

Mechanics & Technology

The following matrix indicates those courses deemed transferable among institutions listed across the top of the matrix. The numbers on the matrix represent the number of semester hours associated with the course at each institution and which institutions have agreed to transfer the commonly numbered course in each row.

You can view the group leaders at the bottom of the page. If you are interested in printing this page, please note that it is best to print in landscape mode.

Electric Power Technology

Prefix	Number	GERTA	Course Title	BSC
ELPW	109		Electrical Industry Safety	3
ELPW	110		Basic Print Reading	3
ELPW	112		Electrical System Components	2
ELPW	118		Industrial Communication	2
ELPW	200		Advanced Print Reading	3
ELPW	202		Advanced Industrial Safety	3
ELPW	204		Advanced Electrical Systems	3
ELPW	206		Electrical System Protection	3
ELPW	208		Advanced Math	4
ELPW	210		Overhead Transmission and Distribution Line Construction	4
ELPW	211		Substation Relays	4
ELPW	212		System Design Basics	3
ELPW	213		Fundamentals of Metering	3
ELPW	214		Introduction to System Operations	2

ELPW	215		Power Principles & Terminology	4
ELPW	230		Underground Line Construction	4
ELPW	231		Substation Operations	4
ELPW	232		System Design Analysis	3
ELPW	233		Single-Phase Polyphase Metering	3
ELPW	234		Power Flow	3
ELPW	235		Power Plant Systems	4
ELPW	250		Transformers	4
ELPW	251		Substation Construction and Maintenance	4
ELPW	252		Civil Design	2
ELPW	253		Advanced Metering Technology	2
ELPW	255		Power Generation	4
ELPW	274		Emergency Analysis & Response	3
ELPW	284		Economic Operations	3

ELPW 109 Electrical Industry Safety

This course will study the general safety practices and information employees need while working in any segment of the electrical industry. This course will study the Federal Agencies responsible for insuring an safe working environment Students will also gain an understanding of the workers Right to Know regulations and gain an awareness of public Safety issues.

ELPW 110 Basic Print Reading

This course will give students an introduction to the different schematics used in power plant operations and electrical transmission and distribution systems. Students will gain an understanding of the standard symbols used in the various systems schematics and how to read them. Students will begin this course by learning how to read basic Piping and Instrumentation diagrams. Next, students will learn to interpret single line electrical diagrams. Students will finish this

course by studying electrical system diagrams beginning at the generator and following through to the distribution system.

ELPW 112 Electrical System Components

This course will take an in-depth look into the components used in the transmission of electricity. Students will begin with a study of switchyards and substations. Students will learn the operation of transformers, circuit breakers, regulators, capacitor banks, and tap changers, disconnects, current and potential transformers and lightning arrestors. Students will also study the various types of electrical conductors, structures and insulators used in the transmission of electricity. Finally, students will learn the components, which make up a typical substation and how it feeds a distribution network that supplies customers with electricity.

ELPW 118 Industrial Communication

This course will define the interpersonal skills needed to communicate with co-workers and customers to effectively work within the electrical industry. Students will learn the proper methods used to resolve on the job conflicts and how to establish positive working relationships with co-workers. During this course you will be given different scenarios to evaluate and you will learn how certain situations must be handled. You will also learn what is acceptable behavior in the workplace, how to recognize discrimination and sexual harassment and understand it is unacceptable in the industry.

ELPW 200 Advanced Print Reading

This course will study advanced electrical prints used to navigate complex electrical systems and feeders maps. Students will also study schematics that are used when working with electronic systems and system instrumentation that is used to control and monitor the flow of electricity through the electrical system. Students in this course will also learn to use the diagrams to troubleshoot system problems and to safely isolate sections of the electrical system.

ELPW 202 Advanced Industrial Safety

In this course students will study specific safety practices used within the industry. Students will begin by studying general practices used within the industry, such as confined space entry, lockout tag out procedures, fall protection, fire safety and working with hazardous materials. Students will also learn some of the specific safety procedure used by lineman, such as proper bucket truck operation and some of the different techniques used when working with electrical conductors. Finally, students will learn some of specific considerations that must be adhered to as an Electrical System Dispatcher to insure the safety of line crews and technicians working on the electrical system.

ELPW 204 Advanced Electrical Systems

This course will provide students with a complete understanding of the design and operation of an electrical system. Students will begin by understanding switchyard construction and the different configurations. Students will learn how different sections of the transmission and distribution system can be safely isolated. Students will also learn how storms and conditions can affect the electrical system. Students will learn some of the different procedures used by System Operators and Line crews to maintain the safe and effective delivery of power during adverse conditions and some of the steps necessary to restore power after outages.

ELPW 206 Electrical System Protection

This course will study the various components used in insuring the safety of the electrical system. Students will study line relays, transformer and bus differential relays, automatic throw-overs and network protectors. Students will then study some of the emergency procedures used by different departments in various scenarios. Students will also learn how large utilities would work together to insure the safety of the electrical system in a dangerous/adverse situation to restore power after a large-scale outage.

ELPW 208 Advanced Math

This course will cover algebra, geometry, and trigonometry needed for energy technicians working in the electrical system design and metering specialization areas. This course will cover the fundamental concepts of algebra, equations, functions and graphs. The course also will cover trigonometric functions, laws of sines and cosines, and vectors. Lastly the course will discuss analytic geometry.

ELPW 210 Overhead Transmission and Distribution Line Construction

This course will study the design and construction of overhead lines and their related parts. Students will begin by studying the standards necessary in line construction to insure supports, conductors, and equipment can withstand the forces imposed on them. Students will study the various types of structures and supports, insulators, conductors, and factors that influence particular use.

ELPW 211 Substation Relays

This course will focus on testing and calibrating substation equipment, including testing on equipment feeder relays and circuit breaker relays. Students will also study various tests that need to be conducted on protective relays, such as overcurrent relays, directional & line relays, as well as ground and test device testing.

ELPW 212 System Design Basics

This course will study the basic principles and applications of electric distribution design and application. It will include design layout, electric distribution components, and apparatuses that are used to provide service to a wide variety of customers requesting electric distribution power from single-phase to three-phase voltages that are classified as electrical distribution service. It will include basic principles such as tariffs, permitting for new construction, and distribution projects that may be classified as overhead or underground service routing.

ELPW 213 Fundamentals of Metering

This course will introduce students to the fundamentals of metering, such as terminology and the basic principles of meters. Students will learn basic math needed in metering, and will review basic electricity and magnetism principles. They will be introduced to meter testing equipment, as well as meter diagrams and standards. Students will learn technical data related to metering and will learn how to read watt hour and demand meters.

ELPW 214 Introduction to System Operations

This course will study the transfer of electrical energy within power systems and the role electrical dispatchers play in insuring a safe and reliable electric supply.

ELPW 215 Power Principles & Terminology

This course will begin by studying the history of the power generation industry and continue on to study basic methods and equipment associated with power plant designs. In addition, students will be introduced to some basic principles of heat/energy transfer found within the equipment of an operating generation station.

