

Electrical engineering	Electronics	Digital electronics and microcomputer technology	Building management systems	Power electronics	Communications technology	Measurement technology	Automation	Mechatronics	Automotive technology	Automotive technology	Basic equipment and accessories
<b>DC technology</b> CO4204-4D <b>1</b>	<b>Semiconductor components</b> CO4204-5A <b>1</b>	<b>Gates and flip-flops</b> SO4204-6A <b>1</b>	<b>Protective measures and power network types</b> SO4204-4M	<b>Self-commutated power converters</b> CO4204-7M <b>2</b>	<b>Quadrupoles and filters</b> SO4204-9A <b>1</b>	<b>Measurement of electric values V/I/P/cos-phi/f</b> SO4204-8A <b>2</b>	<b>Compact automation, PLC and bus technology</b> CO4204-8N <b>3</b>	<b>Transfer system with DC drive</b> SO4204-8K <b>1</b>	<b>DC and AC circuits in vehicles</b> CO4204-7A <b>1</b>	<b>LIN bus</b> SO4204-7E <b>2</b>	<b>Basic equipment</b> UniTrain interface CO4203-2A
<b>AC technology</b> CO4204-4F <b>1</b>	<b>Transistor multivibrators</b> CO4204-5D <b>1</b>	<b>Sequential circuits</b> SO4204-6C <b>1</b>	<b>Control systems / protective circuitry</b> SO4204-4N	<b>Line-commutated power converters, 3-phase</b> CO4204-7N <b>2</b>	<b>Active filters with operational amplifiers</b> SO4204-9B <b>1</b>	<b>Measurement of non-electric values Temp./pressure/force</b> SO4204-8B <b>2</b>	<b>PLC model lift application</b> SO4204-8T <b>1</b>	<b>Transfer system with three-phase drive</b> SO4204-8L <b>1</b>	<b>Electronics and digital technology in vehicles</b> O4204-7B <b>1</b>	<b>CAN bus</b> SO4204-7K <b>2</b>	<b>UniTrain measurement accessories (shunts, jumpers and connection cables)</b> CO4203-2J
<b>Three-phase technology</b> CO4204-4H <b>2</b>	<b>Transistor and amplifier technology</b> CO4204-5H <b>1</b>	<b>Application circuits</b> SO4204-6E <b>1</b>	<b>LED lighting and colour detection</b> CO4204-4P <b>1</b>	<b>Frequency converter drives</b> CO4204-7P Requires SO4204-7M and SO4204-7T	<b>Coaxial cables</b> SO4204-9G <b>1</b>	<b>Measurement of non-electric values Displacement/angle/speed</b> SO4204-8C <b>2</b>	<b>Sensors for automation</b> SO4204-8U <b>1</b>	<b>Sorting sub-system</b> SO4204-8M <b>1</b>	<b>Automotive electrical fundamentals</b> SO4205-1D <b>1</b>	<b>Optical data buses for automotive applications</b> SO4204-7H <b>1</b>	<b>Required accessories</b> Depending on the course one or more UniTrain experimenters are required.
