Introduction to Computer and Programming

Textbook(s): Introduction to Computing Systems, From bits and gates to C and beyond, McGraw Hill (2005), Yale Patt, Sanjay Patel

Topics: Number representation | ASCII code | Digital Logic Operations | The Von Neuman Model | Programming basics: Systematic Analysis, Flowcharts, debugging | Assembly Language | LC3 | C Programming

Industrial Drawing (1 Credit)

Projection concepts, Drawing standards, Volume and surface analysis for drawing, 3D view projection, Isometric and diametric (oblique & no oblique) projections, Types of sectional views, Industrial (assembly and workshop) drawings and dimensioning, AutoCAD and its tools.

Physics I (3 Credits)

Textbook(s):
Fundamentals of Physics Extended, 10th Edition, *David Halliday, Robert Resnick, Jearl Walker*

Measurement, motion in two and three dimensions, forces and Newton's laws and its applications, momentum, systems of particles, rotational kinetics, rotational dynamics, angular momentum, work and kinetic energy, potential energy, conservation of energy, gravitation, temperature, molecular properties of gasses, first law of thermodynamics, entropy and second law of thermodynamics.

Calculus 1 (3 Credits)

Textbook(s): Calculus, Thomas | Calculus, Maron

Study of single variable calculus, Numerical sequences, Limits, Continuity differentiation, the definite integrals and their applications, Inverse functions, logarithmic and exponential functions, inverse trigonometric and hyperbolic functions, Techniques of integration, indeterminate forms, improper integrals. Taylor's formulae, Infinite series.

Numerical Computation (2 Credits)

Building upon calculus and computer programming, the course covers basic numerical methods, including linear and nonlinear algebraic equations, interpolation and approximation, ordinary differential equations, numerical integration and differentiation, finite element and perturbation. Weekly assignments involve both pencil-and-paper and computer work.

Differential Equations (3 Credits)

Textbook(s):

Differential Equations, Dr. Moazzami

Elementary Differential Equations and Boundary Value Problems, William E. Boyce, Richard C. DiPrima

Topics: First order equations | Second order equations | Higher order equations | Total Differential equations | Partial differential equations | Non-linear equations | Laplace Transform

Physics II (3 Credits)

Textbook(s):
Fundamentals of Physics Extended, 10th Edition, *David Halliday, Robert Resnick, Jearl Walker*

Electric charge and Coulomb's law, the electric field, Gauss' law, electric potential energy and electric potential, the electric properties of materials, capacitance and capacitors, DC circuits, the magnetic field and magnetic field of a current, Faraday's law in induction, Ampere's law, magnetic properties of materials, inductance, RC, RL and RLC circuits, self and mutual induction.

Calculus II (3 Credits)

Textbook(s): Thomas

Topics: Single variable calculus | Multi-variable calculus | Curl | Divergent | Gradient | Introduction to linear algebra | Linear independence | Orthogonality | Multidimensional Integrals | Matrix | Eigenvalues | Eigenvectors

Electromagnetic (3 Credits)

Textbook(s):
-U.S. Inan, and A. S. Inan, Engineering Electromagnetics, Addison- Wesley, 1999.
-D.J. Griffiths, Introduction to Electromagnetics, Prentice- H all, 1999.
-D. K. Cheng, Field and Wave Electromagnetics, 2nd ed., Addison- Wesley, 1998.
- J.R. Reitz and F.J. Milford, Foundation of Electromagnetic Theory, 4th ed. , Addison- Wesley, 1992.

Vector analysis, Coulomb's and Gauss' laws, electric potential, Laplace's and Poisson's equations, electrostatic fields in material media, electrostatic energy, electric current, Biot Savart's law, magnetic potentials, Faraday's law, magneto static fields In materials, magneto static energy, displacement current, Maxwell`s Equations.

