Course Descriptions

World Class Shipbuilder Curriculum

**B112 Problem Solving** 45 Hours  3 Credits
Includes methods and tools for problem solving and decision making in industrial environments. Topics include: team concepts, systems analysis, identifying and documenting objectives, functional flow diagrams, timeline analysis, and statistical process modeling. Topics are reinforced through a team-based term project focusing on process improvement.

**B122 Business Operations and Leadership** 45 Hours  3 Credits
Introduces business and leadership concepts with specific application to the shipbuilding industry and leadership principles of Newport News Shipbuilding. Includes topics such as, product mix, business strategies, contracts, process improvement, quality programs, shipbuilding economics, teams and teamwork, communications, the principles of leadership and corporate values. Special emphasis is given to leadership principles and behaviors.

**C111 Technical Communications I** 55 Hours  3 Credits
Prepares apprentices to meet written and oral demands of a business environment. Includes instruction in writing and speaking skills, with application to business communications such as, written reports and procedures, memorandums, and oral presentations. Microsoft Office applications are utilized for writing, editing, and preparation of presentation materials.

**C211 Introduction to Computers** 45 Hours  3 Credits
Provides students with the skills and knowledge related to computer use at Newport News Shipbuilding, which will support computer requirements in subsequent academic courses and prepare apprentices for tasks requiring computer usage after their apprenticeship. Includes an overview of hardware, software, operating systems, workstations, microcomputer processes and NNS policies. Emphasizes the Microsoft Office Suite including Word, Excel, Access, PowerPoint, Outlook, Explorer, and Windows.

**D111 Drafting** 60 Hours  3 Credits
Exposes apprentices to the basic fundamentals and principles of engineering drafting as it relates to the shipbuilding industry. All areas are given special significance through applications to the marine and shipbuilding industries. Includes drafting fundamentals, engineering lettering, principles of orthographic projection, freehand sketching, use of scales, drafting instruments, geometric construction, principles of dimensioning, and development of auxiliary and sectional views.

**M111 Technical Math I** 60 Hours  3 Credits
Supports the craft training programs. It provides apprentices with the basic skills necessary to be successful in the mathematics, science, and engineering courses of their academic curriculum, and prepares apprentices for future educational opportunities. It includes linear equations, factoring, algebraic fractions, exponents, roots, radicals, quadratic equations, graphing, systems of equations, and application-related principles/problems.

**M112 Technical Math II** 60 Hours  3 Credits
Uses algebraic principles to solve shipbuilding applications of plane and solid geometry, right and oblique triangle trigonometry, and vector principles. Includes principles/problems from plane and solid geometry and trigonometry, Pythagorean Theorem, surface area and volume of various figures, trigonometric functions and solution of right triangles, oblique triangles using the Laws of Sines and Cosines, and vectors and equilibrium solutions of concurrent force systems.

**M121 Mechanics** 60 Hours  3 Credits
Builds the bridge between the analytical world of mathematics, science, and engineering and the practical world of shipbuilding design and construction. Includes application of free-body-diagrams (FBDs) to various force systems and the subsequent application of the equations of static equilibrium in finding the external support reactions of the FBDs. The reactions are used in strength of materials problems to determine the required dimensions of the various pieces of material.

**N111 Ship Construction I** 30 Hours  2 Credits
Introduces shipbuilding by providing a common vocabulary of shipbuilding terms, the basic elements of a ship, the concept of a process, the shipbuilding trades, and the company's quality program. Includes specific topics such as: the definition of a ship, ship's mission requirements, ship's hull design, drawings, lines and offsets, ship components of hull structure, the modern shipbuilding process and facilities, the fundamental force support systems, and the concepts of quality and process excellence used at NNS.

**N222 Ship Construction II** 45 Hours  3 Credits
Provides apprentices with an understanding of the typical propulsion plants and their associated components used in today's Navy. Includes the operation and major components of a ship's basic propulsion drive train including: resistances, a conventional steam cycle propulsion system, a pressurized water reactor propulsion system, a gas turbine propulsion system and a basic internal combustion propulsion system. Included are the scientific laws and principles involved.

**P211 Physical Science I** 60 Hours  3 Credits
Introductory physics course that integrates scientific theories with waterfront experiences. Topics include forces, velocity, acceleration, energy, work, power, and momentum (both translational and rotational modes), freely falling bodies, projectile motion, friction, centrifugal and centripetal forces, and simple machines.