ELPW 230 Underground Line Construction

This course will cover the two basic categories of underground line construction, such as direct burial and those found in vaults and ducts. Students will study the design, conductors and the transformers used in residential direct burial and the factors that affect it. The course includes underground line construction design and the factors that affect this type of installation.

ELPW 231 Substation Operations

This course will detail the design and operation components that make up a typical substation, such as transformers, circuit breakers, instrument transformers, disconnect switches, automatic reclosers, reactors & regulators, Students will also gain an understanding of the relay protection designed to protect the substation, transmission & distribution systems in the event of a fault. Finally students will learn some of the routine checks made on substation equipment, such as

monitoring nitrogen gas levels on transformers and the correct method of changing bottles as well as identifying alarms and knowing when to reset alarms and trips. This course will also include information on SF6 equipment.

ELPW 232 System Design Analysis

This course will study the process calculations involved with distribution system design.

ELPW 233 Single-Phase Polyphase Metering

In this course students will learn about single-phase metering and polyphase metering, including meter design, adjustments and compensations, and applications. They will learn about power factor analyzers, and high amperage CT cabinets. They will also understand meter demand theory, demand registers, and the testing and maintenance of thermal demands.

ELPW 234 Power Flow

This course will study the flow of power through inter-connected systems and the operation of parallel power systems. This course will study generator synchronization, phase angle, VAR control and maintaining line voltages.

ELPW 235 Power Plant Systems

This course will study the basic systems found and used in the production of electricity at fossil fired power plants. Studies will also include the various types of pumps, valves, and auxiliary equipment used in the production of electricity.

ELPW 250 Transformers

The course will begin by reviewing basic transformer design and operation. Students will study 3-phase transformers, single phase loads for 3-phase transformers, and the different connections used in such transformers. Finally, students will be introduced to transformer installation procedures and maintenance procedures.

ELPW 251 Substation Construction and Maintenance

This course will begin with a review of hand and power tools used during the construction and maintenance of substations. This course will continue to study safety procedures and equipment put in place to protect workers within a substation. Students will study the basic construction of a substation, including electrical equipment rigging & installation, cable tray & conduit installation, cable controls & panel wiring as well as a wide variety of installation procedures for electrical components and protection equipment.

ELPW 252 Civil Design

This course will study the basic principles of civil design in application to electrical distribution systems, inclusive to drafting and surveying techniques and computer-aided design systems.

ELPW 253 Advanced Metering Technology

Students in this course will be introduced to various instrument transformers, their design, application and troubleshooting. They will learn about high voltage metering equipment and how to safely install such. They also will learn about cogeneration metering, and will understand the principles of load management and the equipment used.

ELPW 255 Power Generation

Students will explore generator and motor design and operating principles. The course also will include the various auxiliary systems and equipment used with large power plant generators.

ELPW 274 Emergency Analysis & Response

This course will focus on recognizing system emergencies and reacting properly to the situation by implementing and coordinating system restoration procedures to restore the electrical system to a safe operating condition.

ELPW 284 Economic Operations

This course will study the economic factors governing electrical system operations, transmission losses, and economic interchange of power. Load management, scheduling and pricing will also be covered.

Electrical Technology

Prefix	Number	Gerta	Course Title	NDSCS
ECAL	100		Introduction to Electricity	3
ECAL	101		Electrical Fundamentals	5
ECAL	102		Electrical Fundamentals	5
ECAL	103		Electrical Code Study	4
ECAL	111		Electric Meters and Motors	3
ECAL	132		Agricultural Wiring	2

ECAL	133		Residential Wiring	3
ECAL	137		Electrical Drafting	2
ECAL	201		Alternating Current Theory	5
ECAL	203		Advanced Electrical Code Study	3
ECAL	204		Electrical Planning & Estimating	4
ECAL	205		Electrical Design and Lighting	3
ECAL	211		AC Measurements	4
ECAL	223		Electronic Devices	4
ECAL	224		Automated Industrial Controls	5
ECAL	233		Commercial Wiring Laboratory	3
ECAL	237		House Wiring Rough-In	1
ECAL	238		House Wiring Trim-Out	1
ECAL	241		Basic Motor Controls	3
ECAL	243		Programmable Controllers	3
ECAL	244		Electric Machines and Solid State Drives	5
ECAL	245		Medium & High Voltage	1
ECAL	246		Alarm, Communications & Data Systems	3

ECAL 100 Introduction to Electricity

An introductory lecture class in electrical fundamentals. A practical approach to the study of electricity including Ohm's law, power, series and parallel circuits, direct and alternating current, with strong emphasis on diagrams and troubleshooting.

ECAL 101 Electrical Fundamentals

This course will introduce the student to the various electrical properties and the equipment which produces those properties. Basic circuitry will be examined, utilizing algebraic skills to perform the calculations.

ECAL 102 Electrical Fundamentals

This course will introduce the student to alternating current. The electrical properties and their affects on the circuit will be examined. Basic trigonometric skills will be utilized to perform calculations for analyzing various electrical circuits.

Prerequisites: ECAL 101, MATH 136.

ECAL 103 Electrical Code Study

A preliminary study of the National Electrical Code. Wiring design and protection, wiring methods and materials, and equipment for general use are covered.

ECAL 111 Electric Meters and Motors

A practical hands-on course using ammeters, voltmeters, wattmeters, and multimeters in testing and troubleshooting electric motors, components, and wiring systems. A study of single and three phase AC motors, their construction features and operating characteristics. This lecture/laboratory class emphasizes electric motor terminology, identification of motor types, enclosures, mounts, motor selection, connections, maintenance, testing and troubleshooting. Students are also introduced to motor loads, protection, controls, and devices used to connect motors to their loads such as pulleys, V-belts, gear boxes, and couplings.

ECAL 132 Agricultural Wiring

Consists of lectures giving an introduction to basic electricity, basic wiring circuits, electric motors, materials and tools used, and wiring methods. Students also perform laboratory work with actual circuit layout and installation in accordance with the rules and regulations of the national Electrical Code. This course deals primarily with residential wiring methods.

ECAL 133 Residential Wiring

Consists of lectures giving a introduction to basic wiring circuits, materials and tools used and wiring methods. Students also perform laboratory work with actual circuit layout and installation in accordance with the rules and regulations of the National Electrical Code. This course deals primarily with residential wiring methods.

ECAL 137 Electrical Drafting

Develop techniques of communicating through the use of mechanical drawings, electrical drawings, heating ventilation, and air conditioning drawings. Basic blueprint reading and sketching are included as well as an introduction to CAD.

ECAL 201 Alternating Current Theory

A study of three phase alternating current circuits and single and three phase transformers and machines. The theory and operation of three phase wye and delta circuits and the relationship of voltage, current and power in these circuits. The use of phasor algebra in the solution of alternating current problems is stressed as are the characteristics and use of electrical instruments such as voltmeters, ammeters, ohmmeters and wattmeters. Students learn the theory and operation of transformers with single and three phase connections and are introduced to alternating current machines. Prerequisite: ECAL 102.

