Associate Degree Program

Specialty	**Industrial Control Technology**
Course Number	**020301243**
Course Title	**Data Acquisition and Signal Conditioning**
Credit Hours	**2**
Theoretical Hours	**2**
Practical Hours	**0**

Brief Course Description:

- The course covers important issues related to noise and guarding techniques, filtering, signal conversion and data acquisition and transmission.

Course Objectives:

The course objective is to make the student familiar with the different operations carried on the electrical signals to make them clean, without noise with an adequate characteristics for further implementation.

Detailed Course Description:

Unit Number	Unit Name	Unit Content	Time Needed
1.	**Principles of analog signal conditioning**	▪ Signal level changes, linearization, conversions and impedance matching	
2.	**Amplification of signals**	▪ Operational amplifiers, differential amplifiers, instrumentation amplifiers, and isolation amplifiers ▪ Impedance matching	
3.	**Modulation and detection**	▪ Amplitude, phase, and frequency modulation and demodulation ▪ F/V and V/F converters, detection of absolute value. Zero detector, peak detector and comparators	
4.	**Logarithmic amplifiers and analog multiplication**	▪ Logarithmic amplifiers, multipliers, dividers and their applications	
5.	**Filtering and analog signal analysis**	▪ LPF, HPF, PBF, PBR filters. Filters circuits and frequency characteristics. Introduction to active filters ▪ Signal analyzers. Frequency analysis methods of frequency analyzers	
6.	**RMS measurements and noise**	▪ Meaning of RMS detector, RMS and true RMS values, examples ▪ Types of noise in electronic systems, ground loops, guarding techniques	
7.	**Data acquisition and conversion**	▪ Introduction. Signal conditioning of inputs ▪ Single channel data acquisition	

		system ▪ Multichannel data acquisition system ▪ Data conversion ▪ A/D and D/A conversions ▪ Multiplexers and sample and hold circuits	
8.	**Introduction to digital signal transmission**	▪ Introduction ▪ Data transmission systems ▪ Pulse code formats ▪ Modulation techniques for digital data transmission	

Text Books & References:

1. Instrumentation. Devices and sysrems, CS Rangan, GR Sarma, VSV mani Tata McGraw hill-1995, India.
2. Principles of measurement and instrumentation; lan S. Morris, Prentice Hall, 1993, London.

Associate Degree Program

Specialty	**Industrial Control Technology**
Course Number	**020301244**
Course Title	**Data Acquisition and Signal Conditioning**
Credit Hours	**1**
Theoretical Hours	**0**
Practical Hours	**3**

Brief Course Description:

- The course covers the following topics: signal amplification, filtering, modulation and demodulation, conversion and detection and data acquisition.

Course Objectives:

The course objective is to give students practical skills related to signal conditioning and processing.

Detailed Course Description:

Unit Number	Unit Name	Unit Content	Time Needed
1.		▪ Investigation of the characteristics of I/V converter and V/I converter by using op. amplifiers	
2.		▪ Investigation of the characteristics of instrumentation. Amplifiers (IC), or building an IA by using (3) operational amplifiers	
3.		▪ Investigation of the work of the comparator and window comparator in order to generate a square pulse wave with a given period	
4.		▪ Investigation of the characteristics of a logarithmic amplifier and to implement this amplifier to realize an analog multiplier	
5.		▪ Practical study of the frequency characteristic of passive and active LPF and HPF by using (EWB) software	
6.		▪ Practically determine the input/output characteristics of an exclusive-or phase detector ▪ Determine the I/O characteristics of the Motorola MC4044 integrated-circuit phase detector	
7.		▪ Demonstration of the operation of a simple 3-decade frequency synthesizer using MC4024, MC4044 and 74192 integrated circuits	

Evaluation Strategies:

Exams		Percentage	Date
Exams	Reports Exam	30%	
	Midterm Exam	20%	
	Final Exam	50%	

Teaching Methodology:

- Lab. work

Text Books & References:

1. Design of OP-AMP Circuits with experiments, Howard M.Berlin Pernick Printing Corp, Manila, 1986.
2. Design of phase-locked loop circuits with experiments, Howard M. Berlin Howard W. Sams company, 1989, U.S.A.

Associate Degree Program

Specialty	**Industrial Control Technology**
Course Number	**020301241**
Course Title	**Process Control**
Credit Hours	**2**
Theoretical Hours	**2**
Practical Hours	**0**

Brief Course Description:
Introduction to control systems and process control. Block-diagram representation of systems. Open loop and closed-loop systems. System performance indicators. Basic control principles: P, I and D controls. Modes of automated process control on- off, P, PI and PID setting controls, Realizing the different control modes using operational amplifiers, open-loop control using PLC and computers and reading schematics of processes by using ISA.

Course Objectives:
Upon the completion of the course, the student will be able to:

1. Identify the functions of the various components of the automatic process control system.
2. Recognize the open and closed Loop systems and their application in process control.
3. Carry out the necessary calculations to guarantee system stability and accepted system performance.
4. Realize PID modes of control using the necessary analogue electronic equipment.
5. Carry out controller tuning using the recommended methods.
6. Assemble and test simple automatic process control system.
7. Write simple programs to control processes using PLC.

Detailed Course Description:

Unit Number	Unit Name	Unit Content	Time Needed
1.	**Introduction to control systems and process control**	▪ Historical background. Application of process control in industry. Advantages of automatic process control. Main components of process control system. Block diagrams. Open-Loop and closed-Loop system. Classification of process control systems in accordance with the nature of power or the nature of control signals	
2.		▪ Transfer functions of the proportional element, integral element differential element, first order element, and second order element	
3.	**Block Diagrams**	▪ Transfer function of series dynamic elements, loops with negative and loops with positive feed backs. Simplification of block diagrams. Transfer function of open-loop and closed-loop systems	
4.	**Stability of automatic Process Control Systems**	▪ The characteristic equation of the closed-loop system. ▪ Introduction to systems stability. Algebraic criteria of stability. The frequency response and bode diagrams	
5.	**Analogue Controllers**	▪ Introduction and general features. Proportional control mode. (PI) control mode. (PID) control mode. Electronic controllers. Pneumatic	

		controllers	
6.	**Controller Tuning**	▪ Open-loop transient response method. Ziegler-Nichols method. Frequency response method	
7.	**Schematic reading of processes by using ISA**		

Text Books & References:

1. Process control instrumentation technology, Curtis D. Johnson, Fifth edition Printice-Hall international, Inc.1997, USA.
2. Introduction to control system technology, Fourth edition. Robert N. bateson, 1993 U.S.A, Macmillan publishing company.

Associate Degree Program

Specialty	**Industrial Control Technology**
Course Number	**020301242**
Course Title	**Process Control Lab**
Credit Hours	**1**
Theoretical Hours	**0**
Practical Hours	**3**

Brief Course Description:

- Laboratory activates include the level, flow, temperature and pressure controls using Pneumatic and electrical control systems. The students shall do the necessary settings for the on-off; P, PI and PID controllers. Open-Loop controls are investigated using operational amplifiers. Conversion from P/I and I/P shall also be investigated.

Course Objectives:

The course objective is to give the students practical skills to investigate the properties of manual self-regulated, proportional, proportional integral, PD and PID in process control.

Detailed Course Description:

Unit Number	Unit Name	Unit Content	Time Needed
1.		▪ Investigation of the properties of manual and self-regulated processes	
2.		▪ Investigation of proportional element by software EWB	
3.		▪ Investigation of (D,I) element by software EWB	
4.		▪ Investigation of first order system by software EWB	
5.		▪ Proportional and proportional integral control of pressure	
6.		▪ (P) Control of flow	
7.		▪ (PI) and (PD) control of flow	
8.		▪ (P) Control of temperature using analog controller	
9.		▪ Program and control the liquid level by using PLC	
10.		▪ On-off process control system (level control)	

Text Books & References:

1. Soft ware EWB or multisim 2001, available for educational community.
2. Process Control and Transducers DL 2314.
3. Technovate. Automatic and process control technology experiments.

Associate Degree Program

Specialty	**Industrial Control Technology**
Course Number	**020301235**
Course Title	**Pressure and Level Measurements**
Credit Hours	**2**
Theoretical Hours	**2**
Practical Hours	**0**

Brief Course Description:
The course shall cover the different methods to measure the pressure of gasses, liquids and solid materials. Different level measurement methods shall be also treated. Calibration and installation of pressure and level instruments is also to be covered.

Course Objectives:
Upon the completion of the course, the student will be able to:

1. Calibrate pressure gauge using dead weight tester or standard pressure gauge.
2. Carry out the necessary repair and parts replacement of the different manometers and barometers.
3. Troubleshoot pressure-measuring instruments that incorporate resistive transducers, piezoelectric transducers and capacitive transducers.
4. Troubleshoot level measuring devices that incorporate potentiomeric transducers, and capacitive transducers.