<b>Magnetism / electromagnetism</b> CO4204-4A <b>1</b>	<b>Field-effect transistors</b> CO4204-5K <b>1</b>	<b>Converter circuits</b> SO4204-6B <b>1</b>		<b>Active power factor correction (PFC)</b> CO4204-7Q <b>1</b>	<b>Signal transmission via optical fibres 650 nm / 820 nm</b> CO4205-4E <b>2</b>	<b>RLC measurements</b> SO4204-8D <b>2</b>	<b>Process technology: IPA 1 Compact station</b> CO4204-3E <b>2</b>	<b>Assembly sub-system</b> SO4204-8O <b>1</b>	<b>PWM signals in automotive engineering</b> SO4204-7J <b>1</b>	<b>FlexRay</b> SO4204-6Y <b>1</b>	<b>UniTrain experimenter (quantity)</b> CO4203-2B
<b>Conducting measurements with the multimeter</b> SO4204-4B <b>2</b>	<b>Operational amplifiers</b> CO4204-5M <b>1</b>	<b>Fundamentals of computer technology</b> SO4204-6H <b>1</b>	<b>Electrical power engineering</b>		<b>Signal transmission via optical fibres 1300 nm</b> CO4205-4F <b>1</b>		<b>Process technology: IPA 2 Mixing station</b> SO4204-3F <b>3</b>	<b>Process sub-system</b> SO4204-8P <b>1</b>	<b>Alternator / 3-phase generator</b> SO4204-7D <b>2</b>	<b>Comfort systems and keyless entry</b> SO4204-6G <b>1 3 *</b>	<b>Basic equipment EloTrain 2-mm plug-in system</b> UniTrain interface CO4203-2A EloTrain experimenter SO4203-3B
<b>Electrical network analysis</b> SO4204-4C <b>1</b>	<b>Power semiconductor devices</b> SO4204-5P <b>1</b>	<b>Supplement to SO4204-6H Applications and programming</b> SO4204-6J <b>2</b>	<b>Photovoltaics</b> CO4204-3A <b>1</b>	<b>Electrical machines</b>	<b>4-wire lines</b> SO4204-9F <b>1</b>	<b>Automatic control technology</b>	<b>Process technology: IPA 3 Filling station</b> SO4204-3G <b>1</b>	<b>Testing sub-system</b> SO4204-8Q <b>1</b>	<b>Sensors in motor vehicles</b> SO4204-7F <b>1</b>	<b>Autoshop communications and RFID</b> SO4204-7G <b>2</b>	<b>EloTrain measurement accessories (bridge connectors and connection cables)</b> SO5146-1N
<b>Electromagnetic compatibility (EMC)</b> CO4204-4K <b>1</b>	<b>Analog power supplies</b> SO4204-5R <b>1</b>	<b>EloTrain 2-mm plug-in system</b>	<b>Transient processes in DC and AC networks</b> SO4204-3B <b>1</b>	<b>DC machines</b> CO4204-7S <b>1</b>	<b>Pulse modulation methods PAM/PCM/Delta</b> SO4204-9J <b>3</b>	<b>Practical introduction to control technology</b> CO4204-8J	<b>Process technology: IPA 4 Corking station</b> SO4204-3H <b>1</b>	<b>Handling sub-system</b> SO4204-8R <b>1</b>	<b>Pulse generation and ignition systems</b> SO4204-7C <b>1</b>	<b>DC-AC conversion in vehicles</b> SO4204-6L <b>1</b>	<b>Digital multimeter Max10</b> LM2332
<b>Measurements using an oscilloscope</b> SO4204-4L <b>1</b>	<b>Switched-mode power supplies</b> SO4204-5S <b>1</b>	<b>Introduction to digital technology</b> SO4206-1F	<b>Fuel cell technology</b> SO4204-3C <b>1</b>	<b>Asynchronous machines</b> CO4204-7T <b>1</b>	<b>Pulse modulation methods, PTM</b> SO4204-9K <b>1</b>	<b>Servo motor technology</b> SO4204-8H		<b>Storage sub-system</b> SO4204-8S <b>1</b>	<b>Common rail diesel injection system</b> SO4204-6X <b>1</b>	<b>Hybrid drives in automobiles</b> CO4204-6V <b>3</b>	<b>Recommended accessories</b> UniTrain storage case CO4203-2Y Digital multimeter Multi 135 LM2330