Engineering Probability and Statistics (3 Credits)

Introduction to Probability Models, Sheldon M. Ross

Probability and Statistics, Degroot, Schervish

Topics: Conditional probability | Random variables and distributions Markov chains | Expectation | Special distributions | Large random samples | Estimation

Engineering Mathematics (3 Credits)

Textbook(s):

-Engineering Mathematics, Dr. J. Rashed Mohassel

-C. R. Wylie, Advanced Engineering Mathematics, 6th ed., McGraw-Hill, 1995.

-E. Kreyszig, Advanced Engineering Mathematics, 10th ed., Wiley, 2011.

Topics: Fourier series | Fourier transform | Wave equations | Heat equation | Partial differential equations | Laplace Transform | Complex calculus | Integral in complex plane | Residue theorem

Technical English (2 Credits)

Engineering technical words, especially in the major of Electrical Engineering for future use. Other skills such as Listening, Speaking and Reading are evaluated.

General Workshop (1 Credit)

Safety issues and procedures of welding, different types of welding methods and instruments, and power supplies. Electric arc welding, creating electric arc, setting the correct electrode gap, and electrode angles, oxidation conditions. Basic weld joints: butt joint, lap joint, corner joint, edge joint, and T-joint. Oxyacetylene welding.

Electrical Circuits I (3 Credits)

Textbook(s):
-Parviz Jabbedar Malarani, basic circuit theory, 2nd ed., University of Tehran Press, 2000.
-R. C. Dorf and J.A. Svoboda, Introduction to Electric Circuits, 8th ed., John Wiley, 2010.
-J.W. Nilsson and S. A. Riedel, Electric Circuits,9th ed. , Prentice-Hall, 2010.
-R.A. DeCarlo and P.M. Lin, Linear Circuit Analysis: Time Domain, Phasor and Laplace Transform Approaches, Oxford University Press, 2001.
-C.K. Alexander and M.N.O. sadiku, Fundamentals of Electric Circuits, 4th ed., McGraw Hill, 2008.

This course covers general electric circuit parameters and laws. Topics include: basic electric circuits, voltage and current sources, resistance, analysis of DC circuits, power considerations. Concepts of capacitance, inductance, and their transient behaviour. Introduction of AC sources, phasors, reactance and impedance, AC analysis of RC, RL, and RLC circuits, the effect of resonance, real and complex power in reactive loads.

Physics Lab II (1 Credit)

Verification of Ohm's and Kirchhoff's laws, magnetic field line detection, study of plate and spherical capacitors, Hysteresis curves, RC and RL circuits, oscilloscope.

Electrical Measurement Lab. 1 (1 Credit)

Multisim, Oscilloscope, Multimeter, Thevenin Equivalent Circuit, Nonlinear Circuits, Op-Amp, T.R. of 1st-Order Circuits, T.R. of 2nd-Order RLC Circuits, F.R. of 1st-Order Circuits, F.R. of 2nd-Order Circuits

Electronics I (3 Credits)

Textbook(s):
-B. Razavi, Fundamentals of Microelectronics, Wiley, 2008.
-A.S. Sedra & K.C. Smith, Microelectronic Circuits, 6th ed., Oxford University Press, 2010.
-A.M. Sodagar, Analysis of Bipolar and CMOS Amplifiers, CRC Press, 2007.
-R.C. Jaeger & T.N. Blalock, Microelectronic Circuit Design, 2nd ed., McGraw – Hill, 2003.

Introduction to electronics, operational amplifiers, diodes, linear and non-linear circuit applications involving op-amps and diodes. Bipolar junction and field-effect transistors: physical structures and modes of operation. DC analysis of transistor circuits. The transistor as an amplifier and as a switch. Transistor amplifiers: small signal models, biasing of discrete circuits, and single-stage amplifier circuits. Biasing of BJT integrated circuits. Multistage and differential amplifiers. Frequency response of single-stage amplifiers. JFET and MOSFET transistors. Important concepts are illustrated with structured lab experiments and through the use of Electronic workbench circuit simulations.