ECAL 203 Advanced Electrical Code Study

This course is a continuation of ECAL 103. Several articles of the National Electrical Code not covered in ECAL 103 are studied in this course. In addition, service calculations for residential, multi-family dwelling, commercial and industrial buildings are covered. This course is designed to prepare the student for the written State Journeyman's exam. Prerequisite: ECAL 103.

ECAL 204 Electrical Planning & Estimating

A residential workbook text is used to go through all parts of a residential electrical system. A complete set of blueprints is supplied with the textbook and is used extensively in the class. A commercial workbook text with a complete set of blueprints for a commercial building is used to learn how to estimate the cost of materials and the total labor hours required to install the electrical system for a typical commercial building. Other factors that must be considered to come up with a total bid price are also discussed. Manual and computerized estimating techniques are covered.

ECAL 205 Electrical Design and Lighting

A class discussion course dealing with electrical material and equipment sizing, layout and application, applicable wiring codes, regulations and rules, and characteristics of common electrical distribution systems as used in industrial plants and commercial building locations. Included is study of short circuit current, current limiting and coordination, power factor correction, and electrical rates. This course includes the study of modern illumination principles, calculation procedures, and equipment for lighting installations. Also included are discussions of building construction, heat loss calculations, and electric heating equipment selection, installation and control.

ECAL 211 AC Measurements

This lecture/lab course consists of a series of experiments to investigate the characteristics of single phase and three phase electrical circuits. The connections and testing of transformers in both single phase and three phase configurations are stressed. Students also learn the operation of three phase motors from conventional sources and phase converters, with an emphasis on efficiency, operating characteristics and connections. Corequisite: ECAL 201.

ECAL 223 Electronic Devices

A combination lecture/laboratory course covering diodes, zener diodes, bipolar and field effect transistors, silicon controlled rectifiers, diacs, triacs and unijunction transistors. These devices are studied in typical power control circuits. The oscilloscope and multimeter are used to verify the correct operation of the circuit as well as for troubleshooting. Also the 555 and 741 integrated circuits and some of their applications are studied.

ECAL 224 Automated Industrial Controls

Automated Industrial Controls is a lecture/lab course that will cover digital electronics, basic pneumatic controls and robot operation. The robot is a 5-axis servo machine with inputs and outputs that is programmed in Scorbace. The final lab projects will integrate all three elements.

ECAL 233 Commercial Wiring Laboratory

An extension of ECAL 133 with lectures emphasizing commercial wiring methods. Students will perform laboratory work consisting of actual installation of various raceways, as well as connecting of special equipment used in commercial and industrial applications, all in accordance with the National Electrical Code. Prerequisite: ECAL 133.

ECAL 237 House Wiring Rough-In

This course will introduce the student to the logistics and procedures involved with wiring of a residential dwelling.

ECAL 238 House Wiring Trim-Out

This course will introduce the student to the logistics and procedures involved with the proper trim-out of a residential dwelling.

ECAL 241 Basic Motor Controls

A lecture and laboratory class oriented to the study of electro-mechanical control system concepts. Experiments are designed to illustrate the principles, applications, connection and installation procedures of electrical controllers. Special emphasis is placed on the analysis and development of control circuits.

ECAL 243 Programmable Controllers

A lecture and laboratory course dealing with the theory, construction, applications, installation, and programming of micro-processor based programmable controllers. Logic networks solving typical industrial control problems are developed and programmed into a variety of controllers to learn the operating techniques and capabilities of each machine.

ECAL 244 Electric Machines and Solid State Drives

A lecture/laboratory class on the theory and operation of both AC and DC machines. The application of solid state drives as a means to obtain the most desirable machine characteristics is stressed. Several specific motor drives, both AC and DC are studied. Controllers are set up following the manufacturer's start-up and adjustment procedures. Students will test real and simulated problems. Prerequisite: ECAL 201, ECAL 211.

ECAL 245 Medium & High Voltage

This lecture/lab course covers medium and high voltage electrical theory, conductors, insulators, overcurrent devices, testing, termination, safety precautions and safety equipment.

ECAL 246 Alarm, Communications & Data Systems

This course will introduce the student to communication systems, fire alarm systems, fiber optics, data and telephone wiring materials and methods.

Electrical Transmission Systems

Prefix	Number	Gerta	Course Title	BSC
ETST	240		Power Industry Concepts	3
ETST	242		Applied Mathematics for System Operators	2
ETST	245		Electrical Systems A.C. Fundamentals	2
ETST	250		Electrical Generation Theories	4
ETST	254		System Elements I - Substations	3
ETST	256		System Elements II - Transformers	3
ETST	258		System Elements III - Protective Relaying	3

ETST	260		Electrical Diagram Interpretation	2
ETST	262		Power System Operations	3
ETST	266		Inter-connected System Operations	3
ETST	268		Power Flow	3
ETST	270		System Operator Work Practices	3
ETST	272		Power System Safety	3
ETST	274		Communications and Control Technology	2
ETST	276		Power System Economics	3
ETST	278		Power System Emergency Concepts	3
ETST	280		Reliability Policies and Procedures	3

ETST 240 Power Industry Concepts

This course will study the basic role System Operators and Electrical Dispatchers play in Electric Power Industry. In addition, students will study the history, development and evolution of the electrical industry over the last 120 years. This course will also explore the effects of deregulation of modern day electrical markets. This course will conclude by studying the working environment of a system Operator, including some of the challenges they face, such as shift work, certification and the tremendous amount of responsibility in operating in a real time market.

ETST 242 Applied Mathematics for System Operators

This course is designed to provide a review of basic mathematical concepts required for work as an Electrical Transmission System Operator. In addition to basic mathematics, students will study basic trigonometry, vectors and phasors and the relationship these mathematical functions have to work as a system operator.

ETST 245 Electrical Systems A.C. Fundamentals

This online course will study basic alternating current theories and apply those theories to electrical transmission and distribution systems and related equipment. This course will also study generator and motor design, construction and operating principles.

ETST 250 Electrical Generation Theories

This course will study the design and construction of large electrical generators. Students will study the sources of voltage and the design and types of A.C. and D.C. generators and related auxiliary equipment. Students will also study the design and operation of A.C. and D.C. motors.

ETST 254 System Elements I - Substations

This course will study the basic equipment found in switchyards, and substations. This study will also include the function and types of substations, related transmission and distribution systems and how each system is tied to one another.

ETST 256 System Elements II - Transformers

This course is an advanced study of the equipment and instrumentation used in the transmission and distribution of electricity and how this equipment interacts to ensure a safe and reliable electrical system. Studies will include transformers, regulators, circuit breakers, air break and disconnect switches, instrument transformers and lightning arrestors. In addition, this course will also study the various relays and protective schemes used to protect the equipment within the electrical system.

ETST 258 System Elements III - Protective Relaying

This course will study the operation and maintenance of all the electrical equipment and instrumentation used in the transmission and distribution of electricity. Studies will include overhaul and or replacement of transformers, regulators, circuit breakers, air break and disconnect switches, instrument transformers, lightning arrestors and protective relaying. In addition, the effects adverse weather conditions can have on this equipment will also be studied.