Detailed Course Description:

Unit Number	Unit Name	Unit Content	Time Needed
1.	**Principles of pressure in liquids and gas pressure**	▪ Units of pressure, factors affecting liquid pressure, gauge pressure and absolute pressure, Gas pressure and Volume gas pressure and temperature. Atmospheric pressure, manometers and barometers	
2.	**Low pressure measurements**	▪ Vacuum, units of low pressure, pirani gauge, thermal conductivity gauge, mcleod gauge, ionization gauge and stack diaphragm gauge	
3.		▪ Force, stress and strain measurements, force Units, static force strain gauges measurements system for strain strain gauge, ½ and ¼ and complete bridge used for strain measurement. Weight and mass beam type and ring type load cells	
4.	**Principle of level measurements**	▪ Measuring liquid level ▪ Storage tank gauges ▪ Sight glasses ▪ Magnetic gauges ▪ Buoyancy and displacer gauges ▪ Level switches in high level tanks ▪ Photo electric level detectors ▪ Magnetic reed switches	
5.	**Measurement of level using pressure head instruments**	▪ Hydrostatic pressure, pressure head ▪ Pressure head instrument ▪ Air purge measurement	

		▪ Liquid purge systems for level measurement ▪ Force balance diaphragm systems for level measurements	
6.	**Electrical methods for level measurement**	▪ Conductivity and liquid level ▪ Level measurement using capacitive transducers. Capacitance probes ▪ Capacitance probe electronics. ▪ Sonic level measurement ▪ Radiation level detection and measurement ▪ Potentiometric method for level measurement	
7.	**Solid level measurement**	▪ Sonic and microwave solid level measurement ▪ Using capacitance probes to measure solid level ▪ Using weight to determine level ▪ Using strain gauge to detect level	

Text Books & References:

1. Instrumentation, Franklyn W. Kirk; Nicholas R. Rimboi; American Technical publishers; Inc Third edition, lllinois, USA.
2. Instrumentation and process measurements W. Balton, Longman scientific and technical, 1991 U. K.
3. Measurements and Instrumentation in heat engineering. V. Preobrazhensky, Volume No (2): Mir publishers, 1978, Moscow, USSR.
4. Instrument technology. E. B. Jones, Newnes-Buttererworths; Volume 1, 1974. U. K.
5. Basic instrumentation, Industrial measurement. Patrick J. O'higgins; McGraw-Hill Book Corporation.
6. Mechanical and industrial measurement. R. K Jain; Khanna publishers; Delhi.

Associate Degree Program

Specialty	**Industrial Control Technology**
Course Number	**020301236**
Course Title	**Pressure and Level Measurement Lab**
Credit Hours	**1**
Theoretical Hours	**0**
Practical Hours	**3**

Brief Course Description:

- The student shall carry out the required experiments demonstrating different methods of level and pressure measurement by using capacitive and resistive transducers. LVDT is used also for level and a pressure measurement, calibration of pressure gauges by using dead weight tester is practiced.

Course Objectives:

Upon the completion of the course, the student will be able to:

1. Practical calibrate the pressure gauges.
2. Practical investigate the different methods for pressure and level measurements.

Detailed Course Description:

Unit Number	Unit Name	Unit Content	Time Needed
1.		▪ Using of U-type shaped manometers with open and closed limbs for pressure and differential pressure measurements	
2.		▪ Measurement of low pressures and their amplification, by using inclined manometers with a storage bulb	
3.		▪ Calibration of pressure gauges by using dead-weight tester	
4.		▪ Measurement of liquid level in closed tanks by using pressure gauges	
5.		▪ Measurement of pressure by using capacitive sensors	
6.		▪ Measurement of pressure by using variable resistance	
7.		▪ Measurement of pressure by using LVDT	
8.		▪ Measurement of level by using capacitive transducer	
9.		▪ Measurement of liquid level by using variable resistance	
10.		▪ Measurement of liquid level by using LVDT	

Text Books & References:
Systems laboratory manuals

Associate Degree Program

Specialty	**Common**
Course Number	**020301131**
Course Title	**Power Electronics**
Credit Hours	**2**
Theoretical Hours	**2**
Practical Hours	**0**

Brief Course Description:

Principles and Methods of Electric Power Conversion. Complementary Components and Systems. AC-to-DC Converters. AC-to-AC Converters. DC-to-DC Converters. DC-to-AC Converters. Switching Power Supplies. Power Semiconductor Devices. List of Principal Symbols. Semiconductor Power Switches. Diodes and Phase-Controlled Converters .Cycloconverters. Voltage-Fed Converters. Current-Fed Converters. Choppers. Basic calculations. Waveforms. Applications

Course Objectives:

Upon the completion of the course, the student will be able to:

1. Distinguish power electronics devices.
2. Identify power electronics devices
3. Use power electronics devices.
4. Investigate characteristics of power electronics devices.
5. Test and troubleshoot power electronics devices.
6. Provide basic calculations of power electronics devices.
7. Use energy converters with different loads

Detailed Course Description:

Unit. number	Unite name	Unite content	Time Needed
1.	**Power Semiconductor Devices**	▪ Diodes. Thyristors. Triacs. Gate Turn-Off Thyristors (GTOs). Bipolar Power or Junction Transistors (BPTs or BJTs). Power MOSFETs. Static Induction Transistors (SITs). Insulated Gate Bipolar Transistors (IGBTs). MOS-Controlled Thyristors (MCTs). Integrated Gate-Commutated Thyristors (IGCTs). Power Integrated Circuits (PICs)	
2.	**Diodes and Phase-Controlled Converters**	▪ Diode Rectifiers. Thyristor Converters. Converter Control	
3.	**Frequency Changers**	▪ Classification and applications. Block diagrams and principle of operation. Examples: Phase-Controlled Cycloconverters. Matrix Converters. High-Frequency Cycloconverters	
4.	**Voltage-Fed Converters**	▪ Single-Phase Inverters. Three-Phase Bridge Inverters. Multi-Stepped Inverters. Pulse Width Modulation Techniques. Three-Level Inverters. Hard Switching Effects. Resonant Inverters. Soft-Switched Inverters. PWM Rectifiers	
5.	**Current-Fed Converters**	▪ General Operation of a Six-Step Thyristor Inverter. Load-Commutated Inverters. Force-Commutated Inverters. Multi-Stepped Inverters. Inverters with Self-Commutated Devices. Current-Fed vs Voltage-Fed Converters	
6.	**Choppers**	▪ Classification, principle of operation, applications	

Text Books & References:

Textbook:

1. M. Rashid, Power Electronics Circuits, Devices and Applications, Upper Saddle River, NJ: Pearson Education, 3d Edition, 2003.

References :

1. Reddy, Rama S., Fundamentals of Power Electronics, Boca Raton, Fla., CRC Press, 2000.
2. S.B. Dewan and A. Straugher, Power Semiconductor Circuits, John Wiley & Sons, USA, 1994

Associate Degree Program

Specialty	**Common**
Course Number	**020301132**
Course Title	**Power Electronics Lab**
Credit Hours	**1**
Theoretical Hours	**0**
Practical Hours	**3**

Brief Course Description:

- Test of semiconductor devices. Investigation of characteristics of power electronics devices. Investigation of rectifier, chopper, and inverter circuits under different loads (R, L-loads)

Course Objectives:

Upon the completion of the course, the student will be able to:

1. Distinguish power electronics devices.
2. Use power electronics devices.
3. Troubleshoot power electronics devices.
4. Control Thyristors and power transistors.
5. Connect the power electronics circuits.
6. Troubleshoot power electronics converters.
7. Provide basic calculations related to the output of power electronics converters

Detailed Course Description:

Unite number	Lab name	Lab content	Time Needed
1.	**Identification and troubleshooting of power electronics semiconductor devices**		(1 week)
2.	**Investigation of characteristics of power electronics devices (Diodes, transistors, Thyristors)**		(2 week)
3.	**Investigation of firing circuit of Thyristor. (Firing circuit with AC voltage, firing circuit with DC voltage and firing circuit with pulse signals)**		(2 weeks)
4.	**Investigation of controlled rectifiers characteristics (Single phase and three phase circuits)**		(3 weeks)
5.	**Investigation of Chopping circuits**		(1 week)
6.	**Investigation of inverter characteristics. (Single phase and three phase circuits)**		(3 weeks)
7.	**Investigation of frequency changers characteristics**		(2 weeks)

Evaluation Strategies:

Exams		Percentage	Date
Exams	First Exam	20%	--/--/----
	Second Exam	20%	--/--/----
	Final Exam	50%	--/--/----
Homework and Projects		10%	
Discussions and lecture Presentations			

Teaching Methodology:

- Lab. work

Text Books & References:

References :

Instructional Lab. Sheets

Associate Degree Program

Specialty	**Industrial Control Technology**
Course Number	**020301233**
Course Title	**Pneumatic and Hydraulic Drives**
Credit Hours	**3**
Theoretical Hours	**3**
Practical Hours	**0**

Brief Course Description:

Introduction to fluid mechanics. Properties of hydraulics and pneumatics. Structure of pneumatic and hydraulic systems. Components of pneumatic and hydraulic systems: Execution final elements, Control valves, Timers, Limit switches, Reed switches, Proximity sensors. Symbols and schematic standards, numbering system and identification of pneumatic and hydraulic components. Basic pneumatic and hydraulic drives

Course Objectives:

The main objective of the course is to provide the necessary background information which will allow the student to build solid understanding of common industrial pneumatic and hydraulic drives. The student will be able to specify, select, install, troubleshoot and run industrial pneumatic and hydraulic drive systems

Detailed Course Description:

Unite number	Unite name	Unite content	Time Needed
1.	Introduction to pneumatic and hydraulic drives, and their basic components. Definition of pneumatic drives, control devices, distribution devices, actuators and transmission mechanisms. Examples		(1 week)
2.	Cylinders: single acting and double acting cylinders. Diaphragm cylinders, impact cylinders, cushioned cylinders, special types pf cylinders. Standard cylinder sizes. Specifications of cylinders. Cylinder air consumption. Piston velocity considerations		(1 week)
3.	Pneumatic and hydraulic motors. Vane-type motors, piston-type motors (axial and radial), rotary actuators. Ratings of motors. Factors defining selection criteria of motors		(1 week)
4.	Valves: classification of valves. Reading schematics of valves. Directional control valves. Pressure control valves. Flow control valves. Check valves. Shuttle valves. Double cut-off valves. Quick exhaust valves. Nozzle valves. Flapper valves. Valves applications and structures		(2 weeks)
5.	Timers, proximity sensors and amplifiers. ON-delay timer, OFF-delay timer, one-shot timer. Back-pressure proximity sensors, reflex proximity sensors, air barriers. Pneumatic and hydraulic amplifiers and intensifiers		(2 weeks)
6.	Piping, fittings and accessories. Service units, pressure regulators (reducers), chocks, fittings and connectors, types of connectors. Pipes and hoses		(1 week)
7.	Control of single acting and double acting cylinder. Control of unidirectional and bidirectional motors, influencing rotational speed, influencing torque and force. Stopping of cylinders, and various circuit combinations. Examples		(2 weeks)
8.	Solenoid valves. Principle of operation. Electro-pneumatic and electro-hydraulic directional valves.		(1 week)