Systems Analysis (3 Credits)

Textbook(s):
-A. V. Oppenheim, A. S. Willsky and S.H. Nawab, Signals and Systems, 2nd ed., Prentice- Hall, 1996.
-R. E. Ziemer, W. H.Tranter and D. R. Fannin, Signals and Systems, Continuous and Discrete, 4th ed., Prentice-Hall, 1998.
-S. Haykin and B. Van Veen, Signals and Systems, 2nd., Wiley, 2003.

This course deals with the analysis of continuous-time and discrete-time signals and systems. Topics include: representations of linear time-invariant systems, representations of signals, Laplace transform, z-transform transfer function, impulse response, step response, the convolution integral and its interpretation, Fourier analysis for continuous-time signals and systems and an introduction to sampling.

Electrical Circuits II (3 Credits)

Textbooks:

-Parviz Jabbedar Malarani, basic circuit theory, 2nd ed., University of Tehran Press, 2000.
-R. C. Dorf and J.A. Svoboda, Introduction to Electric Circuits, 8th ed., John Wiley, 2010.
-J.W. Nilsson and S. A. Riedel, Electric Circuits,9th ed. , Prentice-Hall, 2010.
-R.A. DeCarlo and P.M. Lin, Linear Circuit Analysis: Time Domain, Phasor and Laplace Transform Approaches, Oxford University Press, 2001.
-C.K. Alexander and M.N.O. sadiku, Fundamentals of Electric Circuits, 4th ed., McGraw Hill, 2008.

Use of Laplace transform techniques to analyze linear circuits with and without initial conditions. Characterization of circuits based upon impedance, admittance, and transfer function parameters. Determination of frequency response via analysis of poles and zeroes in the complex plane. Relationship between the transfer function and the impulse response of a circuit. Use of continuous time convolution to determine time domain responses. Properties and practical uses of resonant circuits and transformers. Input - output characterization of a circuit as a two-port. Low and high-pass filter design.

Logic circuits (3 Credits)

Textbook(s):

-V.P. Nelson, et al., Digital logic Circuit Analysis and Design, Prentice-Hall, 2006.

-M.M. Mano, and M. D. Cilleti, Digital Design, 4th ed., Prentice – Hall, 2006.

- C.H. Roth, Fundamentals of Logic Design, 6th ed., Cengage Learning Press, 2010.

-John F, Wakerley, Digital Design: Principles and Practices, 4th ed., 2005.

Topics: MOS Level design | Number representation | Gray code | Karnaugh map | Glitches | Decoder | Multiplexer | Adders | Comparators | Multipliers | Latches | Flip flops | PAL | PLA | Introduction to FPGA | Finite state machine | RT-level design | Circuit debugging | Asynchronous stateful circuits

Electrical Machines I (3 Credits)

Textbook(s):
-P.S. Bimbhra, Electrical Machinery: Theory, Performance and Applications, 7th ed., Khanna Publishers, 2003.
-A.E. Fitzgerald, C. Kingsley and S. D. Umans, Electric Machinery, 6th ed., McGraw-Hill, 2003.

This course firstly discusses about different aspects of magnetic circuits and provides fundamental information about DC motors, which are the main topic of this course. machine construction, review and determination of electromotive force (emf), armature winding, armature reaction, compensating windings, types of machine excitations, load characteristics of motor and generators are some of the subjects.

Linear Control Systems Lab (1 Credits)

Laboratory work consists of experiments with a computer- controlled servomotor positioning system, and MATLAB and Simulink assignments, reinforcing analytical concepts and design procedures. Introduction to Lab-View, etc.

Electronics Lab 1 (1 Credit)

P-N diode I-V static characteristic, full wave and half wave rectifier, voltage limiter, multiplier, BJT I-V characteristic and other parameters, DC bias point, CB amplifier, CE amplifier, CC amplifier, multistage amplifier.