<b>EloTrain 2-mm plug-in system</b>	<b>Circuit design using NI Multisim</b> SO4204-5U <b>1</b>	<b>Sequential circuits</b> SO4206-1G		<b>Synchronous and slip-ring machines</b> CO4204-7U <b>1</b>	<b>Modem methods ASK, FSK, PSK</b> SO4204-9L <b>2</b>		<b>Pneumatics / hydraulics</b>	<b>Routing sub-system</b> SO4204-8W <b>1</b>	<b>Traction control systems ABS/ASR/ESP</b> SO4204-6W <b>1</b>	<b>Interlock in hybrid and electric vehicles</b> CO4205-1H <b>1</b>	<b>LabSoft Classroom Manager</b> LabSoft Classroom Manager SO2001-5A
<b>DC technology</b> SO4206-1A <b>1</b>	<b>PCB layout with NI Ultiboard</b> SO4204-5V <b>1</b>	<b>Microcontroller PIC16F887 (Assembler programming)</b> SO4206-9A		<b>Stepper motor</b> CO4204-7W <b>1</b>	<b>AM / FM Modulation / Demodulation</b> SO4204-9M <b>2</b>		<b>Pneumatics / electropneumatics</b> SO4204-8V	<b>Buffering sub-system</b> SO4204-8X <b>1</b>	<b>Wheel Speed Sensor Technology</b> SO4205-1F <b>1</b>	<b>Battery disconnect unit in hybrid and electric vehicles</b> CO4205-1J <b>1</b>	<b>Collections of assignments (for use with classroom manager)</b> Electronics SO2001-6A Digital electronics SO2001-6C Electrical power engineering SO2001-6D Building management systems SO2001-6E
<b>AC and three-phase technology</b> SO4206-1B <b>1</b>	<b>EloTrain 2-mm plug-in system</b>	<b>8-bit Microcontroller, PIC 16F1937 (UML programming)</b> CO4205-7A		<b>Linear motor</b> CO4204-7X <b>1</b>	<b>AM transmission and receiving technology</b> SO4204-9N <b>3</b>		<b>Hydraulics / electrohydraulics</b> SO4205-8A	<b>Production line</b> SO4204-8Z <b>1</b>	<b>Airbag, belt tensioners and crash response</b> CO4204-6Z <b>2</b>	<b>DC-DC step-up converters in hybrid and electric vehicles</b> CO4205-1K <b>1</b>	
	<b>Semiconductors</b> SO4206-1C	<b>8-bit Arduino UNO (UML programming)</b> CO4205-7B		<b>Three-phase transformer</b> CO4204-7Y <b>1</b>	<b>Data acquisition using RFID</b> SO4204-9S <b>2</b>				<b>EloTrain 2-mm plug-in system</b>	<b>DC-DC step-down converters in hybrid and electric vehicles</b> CO4205-1L <b>1</b>	
	<b>Basic electronic circuits</b> SO4206-1D	<b>16-Bit Microcontroller dsPIC (UML programming)</b> CO4205-7C		<b>BLDC / servo motors</b> CO4204-7Z <b>1</b>	<b>Network technology</b> CO4205-4Q <b>2</b>				<b>Fundamentals of electrical engineering in vehicles</b> SO4206-1J	<b>Safe handling of HV systems</b> CO4205-1M <b>1</b>	
	<b>Optoelectronics</b> SO4206-1E	<b>32-Bit Microcontroller ARM (UML programming)</b> CO4205-7D			<b>Introduction to microwave technology</b> SO4204-9U <b>1</b>					<b>Fuel cell technology in vehicles</b> SO4204-6M	
		<b>Programming 32-bit ARM Cortex M3 microcontrollers (C programming)</b> SO4206-9B			<b>Supplement to SO4204-9U Waveguide components</b> SO4204-9V					<b>Solar technology in vehicles</b> SO4204-6N	
		<b>DSP using microcontroller 32-Bit ARM Cortex-M3 (C programming)</b> SO4206-9C			<b>Antenna technology</b> SO4204-9T <b>1</b>						
		<b>FPGA - Design of circuits using VHDL</b> SO4206-9E			<b>Supplement to SO4204-9T Complex antenna systems</b> SO4204-9Z						
		<b>FPGA Altera Cyclone IV (Verilog)</b> CO4205-7E			<b>Microstrip technology</b> SO4204-9Y <b>1</b>						

\* 3 experimenters are required for extension with CAN bus course (SO4204-7K)