**P222 Physical Science II** 55 Hours  4 Credits
Physical Science II is a continuation of physics introduced in Physical Science I and an introduction to metallurgy. Topics include the principles of fluids at rest and in motion. Emphasis is placed upon density, specific gravity, pressure, Pascal's law, Archimedes' principle, and Bernoulli's principle. The relationships between temperature, pressure, volume, and thermal energy are studied with particular attention to their effects on solids, liquids, and gases. The properties of metals and non-metals are included.

Trade Related Education Curriculum

**COATINGS SPECIALIST**

**X331 Paint and Surface Preparation**
(See PAINTER-INSULATOR)

**X332 Blueprint Reading For Painters**
(See PAINTER-INSULATOR)

**DIMENSIONAL CONTROL TECHNICIAN**

**O681 Industrial Measurement** 440 Hours  18 Credits
This eleven-week course begins with an introduction and orientation to dimensional control and industrial measurement in a large manufacturing and industrial setting. Two to four days of instruction are devoted to each of the following topics: technical communications, interpretation of drawings, hand measurement tools, applied mathematics, laser safety, and geometric dimensioning and tolerancing. The course covers tasks associated with performing on-site visual inspections of components to
determine measurement methodology; planning and coordinating phases of the measurement survey process; performing measurement surveys and collecting survey data; and analyzing and interpreting data using Spatial Analyzer software. One week, each, is devoted to specific industrial measurement instruments and processes including: laser tracker, handi-scan, photogrammetry and Vstars, total station, coordinate measurement machines and optical tooling. Nine intermediate tests and a comprehensive final exam are used to evaluate student competency.

X421 Introduction to Pipefitting  
(See PIPEFITTER)

X422 Blueprint Reading Fundamentals and Procedures  
(See PIPEFITTER)

X431 Machinery Installation Theory  
(See OUTSIDE MACHINIST)

ELECTRICIAN

X311 Applied Theory I: DC Concepts  96 Hours 5 Credits
Introduction to DC theory is a prerequisite for subsequent electrical theory classes as well as, a provider of essential information on electrical safety. This course introduces the effects of DC voltage, current and power in resistive circuits (including series, parallel, and series-parallel networks with emphasis on Kirchhoff’s voltage and current laws), and voltage divider and current divider rules. Circuit analysis includes source conversion, mesh analysis, superposition, and Thevenin’s and Norton’s theorems. Practical lab exercises incorporate standard test equipment, classroom theory, troubleshooting skills, and electrical safety.

X312 Applied Theory II: AC Concepts  96 Hours 5 Credits
This course completes DC concepts by presenting transient effects of capacitors and inductors and discussing magnetic circuits. AC theory concepts and applications are introduced using general sinusoidal format for AC voltage, current, power and frequency as it applies to resistive and reactive series, parallel and series-parallel networks. Circuit analysis includes mesh analysis, superposition, and Thevenin’s and Norton’s theorems. Practical lab exercises incorporate standard test equipment, classroom theory, troubleshooting skills, and electrical safety.

Prerequisite: X311

X313 Applied Theory III: Polyphase Systems and Controls  
120 Hours 6 Credits
This course continues AC theory concepts including resonance, filters, AC power, polyphase systems and transformers. Information on motor controls begins with the principles and applications of DC and AC generators and motors and continues with examples of DC and AC electromechanical controls including schematic symbols, wiring and schematic diagrams, relays and contacts, motor overload devices, time delay circuitry, reduced voltage starting methods, and deceleration methods. The student learns the most effective methods and strategies used to troubleshoot complex electromechanical control systems through hands on laboratory exercises emphasizing electrical safety, electromechanical circuit design and troubleshooting.

Prerequisites: X311 and X312

X314A Electronics I  88 Hours 4 Credits
Involves the study of basic solid state devices including general purpose diodes, Zener diodes, IC regulators and LEDs. Applications include power supplies, BJT and FET biasing methods, BJT amplifiers, power amplifiers and operational amplifiers with emphasis on circuit design, analysis and troubleshooting. Supporting lab work included in course.