	Electro-magnetic relays, connection diagrams. Electrical limit switches		
9.	ON-OFF electro-pneumatic and electro-hydraulic drives. Examples on using electromagnetic relays and the control device to control industrial processes. Examples include the pneumatic-hydraulic circuits and the electrical circuits also. Examples on using PLCs to drive power cylinders or motors		(2 weeks)
10.	Introduction to proportional control. Proportional directional control valves. Pressure proportional control valves. Flow proportional control valves. Comparison between ON-OFF drives and proportional drives		(2 weeks)

Text Books & References:

1. Basic pneumatics. Ing. Buro. J.P. Hasebrink. Editor: Mannesmann Roxroth Pneumatik. GmbH. Schlenungdruck GmbH. 1977, Germany.
٢. القيادة الكهرورئوية والكهروهيدروليكية، د. محمد عالية، م. زيد بولص حجازين، مكتبة المجتمع العربي للنشر والتوزيع، ٢٠٠٥، الأردن

Associate Degree Program

Specialty	**Industrial Control Technology**
Course Number	**020301234**
Course Title	**Pneumatic and Hydraulic Drives Lab**
Credit Hours	**1**
Theoretical Hours	**0**
Practical Hours	**3**

Brief Course Description:

- The course covers the major activities related to industrial pneumatic and hydraulic drives, such as actuator positioning, speed control, event driven controls and realizing different sequential operations

Course Objectives:

- The objectives of the course are to provide the student with the practical skills related to managing pneumatic and hydraulic drive systems. The student is supposed to analyze the task, write the control algorithm, assemble the circuit and run it

Detailed Course Description:

Unit number	Lab name	Lab content	Time Needed
1.	Translation of real industrial processes to a programmed sequence of logical operations by using traditional electrical control and by using PLCs, limit switches, counters, timers and PLC registers		(3 weeks)
2.	Realization of pneumatic out-stroking and in-stroking and controlling the drive velocity by using quick-exhaust valves		(1 week)
3.	Realization of pneumatic sequential control of a cylinder motion by using pressure switch and pneumatic timers		(1 week)
4.	Control of the cylinder velocity of a hydraulic system by using check-chock assembly and traditional electrical circuit		(2 weeks)
5.	Operate and carry out the required adjustments of a PLC driven electro-pneumatic testing station		(1 week)
6.	Operate and carry out the required adjustments of a PLC driven electro-pneumatic storage station		(1 week)
7.	Using the PLC and directional control valves and proximity switches in order to realize the required control sequence of motion of a pneumatic manipulator		(1 week)

References:

Manuals existing at the laboratory and the laboratory sheets prepared by the instructors

Associate Degree Program

Specialty	**Industrial Control Technology**
Course Number	**020301237**
Course Title	**Flow and Temperature Measurements**
Credit Hours	**2**
Theoretical Hours	**2**
Practical Hours	**0**

Brief Course Description:

- The course includes the study of differential pressure and variable area method flow meter. Different types of flow meters. Basic concepts of temperature scales units, measuring methods and devices like TC, RTD, Bimetallic, thermocouple, semiconductor and filled system thermometers.

Course Objectives:

Upon the completion of the course, the student will be able to:

1. Select the most appropriate flow meter for the given task.
2. Connect and commission the selected flow meter.
3. Troubleshoot and maintain the flow meter.
4. Carry out the required simple calculations.
5. Identify different temperature scales and carry out the necessary conversion between them.
6. Distinguish between the different temperature measurement principles and different temperature measurement equipment.

Detailed Course Description:

Unit Number	Unit Name	Unit Content	Time Needed
1.	**Basic theory of flow**	▪ Basic units and definitions ▪ Flow rate equation for incompressible fluids ▪ Flow rate equation for compressible fluids ▪ Applications of Bernoulli equation ▪ Classification of flow measurement methods	
2.	**Differential pressure methods of flow measurement**	▪ Practical hints for the measurement of fluid flow rate by differential pressure flow meters ▪ Flow measurement by differential pressure device installed outside the pipeline ▪ Flow measurement for dirt-laden fluids	
3.	**Variable area flow meters**	▪ General ▪ Basic theory of the ratemeters ▪ Construction of the ratemeters and their applications	
4.	**Volume flowmeters Magnetic flow meters**	▪ Rotary meters for liquids ▪ Rotary rate meters for liquids ▪ Magnetic flow meters	
5.	**Anemometers and anubars**	▪ Introduction ▪ Mechanical anemometers. ▪ Hot wire and hot-film anemometers ▪ Anubars	
6.	**Thermometry**	▪ Introduction ▪ Temperature and temperature scales ▪ Practical temperature scales	

		▪ Classification of temperature measurement methods contacts methods, non contact methods, electrical and non-electrical methods, and radiation methods	
7.		▪ Liquid-in-glass and filled-system thermometers. Liquid in glass thermometers. Liquids used in thermometers. Laboratory and industrial thermometers. Thermometers that include an electrical contact. Filled system thermometers. Gas filled and vapour filled thermometers. Correction for changes in bulb volume	
8.		▪ Solid-expansion and bimetal thermometers – solid-expansion thermometers. The coefficient of linear expansion of the solid materials. Bimetallic thermometers in control system. Bimetallic thermostats	
9.	**Resistance and semiconductor thermometers**	▪ Introduction. Platinum and copper resistance thermometers ▪ Semiconductor resistance thermometers ▪ Thermister, its characteristics, and its applications in temperature measurement and control ▪ Electrical circuit for detection temperature	
10.	**Thermoelectric thermometry**	▪ Connection of a measuring instrument in a thermocouple circuit	

		▪ Basic Principle of thermocouple (peltier, seebic and Thomson effects) ▪ Intermediate metals and compensating leads ▪ Intermediate temperature ▪ Measuring of the differential temperature using thermocouples ▪ Measurement of the average temperature using the thermocouple	
11.	**Pyrometry**	▪ Principles of radiation ▪ The optical pyrometers ▪ The infrared pyrometers ▪ Photon detector temperature instruments	

Text Books & References:

1. Instrumentation for Engineering Measurement, James W. Dally, William F. Rilcy, Kenneth Gmacnnell, 2nd edition John willy and sons. Inc 1993.
2. Measurements and Instrumentation in Heat Engineering Volume. Mir. Publishers. Moscow 1980.
3. Fundamentals of Temperature, Pressure and Flow measurements by Rebert, p. Ben dict, Jul 1984, amazon.com sealer.

Associate Degree Program

Specialty	**Industrial Control Technology**
Course Number	**020301238**
Course Title	**Flow and Temperature Measurements Lab**
Credit Hours	**1**
Theoretical Hours	**0**
Practical Hours	**3**

Brief Course Description:

- The practical activity includes the study of different methods to measure flow and temperature such as RTD, Thermocouple, Thermistor, Rotameters, Vinturi tubes, Orifice plates and optical sensing propeller flow meter.

Course Objectives:

Upon the completion of the course, the student will be able to:

1. Troubleshoot flow meters and carry out the necessary repair or maintenance.
2. Carry out the necessary calibration using the available standard flow meters.
3. Troubleshoot temperature measurement and temperature control circuits and devices.
4. Carry out the required calibrations of the measuring devices.

Detailed Course Description:

Unit Number	Unit Name	Unit Content	Time Needed
1.	**Flow rate through the vinturi tubes**	▪ The student shall assemble the network with the necessary measuring equipment to measure the defferented pressure and the recovery ratio of the pressure	
2.	**Flow rate through the orifice plates**	▪ The student shall fix the different types of orifice plates and realize the differential pressure up stream and down stream	
3.	**Optical Sensing Propeller flow meter**	▪ An impeller placed in the flow stream will be rotated with a velocity proportional to the flow rate. Using optical transducer the impeller shall be calibrated directly for flow rate	
4.	**Rotameters**	▪ Study the construction of different rotemeters. Connect the Rotameter in a pipe network. Carry the necessary check and cleaning for the Rotameter needle valve	
5.	**Capillary bulb Thermostatic Controller**	▪ The experiment illustrates the use of capillary bulb thermostat to control temperature	
6.		▪ Adjustable bi-metallic strip thermostatic controller with anticipatory	
7.	**Thermocouple**	▪ A practical study of the principles of thermocouples and practical study of a two-metal junction as a temperature indicator	

8.	**Thermistor**	▪ The experiment includes the study of the behavior of negative temperature coefficient resistor and its application in the design of practical measurement systems	
9.	**The RTDs**	▪ The experiment includes the practical study of the behaviour of a positive temperature coefficient resistance as a temperature measuring device	
10.	**On-off Temperature Control (Hall-Effect).**	▪ The experiment illustrates the use of hall-effect thermostatic type in the control of temperature	

Text Books & References:
Systems Laboratory manuals of experiments

Associate Degree Program

Specialization	**Common**
Course Number	**020400111**
Course Title	**Electronics**
Credit Hours	**3**
Theoretical Hours	**3**
Practical Hours	**0**

وصف المادة الدراسية:

This course covers the basic subjects in electronics and you will study: Semiconductor theory , the diode , special purpose diodes , diode applications , bipolar junction transistor (BJT) , field effect transistor (FET) , operational amplifiers, thyristor and other devices.