Electronics II (3 Credits)

Textbook(s):
-B. Razavi, Fundamentals of Microelectronics, Wiley, 2008.
-A.S. Sedra & K.C. Smith, Microelectronic Circuits, 6th ed., Oxford University Press, 2010.
-A.M. Sodagar, Analysis of Bipolar and CMOS Amplifiers, CRC Press, 2007.
-R.C. Jaeger & T.N. Blalock, Microelectronic Circuit Design, 2nd ed., McGraw – Hill, 2003.

The course reviews the basic electronic concepts including analog and digital signals, rectifiers and wave shaping circuits, small-signal and large-signal analysis of amplifiers, differential and multistage amplifiers, amplifier frequency response, feedback and stability, etc. Short introduction to basics of semiconductor devices is given including junction diodes, bipolar transistors, and field effect transistors. The popular circuits using semiconductor devices are studied in details. Important concepts are illustrated with structured lab experiments and through the use of Electronic OrCAD circuit simulations

Power Systems Analysis I (3 Credits)

Textbook(s):
-W. D. Stevenson, Elements of Power system Analysis, McGraw-Hill, 1982.
-Hadi Saadat, Power System Analysis, McGraw-Hill, 1999.

Overview of the power system; Introduction to Per Unit calculations; Power Generator and Transformer modeling and operation; Transmission line parameters and steady state operation of Transmission lines; Load Flow study and introduction to ETAP software; symmetrical and unsymmetrical fault analysis; introduction to protection schemes.

Microprocessors (3 Credits)

Introduction to basic concepts in microprocessor systems. Architecture of microprocessor systems, and investigation of all phases of troubleshooting and implementation of reliable microprocessor systems. 8085 ,8086 and AVR ATmega8 microprocessors structure and operation. Hands-on experience, practical applications and projects. Teamwork, critical thinking and problem solving are emphasized.

Linear Control Systems (3 Credits)

-Ogata, Modern Control Engineering, 5th ed., Prentice-Hall, 2009.
-Golnaraghi and B.C.Kuo, Automatic Control Systems, 9th ed., Wiley, 2009.

-R.C. Dorf and R.H. Bishop, Modern Control Systems, 12th ed., Prentice- Hall, 2010.

Introductory course in control theory: system modeling, simulation, analysis and controller design. Description of linear, time-invariant, continuous time systems, differential equations, transfer function representation, block diagrams and signal flows. System dynamic properties in time and frequency domains, performance specifications. Basic properties of feedback. Stability analysis: Routh-Hurwitz criterion, Root Locus method, Bode gain and phase margins, Nyquist criterion. Classical controller design in time and frequency domain: lead, lag, lead-lag compensation, rate feedback, PID controller.

Electricity Workshop (1 Credits)

Fully practical course, which includes basic information about electrical wiring of apartments, demonstrating the concepts of control circuits for industrial uses and working with industrial motors.

Electrical Machines 2 (3 Credits)

Textbook(s):
-P.S. Bimbhra, Electrical Machinery: Theory, Performance and Applications, 7th ed., Khanna Publishers, 2003.
-A.E. Fitzgerald, C. Kingsley and S. D. Umans, Electric Machinery, 6th ed., McGraw-Hill, 2003.
-J. Hindmarsh and A. Renfrew, Electrical Machines and drive systems, 3rd ed., Butterworth-Heinemann, 1997.

Two main topics are detailed: Transformers and AC motors, derivation of equivalent circuit transformer performance, efficiency, voltage regulation, per-unit values autotransformers, parallel operation, AC machine windings, rotating field, equivalent circuit, speed-torque characteristics, speed control, starting methods, Introductions to single – phase induction motors, Introduction to asynchronous machines in AC machines are surveyed.