Prerequisites: X313

X314B Electronics II  88 Hours 4 Credits
The second of a two-course series on solid state devices that includes a review of BJT and FET amplifiers and introduces amplifier frequency response. Advanced topics include Thyristors with SCR and TRIAC motor controls, operational amplifiers, active filters, oscillators, and regulated power supplies. The course also includes an introduction to fiber optics and programmable controllers. Supporting lab work included in course.

Prerequisites: X314A

X316 Programmable Logic Controllers  44 Hours 2 Credits
The course begins with an introduction to digital electronics including numbering systems, gate logic and combinatorial logic, and continues with applications of digital electronics through encoders, decoders, flip-flops and counters. The course continues with programming, hook-up and troubleshooting of programmable logic controllers (PLCs). Industry standard PLCs and programming software are used for specific training on ladder logic diagrams, input/output instructions, internal relays, timers, counters, compare and math functions, control instructions, sequencers, retrofitting, and program design. Prerequisite: X313

HEATING & AIR CONDITIONING WORKER

ALL ELECTRICAL THEORY  
(See ELECTRICIAN)

043H Air Conditioning and Refrigeration I  90 Hours 4 Credits
Studies refrigeration theory, characteristics of refrigerants, temperature, and pressure, tools and equipment, soldering, brazing, refrigeration systems, system components, compressors, evaporators, and metering devices. Presents charging and evaluation of systems and leak detection. Explores servicing the basic system. Explains use and care of oils and additives and troubleshooting of small commercial systems.

HEAVY METAL FABRICATOR

X111 Hull Construction I  18 Hours 1 Credit
Develops a general understanding of safe and efficient shipbuilding manufacturing practices and the tools involved in these practices. Includes hull trade apprentice shipyard safety responsibilities, tools of the trade, ship nomenclature, hull construction, basic ship lines, structural shapes, fractions and plate weight conversions. Also includes, interpretation of drawings, work packages, material layoff, joint fit-up, workmanship, and weld symbols.

INSULATOR

X331 Paint and Surface Preparation  
(See PAINTER-INSULATOR)

X332 Blueprint Reading For Painters  
(See PAINTER-INSULATOR)

X333 Theory of Insulation  
(See PAINTER-INSULATOR)

MACHINIST

M531 Machinist Shop Theory  30 Hours 2 Credits
Covers basic machine shop safety, hand tools, measuring tools (including precision measuring tools), metric measurement, tapers and angles, and basic machine theory. Included are tools and attachments for machines such as the drill press, shaper, slotter, planer, milling machine, and engine lathe. Identification of machines and their principal parts and machine operation are also covered. Apprentices attend two machine shop work package sessions and are introduced to drawings.

M533 Numerical Control Programming/Lab  80 Hrs 3 Credits
Introduces the concepts of Numerical Control Machining. Apprentices will describe the parts and functions of an N/C system, distinguish between Manual/Computer Assisted Programming, define terms, and use the Absolute and Incremental Positioning Systems. Written programming work includes various machining operations, using fixed cycles and subroutines, Linear and Circular Interpolation, Tool Radius Compensation, and M and G codes.

MILLWRIGHT

M531 Machinist Shop Theory  
(See MACHINIST)
0431 Hydraulics I (Introduction)  30 Hours  3 Credits
Provides an understanding of hydraulic systems and associated components found in the shipyard. Covers introductory hydraulics including air and fluid power principles, hydraulic power system components, different types of hydraulic fluids, hydraulic strainers and filters, hydraulic reservoirs and accumulators, hydraulic piping, tubing and fittings, hydraulic directional control valves, hydraulic pressure control valves, hydraulic cylinders, hydraulic motors, and rotary actuators.

MODELING AND SIMULATION

E061 Introduction to Modeling and Simulation  45 Hour 3 Credits
Provides a brief review of the history of modeling and simulation and an overview of technique, applications, and processes used in the field. Students develop an understanding of main concepts and categories of modeling and simulation as well as the process for conducting a modeling and simulation study. Course readings supplement lectures with insights into various industry perspectives.