ETST 260 Electrical Diagram Interpretation

This course will expand upon diagrams introduced in System Elements, including operator one-line diagrams, P&IDs construction diagrams, and relay diagrams. Students will become proficient in reading and interpreting diagrams pertaining to systems operations.

ETST 262 Power System Operations

This course will introduce students to the operational aspects of an interconnected power system. Students will learn the roles, responsibilities, and technology of operating the transmission system in North America.

ETST 266 Inter-connected System Operations

This course will study the operation of power pools, regional reliability organizations and independent system operators

and the role of each. In addition, this course will also study interconnected switching procedures between utilities.

ETST 268 Power Flow

This course will introduce student to power flow through interconnected systems and the control of voltage and power through such systems. Students will learn about paralleling systems, phase angles, power transfer, voltage and reactive power regulation.

ETST 270 System Operator Work Practices

In this course students will learn the role a System Operator plays in the delivery of power and the operation and maintenance of the transmission system. Students will learn what is expected of a System Operator including desired personal characteristics, working environment, employer's expectations/qualifications, educational and training requirements, certification requirements, role in performing reliability functions, tasks and duties and behavior required under code of conduct and other regulatory and legislative orders.

ETST 272 Power System Safety

This course will cover the safe operating practices, system isolation procedures, and accident prevention procedures used in the transmission and distribution of power. Emphasis will be placed on electrical system lock out and safety procedures.

ETST 274 Communications and Control Technology

In this course we will study the theory and application of various communications technologies used in the electric industry.

ETST 276 Power System Economics

In this course we will study economic factors governing electrical system operations. Costs of generation, transmission and distribution will be explained. The organization of markets for electrical energy and how this structure affects participating companies operational and investment decisions will be presented and discussed. The effects of congestion, transmission losses and penalty factors will be studied. Load management, scheduling and pricing will be a focus as well.

ETST 278 Power System Emergency Concepts

This course is designed to concentrate on recognition of and reaction of power system emergencies, and the implementation and coordination of proper procedures to restore the electrical system to a safe operating condition. Learners will study substations bus configurations and the protection schemes used to respond to emergencies within the electrical system. Effective and safe restoration of system operation through proper switching procedures will also be

described.

ETST 280 Reliability Policies and Procedures

This course is designed to familiarize and help the student understand the policies and procedures that ensure the reliability of the power system. North American Electric Reliability Council (NERC) policies, as well as other regulatory agency policies will be explained and discussed. Government agencies, reliability regions, and state reliability concerns will also be defined and discussed.

Electronic Technology

Prefix	Number	Gerta	Course Title	BSC	LRSC	NDSCS
ELEC	100		Direct Current Analysis	4/1	3	5
ELEC	101		Alternating Current Analysis	4	3	4
ELEC	114		Digital Electronics I	3/1		
ELEC	115		Digital Electronics II	3/1		
ELEC	118		Solid State Devices I	4/1		
ELEC	120		AC Analysis	4/1		
ELEC	140		Semiconductor Circuit Analysis I			4
ELEC	144		Electronic Lab I			5
ELEC	145		Electronic Lab II			4
ELEC	170		Electronics Laboratory I		3	
ELEC	180		Electronics Laboratory II		3	
ELEC	216		Digital Electronics III	4/1		
ELEC	222		Electronic Communications I	4/1		
ELEC	224		Electronic Communications II	4/1		
ELEC	226		Electronic/Mechanical Practices	4/1		

ELEC	242		Linear Electronics			4
ELEC	244		Advanced Linear Systems			3
ELEC	248		Microcontroller Applications			4
ELEC	250		Graphical Programming for Electronics			4
ELEC	251		Network Operating Systems			2
ELEC	253		Introduction to Instrumentation			3
ELEC	254		Instrumentation and Control Systems			5
ELEC	255		Process Measurement and Control Valves			4
ELEC	261		Electronic Communications			5
ELEC	262		Electronic Communications II			3
ELEC	265		FCC License Preparation			1
ELEC	271		Emerging Technologies		3	
ELEC	272		Introduction to Simulation		3	
ELEC	274		Simulator Computer Lab		3	
ELEC	275		Visual Systems/Graphics		3	
ELEC	281		Digital Integrated Circuits		3	3-4
ELEC	282		Operational Systems/Technical Simulation		3	
ELEC	284		Semi-conductor Devices		4	
ELEC	285		Electronic Circuits		3	
ELEC	287		Digital Integrated Circuits Laboratory		3	

ELEC 100 Direct Current Analysis

ELEC 101 Alternating Current Analysis

ELEC 114 Digital Electronics I

Study of electronic gates, Boolean algebra, and combination logic circuits. The operation of various logic devices and an introduction to the basic structure of a microprocessor-based system are covered. The lab portion of the course is a lab/lecture, which provides hand-on verification of the theory presented in class. Prerequisite: ELEC 100, 118 or equivalent and approval of instructor.

ELEC 115 Digital Electronics II

An extension of ELEC 114, covering microprocessors, assembly language programming, interfacing, and applications of the microprocessor. The lab portion of the course is a lab/lecture, which provides hands-on verification of the theory presented in class. Prerequisite: ELEC 114.

ELEC 118 Solid State Devices I

The study of semiconductor physics, fundamentals of semiconductors, power supplies, transistor fundamentals and transistor biasing. The lab portion of the course is lab/lecture, which provides hands on verification of the theory presented in class.

ELEC 120 AC Analysis

The study of small signal audio amplifiers and large signal audio amplifiers. Field effect transistors and operational amplifier characteristics and their application are also covered. The lab portion of the course lab/lecture, which provides hands-on verification of the theory presented in class.

ELEC 140 Semiconductor Circuit Analysis I

Familiarization with the operating principles of various devices using a PN semiconductor junction. Includes diodes, diode circuits, special purpose diodes, bipolar transistors, thyristors. Prerequisite: ELEC 100. Corequisite: ELEC 101.

ELEC 144 Electronic Lab I

A laboratory course which covers electronic fabrication, computer simulation of electrical circuits, and troubleshooting of electronic circuits.

ELEC 145 Electronic Lab II

A laboratory course which covers electronic fabrication, computer simulation of electrical circuits, and troubleshooting of electronic circuits.

ELEC 170 Electronics Laboratory I

Electronic components, ohmmeters, voltmeters, Ohm's law circuits and power supplies. Measuring and verifying electronic principles in actual circuits. This lab is taken concurrently with ELEC 100. Fall Semester

ELEC 180 Electronics Laboratory II

A continuation of ELEC 170 with emphasis on application. Taken concurrently with ELEC 101. Spring semester

ELEC 216 Digital Electronics III

Students will become familiar with the architecture, programming, application and troubleshooting of micro-controllers. Configuration of personal computers, including applications, basic networking and troubleshooting. Basic data acquisition theory and practices are also covered. The lab portion of the course is a lab/lecture, which provides hands-on verification of the theory presented in class. Prerequisite: ELEC 214.