Electrical Machinery Lab 1 (1 Credits)

DC Generator (Separately excitation)| DC Generator (Shunt)| DC Generator (Series)| DC Generator (Compound)| DC Motor (Separately excitation)| DC Motor (Shunt)| DC Motor (Series)| DC Motor (Compound)

Logic circuits Lab (1 Credits)

Implementing Basic Circuits with AND, OR, XOR in CMOS or TTL Logics| Verilog Coding & Implementing VGA Controller, Binary-Search, and Digital Plant Words system, Function Generator(PWM, Rhomboid,

Sine, Square, Triangle, Saw tooth) and Digital Oscilloscope on Altera DE2 Development and Education Board.

Industrial Electronics (3 Credits)

Textbook(s):
-M.H. Rashid, Power Electronics: Circuits, Devices, and Applications, 3rd ed., Prentice-Hall, 2004.

-N. Mohan, T.M. Undeland and W.P.Robbins, Power Electronics, Wiley, 2003.

-R.W. Erickson and D. Maksimovic, Fundamentals of Power Electronics, 2nd ed., Springer, 2001.

-D.W. Hart, Introduction to Power Electronics, Prentice-Hall, 1996.

-K. Thorborg, Power Electronics, Prentice-Hall, 1998.

-A.M. Trzynadlowski, S. Legowski, Introduction to Modern Power Electronics, Wiley, 1998.

A course on solid state power converters. Major topics include: switching devices (SCR, MOSFET, IGBT, GTO, etc.), dc-dc switch mode converters, diode and thyristor rectifiers, current and voltage source inverters, ac-ac converters and industry applications. Typical control, gating and protection schemes for these converters will also be discussed. Important concepts are illustrated through laboratory projects. Real-time DSP based experimental platform will be used in the projects.

Physics Lab. I (3 Credits)

Laboratory experiments designed to complement Physics I. Basic concepts of measurement, mechanics: motion and oscillation, heat and forces.

Internship (3 Credits)

Full Time, 8 Weeks internship in research centers or firms or companies and preparing a report about the activities during this period.

Communication Systems 1 (3 Credits)

Textbook(s):

-J.G. Proakis, M. Salehi, Communication Systems Engineering, 2nd ed., Prentice-Hall, 2002.

-S. Haykin, M. Moher, Introduction to Analog and Digital Communications, 2nd ed., Wiley, 2007.

-A.B. Corson, P.B. Crilly and J.C. Rutledge, Communication Systems: An Introduction to signals and Noise in Electrical Communication, 4th ed., McGraw-Hill, 2002.

Short description of an analog communication system, analysis of deterministic signals in frequency domain, analysis of random signals, noise in communication systems, white noise, noise band-width, signal transmission in base band, linear distortion, nonlinear distortion, analog modulation systems, analysis of linear modulations such as AM, VSB,DSB and SSB, linear modulation and demodulation techniques also combined with FDM, nonlinear modulation techniques such as PM and FM, noise and interference effects on various types of modulation, pulse modulation, survey of sampling techniques for analog pulse modulations such as PAM, PPM, and PDM, familiarity with digital modulation systems such as FSK, PSK, and ASK.

Linear Algebra (3 credits)

Text book(s):

-G. Strang, Linear Algebra and Its Applications, Wiley, 4th ed., 1976

Linear algebra is the study of linear systems of equations, vector spaces, and linear transformations. Solving systems of linear equations is a basic tool of many mathematical procedures used for solving problems in science and engineering. In this class we will concentrate on the mathematical theory and methods of linear algebra. The student will become competent in solving linear equations, performing matrix algebra, calculating determinants, and finding eigenvalues and eigenvectors. On the theoretical side, the student will come to understand a matrix as a linear transformations relative to a basis of a vector space.
The student will become comfortable with the vector space *Rn* and be exposed to vector spaces more generally by working on examples with polynomials in *Pn* and continuous functions in *C* [*a ,b*]. The definite integral from calculus will be revisited and recognized as an inner product. The student will understand the concept of orthogonality of vectors and its use in projecting vectors into subspaces and decomposing vectors into components. Finally the student will learn how to solve over constrained systems using the method of least squares.