E062 Modeling and Simulation Applied  90 Hours 4 Credits
This course is a variation of the traditional Discrete Event Simulation (DES) course. It shifts focus and places it on the process of conducting a study rather than a technique. The primary objective of this course is to learn the best practices of planning and executing an M&S project and be able to apply them independently of the tool or approach. It includes such common topics as problem definition, solution design, validation and verification, and analysis of results. The course thoroughly covers DES and includes best practices from Software Engineering and Systems Engineering, as they apply to M&S. This includes Iterative Development techniques, UML, documentation, object oriented design, and finite state machine concepts, among others.

MOLDER

A5721 Foundry Processes  40 Hours 3 Credits
The scope of this course covers the fundamental processes of metal casting including its history and the design parameters to apply for optimum consistent production of quality metal castings in the Foundry. It is an in depth study of each of the interconnected processes of metal casting including patternmaking, molding, choosing proper alloys, melting and pouring, cleaning and inspection. Proficiency is tested at all levels to validate learning using written tests that include applications for problem solving.

A5722 Blueprint Reading for Molders  60 Hours 4 Credits
This course is designed to encourage best practices for interpreting, visualizing and communicating industrial drawing contents. The sessions include learning the skills required to recognize the components of a drawing and their contents and be able to relate the parts to each other. Use of appropriate measuring tools, identifying and interpreting lines and symbols, recognizing and interpreting various drawing views, locating information blocks, introduction of necessary vocabulary and abbreviations, and fraction and decimal math computations are included. A comparison of a M&S drawing with a commercial drawing is also investigated. Proficiency evaluations include tests, sample drawings and models.

NON-DESTRUCTIVE TESTER

X311 Applied Theory I: DC concepts  (See ELECTRICIAN)
X312 Applied Theory II: AC Concepts  (See ELECTRICIAN)
X313 Applied Theory III: Polyphase Systems and Controls  (See ELECTRICIAN)
O381 Non-Destructive Testing (NDT) Theory  13 Hours 0 Credit
Includes the fundamental knowledge of NDT methods used to examine welds. Provides training in surface testing methods with magnetic particle, liquid penetrant, and eddy current testing, and volumetric/subsurface testing with radiographic and ultrasonic methods. Note: for qualification purposes only.

Last Revision: August 2012

OUTSIDE MACHINIST

X431 Machinery Installation Theory  40 Hours 3 Credits
Includes an introduction to measurement tools, drawings and blueprints, flanges, gaskets, fastener/material control, and identification and information on shop machines and portable machines. Also covered in this course are the care and handling of machines and the safety requirements for working with rotating machinery. Finally, students taking the class will get a short overview of the material that will be covered in the X433 Ship Systems course.

X432 Hydraulics I (Introduction)  30 Hours 3 Credits
With specific applications to shipboard environments, covers introductory hydraulics which includes air and fluid power principles, hydraulic power system components, different types of hydraulic fluids, hydraulic strainers and filters, hydraulic reservoirs and accumulators, hydraulic piping, tubing and fittings, hydraulic directional control valves, hydraulic pressure control valves, hydraulic cylinders, hydraulic motors, rotary actuators, and system troubleshooting.

X433 Ship Systems  40 Hours 3 Credits
This course is intended to provide each student in-depth knowledge of various major shipboard systems. The following topics will be covered in the course: Hydraulic systems, Aircraft Carrier (Navigation/Surveillance/Weapons systems); Submarine (Surveillance and Weapons systems); Main Propulsion systems; Auxiliary systems; Aircraft Carrier (Deck Machinery); and, Aircraft Launch and Recovery systems (ALRE).

PAINTER-INSULATOR

X331 Paint and Surface Preparation  40 Hours 2 Credits
Provides the apprentice with an understanding of safety, surface preparation, and typical paint installation techniques for new ship construction and overhaul. Describes the function and use of hand and mechanically operated trade tools used for surface coating calculation, preparation, application, and final surface presentation. Creating and maintaining safe work habits and conditions are stressed throughout the course.

X332 Blueprint Reading for Painters  10 Hours 1 Credit
Instructs the apprentice in reading, interpreting, and applying painting information from blueprints and other construction documents to new ship construction and overhaul. Provides the apprentice with an understanding of safety, application and installation of insulation materials for new ship construction and overhaul. Describes the function and use of hand and mechanically operated trade tools used on various types of blueprints, schedules, inspection procedures, and other trade documents and forms.

