Undergraduate Handbook

Department of Mechatronics Engineering

Philadelphia University
Amman – Jordan

2011-2012

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1. Contact Information

Department Contacts

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Important websites

Admission and Registration information

http://www.philadelphia.edu.jo/admission.asp
http://www.philadelphia.edu.jo/arabic/admission.asp

Department of Mechatronics Engineering

http://www.philadelphia.edu.jo/engineering-se.asp

Deanship of Student affairs

http://www.philadelphia.edu.jo/students.asp

2. Introduction

Philadelphia University

History

Philadelphia University was established in 1989 as a private, accredited university in Jordan. The college of Engineering was established in 1991, and has graduated more than 450 engineers, who are working inside Jordan and abroad. The faculty of Engineering comprises the following departments:

- Computer Engineering
- Electrical Engineering
- Mechanical Engineering
- Communications and Electronics Engineering
- Mechatronics Engineering

The faculty of engineering is housed in several buildings with a total area of 5400m^2, and has 28 specialized and highly equipped laboratories. The total number of engineering students is about 1200 students.

Mission Statement

As a distinguished academic institution, Philadelphia University commits itself to becoming a full partner in the development of both Jordanian society and other societies at the regional and global levels. The role of science, technology, information and means of communication is becoming absolutely vital to the well-being of humanity. In the coming few years, this role is bound to become a decisive engine of growth. High-quality relevant education, supported by problem-oriented, inter-disciplinary and inter-institutional research, is the only means of leading any society to become an active and productive partner in human civilization.

The speed of globalization and the collapse of cultural and economic barriers require modern education, e-learning and interactive systems to be rooted in democratic interaction, human rights, complete freedom of thought and greater creativity by the younger sectors of society.

As the rapid development of knowledge, science and technology could widen the cultural divide between generations and society, modern approaches to education and lifelong interactive learning will be indispensable in alleviating the effects of this trend.

Carrying a revered name, with deep roots in history, of a major city of the Decapolis on the King Road linking old civilizations, Philadelphia is committed

to moving forward, through the twin engines of quality and modernity, along the information highway. It hopes to make a strong bond between knowledge, learning and modern civilization.

The keynote here is proper, fast-developing and morally charged education. Young men and women are the vehicle that launches societies into a future propelled by quality education to prosperity and innovation. Philadelphia University and its sister institutions will be instrumental in bringing this about.

3. Mechatronics Engineering Department

Overview

The term mechatronics was first used in the late 1960s by a Japanese Electric Company to describe the engineering integration between mechanical and electrical systems. Mechatronics can be defined as the analysis, design, and integration of mechanics with electronics through intelligent computer control. Today, mechatronics system engineering has gained much recognition and importance in the industrial world and therefore many universities have established engineering degrees in mechatronics.

PU in Jordan is one of the mechatronics engineering pioneers in the middle east region. The mechatronics program was initiated in year 2000 and accredited by the Ministry of Higher Education in Jordan by 2004. The mechatronics faculty at PU includes well qualified professors with educational and industrial experiences from around the globe: USA, Japan, England, and Egypt. This faculty was, and still is heavily involved in workshops around the middle east (Jordan, Lebanon, and Egypt) that discuss, compare, and develop mechatronics systems curricula.

Mission

The main objectives of the mechatronics department is to provide the following:

a. Integrated system education to equip the graduates with the necessary knowledge and skills needed for the regional industry.
b. In-depth knowledge in the analytical, experimental, and computational areas of mechanics, electronics, control, and computer engineering.
c. Knowledge and skills to analyze, design, program, build, and maintain fully integrated engineering systems.

Facilities

Department Laboratories

Mechatronics is a practical engineering field and therefore there is heavy emphasize on laboratories and projects work

The mechatronics curriculum contains eight laboratories (each with one credit hour). Since mechatronics is multi-disciplinary, five of those labs are supported by other engineering departments. These are:

- Electrical circuits lab
- Electric machines lab
- Electronics lab
- Mechanical and vibration labs
- Computer lab

These are traditional laboratories that include oscilloscopes, function generators, power supplies, IC components, spring-mass systems, vibrations apparatus, circuit components, DC & AC Motors, etc.