ELEC 222 Electronic Communications I

Review of reactive and resonant circuits, component and circuit noise generation, amplitude modulation generation and detection, single sideband generation and detection and radio frequency oscillators. The lab portion of the course is a lab/lecture, which provides hands-on verification of the theory presented in class. Prerequisite: Completion of first year of Electronics Technology program, or equivalent and instructors approval.

ELEC 224 Electronic Communications II

Study of phase and frequency generation and detection, digital communications and modulation, transmission lines, antennas and fiber optics. The lab portion of the course is a lab/lecture, which provides hands-on verification of the theory presented in class. Prerequisite: ELEC 222.

ELEC 226 Electronic/Mechanical Practices

Students will become familiar with common hand-tools and their proper use, wire, cable and fiber optic connectors and their assembly; soldering of surface mounted components; use and mounting of hardware; efficient use of schematics and how to troubleshoot selected pieces of equipment. The lab portion of the course is a lab/lecture, which provides hands-on verification of the theory presented in class.

ELEC 242 Linear Electronics

A lecture/lab study of linear devices and systems. Includes advanced usage of test equipment, considerable usage of op-amps and circuits and other linear applications. Prerequisite: ELEC 141.

ELEC 244 Advanced Linear Systems

A lecture/lab course continuing on the topics from ELEC 242 Linear Electronics. Topics to include switching power supplies and sensor theory and applications.

ELEC 248 Microcontroller Applications

A lecture/lab course on microprocessor based systems. Concentrates on chip architecture and assembly language programming. The Intel microprocessor family is studied. Prerequisite: ELEC 281.

ELEC 250 Graphical Programming for Electronics

This course used LABVIEW, a graphical method of computer programming. It includes a study of the steps required to develop a computer program. The emphasis of these programs will be on applications related to the electronics industry.

ELEC 251 Network Operating Systems

Network Operating Systems is an intensive introduction to multi-user, multi-tasking network operating systems. Characteristics of the Linux, Windows 2000, NT and XP network operating systems will be discussed. Students will explore a variety of topics including installation procedures, security issues, back up procedures and remote access. Prerequisite: CIS 219.

ELEC 253 Introduction to Instrumentation

This lecture/lab course deals with the basic concepts of process control. Emphasis is on closed loop proportional control systems.

ELEC 254 Instrumentation and Control Systems

This lecture/lab course covers the concepts of process control. Major topics are feedback, cascade, ratio, and feed forward control schemes. Operating the equipment used in control loops is included. Prerequisite: ELEC 141 or ECAL 102.

ELEC 255 Process Measurement and Control Valves

This lecture/lab course deals with the operation and function of devices used to measure the process output. Control

valves and actuators are also included, as is the calibration of these devices.

ELEC 261 Electronic Communications

An introduction to the transmission of intelligence over distance by RF carrier. This includes the study of the limiting effects of frequency spectrum, noise and bandwidth. RF generating devices, modulators, frequency synthesizers, and other RF circuitry are introduced. Various types of modulation is discussed. Prerequisite: ELEC 140 and ELEC 141.

ELEC 262 Electronic Communications II

A continuation of communications topics from ELEC 261 that includes digital modulation techniques, transmission line theory, RF propagation, and antenna theory. Two-way radio, basic television transmission, GPS, and satellite systems are also covered. Prerequisite: ELEC 261.

ELEC 265 FCC License Preparation

A course to assist the student in preparing for the Federal Communication Commissions General Radiotelephone License examination. This license is required for maintenance of transmitters in the aviation, maritime, or international broadcast field. Prerequisite: ELEC 261.

ELEC 271 Emerging Technologies

This course provides a study of modern computer systems and will include, but may not be limited to the following topics: identifying computer components and operating systems, computer assembly/disassembly, network setup and configuration to include wireless systems. This course will also utilize the simulator computer systems.

ELEC 272 Introduction to Simulation

An introduction to simulation techniques, including simulation, emulation, and imitation is provided. Reviews of applicable physics, aerodynamics, and computer fundamentals are also provided. Other topics include an introduction to environment creation techniques, simulator architecture, hardware/software interface, mission development, and maintenance related tasks and skills.

ELEC 274 Simulator Computer Lab

Information covered in this course include complex peripheral integrated circuits and systems on the SEL computer and how it is configured to run the simulator. Student teams will set-up various SEL computer configurations, perform system diagnostics, and run function test to ascertain successful integration of software and hardware. This course will utilize the simulator computer. Prerequisite: ELEC 273.

ELEC 275 Visual Systems/Graphics

An introduction to visual displays systems, topics include system data flow and signal distribution, computer system (mainframe), computer system (input/output) to include priority interrupt module, buffer interface controller, transformation arithmetic scene controller (TASC), image processing equipment and display unit.

ELEC 281 Digital Integrated Circuits

A lecture/lab course in digital integrated circuits with industrial applications. Includes an introduction to computer systems.

ELEC 282 Operational Systems/Technical Simulation

An in-depth examination of navigation, navigational procedures, flight instrumentation, and methods for simulation their characteristics and effects. Topics include preflight, methods of navigation control and landing, instrumentation, communications, and environmental/special effects. Prerequisite: ELEC 272.

ELEC 284 Semi-conductor Devices

Provides and analysis of active electronics devices to include transistors, thyristors, diodes, FET's, IC's as the building blocks for Oscillators, Detectors, power supplies, multi-vibrators, and amplifiers. Prerequisites: ELEC 100 and ELEC 101.

ELEC 285 Electronic Circuits

Concentrates on interpretation and understanding of schematic diagrams, electronic tables, data books, timing diagrams, and flow charts to facilitate expeditious identification and repair of circuit malfunctions. **The thrust of this class will be to utilize all that has been learned, to aid troubleshooting. Prerequisites: ELEC 284, ELEC 281 and ELEC 272.

ELEC 287 Digital Integrated Circuits Laboratory

This course is closely linked to ELEC 281. It provides hands-on application of concepts learned in ELEC 281. Digital circuits are constructed to help in understanding the operation of basic logic gates, flip-flops, adders, multi-vibrators, and comparators; timing diagrams, and the relationship of timing signals to system operation. Circuits will be analyzed using Oscilloscope, logic pulsers and probes. **Taken concurrently with ELEC 281. Prerequisite: ELEC 100 and ELEC 101.

Lineworker

Prefix	Number	Gerta	Course Title	BSC
LNWK	101		Applied Electrical Distribution	5
LNWK	103		Electrical Distribution	4

LNWK	105		Basic Electricity D.C. and A.C.	3
LNWK	107		Equipment Operations	2
LNWK	111		Safety I	2
LNWK	112		Fundamentals of Electrical Distribution	5
LNWK	114		Electrical Distribution	4
LNWK	116		Electrical Apparatus and Transformers	4
LNWK	118		Safety II	2
LNWK	120		Rope and Rigging	2

LNWK 101 Applied Electrical Distribution

This is a lab course in which students will learn to climb and work on poles, dig holes, set and frame poles, string and sag conductors, and build single-phase lines.