X333 Theory of Insulation  27 Hours 2 Credits
Provides apprentice with an understanding of safety, application and installation of insulation materials for new ship construction and overhaul. Provides the apprentice with an understanding of safety, application and installation of insulation materials for new ship construction and overhaul. Describes the function and use of hand and mechanically operated trade tools used on various types of blueprints, schedules, inspection procedures, and other trade documents and forms.

Patternmaker

A5721 Foundry Processes  40 Hours 3 Credits
The scope of this course covers the fundamental processes of metal casting including its history and the design parameters to apply for optimum consistent production of quality metal castings in the Foundry. It is an in depth study of each of the interconnected processes of metal casting including patternmaking, molding, choosing proper alloys, melting and pouring, cleaning and inspection. Proficiency is tested at all levels to validate learning using written tests that include applications for problem solving.

A5722 Blueprint Reading for Molders  60 Hours 4 Credits
This course is designed to encourage best practices for interpreting, visualizing and communicating industrial drawing contents. The
sessions include learning the skills required to recognize the components of a drawing and their contents and be able to relate the parts to each other. Use of appropriate measuring tools, identifying and interpreting lines and symbols, recognizing and interpreting various drawing views, locating information blocks, introduction of necessary vocabulary and abbreviations, and fraction and decimal math computations are included. A comparison of a NNS drawing with a commercial drawing is also investigated. Proficiency evaluations include tests, sample drawings and models.

PIPFITTER

X421 Introduction to Pipelfitting 20 Hours 1 Credit
Provides the apprentice with an understanding of basic hand tools, material identification (pipe / fittings / valves), trade math, and rule reading / measurement.

X422 Blueprint Reading Fundamentals and Procedures 20 Hours 1 Credit
Provides the apprentice with the basic principles of blueprint reading and procedures used in pipelfitting. Areas covered include blueprint terminology and navigation, drawing scales, material lists, welding, brazing, and NDT procedures.

X423 Sketching and Bending Fundamentals 21 Hours 2 Credits
Provides the apprentice with the principles of sketching and bending for various piping configurations. Areas covered include determining sizes of bending heads, true lengths between bends, calculating roll and bend angles, bending flat and rolling offsets, and determining bent pipe characteristics mathematically.

X424 Piping Systems 12 Hours 1 Credit
Provides the apprentice with principles of shipboard piping systems and their operation. Piping systems discussed include propulsion, seawater, hydraulics, plumbing drains, potable water, lube oil, JP-5, and various nuclear piping components and systems in shipbuilding.

RIGGER

X361 Stagebuilding, Blocking, and Shoring Theory 30 Hours 2 Credits
Provides the apprentice with a basic understanding of rigging safety, stagebuilding, blocking, and shoring for new ship construction and overhaul.

X362 Lifting and Handling Equipment Theory 30 Hours 2 Credits
Provides the apprentice with a basic understanding of rigging safety, lifting, and handling equipment used in new ship construction and overhaul. (Currently under development)

X363 Ventilation Theory 15 Hours 1 Credit
Provides the apprentice with a basic understanding of tank safety and the proper installation of ventilation for new ship construction and overhaul. (Currently under development)

SHEET METAL WORKER

X321 Blueprint and Group Sheet Reading 15 Hours 1 Credit
Provides the apprentice with a thorough knowledge of basic print reading and grouping that is essential to the sheet metal trade. This course covers fundamental drawing information, including isometric and orthographic objects, weld symbols, shop terms and abbreviations, scaling, types and parts of drawings, and work packages. Also includes interpreting group sheets and computer bills of material.

X322 Materials, Machine Processes, Drilling and Tapping 20 Hours 1 Credit
Exposes the apprentice to various sheet metal materials as well as the machinery and processes involved in the fabrication and installation of sheet metal products. This course includes material identification and characteristics along with types of fasteners and pipe sizes. In addition, the course covers basic sheet metal tools and machines, machine processes, shielded metal arc welding, drilling, and tapping operations, with emphasis placed on safe work practices.

X323 Sheet Metal Layout 18 hours 1 Credit
Introduces the apprentice to the concepts of planning, designing, and shaping complex sheet metal components using applied math and geometry. This course covers sheet metal and heavy metal layout for breaking, forming, rolling, and notching to form material into three dimensional objects and components. The course includes square breaks, radius breaks, and rolling by hydraulic presses, hand brakes, and hand and power rollers, with an emphasis on safe, efficient work practices.