PU invested heavily in the specialized mechatronics laboratories. Four Labs are offered by the department:

1. Mechtaronics lab: contains experiments that are concerned with the design and analysis of fully integrated mechatronics systems. It emphasizes the microcontrollers and microprocessors input/output interface through sensors and motors. The lab is equipped with PIC microcontrollers kits, Intel 8085 kits, Motorolla 68HC11, and TI DSP kits. Programming interfaces include assembly and C languages.
2. The instrumentation lab: contains different sensors and transducers such as temperature, optical, conductive, capacitive, and strain gauge sensors. The sensors are interfaced with processors and computers through data acquisition systems interfaced through dedicated software such as LabView and Matlab.
3. The control lab: contains speed-and-position motor control kits, inverted pendulum system (which represents conventional and intelligent control strategy), and complete pneumatic and hydraulic control units (which include servo drives, PID controllers, and fluidic memory).
4. The automation lab: contains a CNC machine, a robotic system (with conveyers, motors, and sensors, which represents flexible manufacturing system), and PLC units.

4. Faculty Members

The Mechatronics Engineering Department includes the following faculty members:

Dr. Tarek Tutunji,
Assistant Professor
Fields of Expertise: Microcontrollers, DSP, and System Design

Dr. Ashraf Saleem
Assistant professor
Field of expertise: Modeling, Simulation, and Pneumatic Systems

Dr. Muhammad alshabi
Assistant Professor

Dr.Ibrahim Alneemi
Assistant Professor

Eng. Sona Alyounis
Lecturer
Field of expertise: Transdusers, biomedical applications in Mechatronics.

5. Curriculum

Overview

The mechatronics curriculum at PU was initially developed by the combined efforts of the mechanical, electrical, and computer departments at PU. A specialized committee that consisted of two associate and two assistant professors (two mechanical engineer, one electrical engineer, and one computer engineer) was given the task of developing the curriculum in 1999. The committee studied global curricula (mainly in North America and Europe), modified per regional needs and available expertise, and proposed the mechatronics curriculum in 2000. The initial proposal had heavy emphasis on mechanical engineering since it was the offering (mother) department.

In 2002, the mechatronics engineering department was established as an independent entity in order to nurture and further develop the curriculum, identify the detailed course contents, and establish the laboratories. Initially the department had one professor, two assistant professors, and one lab engineer that provided for 39 students. By 2005, the department had grown to include two professors, two associate professors, two assistant professors, three lab engineers, and two technicians that provide for 206 students.

The current curriculum is a collaborated result from all faculty members with regional workshop consultations over several years of development . The curriculum is described in the rest of this section.

1 University requirements

PU, guided by the ministry of higher education and scientific research in Jordan, has set 27 credit hours for general university requirements to be studied by all university students. They include arabic and english languages, computer skills, and national studies courses.

2 Engineering faculty requirements

The faculty of engineering has set 29 credit hours divided into two main areas: mathematics and engineering skills. The former includes the general calculus, differential equations, and numerical analysis needed for engineering students. The later, engineering skills, is concerned with developing the students' engineering personality and leadership. It was noted that in many programs, graduating students lacked the essential communication skills needed to excel in the real world. In order to treat this phenomena, PU offers three well designed courses: engineering fundamentals, engineering skills, and entrepreneurship to be studied in the first, third, and fifth years accordingly. These three chain courses form the backbone of engineering thought.

3 Mechatronics department requirements

The mechatronics department requirements were set to 104 credit hours. Those include 95 compulsory and nine elective hours. mechatronics engineering was divided into five main fields: electrical & electronics, mechanics, computer, control & instrumentation, and systems as described below:

1. Electrical and electronics

This field includes electrical circuits, analog and digital electronics, power electronics, drive circuits, and electric machines.

2. Mechanics

This field includes statics, dynamics, vibrations, thermodynamics, heat transfer, fluids, CAD, manufacturing, material science, machine design, hydraulic and pneumatic systems.

3. Control and instrumentation

This field includes analog and digital control systems, robotics, automation, signal processing, sensors & actuators, statistics and quality control.

4. Computer engineering

This field includes logic circuits, microprocessors, microcontrollers, PLC, programming, simulation, interface, and machine intelligence.

5. Mechatronic system design

This field concentrates on the integration among electronics, mechanics, computer, and control in order to analyze and design fully integrated systems.

Philadelphia University — **Study Plan of Mechatronics Engineering Department (2011/2012)**

Faculty of Engineering — **CH(160).**

Student Name:

Student No.:

First: University Requirements (27) Cr.H.