LNWK 103 Electrical Distribution

This course includes the principles to function as a lineworker. Course includes climbing equipment, poles, pole guying, conductors, insulators, proper grounding of equipment, personal protective grounding, distribution transformer installation, and proper use of equipment and tools as well as related safety to accomplish the above.

LNWK 105 Basic Electricity D.C. and A.C.

Study of the fundamentals of basic electricity. Subjects include DC and AC theory, Ohm's law and circuit calculations, reactance and power factor, and related math skills.

LNWK 107 Equipment Operations

A mix of classroom training and outdoor lab work studying the safe and efficient operation of digger derricks, pressure diggers, back hoes, and trenchers.

LNWK 111 Safety I

Study and practice of accident prevention and job safety.

LNWK 112 Fundamentals of Electrical Distribution

This is a lab course in which students will learn to construct two-phase and three-phase lines. Students will also learn about the installation of underground lines and electrical equipment apparatus. Prerequisite: LNWK 101 and 103.

LNWK 114 Electrical Distribution

This course includes the principles to function as a lineworker. Course includes URD cable procedures, line patrol, troubleshooting, system knowledge, work procedures for overhead and underground construction, line and equipment symbols, map readings and related safety to accomplish the above.

LNWK 116 Electrical Apparatus and Transformers

Study of the fundamentals of power line apparatus. Subjects include transformer theory and connections, substation and switch-yard functions, meter connections and readings, PT's and CT's, regulator operation, breakers and switches. Prerequisite: LNWK 105

LNWK 118 Safety II

Continuation of the study and practice of accident prevention and job safety. Prerequisite: LNWK 111.

LNWK 120 Rope and Rigging

Students learn knots, tying, splicing, uses of rope and basic rigging techniques.

Machine Tooling

Prefix	Number	Gerta	Course Title	NDSCS
MATL	101		Machine Tool Theory I	4
MATL	102		Machine Tool Theory II	4
MATL	111		Machine Tool Lab I	7
MATL	112		Machine Tool Lab II	7
MATL	201		Toolmaking Theory I	3
MATL	202		Toolmaking Theory II	2
MATL	205		CNC Theory & Operation	4

MATL	206		CNC Programming	3
MATL	212		Toolmaking Lab II	7
MATL	213		Machinist Lab I	7
MATL	214		Machinist Lab II	7

MATL 101 Machine Tool Theory I

An introduction to the hand tools used in the trade such as layout tools, measuring tools, drills, and files. A detailed study of the engine lathe and vertical milling machine including their many cutting tools and the procedures to use them are emphasized. Safety of the student and machine are stressed.

MATL 102 Machine Tool Theory II

Continued study of MATL 101 using the vertical band saw, horizontal mill, surface and cylindrical grinders including procedures, tool selection, cutting fluids, and shop terminology. Basic introduction to the CNC vertical mill and lathe is included.

MATL 111 Machine Tool Lab I

Basic skills such as layout using scribe, combination square and center punch are learned. Drill sharpening is followed by using this tool to produce a variety of holes, many of which are then tapped to several designated sizes. Careful use of the file to deburr and round corners to help produce safe product is covered. Students are introduced to the lathe and the use of carbide and high speed cutting tools to turn, thread and bore. This is followed by learning to use the vertical mill to produce flat surfaces, accurately locate holes and mill key seats.

MATL 112 Machine Tool Lab II

Students continue to learn to operate surface and cylindrical grinders, horizontal milling machine and band saw. The basic use of the CNC vertical mill and lathe is introduced.

MATL 201 Toolmaking Theory I

The basic theory of Mold Making and Die Making practices are studied. Procedures to use sinker and Wire Electrical Discharge machines, rotary table, cross slide rotary table, rotary head die mill, jig boring, and grinding machines are included. Advanced identification and usage of carbides, toolholders, toolsteels and heat treating are also covered. The injection molding machines and the punch press are studied so the student will be prepared to set up and produce plastic

and die stamped parts. Students will study the nomenclature and terms associated with mold and die making, as well as the various components involved in each. Upon completion, students will be capable of designing and building a simple blanking die and a simple injection mold based on a piece part print.

MATL 202 Toolmaking Theory II

Continued study of procedures and practices used to build the molds and dies which mass produce the many parts a modern society requires. Advanced Tooling such as compound, progressive, bending and forming dies, cam and three plate molds, hot runner systems, and jogs and fixtures are also covered in this course. Students will actually design, build and run a complex mold or die or possibly both.

MATL 205 CNC Theory & Operation

The principles of Computer Numerical Control of machine tools are studied. The lathe and vertical mill are two of the most commonly CNC controlled machines in production and tool room work so their setup, tool selection and codes are included in detail. Students will actually program, setup and run several CNC lathe and mill projects during this course.

MATL 206 CNC Programming

The theory and practices learned in MATL 205 along with the 4th axis work are put into use in programming the vertical mill and lathe. Several advanced projects will be programmed, set up and run by students. In addition to required projects. Advanced Machinists will be involved in a full-scale production job involving simple to complex programming. All students will get experience on both CNC lathes and mills. Advanced use of the computer on such operations as program development, verification, and DNC (uploading and downloading) to and from machine tool will be stressed. Each student will advance from simple to complex programming as their ability and interest permits.

MATL 212 Toolmaking Lab II

Toolmaking students will specialize in either mold-making or die-making. They will design and build either a complex mold or die depending upon the area in which they choose to specialize. They will be required to complete a portion of their mold or die using EDM and a portion on CNC. They will also be involved in the design and building of jigs and fixtures used in the production job by the machinist students. Students will also learn how to make single flute carbide and HSS form cutters.

MATL 213 Machinist Lab I

Basic projects using the CNC lathe and vertical mill are introduced. More complicated setups and procedures on lathe, vertical and horizontal mills and surface grinders to produce parts in quantity or repair situation are learned. ID/OD and

form grinding are introduced.

MATL 214 Machinist Lab II

Each student is encouraged to program, set up and operate the CNC lathe and mill on several jobs. They are limited only by their ambition and ability. Additional experiences producing parts to accurate dimensions is stressed. Speed and time become more important. The machinist students will be involved in a full-scale production project that will involve several parts to be manufactured and assembled in a finished project. This project requires them to use all of the knowledge gained in both MATL 205 and 206 to efficiently use time and resources available to complete the job while meeting stringent timelines and quality standards. This process gives students real world manufacturing experience as well as the chance to work with other departments as a team to identify and solve problems. Jigs and fixtures required to align and hold parts during machining will also be designed and built by students.