X324 Advanced Print Reading 34 Hours 2 Credits
Provides a wide-ranging exposure to the sheet metal blueprints and drawings that relate to specific areas of shipbuilding, including carriers, submarines, and shops. This course provides comprehensive instruction on a variety of Sheet Metal drawings including the information and makeup of 24 different arrangement, detail, and list drawings. Additional topics include the major categories of work performed in the Sheet Metal Department.

SHIPFITTER

X111 Hull Construction Theory I (See HEAVY METAL FABRICATOR)

X113 Hull Construction II CVN Drawings and Work Packages 8 Hours 1 Credit
Develops an understanding of efficient shipbuilding manufacturing practices through detailed drawing and work package interpretation. Includes analysis of carrier construction documents.

X114 Hull Construction II VCS Drawings and Work Packages 8 Hours 1 Credit
Develops an understanding of efficient shipbuilding manufacturing practices through detailed drawing and work package interpretation. Includes analysis of submarine construction documents.

X115 Hull Construction III 24 Hours 1 Credit
Develops a more advanced understanding of safe and efficient shipbuilding and manufacturing practices. It builds on information, skills and experiences gained in X111 and rotation experiences. It offers more specific application of tool safety, math calculations, material layoff, and joint fit-up and workmanship.

WELDER

X111 Hull Construction Theory I (See HEAVY METAL FABRICATOR)

X181 Shielded Metal Arc Welding 15 Hours 1 Credit
Develops a general understanding of safe and efficient welding practices and the tools involved in these practices. Includes shipyard safety, fundamentals of SMAW electrical circuits, terms and definitions, weld symbols, the structural joint numbering system, and proper welding sequence.

X182 Gas-Metal Arc Welding 14 Hours 1 Credit
Develops an advanced understanding of safe and efficient welding practices enabling apprentices to assume increased leadership responsibilities in the welding trade. Consists of shipyard safety, an examination of GMAW components, and electrical characteristics of the system. Also includes steps to execute satisfactory welds, welding parameters, heat input, and system troubleshooting.

X185 Introduction to Non-Destructive Testing 12 Hours 1 Credit
Develops an academic and hands-on understanding of non-destructive weld testing techniques. Includes the most common types of weld discontinuities, the most commonly used NDT methods, and the advantages and limitations of each. The course also includes the interrelationships between welding processes, discontinuities, and inspection methods.
A211-212 (ACC 211-212) Principles of Accounting I-II
45 Hours 3 Credits
Presents accounting principles and their application to various businesses. Studies services, income determination, asset valuation, and financial reporting. Studies services, merchandising, and manufacturing operation, including internal controls, analysis of financial statements, cost accounting systems, and managerial concepts. Lecture 3 hours per week.

B117 (BUS 117) High Performance Work Teams (Leadership Development)
45 Hours 3 Credits
Covers interpersonal relations in hierarchical structures. Examines the dynamics of teamwork, motivation, handling change and conflict and how to achieve positive results through others. Lecture 3 hours per week.

B209 (BUS 209) Total Quality Management (Continuous Quality Improvement)
45 Hours 3 Credits
Presents the different philosophies in Quality Control. Introduces students to Process Improvement, Team Development, Consensus Building, and Problem-Solving strategies. Identifies methods for Process Improvement in manufacturing and service organizations which includes Statistical Process Control when used in the quality control function of business and industry. Lecture 3 hours per week.

B215 Production Planning
45 Hours 3 Credits
Prepares apprentices in the functional use of production planning. Includes the generation and execution of business plans, production plans, master production schedules, and material requirements plans. Additional topics cover forecasting, capacity planning, inventory management, just-in-time principles, and production activity control related to the execution of plans and schedules.

B216 (BUS 216) Probability and Statistics for Business and Economics
45 Hours 3 Credits
Introduces methods of probability assessment and statistical inference. Topics include descriptive statistics, normal and binomial distributions, decision making under uncertainty and under risk, decision analysis incorporating sample information, sampling distributions and central limit theorem, interval estimation, and hypothesis testing. Business and economic applications are emphasized. Computer software, as a tool for problem solving, is utilized where appropriate. Lecture 3 hours per week.