1- Compulsory University Requirements (12) Cr.H.

Course No.	Course Title	Cr.H.	Prere.
0110101	Arabic Skills(1)	3	0110099
0111100	Military Science(*)	3	---
9111101	National Education	3	---
0130101	English Skills(1)	3	0130099

2- Elective University Requirements (15) Cr.H.

*** Social Science : (3-6) Cr.H.**

Course No.	Course Title	Cr.H.	Prere.
0110102	Arabic Skills(2)	3	0110101
0130103	English skills (3)	3	0130102
0140101	French Skills (1)	3	---
0140104	Foreign Language (Italian)	3	---
0140106	Foreign Language (Hebrew)	3	---

*** Social Science and Economics : (3-6) Cr.H.**

Course No.	Course Title	Cr.H.	Prere.
9111111	Introduction to Sociology	3	---
9111112	Introduction to Psychology	3	---
9111133	Human Thought and Civilization(1)	3	---
9111142	Society	3	---
0115255	Culture of Development	3	---

*** Science , Technology, Agriculture and Health : (3-6) CH.**

Course No.	Course Title	Cr.H.	Prere.
9240151	Human and Environment	3	---
9620105	Car Fundamentals	3	---
9761111	Computer Skils	3	0761099
9910101	Human Health & Society	3	---
9910105	Principles of Nursing & First Aid	3	---

Note:

Numbers Using in Study Plan:

(610) Electrical Eng. (620) Mechanical Eng.
(630) Computer Eng. (640) Mechatronics Eng.
(650) Communication & Electronics Eng. (660) Architecture Eng.

Second: Faculty Requirements (29) Cr.H.

2-1 Compulsory Requirements (26) Cr.H.

Course No.	Course Title	Cr.H.	Prere.
0130102	English Skills (2)	3	0130101
0250101	Calculus (1)	3	---
0250102	Calculus (2)	3	0250101
0211104	Applied Physics	3	---
0620171	Engineering Workshop(1)	1	---
0620172	Engineering Workshop(2)	1	0620171
0620131	Engineering Drawing	3	---
0630263	Programming Language	3	---
0640233	Engineering Skills	3	0130102
0610550	Entrepreneurship	3	0640233+120Cr.H

2-1 Elective Requirements (3) Cr.H.

Course No.	Course Title	Cr.H.	Prere.
0212101	General Chemistry (1)	3	---
0610111	Engineering Principles	3	---

Third: Department of Mechatronics Engineering Requirements(104) Cr.H.

3-1 Compulsory Requirements (89) Cr.H.

Course No.	Course Title	Cr.H.	Prere.
0610211	Electrical Circuits (1)	3	0211104
0610212	Electrical Circuits(2)	3	0610211
0610216	Electrical Circuits Lab	1	0610211*
0650242	Electronics (1)	3	0610211
0620211	Statics	3	0250101
0640233	Dynamics & Vibrations	3	0620211
0640235	Mechanics of Engineering Materials	3	0620211
0620239	Mechanical Drawing	1	0620131
0630211	Logic Circuits	3	0630263
0640221	Mechatronics Programming Lab	1	0630263*
0640242	Sensors & Transducers	3	0650242
0650343	Electronics(1) Lab	1	0610216+0650242*
0640312	Power Electronics & Drives	3	0650242
0640314	Electrical Machines for Mechatronics	3	0650242
0620333	Machine Theory	3	0640233
0640327	Modeling & Simulation	3	0640233+0640242
0640328	Microprocessors & Microcontrollers	3	0630211+0640242
0640335	Thermo fluids	3	0620211+0650260
0640337	Mechanics & Vibration Lab	1	0640233*
0640344	Automatic Control	3	0640327
0640350	Engineering Project (1)	1	0640233+0650242
0640415	Power Electronics & Machine Lab	1	0650343+0640314*
0640432	Mechanical Design	3	0620333
0640435	Pneumatic & Hydraulic Systems	3	0640335+0640344
0640441	Digital Control	3	0640328+0640344
0640442	Automatic Control Lab	1	0640344*
0640446	Microprocessors & Transducers Lab	1	0650343+0640328*
0640458	Reverse Engineering	3	0640350
0640424	Machine Intelligence	3	0630263+0640344
0640445	Programmable Logic Controllers	3	0640328
0640447	Mechatronics Systems Design	3	0640344+0640445
0640542	Robotics & Automation	3	0640344+0640445
0640544	Mechatronics System Design Lab	1	0640446+0640447*
0640524	CAD/CAM	3	0620172+0640432
0640531	Fluids & Automation Lab	1	0640435*
0640543	Signals Processing	3	0640441
0640551	Engineering Project (2)	1	0640350+120Cr.H.
0640555	Engineering Project (3)	2	0640447+0640551
0640450	Engineering Practicing	0	90 Cr.H.