Manufacturing Technologies

Prefix	Number	Gerta	Course Title	NDSCS
MFGT	101		Robotics I	2
MFGT	107		Introduction to CNC	2
MFGT	115		Manufacturing Processes I	4
MFGT	121		Basic Welding II	1
MFGT	123		Fabrication Methods I	2
MFGT	124		Mechanical Drives I	2
MFGT	125		Total Quality Improvement	2
MFGT	126		Manufacturing Process II	2
MFGT	127		Precision Measuring Techniques	2
MFGT	135		Basic Metallurgy	2
MFGT	137		Print Reading I	2
MFGT	140		Fabrication Methods II	2

MFGT	141		Print Reading II	2
MFGT	150		Hydraulics I	2
MFGT	160		Pneumatics	2
MFGT	202		Robotics II	2
MFGT	208		Electro/Mechanical Systems	2
MFGT	225		Intro to SPC	2
MFGT	228		Geometric Tolerancing	2
MFGT	230		CIM Lab	5

MFGT 101 Robotics I

A lecture/lab introductory course in robotic principles and applications. Includes programming a 5-axis servo scrobot robot with a teach pendant, and an IBM compatible computer. Basic sensors and the use of inputs and outputs to interface controls with the robot are studied.

MFGT 107 Introduction to CNC

A lecture/lab introductory course that introduces the student to the basic fundamentals of CNC programming. Applied lab exercises in programming bench top mills and lathes are included.

MFGT 115 Manufacturing Processes I

The study of basic machine tool operations and forming processes topics include: Lathe Work, Milling, Drilling Operations, Tooling, and Fixture Work.

MFGT 121 Basic Welding II

Continuation of MFGT 120. This course covers basic horizontal and vertical welding using Oxy-Acetylene (OAW), Shielded Metal Arc Welding (SMAW) and Gas Metal Arc Welding (GMAW). Prerequisite: MFGT 120.

MFGT 123 Fabrication Methods I

This course covers basic fabrication techniques as they relate to product manufacturing, maintenance and repair. Topics include: bending, forming, shearing, simple punching operations, flat pattern layouts, basic jig and fixture applications, and

assembly methods.

MFGT 124 Mechanical Drives I

Basic mechanical systems components and their application to industrial machinery. Emphasis is given to how these components work, their use in a mechanical system, and proper installation and maintenance procedures. Topics include: Precision measuring, basic hand and power tool usage, fasteners, horsepower/torques, bearings/seals, belt drives, chain drives, gear drives, and couplings.

MFGT 125 Total Quality Improvement

A study of the introductory concepts of total quality improvement. Fundamentals of quality, commitment, teamwork, cause/effect, data collection and decision making.

MFGT 126 Manufacturing Process II

A lecture/lab introductory course that introduces students to robotics and automated systems and their operating characteristics. Students will learn basic coordinate systems and how hydraulic, pneumatic and electromechanical systems function together as a production cell. Applied work cell projects will be utilized.

MFGT 127 Precision Measuring Techniques

A lecture/lab introductory course that introduces the student to common measuring tools and measurements. Topics include: common measuring tools, gauge blocks, surface measurement, dial indicators, micrometers, optical measuring techniques, surface measurements, tolerance zones, and basic calibration methods.

MFGT 135 Basic Metallurgy

A basic study of the fundamentals of metallurgy. Topics include classification and properties of materials, alloys, heat treatment, destructive and non-destructive tests, non-ferrous materials, cast iron, plastics, and powder metallurgy basics. Includes applied metallurgy lab testing exercises.

MFGT 137 Print Reading I

Basic blueprint interpretation and shop-sketching course for students with little or no previous experience. The principles of blueprint reading and the techniques of making shop sketches are covered in sufficient detail to give the students a working knowledge of the subject.

MFGT 140 Fabrication Methods II

This course covers more advanced topics including: bending, forming, shearing, punching operations, template development straightening techniques, fixturing, and heat treatment.

MFGT 141 Print Reading II

For those students who have a basic understanding of blueprint reading. Selected blueprints cover methods of representation and unusual applications of drafting principles including sketches, auxiliary sections, distorted views, and representation of some common production methods. Introduction to tolerancing methods.

MFGT 150 Hydraulics I

A study of the basic hydraulic system and system components. The student will: explain how each component works, relate each component's relationship to a functioning system, read and interpret basic hydraulic schematics, review general component troubles

MFGT 160 Pneumatics

A study of the basic pneumatic system and system components. This study will: explain how each component works, relate each component's relationship to a functioning system, include reading and interpreting basic pneumatic schematics, and review general c

MFGT 202 Robotics II

A lecture/lab introductory course that is a continuation of Robotics I. This course introduces non-servo robots and their controls, the use of continuous path robot, and basic work cell applications.

MFGT 208 Electro/Mechanical Systems

A continuation of MFGT 126. This course covers more advanced topics in robotics and automated systems and their operating characteristics. Students will work with more complex systems requiring a functioning system that requires fluid power, controls, and electromechanical devices. Applied work cell projects will be utilized. Prerequisite: MFGT 126.

MFGT 225 Intro to SPC

A study of the introductory concepts of statistical process control. Fundamentals of statistics, control charts, process capability, sampling plans, quality costs. ISO 9000 and quality teams.

MFGT 228 Geometric Tolerancing

A course dealing with the basic principles used in geometric tolerancing and its use in the world of manufacturing. Topics include: general tolerancing methods, geometric symbols, datums, material conditions, form tolerances, orientation tolerances, and location tolerances, measuring methods, and basic bonus tolerancing methods.

MFGT 230 CIM Lab

Selected production project work to give students real world experience and practice in CIM.

Nuclear Power Technology

Prefix	Number	Gerta	Course Title	BSC
NUPT	101		Overview of Nuclear Energy	2
NUPT	103		Nuclear Mathematical Fundamentals	3
NUPT	105		Classical Physics	3
NUPT	107		Engineering Drawings, Diagrams, and Schematics	3
NUPT	109		Electrical Science	4
NUPT	111		Instrumentation and Control	4
NUPT	213		Nuclear Physics	3
NUPT	215		Nuclear Plan Chemistry	3

NUPT 101 Overview of Nuclear Energy

This course will cover the history and development of nuclear energy from the discovery of radiation to the present. The types of reactors and an introduction into how nuclear reactors work will also be covered. Students will study background information needed to understand nuclear power and waste disposal issues. Lastly the course will cover reactors and spent fuel locations within the United States.

NUPT 103 Nuclear Mathematical Fundamentals

This course will review basic math, including arithmetic functions, fractions, and decimals. This course will continue by covering scientific notation, dimensional analysis, algebra, basic geometry and trigonometry. Control charts and graphs,

logarithms and exponential functions, and rate concepts will also be covered.

NUPT 105 Classical Physics

This course is designed to introduce students to classical physics. Topics covered include: units of measurement, kinematics, force, energy, momentum, work, fluids, and mechanical principles.

NUPT 107 Engineering Drawings, Diagrams, and Schematics

This course will introduce students to engineering drawings, diagrams, and schematics that are used in nuclear operations. Students will learn how to read and decipher the various nuclear symbols, components, systems, and legends found on diagrams, drawings, and schematics.