أهداف المادة الدراسية:

Upon the completion of the course, the student will be able to:

1. Explain the basic structure of atoms.
2. Define and discuss semiconductors, conductors, insulators .
3. Identify the bias and applications of diode, zener ,varactor, and other special diodes.
4. Study of BJT & FET ,oscillators ,operational amplifiers, thyristors and other devices

الوصف العام:

رقم الوحدة	اسم الوحدة	محتويات الوحدة	الزمن
1.	**Introduction to Semiconductors**	▪ Atomic structure ▪ Semiconductors ▪ Conductors ▪ Insulators ▪ Covalent bonds ▪ Conduction in semiconductors ▪ Intrinsic and extrinsic semiconductors ▪ N-type and p- type semiconductors	**1 week**
2.	**The Diode**	▪ P-N junction ▪ Biasing the diode ▪ Voltage – current characteristic of diode ▪ DC load line ▪ Operating point ▪ DC and AC resistance ▪ Comparison between silicon and germanium diodes ▪ Data sheet of diode	**2 weeks**
3.	**Special – Purpose Diode**	▪ Zener diode (symbol , structure , principle of operation ▪ Zener diode applications (regular and limiter) ▪ Varactor diode. Light- emitting diode (LED), photodiode	**1 weeks**
4.	**Applications of The Diode**	▪ Half – wave and full – wave rectifiers ▪ Filters and regulators in power supply circuits.	**2 weeks**
5.	**Bipolar Junction Transistor (BJT)**	▪ Introduction ▪ Structure and principle of operation ▪ Characteristics and parameters. ▪ Regions of operation	**2 weeks**

		▪ The DC operation point)load line) ▪ BJT as an amplifier and as switch ▪ Voltage divider bias and other bias methods ▪ Basic circuits connection ▪ (C.E, C.C, C.B) amplifier ▪ Data sheet of a BJT	
6.	**Field – Effect Transistor(FET)**	▪ Introduction. ▪ Structure and principle of operation of junction field effect transistor (JFET). ▪ JFET characteristics, Parameters and biasing. ▪ Structure and principle of operation of metal oxide semiconductor field effect transistor (MOSFET). ▪ Enhancement and depletion types. ▪ MOSFET characteristics, Parameters and biasing. ▪ FET amplification, connections modes (C.S, C.D, C.G,) amplifiers, data sheet of a JFET and a MOSFET.	**2 week**
7.	**Oscillators**	▪ Introduction ▪ Negative and positive feedback, (basic circuit, principle of operation, oscillation frequency calculation for the following oscillators. Phase – shift oscillator ▪ Colpitts and Hartley oscillators	**1 week**
8.	**Operational Amplifiers**	▪ Symbol, terminals and basic op-amp representations (idea and practical)	**2 week**

9.	**Thyristor and Other Devices**	▪ Structure ,principle of operation ▪ Characteristics curves and applications of the following devices: (Four – layer device, SCR (Silicon – controlled rectifier), siac, triac, Uninjunction transistor (UJT), and phototransistor	**2 week**
10.	**Introduction to Electronic Measurements**	▪ Applications of oscilloscope in electronic measurements	**1 week**

❖ Lectures

الكتب و المراجع :

1. Thomas L. Floyd, electrical devices, prentice hall international, 6th edition , 2002.
2. Basic operational Amplifiers and Linear Integrated Circuits , David Buchla ,Prentice Hall , 1999.
3. Electronics fundamental and Experiments, Cynthia B. Leshin, David Buchla, Tjomas L. Floyd, prentice hall international ,1999.

Associate Degree Program

Specialization	**Common**
Course Number	**020400112**
Course Title	**Electronic Circuits and Devices Lab.**
Credit Hours	**1**
Theoretical Hours	**0**
Practical Hours	**3**

وصف المادة الدراسية:

- Lab in support of the basic electronics course, experiments in basic electronics have to cover all electronics devices (diode, zener diode, diode applications, BJT,op – amp ,oscillators ,SCR).

أهداف المادة الدراسية:

Upon the completion of the course, the student will be able to:

1. Become familiar with electronics devices and using data sheet.
2. Demonstrate how to test electronic devices by using AVO meter or through DC measurements.
3. Construct electronic circuit.
4. Investigate characteristics curves.
5. Calculate the value the values of currents and voltage and compare them with measured values

الوصف العام:

رقم الوحدة	اسم الوحدة	محتويات الوحدة	الزمن
1.	**The diode**	▪ Forward and reverse biasing. ▪ Characteristic curve. ▪ Data sheet.	**2 weeks**
2.	**The zener Diode.**	▪ Breakdown voltage. ▪ Regulation. ▪ Characteristic curve. ▪ Data sheet	**2 weeks**
3.	**Rectification Circuits with Filter and Regulator**	▪ Half- wave and full- wave. ▪ Ripple factor. ▪ Line and load regulation	**1 week**
4.	**A BJT testing by using AVO meter , and how to determine the specifications of transistor through data sheets**		**1 week**
5.	**A BJT with Voltage – Divider Bias**		**1 week**
6.	**A BJT as a switch**		**1 week**
7.	**Common Emitter Amplifier Circuit**		**1 week**
8.	**Common collector Amplifier circuit**		**1 week**
9.	**Common Base Amplifier Circuits**		**1 week**
10.	**Common source Amplifier Circuits**		**1 week**
11.	**Operational Amplifier as Inverting and Noninverting Amplifier**		**1 week**
12.	**Operational Amplifier as Differentiator and Integrator**		**1 week**
13.	**RC phase-shift Oscillator**		**1 week**

14.	**SCR as a switch**		**1 week**

طرق التقييم المستخدمة :

الامتحانات	نسبة الامتحان من العلامة الكلية	التاريخ
التقارير	30%	
الامتحان المتوسط	20%	
الامتحانات النهائية	50%	

الكتب و المراجع :

1. Instructional Lab. Sheets
2. Thomas L. Floyd – " Principles of electric circuits" Electron flow version - prentice hall International – eighth edition 2006.
3. Robert L. Boy listed - Introductory circuit analysis - prentice hall International 1997.
4. Experiments in electronics Fundamentals and electric circuits fundamentals – David Buchla -. prentice hall 2000.

Associate Degree Program

Specialization	Common
Course Number	020300115
Course Title	Electrical workshops
Credit Hours	1
Theoretical Hours	0
Practical Hours	3

Brief Course Description:

- Electric wiring for building, such as lighting wiring systems ,alarm systems ,motor control systems ,inspecting maintaining rewinding electrical transformers ,and machines ,Applying safety and security means in electrical works , Electronic circuits building and printed circuits , repair and maintenance techniques.

Course Objectives:

Upon the completion of the course, the student will be able to:

1. To construct Electrical wiring for buildings.
2. To construct Electrical wiring for alarm systems.
3. To construct Electrical wiring for single and three phase motors and control circuits.
4. To construct Electrical wiring for transformers.
5. To construct Electrical wiring for DC motors.
6. Preparing and designing electronic circuits.

.

Detailed Course Description:

Unit Number	Unit Name	Unit Content	Time Needed
1.	**Introduction**	▪ Tools ,apparatus and equipment presentation ▪ Workshop safety instructions ▪ Types and classification of cables and wires, wires connecting	
2.	**Electrical wiring fixtures and accessories**	▪ Switches , outlets, junction boxes, lamp accessories and their fixing methods ▪ Underground low voltage raceway cable techniques and practices	
3.	**Electrical wiring circuits**	▪ Wiring practices of lighting circuits (single-pole switch, double-way switch, staircase switches florescent lamp assembling) ▪ Single-phase and three-phase outlets wiring and practices, with and without earthing ▪ Telephone, intercom, interphone wiring practices, bell and call system wiring	
4.	**Conduits and trunks for electrical wiring**	▪ Conduits classification, conduit bending methods and practices ▪ Trunks and conduits fixing and wiring practices	
5.	**Transformers**	▪ Single-phase and three-phase transformers (cored and unvaried), autotransformers and voltage regulators ▪ Current and voltage transformer	

		techniques and maintenance ▪ Rewinding transformers.	
6.	**Single-phase motors**	▪ Shaded pole, split, wounded and capacitor motors, universal motor ▪ Motors inspections, repairing and rewinding techniques.	
7.	**Three-phase motors.**	▪ Motor construction presentation for wounded motor, squirrel-cage motor and synchronous ▪ Three-phase motor inspection, maintaining and rewinding techniques	
8.	**DC motors**	▪ Construction presentation of DC machines (series, shunt and compound machines) ▪ Armature coil rewinding for ring type and waving type windings	

Textbook & References :

1. Wiring simplified. Based on the 2005 National code. By H.P. Richter 2005.
2. Practical electrical wiring : Residential , Farm , commercial and industrial ,By H. P. Richter and W. Creighton Schwan ,1996.
3. Manuals existing at the laboratory and the laboratory sheets prepared by the instructors

Associate Degree Program

Specialty	**Industrial Control Technology**
Course Number	**020301231**
Course Title	**Electrical Drive Systems**
Credit Hours	**3**
Theoretical Hours	**3**
Practical Hours	**0**

Brief Course Description:

Definition and structure of electric drive system. Industrial loads. Static characteristics of loads and motors. Equation of motion. Equivalent electric drive system. Transient operations: starting, reverse, braking. Power and control circuits of transient operations using time principle. Methods of speed control. Introduction to semiconductor electric drives.