* Synchronously
** 8 Weeks Continually After Completing 90 Cr.H.

3-2 Aiding Compulsory Requirements (9) Cr.H.

Course No.	Course Title	Cr.H.	Prere.
0650163	Principles of Engineering Analysis	3	0250102
0650260	Engineering Analysis (1)	3	0250102
0630262	Engineering Analysis (2)	3	0650260

3-3 Elective Requirements in Mechatronics Engineering (6) Cr.H.

Course No.	Course Title	Cr.H.	Prere.
0630512	Real Time Systems	3	0640344
0640462	Automation & Operations Control	3	0640344
0640593	Special Topics in Mechatronics	3	Dep. Approval
0640333	Industrial Electronics	3	0640314+0640312

Course Description:

610211	Electrical Circuits (1) (3C, 3H)
	Definitions and Units. Basic Concepts (Charge, Current, Voltage, Power Energy). Circuit Elements (Independent and Dependent Voltage and Current Sources. Resistors. Capacitors. Inductors). KVL and KCL. Mesh and Nodal Circuit Analysis. Network Theorems. Transient Analysis of RL, RC, and RLC Circuits. Introduction to AC Circuits Pre. Physics (211104)
610212	Electrical Circuits (2) (3C, 3H)
	Periodic waveforms. AC response of RL. RC and RLC circuits. Phasor analysis. Impedance concept. Resonance. Steady State analysis of AC circuits. Coupled circuits. Three Phase circuits. Fourier analysis. laplace analysis. Two-Port networks. Circuit analysis using computers. Pre. Electrical Circuits (1) (610211)
620121	Engineering drawing(3C, 3H)
	Instruments and their use, Graphic geometry, Lettering, Orthographic and isometric drawing and sketching, Sectional views, Introduction to descriptive geometry, Surface intersections and developments, Computer (ACAD).
620211	Statics(3C, 3H)
	Introduction to mechanics of rigid bodies, Basic concepts: force and displacement vectors, Force systems, Equivalent force systems, Static equilibrium, Analysis of simple structures, Friction, Geometric properties: centroids and moments of inertia. Pre. Math(1) (210101)
620217	Strength of Materials (2C, 2H)
	Stress and strain axial loading, pure bending, shear stresses, transformation of stresses and strain, moher's circles and principle stresses and strain, deflection of beam and shafts. Pre. Statics (620211)
620261	Engineering Materials and Manufacturing Technology (3C, 3H)
	Fundamental of mechanical behavior 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. Pre. Strength of Materials (620217)
620343	Thermofluids (3C, 3H)
	Introduction to first and second law of thermodynamics, modes of heat transfer, one-dimensional conduction heat transfer, Introduction to convection heat transfer, Boiling and condensation, Internal flow heat exchangers Fluid and gas properties, Equation of: continuity, Momentum and Energy. Introduction to Boundary layer theory. Introduction to viscous fluid flow. Turbomachinery. Pre. Statics (620211) + Engineering Analysis I (650201)