NUPT 109 Electrical Science

This course begins by studying basic electrical fundamentals, theory, laws, and magnetism. Direct current and alternating current electrical circuits, generators, motors, and other components along with their applications will be covered. Single-phase AC circuits and three-phase AC circuits will be discussed. Inductance, capacitance, impedance, and resonance will be covered along with construction of conductors, insulators, and relays.

NUPT 111 Instrumentation and Control

This course will cover the construction, operation, and failure modes of basic sensors and detectors used in nuclear generation. Included in this are gamma and neutron core power detector construction, operation and effects. Various control systems will be covered including failure symptoms and troubleshooting techniques from an operational perspective.

NUPT 213 Nuclear Physics

This course will tour the topics that comprise the fundamentals of how reactors are built and operated, giving the student understanding and appreciation of the theory and principles that govern control room operation and activities outside the control room and how they/could they affect the reactor. This course starts with the fundamental atomic structures. Other topics such as the famous $E=mc^2$ equation, and understanding what criticality means in terms of reactor operation is discussed as part of the lessons on understanding the fission process. Lastly, a discussion of reactor shutdown operation and decay heat removal and significant reactor events.

NUPT 215 Nuclear Plant Chemistry

This course will study basic chemistry fundamentals relating to maintaining water purity in primary and secondary

systems. This course will cover chemistry concepts for both pressurized water reactors and boiling water reactors. Principles of water treatment, hazards and safety requirements will also be contained in the course.

Power Plant Technology

Prefix	Number	Gerta	Course Title	BSC
PWRP	103		Applied Math	2
PWRP	106		Water Chemistry	2
PWRP	109		Schematics & Diagrams	3
PWRP	203		Energy Sources and Conversions	2
PWRP	207		Boilers	4
PWRP	210		Gas Turbines and Combined Cycle Operations	4
PWRP	214		Power Generation	2
PWRP	216		Electrical System Components and Protection	4
PWRP	242		Plant Instrumentation and Control	4

PWRP 103 Applied Math

The study of advanced math principles as applied to power and process plants and refineries.

PWRP 106 Water Chemistry

The study of water chemistry as used in the modern fossil fuel power plants and process industry. Water treatment systems as applied to power generation, process plants and refineries are covered.

PWRP 109 Schematics & Diagrams

The study of the cycle of power and process plants using piping and instrumentation diagrams. Power and process plant operation is studied.

PWRP 203 Energy Sources and Conversions

This course explains the difference between solid and liquid fuels, their combustion properties, and uses in the power and

process plants. Study of environmental protection systems as applied to refineries and power plants.

PWRP 207 Boilers

The study of safe and efficient operation of high pressure and low pressure boilers and related equipment, as used in power generation, process plants, refineries, and heating systems.

PWRP 210 Gas Turbines and Combined Cycle Operations

This course covers construction and operation of water and gas turbines, as well as diesels.

PWRP 214 Power Generation

Covers construction of motors and generators used in power plants.

PWRP 216 Electrical System Components and Protection

Transformers, circuit breakers, switch gear, and switch year equipment are covered in detail as to construction and maintenance required.

PWRP 242 Plant Instrumentation and Control

Covers the construction and operation of controllers and final control elements and their interaction in power generation systems. Study and lab exercises on programmable controllers as used in power generation.

Technology

Prefix	Number	Gerta	Course Title	LRSC	NDSCS	WSC
TECH	101		Engineering Drawing		2	
TECH	102		Charging and Starting Systems		3-4	
TECH	109		Air Conditioning		2	
TECH	118		Orientation			1
TECH	120		Applied Welding			1-2
TECH	130		Industrial Safety		2	
TECH	164		Introduction to Hydraulic Components and Systems		5	

TECH	165		Applied Fundamentals of Hydraulic Theory		5	
TECH	178		Heavy Duty Air Conditioning			2
TECH	184		Fuel Injection Systems		4	
TECH	238		Basic Welding	2-5		
TECH	265		Applied Hydraulic Systems		6	

TECH 101 Engineering Drawing

An introduction and practice in the use of mechanical drawing instruments, freehand lettering techniques, sketching, orthographic projection, section views, auxiliary views, isometric and oblique projection, and basic dimensioning practices. It is a core drafting course for students going into a more specialized field such as mechanical drafting, or civil engineering technology.

TECH 102 Charging and Starting Systems

A lecture, demonstration and performance type course covering the design and operation of charging and cranking systems. Included is the study of the operation, control, diagnosing, and repair of these systems. Emphasis is placed on the proper use of special instruments and tools to test and service the systems involved. This is a 9-week course.

TECH 109 Air Conditioning

A lecture, discussion, and lab-type course covering the design and principles of operations of various air conditioning systems. Work in lab consists of leak detecting, evacuation, reclaiming, charging, component overhaul, component installation, electrical systems, and troubleshooting of various units. This is a 9-week course.

TECH 118 Orientation

Safety in the operation of hand and power tools; proper selection and use of fire extinguishers; safety procedures and rules stressed. Employee right-to-know information will be discussed. Students will be developing small projects to use in the lab area.

TECH 120 Applied Welding

Study and skill development of oxyacetylene welding (cutting, fusion, brazing); shielded metal arc welding of carbon steels in flat, vertical, overhead, horizontal positions; wire feed welding of carbon steels in various positions.

TECH 130 Industrial Safety

A basic study covering occupational safety standards and codes with emphasis on applications to typical industrial, construction, and shop situations. Topics include: the role of OSHA and other regulatory agencies, fire protection, hazardous materials, personal protection, operations and constructive safety, as well as the study of accident causation and prevention.

TECH 164 Introduction to Hydraulic Components and Systems

A study of principles of operations and construction and functions of hydraulic components in open and closed center systems. Flow-rate and calculate oil flows and pressures on hydraulic units found on agricultural and industrial type hydraulics. This is a 9-week course.

TECH 165 Applied Fundamentals of Hydraulic Theory

A lab/lecture type course that covers the fundamental of hydraulic components and systems as they relate to diesel powered equipment. Students will disassemble, assemble, and test hydraulic components used with both open and closed center systems.

TECH 178 Heavy Duty Air Conditioning

Introduction to the theory and operation of air conditioning systems; practical application of theory and operation of air conditioning systems; safety in recovering, recycling, and handling of refrigerants stressed; special attention given to governmental regulations as to handling materials.

TECH 184 Fuel Injection Systems

A study of and exposure to different types of diesel fuel injection systems found on agricultural and industrial engines. Fuel system requirements, operation, disassembly, reassembly, and testing to procedure are covered. This is a 9-week course.

TECH 238 Basic Welding

Is designed to give the student a broad overview of safe work habits and to become aware of safe working conditions for welding as well as providing basic principles and practices in the fundamentals of shielded metal arc welding and oxyacetylene gas welding.

TECH 265 Applied Hydraulic Systems

A lab/lecture course covering the service and repair of the hydraulic functions on agricultural and other mobile equipment.

Open center, closed center, and load sensing systems are covered as well as steering, hydrostatic drives, and hydraulic control functions of today's equipment.

The following individuals are leaders for this discipline. Those marked with an asterisk (*) are chairs.

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