C201 Computer Science
60 Hours 4 Credits
Introduces algorithm and problem solving methods. Emphasizes structured programming concepts, elementary data structures and the study and use of a high level programming language. Prerequisites: CSC 110 or equivalent and MTH 173 or equivalent. Lecture 4 hours per week.

C210 Programming with C++
60 Hours 4 Credits
Includes language syntax, problem-solving techniques, top-down refinement, procedure definition, loop invariance, theory of numerical errors and debugging. Covers the syntax of the C++ language. Prerequisite: CSC 201 or EGR 125. Lecture 4 hours per week.

C221 (CHM 111) College Chemistry I
90 Hours 4 Credits
Explores the fundamental laws, theories, and mathematical concepts of chemistry. Designed primarily for science and engineering majors. Lecture 3 hours + lab 3 hours, total 6 hours per week.

C222 (CHM 112) College Chemistry II
90 Hours 4 Credits
Explores the fundamental laws, theories, and mathematical concepts of chemistry. Designed primarily for science and engineering majors. Lecture 3 hours + lab 3 hours total 6 hours per week.

C232 Technical Communications II
45 Hours 3 Credits
Prepares the apprentice to fulfill the varied writing demands of the business environment. Includes instruction in technical writing style and mechanics as it relates to business communications. Tone, style, content, and cross-cultural communication are covered as appropriate for audience and purpose through computer generated memoranda, procedures, summaries, and various technical reports. Computer generated graphics are designed to assist with understanding of technical information.

C243 Technical Communications III
45 Hours 3 Credits
Emphasizes concepts and principles of oral communications with emphasis on techniques that produce effective oral communications. Topics include listening, feedback, nonverbal communications, attitudes, and other interpersonal skills affecting speech communications. Emphasis is placed on application of oral communication skills for conveying technical information to varying levels of personnel in an industrial organization. Presentations are made at the individual, small, and large group levels.

D211 (CAD 211) Advanced Technical Drafting I
45 Hours 3 Credits
Teaches use of drafting equipment and applications, emphasizing knowledge and skill required for industrial drafting. Includes piping, gearing, geometric and positional tolerances and 2D/3D drawing layout. (Credit will not be awarded for both CAD 211 and DRF 211.) Prerequisites: CAD 151 or DRF 151. Lecture 2 hours + lab 3 hours, total 5 hours per week.

D241 (DRF 241) Parametric Solid Modeling I
75 Hours 4 Credits
Focuses on teaching students the design of parts by parametric solid modeling. Topics covered will include, but not limited to, sketch profiles; geometric and dimensional constraints; 3-D features; model generation by extrusion, revolution, and sweep; and the creation of 2-D drawing views that include sections, details and auxiliary. Lecture 3 hours + lab 2 hours, total 5 hours per week.

D243 Shipbuilding Design Project
75 Hours 4 Credits
Requires apprentices to employ several design skills they have acquired through previous courses in the solution of actual design problems and the development of a project. Skills will be applied to the analysis and design of the ship's structural components and the development of a ship's lines drawing. Apprentices use all the hull form calculations and associated graphs required to determine the displacement, speed, power, etc... of a ship. A final report and exam are required.

E110 (EGR 110) Engineering Graphics
60 Hours 3 Credits
Presents theories and principles of orthographic projections. Studies multi-view, pictorial drawings and sketches, geometric construction, sectioning, lettering, tolerancing, dimensioning and auxiliary projections. Studies the analysis and graphic presentation of space relationships of fundamental geometric elements: points, lines, planes and solids. Includes Instruction in Computer Aided Drafting. Lecture 2 hours + lab 2 hours = 4 hours per week.

E111 (ENG 111) College Composition I
45 Hours 3 Credits
Develops writing ability for study, work, and other areas of writing based on experience, observation, research, and reading of selected literature. Guides students in learning writing as a process: understanding audience and purpose, exploring ideas and information composing, revisions, and editing. Supports writing by integrating experiences in thinking, reading, listening, and speaking. Lecture 3 hours per week.
E112 (ENG 112) College Composition II  45 Hours  3 Credits
Continues to develop college writing with increased emphasis on critical essays, argumentation, and research through the examination of a range of texts about the human experience. Requires students to locate, evaluate, integrate, and document sources and effectively edit for style and usage. Lecture 3 hours per week.