620367	Mechanics and Vibrations Laboratory (1C, 3H)
	Experiments related to the material covered in Dynamics and Vibrations. Pre. Dynamics and Vibrations (620472)
620472	Dynamics and Vibrations (3C, 3H)
	Equilibrium of rigid bodies and Newton's second low, rotational motion, kinematics of rigid bodies, kinetics of rigid bodies, work and energy, impulse and momentum. Free and damped vibrations, harmonically excited motion, rotating and reciprocating unbalance, vibration measurements. Pre. Statics (620211)
630261	Logic Circuits (3C, 3H)
	Number Systems: Decimal Binary. Octal. and Hexadecimal. Boolean Algebra: Basic identities and Algebraic Manipulation. Map Simplification. Combinational Circuits Design With MSI Components. Sequential Circuits Analysis and Design. MSI Counters and Registers. Pre. Programming languages (630203)
640229	Electrical Engineering Laboratory (1C, 3H)
	Experiments included: AC Current Circuits. Kirchof's Law. Network Analysis. Resistance Theory. Power Measuring. Pre. Electrical Circuits (1) (610211)
640270	Programming for Mechatronics Laboratory (1C, 3H)
	Mechatronics application computer Packages, and mechatronics application programming with C++ Pre. Programming languages (630203)
640324	Power Electronics and Drives (3C, 3H)
	Steady State Specifications For SCR Devices. Triggering circuits. Correct Methods for SCR Devices. Rectification circuits with different Loads. AC Voltage Controller. DC Voltage Controller. AC to DC Converter (Inverter). Wave Transformer Application. TRIAC Device Application. Pre. Electronics Engineering Laboratory (650227)
640325	Electric Machines for Mechatronics (3C, 3H)
	Transformers. Single Phase & Three Phase Transformers. DC Current Motors & Generators. Single Phase & Three Phase Motors & Generators. AC Current Motors & Generators. Induction Motors & Generators. Synchronounce Motors & Generators. Pre. Electronics Engineering (650222)
640326	Electric Machines and Power Electronics Laboratory (1C, 3H)
	Experiments Included: Transformers. DC current Motors & Generators. Single Phase & Three Phase Generators & Motors. Synchronounce Motors & Generators. AC Motors. Pro. Power Electronics and Drives (640324) + Electric Machines for Mechatronics (640325)
640352	Mechanics of Machinery (3C, 3H)
	Position analysis, mechanisms, and velocity and acceleration analysis by vector, analytical, graphical and loop closure methods. Cam design spur bevel and helical gears. Gear trains. Force analysis, static and dynamic balance of rotors. Synthesis of linkage, spatial mechanisms. Pre. Dynamics and Vibrations (620472)
640353	Mechanical Design (3C, 3H)

	Introduction to design processes, Fit and tolerance, Review of stress and deflection analysis, Prevention of failure due to static loads, Prevention of failure due to fatigue and dynamic loads, Threaded connections and fasteners, Welded and riveted joints, Mechanical springs, Design of shafts and pulleys, Rolling and sliding bearings, Gear design, Friction drives, Flexible mechanical elements. Pre. Mechanics of Machinery (640352) + Strength of Materials (620217)
640364	Sensors & Actuators (3C, 3H)
	Review of statistical methods – Sensors characteristics (Static- Dynamic)- Sensors for measurements of (displacement, speed, acceleration, force, pressure, flow, level, thermal, proximity, & etc…) – Signal Conditioning – Actuators (Mechanical, Hydraulic, Pneumatic,& Electrical). Pre. Electronics Engineering (650222)
٦٤٠٣٩٠	Engr. Project 1(1C, 3H)
	Applied Projects Included Mechanical Design , Electronics, Control & Programming Pre. Electronics Engineering (650222) + Engr. Workshop II (620163)
640397	Reverse Engineering (3C, 3H)
	Reverse engineering methodology, design vs. redesign, assembly vs. disassembly, schematics analysis, measurement and data collection, customer requirements, prototype building and modification Pre. Engr. Project 1 (٦٤٠٣٩٠)
640444	Pneumatic & Hydraulic Systems (3C, 3H)
	Fluid systems – Properties of hydraulic fluids- Components of hydraulic systems- Components of Pneumatic systems – Hydraulic circuits – Pneumatic circuits – Electrical control of hydraulic & pneumatic circuits – P.L.C. Control of hydraulic & pneumatic circuits. Pre. Sensors & Actuators (640364) + Thermofluids (620343)
640460	Digital Control (3C, 3H)
	Discrete System Analysis (Transfer Function, Z-Transform, and Stability), Discrete Equivalents (Numerical Integration, Zero-Pole mapping, and Hold), Design using Transform Techniques (Emulation, Root Locus, and Frequency Response), Introduction to Design using State Space Methods Pre. Automatic Control Systems (640461)
640461	Automatic Control Systems (3 C, 3H)
	Introduction to Feedback System, Review of Systems mathematical back ground , modeling of physical systems, mechanical systems, electrical systems, hydraulic system, pneumatic system, thermal systems, block diagram reduction technique and Signal Flow Graphs. Transient response and steady state error,, Routh's Stability Criterion. The Root Locus Method,. Frequency response methods (Nyquist and bode diagram), different type of controllers, methods of Compensation Techniques, Introduction to Sampled Control System. Pre. Modeling & Simulation (640465)
640465	Modeling & Simulation (3C, 3H)
	Modeling definition (H.W/S.W)- principles of physical systems modeling (Mechanical – Fluid – Thermal – electrical – Bio)- Computer simulation techniques- applications using one or more of the available software packages. Pre. Sensors & Actuators (640364) + Dynamics and Vibrations (620472)