Course Obje

Upon the completion of the course, the student will be able to:

1. Understand the basic components of an electric drive system.
2. Understand and design various speed controls, braking and holding techniques for electric motors.
3. Understand and design a complete electric drives system for industrial applications.
4. Enable students to carry out a final project on an electric drives system for industrial applications.
5. Identify, select and use components of electrical drives.
6. Identify DC and AC drives characteristics.
7. Control motor speed in electrical drives systems.
8. Use servo drive systems.
9. Construct starting, stopping and reversing systems using timers, relays, contactors and switches.

Detailed Course Description:

Unit number	Unite name	Unite content	Time Needed
1.	**Electrical drive systems. Definition, functions and application, classification. Block-diagram and basic components. Specifications**		
2.	**Electrical drives characteristics. Static and dynamic characteristics of DC and AC drives**		
3	**Starting, braking and reversing of electrical drives. Methods of manual and automatic starting, braking and reversing of DC and AC drives. Static and dynamic characteristics**		
4	**Speed control in DC and AC drives systems. Methods of speed control. Resistance speed control. Voltage variation speed control. Flux speed control. Frequency speed control**		
5	**Power and control circuits based on time principle.**		
8	**Introduction to semiconductor electric drives: Chopper and controlled-rectifier-DC Drives, Inverter-controlled AC drives.**		

Text Books & References:

Textbook:

1. Textbook: Fundamentals of Electric Drives, Mohamed A. El-Sharkawi, Brooks/Cole Pub, 2000.

References:

1. P.C. Sen, Thyristor DC drives, Krieger Pub. C, New York, 2005.
2. D.K. Anand, Introduction to control systems, New-York, Pergamon Press, 1988.
3. M.H. Rashid, Power electronics, Prentice-Hall, USA, 1988.
4. S.B. Dewan, Power semiconductor drives, John Wiley and Sons, New York, 1988.
5. M.M. Chilikin, electric drive, Moscow, 1981.

Associate Degree Program

Specialty	**Industrial Control Technology**
Course Number	**020301232**
Course Title	**Electrical Drive Systems Lab**
Credit Hours	**1**
Theoretical Hours	**0**
Practical Hours	**3**

Brief Course Description:

- Investigation of torque/speed characteristics of drive systems. Automatic start, stop and reverse of drive systems. Speed control. Effect of feedback on torque/ speed characteristics. Servo drives

Course Objectives:

Upon the completion of the course, the student will be able to:

1. Identify, select and use components of electrical drives.
2. Identify DC and AC drives characteristics.
3. Control motor speed in electrical drives systems.
4. Implement open-loop and closed-loop control in electrical drives systems.
5. Use servo drive systems.
6. Construct starting, stopping and reversing systems using timers, relays, contactors and switches.
7. Program PLCs to control electrical drive systems

Detailed Course Description:

Lab. NO.	Content	Notes	Time Needed
1.	**Speed control and characteristics of DC drives**		(2 weeks)
2.	**Speed control and characteristics of AC drives**		(2 weeks)
3	**DC drives starting, braking and reversing**		(2 weeks)
4	**AC drives starting, braking and reversing**		(2 weeks)
5	**Closed-loop drives systems**		(2 week)
6	**Servo drive systems**		(2 weeks)
7	**Semiconductor drive systems**		(2 weeks)

Text Books & References:

Instructional Lab. Sheets

Associate Degree Program

Specialization	**Common**
Course Number	**020301121**
Course Title	**Electrical Machines**
Credit Hours	**2**
Theoretical Hours	**2**
Practical Hours	**0**

وصف المادة الدراسية:

This course throws light on all types of electrical machines ,transformers ,motors, ,generators ,special machines ,These machines which may face a diploma holder in his practical life ,He must be aware of many related things about these machines ,construction ,principles of operation , characteristics , applications , maintenance .

أهداف المادة الدراسية:

بعد دراسة هذه المادة يتوقع من الطالب أن يكون قادراً على تحقيق الأهداف التالية:

1. Explain & describe the operating principles, construction of generators.
2. Explain & describe the operating principles, construction of three phase synchronous generators.
3. Explain & describe the operating principles, construction & excitation of DC & AC motors & generators.

الوصف العام:

رقم الوحدة	اسم الوحدة	محتويات الوحدة	الزمن
1.	**Introduction to Magnetic Circuits**	▪ I-H relation ▪ B-H relation ▪ Magnetic equivalent circuit ▪ Hysteresis losses ▪ Eddy current losses ▪ Core losses	**1 weeks**
2.	**Transformers**	▪ Construction and principle of operation ▪ EMF Equation ▪ Practical transformer; referred equivalent circuit ▪ Open – circuit test ▪ Short – circuit test ▪ Full – load copper losses. ▪ Efficiency ,all – day efficiency ,maximum efficiency ▪ Voltage regulation ▪ Ideal transformer ▪ Auto transformer ▪ Three – phase transformers	**2 weeks**
3.	**Direct Current Machines**	▪ Construction and principle of operation ▪ Armature windings ▪ Developed torque ▪ DC generators, types; characteristics, interlopes, armature reaction , voltage regulation . ▪ DC Motors, types; mechanical characteristics; losses and efficiency speed control	**3 weeks**
4.	**Three – Phase Indication Motors**	▪ Introduction ▪ Construction and types ▪ Rotating magnetic field ▪ Induced E.M.F ▪ Slip	**3 weeks**

		▪ Performance characteristics ▪ No – load test ▪ Blocked – rotor test ▪ Speed control ,pole changing , line voltage control; line frequency ▪ Control , rotor resistance control	
5.	**Single – phase Induction Motors** .	▪ Double revolving field theory ▪ Types , capacitor – start motor ,split – phase motor ; shade – ▪ Pole motor, capacitor – start and run motor, universal motor. ▪ Characteristics and typical applications ▪ Speed control	**2 weeks**
6.	**Synchronous Machines** .	▪ Construction of 3-ph synchronous machine ▪ Synchronous generators , principle of operation , types ▪ characteristics , armature reaction , voltage regulation ▪ Synchronous motors , principle of operation , power and torque ▪ characteristics , P.F control speed control , applications	**2 weeks**
7.	**Special Machines**.	▪ DC servomotor, construction and applications. ▪ AC servomotor, construction and applications. ▪ Stepper motor, types, construction and applications.	**1 week**

الكتب و المراجع :

1. Principle of Electric Machines and Power Electronics , P.C. Sen , John Wiley and Sons , Inc , 1997
2. Small Electric Motors , Helmut Moczala , Jugen Draeger , Hermann Kraub , 1998
3. Electrical Machines , M.S.Sarma , West Publishing Company , 1994

Electrical machinery Fundamental, Stephen J. Chap man, Mc GRAW , Hill , 1996 .

Associate Degree Program

Specialization	**Common**
Course Number	**020301122**
Course Title	**Electrical Machines Lab**
Credit Hours	**1**
Theoretical Hours	**0**
Practical Hours	**3**

وصف المادة الدراسية:

This course focus ,on connection of various types of electrical machines , measurement of losses and efficiency ,speed control and mechanical characteristics of types of motors ,external characteristics of generators.

أهداف المادة الدراسية:

Upon the completion of the course, the student will be able to:

1. Make connection of all type of electrical machines , motors , generators and transformers
2. Measure; power ,current, voltage and cosup of electrical machines
3. Measure sped of different types motor
4. Draw the characteristics of transformers ,motors and generators
5. Calculate the parameters of electrical machines

الوصف العام:

رقم الوحدة	اسم الوحدة	محتويات الوحدة	الزمن
1.		**Experiments on transformers no- load test, short- circuit test and loading test. Cage type , Capacitor-start motor, shaded- pole type**	**1 weeks**
2.		**Experiments on three – phase induction motors; wound rotor type and squirrel**	**2 weeks**
3.		**Experiments on single – phase induction motors split phase type ،**	**3 weeks**
4.		**Experiments on synchronous machines ; synchronous generator**	**2 weeks**

		(alternator) and synchronous motor	
5.		**Experiments on DC motors ;shunt, series, compound**	**4 weeks**
6.		**Experiments on DC generators ;shunt, series, compound**	**4 weeks**

الكتب و المراجع :

المراجع:

1. Lab. Sheets Prepared by Instructor
2. Manuals of each type of machines.
3. Electric machinery fundamentals, Stephen J.Chapman, 1996.

Associate Degree Program	
Specialization	**Common**
Course Number	**020400113**
Course Title	**Digital Fundamentals**
Credit Hours	**2**
Theoretical Hours	**2**
Practical Hours	**0**

وصف المادة الدراسية:

Study of numerical systems, theory of Boolean algebra and logic circuits, applications to different types of circuits, study of flip-flops, counters, registers and accumulators, digital system memory including ROM, RAM, and EPROM.

أهداف المادة الدراسية:

1. To be familiar with number systems and its conversion.
2. To understand logic functions, gates, and Boolean algebra.
3. To understand combinational circuits.
4. To understand sequential logic circuits.
5. To be familiar with different types of memory.