Instrumentation and industrial Control Elements (3 credits)

Text book(s):

-Alan S Morris, Reza Langari, “Measurement and Instrumentation, Theory and Application”, Elsevier Inc , Second Edition,2015.

-William C.Dunn, “Fundamentals of Industrial Instrumentation and Process Control”, McGraw-Hill, 2010.

-William C. Dunn, “Introduction to Instrumentation, Sensors, and Process Control”, ARTECH HOUSE, INC.,2006

-Bela G. Liptak, “Instrument Engineers' Handbook”, Volume 1, Fourth Edition_ Process Measurement and Analysis, 2003.

This course will introduce industrial instrumentation as used for troubleshooting, process measurements and process control. Specifically, the course will discuss measurement terminology, differentiating between analog and digital, describe the instrumentation used for electronic testing and develop the principles of operation of transducers used for industrial process measurement and control.

Computer Architecture (3 credits)

Text book(s):

-David A. Patterson, John L. Hennessy, Computer Organization & Design: The Hardware/Software Interface, 5th Edition, Morgan Kaufmann Publishers Inc., 2014.
-M. Mano, Computer System Architecture, 3rd Edition, Prentice Hall, 1993.
-Z. Navabi, Verilog Digital System Design, McGraw-Hill, NewYork, 1999.
-Milos D. Ercegovac & Tomas Lang, Digital Arithmetic, Morgan Kaufmann Publishers, San Francisco, USA, 2004.
-John P. Hayes, Computer Architecture and Organization, McGraw-Hill, 1988.

Number systems, codes and coding, minimization techniques applied to design of logic systems. Component specifications. Discussion of microprocessors, memory and I/O logic elements. Microcomputer structure and operation. I/O modes and interfacing. Machine language and Assembler programming. Design and application of digital systems for data collection and control of pneumatic hydraulic and machine systems.

Advanced control Systems (3 credits)

Text book(s):
-Ch. Lifu, linear systems theory and design, Oxford University Press,3rd ed.,1984

Analytical representation of the finite dimensional linear systems, analysis and design of linear feedback control systems based on the state space model, and state/output feedback. Topics include: review of the linear spaces and operators, mathematical modelling, state space representation and canonical forms, controllability, observability, realization of transfer function, and solution of the state equation. Applications include: stability concepts and definitions, Lyapunov's Direct Method, design of the state and output feedback control systems, eigenspectrum assignment and state estimator design.

Industrial Control (3 credits)

Text book(s):

-B. Wayne Bequette (Author), Process Control: Modeling, Design and Simulation, Prentice Hall; edition (January 5, 2003).
-Terry L.M. Bartle, Industrial Automated Systems: Instrumentation and Motion Control, Cengage Learning; 1 edition (June 8, 2010)
-Frank Petruzella, Programmable Logic Controllers 4th Edition, McGraw-Hill Education; 4 edition (September 3, 2010).
-Sunit Kumar Sen, Fieldbus and Networking in Process Automation, CRC Press (May 14, 2014)

This course aims to introduce the basic concept of industrial automation and modeling and control of industrial process. The course is divided into two parts, namely industrial automation and process modeling and control. The first part of the course covers modeling of industrial processes through physical principles, and also identification of them using time and frequency domain techniques. Tuning of industrial controllers like PID is elaborated using Ziegler-Nichols criteria as well as other techniques. Finally the controller implementation through pneumatic, electric, electronic hardware as well as digital implementation is introduced. In the second part, hydraulic and pneumatic system in industrial automation is introduced and their logic design is elaborated. Next, Programmable logic controllers (PLC) are introduced and their hardware and software are explained, special attention to ladder programming for industrial processes are examined through comprehensive examples. Siemens S7 PLC's are briefly introduced here, due to its intensive use in industries. The student will practice their knowledge of PLC programming in the PLC LAB.