640467	Automatic Control Laboratory (1C, 3H)
	Open and Closed Loop System, Servomechanism Principles. The Effect of proportional gain, Integral Control, Derivative Control and Velocity Feedback on System, Performance, Frequency Response Measurement. Pre. Automatic Control Systems (640461) + Electronics Engineering Laboratory (650227)
640368	Microprocessors & Transducers Lab (1C, 3H)
	Experiments related to the various topics in mechatronics especially to material covered in 640364+640476 Pre. Sensors & Actuators (640364)+ Microprocessors systems (640476)
640473	Machine Intelligence (3C, 3H)
	Introduction to neural networks, expert systems, Fuzzy logic, Robotics control, Image processing, industrial applications for machine intelligence, new trends in machine intelligence Pre. Automatic Control Systems (640461) + Programming languages (630203)
640475	Programmable Logic Controllers (3C, 3H)
	Programmable logic controllers architecture, Input/output devices, Input/output process and addressing, programming using ladder diagram, Internal relays, Timers, Counters, Shift registers, Data handling, Instruction list, function block diagram, applications, test and debugging. Pre. Microprocessors systems (640476)
640476	Microprocessors & Microcontrollers (3C, 3H)
	General Microcontroller Architecture. PIC16F84 Architecture, Instruction Set, and Assembly Language. Programming PIC16F84 with applications to mechatronic systems. Special Function Registers, I/O Potrs, RAM/ROM, Timers, and Interrupts. 8085 microprocessor architecture and assembly language programming Pre. Logic Circuits (630261), Sensors & Actuators (640364)
640488	Mechatronics Systems Design (3C, 3H)
	General Diagram of Mechatronics System. Design Methodology, Different Control Method for Mechatronics System (PLC – Microprocessor). Actuators Selections, Sensors Selections, Interfacing Systems & Electronics Connections. Pre. Programmable Logic Controllers (640475) + Automatic Control Systems (640461)
640501	Engr. Project (2) (1C)
	The student should attach himself to one or more faculty members who assign him a project; He analyses this project and suggests a method to carry out the project in the next stage. Pre. Reverse Engineering (640397)
640502	Engr. Project (3) (2C)
	Based on the results obtained from the first stage, the student carries out the project Pre: Engr. Project 2 (640501)
640515	Robotics and Automation (3C, 3H)