الوصف العام:

رقم الوحدة	اسم الوحدة	محتويات الوحدة	الزمن
1.	**NUMBERS SYSTEM AND CODES**	▪ Introduction ▪ Decimal, binary, octal and hexadecimal numbers system ▪ Number system conversion ▪ Binary arithmetic ▪ 1's and 2's complement of binary number ▪ binary coded decimal (BCD) ▪ digital coded (Gray,Excess-3 and ASC II codes)	**2 Weeks**
2.	**LOGIC GATES**	▪ The inverter ▪ The AND gate ▪ The OR gate ▪ The NAND gate ▪ The NOR gate ▪ The Exclusive-OR and Exclusive-AND gates ▪ Application of logic gates in industry	**2 Weeks**
3.	**BOOLEAN ALGEBRA AND LOGIC SIMPLIFICATION**	▪ Boolean operation and expressions ▪ Laws and rule of Boolean algebra ▪ De Morgan's theorem ▪ Simplifications using Boolean algebra ▪ Standard forms of Boolean expression ▪ The Karnaugh map ▪ Karnaugh map minimization	**2 Weeks**
4.	**COMBINATIONAL LOGIC**	▪ Implementing combinational logic ▪ The universal property of NAND and NOR gates ▪ Implementation using NAND and NOR gates ▪ Operation with pulse waveforms ▪ Troubleshooting and application	**2 Weeks**
5.	**FUNCTIONS OF COMBINATIONAL LOGIC**	▪ Half adders, full adders, parallel adders ▪ Comparators ▪ Encoders and decoders ▪ Multiplexing ▪ Application	**2 Weeks**

6.	**FLIP-FLOPS**	▪ Sequential logic circuits ▪ Edge-trigged Flip-Flops (S-R, J-K, D) ▪ Master-slave Flip-Flops ▪ Flip-Flop operation characteristic ▪ Flip-Flops application	**2 Weeks**
7.	**COUNTERS**	▪ Asynchronous counters ▪ Synchronous counters ▪ Up/Down synchronous ▪ Cascaded counters ▪ Counter application	**2 Weeks**
8	**SHIFT REGISTERS**	▪ Basic shift registers functions ▪ Serial in / serial out shift registers ▪ Serial in / parallel out shift registers ▪ parallel in / serial out shift registers ▪ parallel in / parallel out shift registers	**Week**
9	**MEMORIES**	▪ Basic of semiconductors memories ▪ Read-only memories (ROMs) ▪ Programmable ROMs (PROMs and EPROMs) ▪ Read/Write Random –Access Memories(RAMs) ▪ Memory expansion	**Week**

الكتب والمراجع:

1. Tomas Floyd "Digital Fundamentals" sixth edition, Prentice-Hall, Inc.NJ.,USA,1997
2. William Kleitz, "Digital Electronics a practical approach" third edition, prentice-Hall career &technology Englewood Clifts, NJ.,USA, 1993.
3. Morris Manor: digital design, Prentice Hall

Associate Degree Program	
Specialization	**Common**
Course Number	**020400114**
Course Title	**Digital Fundamentals Lab**
Credit Hours	**1**
Theoretical Hours	**0**
Practical Hours	**3**

وصف المادة الدراسية:

- Testing and troubleshooting instruments, Logic circuits, adders, comparators, encoders and decoders, flip-flops, counters, registers, memories RAM, ROM, EPROM

أهداف المادة الدراسية:

1. This lab course is to provide an introduction to the characteristics of digital logic and the design, construction, testing and debugging of simple digital circuits.

الوصف العام:

رقم التجربة	اسم التجربة	محتويات التجربة	الزمن (أسبوع)
.١	**Testing and troubleshooting instruments**		**Week**
.٢	**Logic gates**	NOT, OR, AND, NOR, NAND, XOR, XNOR	**2 Weeks**
.٣	**Boolean algebra and Demorgan theorems**		**Week**
.٤	**Karnaugh maps**		**Week**
.٥	**Half-adders , full adders , and parallel adders**		**Week**
.٦	**comparator**		**Week**
.٧	**encoders**		**Week**
8.	**Decoders and seven-segment display**		**Week**
9.	**Multiplexer and de-multiplexer**		**Week**
10	**Flip-flop**		**Week**
11.	**Asynchronous counters**		**Week**
12	**synchronous counters**		**Week**
13	**Registers**		**Week**
14	**memories**		**Week**
15	**ALU (Arithmetic Logic Unit)**		**Week**

الكتب والمراجع:

١. كراسة مختبر الالكترونيات الرقمية / اعداد : مدرس المادة
2. William Kleitz, "Digital Electronics a practical approach" third edition, prentice-Hall career &technology Englewood Clifts, NJ.,USA, 1993.
3. Morris Manor: digital design, Prentice Hall

الخطة الدراسية لبرنامج "الدرجة الجامعية المتوسطة"

في

تخصص تكنولوجيا التحكم الصناعي

{تم اعتماد هذه الخطة الدراسية بموجب قرار مجلس عمداء جامعة البلقاء التطبيقية رقم ٢٠١٧/٢٠١٦/١٧٠٦ تاريخ ٢٠١٧/٨/٣٠م (الجلسة ٣٣) وتطبق اعتباراً من مطلع العام الجامعي ٢٠١٨/٢٠١٧، وتمت الموافقة على تعديلها بموجب قرار لجنة الخطة الدراسية رقم ٢٠١٨/٢٠١٧/٢/١٠ بتاريخ ٢٠١٧/١٠/٤م (الجلسة رقم (٢)}

تتكون الخطة الدراسية لنيل الدرجة الجامعية المتوسطة في برنامج تكنولوجيا الهندسة الكهربائية والكهروميكانيكية/ تخصص تكنولوجيا التحكم الصناعي من (٧٢) ساعة معتمدة، موزعة على النحو الآتي:

الرقم	المتطلب	ساعة معتمدة
١.	المهارات العامة	١٢
٢.	مهارات التشغيل	٦
٣.	العلوم المساندة	٩
٤.	المهارات المتخصصة	٤٥
المجموع		٧٢

وصف مخرجات التخصص:

يهدف التخصص إلى إعداد تقنيين مؤهلين للقيام بأعمال تركيب وتشغيل وصيانة النظم والتجهيزات الكهروميكانيكية والهيدروليكية والرئوية المبنية على أساس وسائل التحكم المتقدمة المستخدمة في المعامل والمصانع.

المجالات المعرفية للمهارات المتخصصة:

الرقم	اسم المجال	الساعات المعتمدة		المواد التعليمية للمجال
		نظري	عملي	
.١	أساسيات الكهرباء والإلكترونيات	٨	٣	دارات كهربائية، أجهزة إلكترونية، دارات المنطق الرقمي، إلكترونيات التحكم الصناعي
.٢	القيادات	١٠	٥	آلات كهربائية، إلكترونيات القدرة، قيادة كهربائية، قيادة هيدروليكية ورئوية، مشاغل كهرباء
.٣	القياس والتحكم	١١	٥	قياسات متغيرات العمليات، التحكم بالعمليات، التقاط البيانات ومعالجة الإشارة، تكنولوجيا الأتمتة الصناعية
.٤	التدريب الميداني	–	٣	
مجموع الساعات المعتمدة		**٢٩**	**١٦**	**٤٥ س.م**

الخطة الدراسية لتخصص "تكنولوجيا التحكم الصناعي"

==========

أولاً: المهارات العامة، (١٢) ساعات معتمدة موزعة على النحو الآتي:

رقم المادة	اسم المادة	س.م	نظري	عملي	المتطلب السابق
020000111	المواطنة الإيجابية ومهارات الحياة	٣	٣	٠	
020000121	الثقافة الإسلامية	٣	٣	٠	
020000131	التربية الوطنية	٢	٢	٠	
٠٢٠٠٠٠١٨١	العلوم العسكرية	١	١	٠	
٠٢٠٠٠٠١٠١	مهارات لغوية/ انجليزي	٣	٣	٠	
المجموع (س.م)		١٢	١٢	٠	

ثانياً: مهارات التشغيل ، (٦) ساعات معتمدة موزعة على النحو الآتي:

رقم المادة	اسم المادة	س.م	نظري	عملي	المتطلب السابق
020000122	مهارات التواصل باللغة الإنجليزية	٢	٢	٠	
020000231	ريادة الأعمال	٢	٢	٠	
020000141	الصحة والسلامة والبيئة المهنية	٢	٢	٠	
المجموع (س.م)		**6**	**6**	٠	

ثالثاً: المهارات المساندة، (٩) ساعات معتمدة موزعة على النحو الآتي:

رقم المادة	اسم المادة	س.م	نظري	عملي	المتطلب السابق
020000151	مفاهيم رياضية	٣	٣	٠	
020000161	مفاهيم فيزيائية	٣	٣	٠	
020000162	مختبر مفاهيم فيزيائية	١	٠	٣	020000161*
020000171	الرسم الهندسي بالحاسوب	٢	٠	٦	
المجموع (س.م)		٩	٦	٣	

الخطة الدراسية لتخصص "تكنولوجيا التحكم الصناعي"

==========

رابعاً: المهارات المتخصصة، (٤٥) ساعة معتمدة، موزعة على النحو الآتي:

رقم المادة	اسم المادة	س.م	نظري	عملي	المتطلب السابق
020300111	دارات كهربائية	٣	٣	٠	
020300112	مختبر دارات كهربائية	١	٠	٣	020300111*
020400111	أجهزة ودارات إلكترونية	٣	٣	٠	
020400112	مختبر أجهزة ودارات إلكترونية	١	٠	٣	020400111*
020400113	أساسيات رقمية	٢	٢	٠	
020400114	مختبر أساسيات رقمية	١	٠	٣	020400113*
020301121	آلات كهربائية	٢	٢	٠	020300111
020301122	مختبر آلات كهربائية	١	٠	٣	020301121*
020301131	إلكترونيات القدرة	٢	٢	٠	020400111
020301132	مختبر إلكترونيات القدرة	١	٠	٣	020301131*
020301231	القيادة الكهربائية	٣	٣	٠	020301121
020301232	مختبر القيادة الكهربائية	١	٠	٣	020301231*
020301233	القيادة الرئوية والهيدروليكية	٣	٣	٠	
020301234	مختبر القيادة الرئوية والهيدروليكية	١	٠	٣	020301232*
020300115	مشاغل كهرباء	١	٠	٣	020300111*
020301235	قياسات الضغط والمستوى	٢	٢	٠	
020301236	مختبر قياسات الضغط والمستوى	١	٠	٣	020301235*
020301237	قياسات التدفق والحرارة	٢	٢	٠	020301237*
020301238	مختبر قياسات التدفق والحرارة	١	٠	٣	
020301241	التحكم بالعمليات	٢	٢	٠	020301235*+020301237*
020301242	مختبر التحكم بالعمليات	١	٠	٣	020301241*
020301243	التقاط البيانات ومعالجة الإشارة	٢	٢	٠	
020301244	مختبر التقاط البيانات ومعالجة الإشارة	١	٠	٣	020301243*
020301245	تكنولوجيا الأتمتة الصناعية	٣	٣	٠	
020301246	مختبر تكنولوجيا الأتمتة الصناعية	١	٠	٣	020301245*
020301291	التدريب	٣	٠	*	
المجموع (س.م)		**٤٥**	**٢٩**	**١٦**	

