air conditioning processes; inside and outside design conditions; heating load calculations, infiltration; cooling load calculations, solar gain; heating systems, design, layout; hot water, steam, hot air systems; under floor heating.

0904554 **Solar Energy**   **(3 Credit Hours)**
Prerequisite: (0908344)
Fundamentals of solar radiation; methods of solar radiation collection; thermal systems components and analysis; transfer of collected heat; storage of collected heat; domestic hot water system; introduction to solar energy applications.

0907520 **Information Security and Networks**   **(3 Credit Hours)**
Prerequisite: (0908333)
Basic concepts in network security. Fundamental techniques used in implementing secure network communications, common threats and attacks, as well as some practical experience in attacking and defending networked systems. Basics of cryptography, cryptographic hash functions, symmetric and public-key encryption, authentication and key establishment, buffer overflow attacks, web security, internet worms, viruses, spyware, Spam, phishing, denial of service (DOS), TCP/IP and DNS security, firewalls and intrusion detection systems, and Wireless security.

0917521 **Internet of Things**   **(3 Credit Hours)**
Prerequisite: (0908333 & 0908434)
Internet in general and Internet of Things (IoTs): layers, protocols, packets, services, performance parameters of a packet network as well as applications such as web, peer-to-peer, sensor networks, and multimedia, transport services, mobile networking which includes roaming and handoffs, mobile IP, and infrastructure-less networks, IoT definitions which include overview, applications, potential & challenges, and architecture, IoT examples such as case studies, e.g. sensor body-area-network and control of a smart home.

0908444 **Design of Machine Elements**   **(3 Credit Hours)**
Prerequisite: (0904331)
Review of stress analysis. Theories of failure. Power transmission shafts. Tension and shear. Connections and selection of bolts. Helical tension and compression spring design. Weld analysis and design. Selection of rolling element bearings. Gears

geometry, Force and stress analysis. Mechanical couplings. Flexible power transmission elements.

0908445   **Autotronics**   **(3 Credit Hours)**

Prerequisite: (0908344)

general overview of automotive systems, fundamentals of internal combustion engine (ICE) construction and operation, engine control unit (ECU), transmission, suspension, steering, electric and electronic systems. mechatronics systems in the modern automobile and presents basics, advantages, layout, components, and functional operation of various computer-controlled vehicle systems. engine and drive-train control, cruise control, suspension control, anti-lock braking (ABS), airbag control, climate control, stability management system, instrumentation, and others.

0908527   <mark>**Advanced Power Electronics and Drive Systems**</mark>   **(3 Credit Hours)**

Prerequisite: (0908425)

Electric drive system components; Drive system mechanical loads; Load torque and moment of inertia calculations for different types of motion; DC and AC motors torque-speed characteristics; DC and AC motors starting, braking & reversing methods; studying dynamic characteristics of DC and AC motors; Automatic DC and AC motors starting, braking & reversing using timers; DC and AC motors speed control using power converters; closed-loop control systems.

0908548   **Fluid Power Control**   **(3 Credit Hours)**

Prerequisite: (0908446)

An overview of Pneumatic systems analysis and design. Modeling and control of hydraulic and Pneumatic systems. Basic of pneumatics system. Pneumatic components: compressors, valves. Pneumatic cascade design. Design of Electrohydraulic/Electropneumatic systems, and application of digital logic and PLC to fluid power systems

0908552   <mark>**Mobile Robots**</mark>   **(3 Credit Hours)**

Prerequisite: (0908474)

<mark>An introduction to mobile robot essentials covering the following topics: mobile robot types, categories, platforms, locomotion mechanisms, kinematics, modelling, autonomous systems sensing / perception, motion and feedback control, path planning and navigation. This course includes a term project carried out in teams.</mark>

0908586   **Industrial Process Control**   **(3 Credit Hours)**

Prerequisite: (0908483)

Introduction to process control, features of PID controllers, control system instrumentation, process safety, practical considerations, tuning of PID controllers using model-based design methods, enhance single-loop control strategies (e.g. feedforward control, time-delay compensation, cascade control, controller de-coupling), multivariable loop identification. Application of PID controllers to real life systems.

0908587   Modern Control   (3 Credit Hours)
Prerequisite: (0908483)
state-space representation of dynamical systems, advantages of state space models over transfer function models, decomposition of transfer functions to CCF, OCF, DCF,JCF forms, similarity transformation between state-space models, response and stability issues of a linear time-invariant state-space models, state transition matrix, controllability and observability of state-space models, controllers design based on pole placement technique, design of state observers, Linear Quadratic Regulator (LQR).

0958500   Employability Readiness and Field Training   (5 Credit Hours)
Prerequisite: Pass 120 Credit Hours Successfully
The course offers a comprehensive blend of theoretical and practical instruction, spanning university classrooms and external settings such as companies, factories, and government institutions. Intensive coursework, totalling 105-120 contact hours over four weeks, covers essential topics like: Technical Skills Development, Teamwork, Written and Oral Communications, Career Services, Networking and Professional Associations, Work Ethics, Professionalism, Industry Projects and Case Studies, Certification and Continuing Education. Emphasis is placed on practical application through assignments, assessments, and field training, both domestically and internationally. The program aligns with University of Jordan regulations and aims to equip students with the skills necessary for successful careers.

0908598   Project (1)   (1 Credit Hours)
Prerequisite: (0958500)
Students will start their actual work at this phase. They will start their project with an extensive literature review. They should follow the project implementation time frame provided in project and submit all required forms and documents of this phase.

0908599   Project (2)   (2 Credit Hours)
Prerequisite: (0908598)
The student is required to complete the work begun in the first semester. Wherever possible, the student is asked to use the appropriate and available software to solve the problem at hand, simulate the solution, build a practical model, and conduct necessary measurements. Additionally, the student is required to write a comprehensive report in accordance with the instructions issued by the department. Special attention will be given to technical writing skills, ethics, and teamwork within the group.

Study Plan- Bachelors