Operations Research (3 credits)

Text book(s):
-F. S. Hillier and G. J. Lieberman, Introduction to Operations Research, 9th edition, 2005

Operations Research is a science of modeling and optimization. It allows you to model real-world problems by using mathematics, statistics, and computers. It provides you tools and theories to solve these real-world problems by finding the optimal solutions to the models subject to constraints of time, labor, resource, material, and business rules. With Operations Research, people make intelligent decisions to develop and manage their processes and businesses.

Operations Research is composed of the following five areas:

- Linear programming
- Nonlinear programming
- Dynamic programming
- Stochastic modeling and simulation
- Dynamical systems

These five areas define various theories and techniques for modeling real-world problems and methods to find their optimal solutions.

Fundamentals of Thermal Systems (3 credits)

Text book(s):
-Van Wylen, Gordon J., Sonntag, Rechard E. , Fundamentals of Thermodynamics, 8th ed.

Covers principles of classical thermodynamics. Develops understanding of mass, energy, heat, work, efficiency, ideal and real thermodynamic cycles and processes. Teaches first and second laws of thermodynamics, perfect gas law, properties of real gases, and the general energy equation for closed and open systems.

Electronics Lab 2 (1 credits)

Laboratory experiments designed to complement Industrial Electronics 2.

FPGA-Based Embedded System Design (4 credits)

Text book(s):

-Pong P. Chu, Embedded SoPC Design with NiosII Processor and Verilog Examples, Wiley, 2012
-Daniel Gajski, Samar Abdi, Andreas Gerstlauer, GunarSchirner, Embedded system design, modeling, synthesis and verification,Springer 2009
-Frank Vahidand Tony Givargis, Embedded System Design: A Unified Hardware/Software Introduction, John Wiley 2002
-Steve Kilts, Advanced FPGA Design: Architecture, Implementation, and Optimization, John Wiley 2007.

Learning about complicated hardware-sfotware design, designing and implementing various systems using Altera DE2 board

Mechatronics (3 credits)

Text book(s):

-Angeles, Jorge. *Fundamentals of robotic mechanical systems: theory, methods, and algorithms*. Vol. 124. Springer Science & Business Media, 2013.
-Bishop, Robert H., ed. *The Mechatronics Handbook*. Vol. 1. Boca Raton: CRC press, 2002.

Mechatronic engineering is a synergistic combination of precision mechanical engineering, electronics and computer systems. A typical mechatronic system is characterised by close integration of the mechanical components, electronic sensors, mechanical and electrical actuators and computer controllers. Mechatronic engineering is an interdisciplinary engineering field that specialists in the control of advanced hybrid systems. These systems are found in numerous industry sectors where mechanical and electronic engineering are interfaced with computer systems, such as Robotics, aerospace, automotive, computers, communications, electronics and manufacturing.

Digital Control (3 credits)

Text book(s):

Ogata, *Discrete-Time Control Systems* (2nd edition), Prentice Hall, 1995.

Techniques for analysis and synthesis of computer-based control systems. Design projects provide an understanding of the application of digital control to physical systems.

Digital Control Lab (1 credits)

Laboratory experiments designed to complement Digital Control course.

Advanced Programming (optional) (maybe) (3 credits)

Text book(s):
B. Stroustrup, The C++ Programming Language, 3rd ed., 1985

Performing 6 computer assignments ranging from simple programs like chess game to object oriented programs

Industrial Electronic Lab (1 credit)

Laboratory experiments designed to complement Industrial Electronics course.

Bachelor Thesis (3 credits)

Each individual or group will select, with faculty guidance and approval, a topic for independent research or investigation resulting in a thesis or project to be used to satisfy the requirement for the degree. An appropriate experimental or analytical thesis or project may be accepted.