	Introduction to Robot system components, Sensors & actuators in a robot system ,robot specification and data sheets, Linear control of manipulators, Nonlinear control of manipulators, Microprocessor control, Trajectory planning & control, Robot programming languages, Robot vision. Pre. Programmable Logic Controllers (640475) + Automatic Control Systems (640461)
٦٤٠٥٧٩	Mechatronics Systems Design lab(1C, 3H)
	The Mechatronics Design Lab focuses on application of theoretical principles in electrical and computer engineering to control mechatronic systems incorporating sensors, actuators and intelligence. This Lab. gives the student a chance to use his knowledge of (or learn about) power electronics, filtering and signal processing, control, electro mechanics, microcontrollers, and real-time embedded software in designing certain mechatronic system. The Lab. requires students to consider real-world constraints such as limited volume, payload, electrical power, processing power and time. Written reports will be required justifying design choices. Grading will be based upon design checkpoints, the reports and a final exam. Pre. Mechatronics Systems Design (640488)
640581	Computer Aided Design and Manufacturing (3C, 3H)
	Fundamentals of hardware and software, Solid modeling, Transformation, rotation, Scaling, windowing, simulation and animation of mechanical problems, Optimal synthesis and selection of machine elements, Applications and individual problems, Implementation of CAD-package for visualization, Simulation & animation of specific types of machine units. Basic concepts of CNC and , DNC, Programming CNC milling using G code, Programming CNC lathe using G code, APT programming. Pre : Programmable Logic Controllers (640475)
640586	Automation and Fluids Control Laboratory (1C, 3H)
	Experiments Included Subjects For Pneumatic & Hydraulic Systems Course. Pre. Pneumatic & Hydraulic Systems (640444) + Measurements & microcontroller Lab (640468)
٦٤٠٥٨٧	Signal Processing for Mechatronics (2C, 2H)
	This course introduces signal processing, with an emphasis on digital signal processing, from the perspective of mechatronics, providing the theoretical and practical framework for understanding signal processing algorithms, architectures, and applications. Basic concepts for signal analysis, including signal presentation, time and frequency domains, spectral analysis, and noise are introduced. Components of signal processing, such as systems, filters, correlators and convolvers, and adaptive processes are defined. Architectures and algorithms, including fast algorithms for Fourier transforms, correlation, convolution, spectral estimation, graphical techniques, and DSP processor devices are presented. Students will complete several homework problem sets and a term project, and will program using Matlab. Pre. Digital Control (640460)
650222	Electronics Engineering (3C, 3H)
	Semiconductors Theory. Bipolar Semiconductors. Bipolar Diodes Circuit & Application. Transistor Specification. Small Signal Analysis. Transistor Theory & Application. Amplifiers. Pre. Electric Circuit 1 (610211)
650227	Electronics Engineering Laboratory (1C, 3H)

	Experiments included: Diodes Specification. Diodes Application. Zener Diode Application. Transistor Specification. Small Signal Analysis using Operational Amplifiers. Pre. Electronics Engineering (650222)
٦١٠٤٨٨	Fractional Small Machines(3C, 3H)
	Servo motor, Permanent magnet, stepper motor, brushless DC motor, Switched reluctance motor, synchronize machines. Pre. Electric Machines for Mechatronics (640325)
٦٣٠٤٧٠	Embedded Computing Systems (3C, 3H)
	Overview of embedded systems theory and architecture. Programming embedded processors and controllers Pre. Microprocessors systems (640476)
٦٣٠٥٨١	Real Time Systems (3C, 3H)
	Introduction to real-time systems. Concepts of computer control : Hardware requirements for real-time systems. Real-time computer control. Languages for real-time applications. Real-time software & program design. Operating systems for real-time applications. Pre. Automatic Control (640461)
٦٤٠٤٢٢	Electric Drive Systems (3C, 3H)
	Analysis and design of electric motor drives. Major topics include: rectifier drives, chopper drives, voltage-controlled drives, slip-energy recovery drives, voltage-source inverter drives, current-course inverter drives and cycloconverter drives. Analysis of the steady-state operation of drive systems that provides the specifications of suitable converters and machines for the speed and position controls. Pre. Electric Machines for Mechatronics (640325)
٦٤٠٤٦٢	Process control (3C, 3H)
	A basic study of open and closed-loop automatic control theory. Pneumatic, electronic (Analog), and digital electronic controllers are studied and applied to specific processes. Transmitters, positioners, valve operators, and controller mechanisms which produce proportional, rate, and reset responses are studied. Techniques of obtaining optimal controller settings are studied. Pre. Automatic Control (640461)
٦٤٠٤٨٩	Data Acquisition Systems (3C, 3H)
	This course should provide students with the knowledge required to specify, evaluate and use a wide variety of data acquisition systems in laboratory and field applications. Basic principles of sampling and digitizing theory are presented and reinforced with practical examples from everyday testing operations. Emphasis is placed on understanding the theoretical concepts through practical mechatronic systems rather than mathematics. Pre. Modeling & Simulation (640465)
٦٤٠٥٩٣	Special Topics in Mechatronics (3C, 3H)
	Modern Subjects in Mechatronics Engineering (Choosing by Department) Pre. Department Approval
٦٥٠٣٢١	Electronics 2 (3C, 3H)

	Multi-stage amplifiers. Power amplifiers. Single-stage amplifier frequency response. Difference amplifiers. Operational amplifiers. Feedback amplifiers and oscillators. Pre. Electronics (650222)
٦٥٠٤٢١	Digital Electronics 2 (3C, 3H)
	Semiconductors Devices & Conversion Specification. Memory Elements & Types. Timers Circuits. Signal Transformation (ADC – DAC) Pre. Electronics (650222)