*** – تدريب عملي متواصل لمدة (٨) أسابيع.**

الخطة الاسترشادية لتخصص "تكنولوجيا التحكم الصناعي"

==========

الفصل الدراسي الأول			الفصل الدراسي الثاني		
اسم المادة	رقم المادة	س.م.	اسم المادة	رقم المادة	س.م.
المواطنة الإيجابية ومهارات الحياة	٠٢٠٠٠٠١١١	٣	مهارات التواصل باللغة الإنجليزية	٠٢٠٠٠٠١٢٢	2
مهارات لغوية/ انجليزي	٠٢٠٠٠٠١٠١	٣	تربية وطنية	٠٢٠٠٠٠١٣١	2
مفاهيم رياضية	٠٢٠٠٠٠١٥١	٣	الصحة والسلامة والبيئة المهنية	٠٢٠٠٠٠١٤١	٢
مفاهيم فيزيائية	٠٢٠٠٠٠١٦١	٣	علوم عسكرية	٠٢٠٠٠٠١٨١	١
مختبر مفاهيم فيزيائية	٠٢٠٠٠٠١٦٢	١	مختبر دارات كهربائية	٠٢٠٣٠٠١١٢	١
الرسم الهندسي بالحاسوب	٠٢٠٠٠٠١٧١	٢	أجهزة ودارات إلكترونية	٠٢٠٤٠٠١١١	٣
دارات كهربائية	٠٢٠٣٠٠١١١	٣	مختبر أجهزة ودارات إلكترونية	٠٢٠٤٠٠١١٢	١
			آلات كهربائية	٠٢٠٣٠١١٢١	٢
			مختبر آلات كهربائية	٠٢٠٣٠١١٢٢	١
			أساسيات رقمية	٠٢٠٤٠٠١١٣	٢
			مختبر أساسيات رقمية	٠٢٠٤٠٠١١٤	١
المجموع		**١٨**	**المجموع**		**١٨**

الفصل الدراسي الثالث			الفصل الدراسي الرابع		
اسم المادة	رقم المادة	س.م.	اسم المادة	رقم المادة	س.م.
الثقافة الإسلامية	٠٢٠٠٠٠١٢١	٣	القيادة الرئوية والهيدروليكية	٠٢٠٣٠١٢٣٣	٣
القيادة الكهربائية	٠٢٠٣٠١٢٣١	٣	مختبر القيادة الرئوية والهيدروليكية	٠٢٠٣٠١٢٣٤	١
إلكترونيات القدرة	٠٢٠٣٠١١٣١	٢	مشاغل كهرباء	٠٢٠٣٠٠١١٥	١
مختبر إلكترونيات القدرة	٠٢٠٣٠١١٣٢	١	قياسات التدفق والحرارة	٠٢٠٣٠١٢٣٧	٢
ريادة الأعمال	٠٢٠٠٠٠٢٣١	٢	مختبر قياسات التدفق والحرارة	٠٢٠٣٠١٢٣٨	١
قياسات الضغط والمستوى	٠٢٠٣٠١٢٣٥	٢	التحكم بالعمليات	٠٢٠٣٠١٢٤١	٢
مختبر قياسات الضغط والمستوى	٠٢٠٣٠١٢٣٦	١	مختبر التحكم بالعمليات	٠٢٠٣٠١٢٤٢	١
التقاط البيانات ومعالجة الاشارة	٠٢٠٣٠١٢٤٣	٢	تكنولوجيا الأتمتة الصناعية	٠٢٠٣٠١٢٤٥	٣
مختبر التقاط البيانات ومعالجة الاشارة	٠٢٠٣٠١٢٤٤	١	مختبر تكنولوجيا الأتمتة الصناعية	٠٢٠٣٠١٢٤٦	١
مختبر القيادة الكهربائية	٠٢٠٣٠١٢٣٢	١	التدريب	٠٢٠٣٠١٢٩١	٣
المجموع		**١٨**	**المجموع**		**١٨**

الوصف المختصر للمواد التعليمية لتخصص "تكنولوجيا التحكم الصناعي"

أولاً: الثقافة العامة

المواطنة الإيجابية ومهارات الحياة٠٢٠٠٠٠١١١ (٣: ٣-٠) يوضح المساق مفهوم المواطنة ومهارات الحياة وأهميتهما في اكتساب مهارات قيمه، والعمل على استخدام هذه المهارات في سعيهم للحصول على تعليم افضل ونتائج ايجابيه في العمل، حيث ان المساق يراعي بناء المعرفه في الموضوعات التي يتضمنها البرنامج كما ويبني المهارة عند الشباب لاستخدامها في تطبيق المعرفه كما ويبني الثقه في قدرات الشباب على استخدام هذه المعرفه والمهارة بالاضافه الى توفير الدعم الشخصي والبيئي لتغيير السلوك من خلال تعزيز قيم المواطنة الايجابية والثقافة المجتمعية البناءة والعمل المجتمعي التطوعي.
الثقافة الإسلامية ٠٢٠٠٠٠١٢١ (٣: ٣-٠) ١. تعريف الثقافة الإسلامية وبيان معانيها وموضوعاتها والنظم المتعلقة بها – وظائفها وأهدافها. ٢. مصادر ومقومات الثقافة الإسلامية والأركان والأسس التي تقوم عليها. ٣. خصائص الثقافة الإسلامية. ٤. الإسلام والعلم، والعلاقة بين العلم والإيمان ٥. التحديات التي تواجه الثقافة الإسلامية. ٦. رد الشبهات التي تثار حول الإسلام. ٧. الأخلاق الإسلامية والآداب الشرعية في إطار الثقافة الإسلامية. ٨. النظم الإسلامية.
التربية الوطنية ٠٢٠٠٠٠١٣١ (٢: ٢-٠) يعد مساق التربية الوطنية من المتطلبات الإجبارية لجميع طلبة كليات المجتمع الأردنية وامتدادا عضويا لفلسفة التربية الوطنية والتعليم باعتبارها بعدا من أبعاد الإستراتيجية الوطنية للتعليم العالي، وينطلق مساق "التربية الوطنية" من مجموعة الثوابت الأردنية وعلى رأسها العقيدة الإسلامية السمحة، ومبادئ الثورة العربية الكبرى، والدستور الأردني والتجربة الوطنية.
علوم عسكرية ٠٢٠٠٠٠١٨١ (١: ١-٠)

المحور الأول: نشأة وتطور القوات المسلحة/ الجيش العربي، أسلحة المناورة، أسلحة الإسناد، أسلحة الخدمات المحور الثاني: الثورة العربية الكبرى، الحروب العربية الإسرائيلية (حروب ١٩٤٨، ١٩٦٧، معركة الكرامه ١٩٦٨، حرب تشرين ١٩٧٣)، دور القوات المسلحة الأردنية– الجيش العربي في التنمية الوطنية الشامله المحور الثالث: الأمن العام، المخابرات العامة، قوات الدرك، الدفاع المدني
مهارات لغوية ٠٢٠٠٠٠١٠١ (٣: ٣-٠) The course consists of 8 units. Each unit has speaking activities that deal with dialogues, introducing oneself, talking about families. Also the units include pronunciation and listening with intonation activities. The reading and writing activities concentrate on question writing biography, E-mail, and writing blog post.

ثانياً: مهارات التشغيل والاستخدام

مهارات التواصل باللغة الإنجليزية ٠٢٠٠٠٠١٢٢ (٢: ٢-٠) This is a communication skills course which aims at improving learners' oral and written communication skills by providing learners with the language needed to naturally and confidently communicate in an English speaking workplace environment and real life situations.
ريادة الأعمال ٠٢٠٠٠٠٢٣١ (٢: ٢-٠) يوضح المساق مفهوم ريادة الأعمال، تأثيرها في الإقتصاد الوطني ودورها في القضاء على البطالة، وكيفية استحداث أفكار ريادية ومبتكرة لتوائم احتياجات المجتمع و مواجهة المخاطر والتحديات التي تعترضها، وتقييم فرص نجاحها من خلال دراسة الجدوى، وكيفية حساب كلفتها وتمويلها وإدارة شؤؤونها المالية، وكيفية عمل تسويق لها، والطبيعة القانونية لها وخطة العمل اللازمة للبدء بها مع التركيز على التجربة الأردنية في هذا المجال.
الصحة والسلامة والبيئة المهنية ٠٢٠٠٠٠١٤١ (٢: ٢-٠) اهداف الصحة والسلامة في بيئة العمل وطرق حماية المتواجدين والمتأثرين. دراسة أهم الاخطار وأكثرها إنتشارا في مختلف مجالات العمل ، تمييز المخاطر الكيماوية والبيولوجية والسقوط من المرتفعات والمخاطر الفيزيائية في بيئة العمل و الحريق والكهرباء والمخاطر الناتجة من الملائمة، تمييز مصادر المخاطر وتأثيرتها على الصحة وسلامة العمل وطرق ضبط المخاطر لتخفيف إحتمالية حدوثها والتخفيف من نتائجها في حالة حدوثها. مناقشة التسلسل الهرمي للسيطرة على المخاطر وطرق إختيار معدات الحماية الشخصية وتطبيق الاسعافات الاولية في حالات الاصابات البشرية. التعرف على المتطلبات القانونية الاردنية الرئيسية لحماية العاملين.

ثالثاً: العلوم المساندة

مفاهيم رياضية ٠٢٠٠٠٠١٥١ (٣: ٣-٠) يعتبر هذا المساق تمهيدا لعلم التفاضل والتكامل حيث يبدأ بمجموعات الاعداد والمجموعات والعمليات عليها ومعادلة الخط المستقيم وحل انواع من المعادلات والمتباينات، ومن ثم الاقترانات (كثيرات الحدود والجذرية والنسبية والمثلثية والاسية

واللوغريتمية) اضافة للتطرق للمتطابقات المثلثية الاساسية وحل معادلات مثلثية وبعد ذلك التعرف على المفهوم الهندسي للمشتقة وقواعد وقوانين الاشتاق لبعض الاقترانات وكذلك مفهوم النهايات واخيرا قواعد وقوانين تكامل الاقترانات الاساسية والمحددة في الاهداف الخاصة.
مفاهيم فيزيائية ٠٢٠٠٠٠١٦١ (٣: ٣-٠) • شرح وتوضيح لمفاهيم و تطبيقات الفيزياء الميكانيكيه (الحركه و القوه و الطاقه الميكانيكيه) • توضيح المفاهيم الأساسيه في الضوء و خصائصه. • تعريف الطالب باساسيات الفيزياء الحراريه و مفاهيمها. • مفاهيم في الكهرباء السكونيه و المكهرباء المتحركه .(القوه الكهربائيه، المجال الكهربائي، الجهد الكهربائي ،. التيار و المقاومه الكهربائيه) • التعريف بمفاهيم الفيزياء المفناطيسيه الأساسيه و تطبيقاتها .(الحث المغناطيسي، النفاذيه المغناطيسيه.المواد المغناطيسيه)
مختبر مفاهيم فيزيائية ٠٢٠٠٠٠١٦٢ (١: ٠-٣) يشمل المختبر التجارب الفيزيائية الاساسية في مجال الميكانيكا و الكهرباء و المغناطيسيه لتعزيز المفهوم الفيزيائي النظري
الرسم الهندسي بالحاسوب ٠٢٠٠٠٠١٧١ (٢: ٠-٦) Introduction to AutoCAD, application of AutoCAD, commands, geometric entities. geometric construction. dimensioning, free –hand sketching, object representation, orthographic drawing and projections.

رابعاً: المهارات المتخصصة

Electrical circuits 020300111 (3: 3-0) Circuits and circuit elements. DC and AC current. Circuit variables: Voltage, Current, Energy, Power factor, Power, Active power, Reactive power, Apparent power. Connection of circuit elements: series, parallel and compound connections. Energy sources. Basic calculations: Equivalent resistance, impedance, current, voltage, power and energy calculations.KVL, KCL, Superposition principle. Resonance. Measurements of circuit variables.
Electrical circuits lab. 020300112 (1: 0-3) DC and AC circuit construction and measurements. Resonance. Measuring devices
Electronic circuits and devices 020400111 (3: 3-0) Semiconductor devices. Diodes: classification, characteristics and applications. Transistors: Classification, characteristics and applications. Amplifiers. Oscillators. Logic gates and Integrated circuits: Basic function s, symbols and applications. Introduction to electronic measurements: Oscilloscope applications.

Electronic circuits and devices lab. 020400112 (1: 0-3) Use of oscilloscope in measurements. Investigation of characteristics of semiconductor devices. Construction and study of electronic circuits. Experiments in electronics have to cover the main electronic devices (diode, zener diode, diode applications, BJT, FET, op – amp, oscillator, SCR)
Digital fundamentals 020400113 (3: 0-3) Numerical systems, operations, and codes, logic gates, Boolean algebra and logic simplification, combinational logic and function of combinational logic, flip – flops, counters, shift registers. Fixed – function Integrated Circuits, and Programmable Logic Devices (PLDs).
Digital fundamentals lab. 020400114 (1: 0-3) Experiments in digital fundamentals have to cover logic gates, combinational logic, flip – flops, counters, shift registers.
Electrical machines 020301121 (2: 2-0) Construction, principles of operation, characteristics, and applications of various types of electrical machines: DC/AC, transformers, motors, generators, single-phase and three phase, synchronous and special machines.
Electrical machines lab. 020301122 (1: 0-3) Identification of various types of electrical machines components, measurement of electrical machines characteristics like losses, efficiency, speed control, and external connections.
Power electronics 020301131 (2:2-0) Principles and Methods of Electric Power Conversion. AC-to-DC Converters. AC-to-AC Converters. DC-to-DC Converters. DC-to-AC Converters. Power Semiconductor Devices. List of Principal Symbols. Cycloconverters. Voltage-Fed Converters. Current-Fed Converters. Choppers. Basic calculations. Waveforms. Applications.
Power electronics lab. 020301132 (1: 0-3) Test of semiconductor devices. Investigation of characteristics of power electronics devices. Investigation of rectifier, chopper, and inverter circuits under different loads (R, L-loads)
Electrical drive 020301231 (3: 3-0) Definition of electrical drive system. Elements of electrical drive system. DC and AC drive systems. Conversion of electrical energy into mechanical energy. Transmission of mechanical power. Main characteristics and modes of drive systems. Principles of speed control in drive systems using timers, relays, limit switches and speed signals. Open-loop speed control using variable voltage, flux and resistance in armature circuit.
Electrical drive lab. 020301232 (1: 0-3) Investigation of torque/speed characteristics of drive systems. Automatic start, stop and reverse of drive systems. Speed control.
Pneumatic and hydraulic drive 020301233 (3;3-0) Introduction to fluid mechanics. Properties of hydraulics and pneumatics. Structure of

pneumatic and hydraulic systems. Components of pneumatic and hydraulic systems: Execution final elements, Control valves, Timers, Limit switches, Reed switches, Proximity sensors. Symbols and schematic standards, numbering system and identification of pneumatic and hydraulic components. Basic pneumatic and hydraulic drives.
Pneumatic and hydraulic drive lab. 020301234 (1: 0-3) Industrial pneumatic and hydraulic drives, such as actuator positioning, speed control, event driven controls, and realizing different sequential operations.
Electrical workshops 020300115 (1: 0-3) Electric wiring for building, such as lighting wiring systems ,alarm systems ,motor control systems ,inspecting maintaining rewinding electrical transformers ,and machines ,Applying safety and security means in electrical works , Electronic circuits building and printed circuits , repair and maintenance techniques.
Pressure and level measurements 020301235 (2: 2-0) The course shall cover the different methods to measure the pressure of gasses, liquids and solid materials. Different level measurement methods shall be also treated. Calibration and installation of pressure and level instruments is also to be covered.
Pressure and level measurements lab. 020301236 (1: 0-3) The student shall carry out the required experiments demonstrating different methods of level and pressure measurement by using capacitive and resistive transducers. LVDT is used also for level and a pressure measurement, calibration of pressure gauges by using dead weight tester is practiced
Temperature and flow measurements 020301237 (2: 2-0) The course includes the study of differential pressure and variable area method flow meter. Different types of flow meters. Basic concepts of temperature scales units, measuring methods and devices like TC, RTD, Bimetallic, thermocouple, semiconductor and filled system thermometers.
Temperature and flow measurements lab. 020301238 (1: 0-3) The practical activity includes the study of different methods to measure flow and temperature such as RTD, Thermocouple, Thermistor, Rotameters, Vinturi tubes, Orifice plates and optical sensing propeller flow meter. The practical activity includes the study of different methods to measure flow and temperature such as RTD, Thermocouple, Thermistor, Rotameters, Vinturi tubes, Orifice plates and optical sensing propeller flow meter.
Process control 020301241 (2: 2-0) Introduction to process control, studying transfer functions for basic elements P, I and D setting controls. Modes of automated process control on- off, P, PI and PID setting controls, Realizing the different control modes using operational amplifiers, open-loop control using PLC and computers and reading schematics of processes by using ISA.
Process control lab. 020301242 (1: 0-3) Laboratory activates include the level, flow, temperature and pressure controls using Pneumatic and electrical control systems. The students shall do the necessary settings for the on-off; P, PI

and PID controllers. Open-Loop controls are investigated using operational amplifiers. Conversion from P/I and I/P shall also be investigated.
Data acquisition and signal processing 020301243 (2: 2-0) The course covers important issues related to noise and guarding techniques, filtering, signal conversion and data acquisition and transmission. Instrumentation. Data acquisition. Signal conditioning. Feedbacks.
Data acquisition and signal processing 020301244 (1: 0-3) The course covers the following topics: signal amplification, filtering, modulation and demodulation, conversion and detection and data acquisition.
Industrial automation technology 020301245 (3: 3-0) PLCs, classifications, programming, applications. NC and applications. Microprocessors and microcontrollers and their applications. Examples of automated Mechatronics systems: elevators, transportation belts, production lines, …
Industrial automation technology lab. 020301246 (1: 0-3) Practical experiments related to theoretical course.
Training 020301291 (3 c.h: 8 continuous weeks) Equivalent to 280 hours of field training targeted to emphasize the ability of students to apply the theories in operating, maintaining and troubleshooting of Mechatronics components and systems.