E120 (EGR 120) Introduction to Engineering  30 Hours  2 Credits
Introduces the engineering profession, professional concepts, ethics, and responsibility. Reviews hand calculators, number systems, and unit conversions. Introduces the personal computer and operating systems. Includes engineering problem solving techniques using computer software. Lecture 1 hour + lab 2 hours – 3 hours per week.

E125 (EGR 125) Introduction to Engineering Methods  60 Hours 4 Credits
Applies problem-solving techniques to engineering problems utilizing computer programming and algorithms in a higher level computer language such as FORTRAN, PASCAL, or C++. Lecture 3 hours + lab 2 hours = 5 hours per week.

E126 (ENG 125) Introduction to Literature  45 Hours  3 Credits
Introduces students to a range of literary genres that may include poetry, fiction, drama, creative nonfiction, and other cultural texts, as it continues to develop college writing. Prerequisite: ENG 111. Lecture 3 hours per week.

E140 (EGR 140) Engineering Mechanics – Statics  45 Hours  3 Credits
Introduces mechanics of vector forces and space, scalar mass and time, including S.I. and U.S. customary units. Teaches equilibrium, free-body diagrams, moments, couples, distributed forces, centroids, moments of inertia, analysis of two-force and multi-force members and friction and internal forces. Lecture 3 hours per week.

E201 (ECO 201) Principles of Economics I – Macroeconomics  45 Hours  3 Credits
Introduces macroeconomics including the study of Keynesian, classical, monetarist principles and theories, the study of national economic growth, inflation, recession, unemployment, financial markets, money and banking, the role of government spending and taxation, along with international trade and investments. Lecture 3 hours per week.

E202 (ECO 202) Principles of Economics II – Microeconomics  45 Hours  3 Credits
Introduces the basic concepts of microeconomics. Explores the free market concepts with coverage of economic models and graphs, scarcity and choices, supply and demand, elasticities, marginal benefits and costs, profits, and production and distribution. Lecture 3 hours per week.

E231 (ETR 231) Principles of Lasers and Fiber Optics  60 Hours  3 Credits
Teaches the theory and application of lasers and fiber optics. Includes optics, fiber optic cables and connecters, photo detectors, optical pulse generation, sensors, multiplexers, lasers, gas lasers, semiconductor lasers, laser safety, and laser test instruments. May include preparation of a report as an out-of-class activity. Lecture 2 hours + lab 2 hours, total 4 hours per week.

E241 (EGR 241) Survey of American Literature  45 Hours  3 Credits
Examines American literary works from colonial times to the present, emphasizing the ideas and characteristics of our national literature. Involves critical reading and writing. Lecture 3 hours per week.

E245 (EGR 245) Engineering Mechanics – Dynamics  45 Hours  3 Credits
Presents approach to kinematics of particles in linear and curvilinear motion. Includes kinematics of rigid bodies in plane motion. Teaches Newton’s second law, work-energy and power, impulse and momentum, and problem solving using computers. Lecture 3 hours per week.

E246 (EGR 246) Mechanics of Materials  45 Hours  3 Credits
Teaches concepts of stress, strain, deformation, internal equilibrium, and basic properties of engineering materials. Analyzes axial loads, torsion, bending, shear and combined loading. Studies stress transformation and principle stresses, column analysis and energy principles. Lecture 3 hours per week.

E247 (EGR 247) Mechanics of Materials Laboratory  30 Hours  1 Credits
Examines mechanical behavior of bars, rods, shafts, tubes and beams subjected to various types of loading. Introduces experimental stress analysis techniques, such as the use of strain gages and data reduction. Laboratory 2 hours per week.

E260 (EGR 260) Circuit Analysis  45 Hours  3 Credits
Covers topics in linear circuit analysis, including basic electrical properties, resistive circuits, network equations, operational amplifiers, network reduction techniques, network theorems, two-port parameters and networks, inductors, capacitors, first-order circuits, second-order circuits and phasor analysis. Lecture 3 hours per week.

E261 (EGR 261) Signals and Systems  45 Hours  3 Credits
Covers topics including Laplace transforms and Laplace transform analysis of circuits, time and frequency domain representation of linear systems, methods of linear systems analysis including convolution and Laplace transforms, frequency domain representation of signals including frequency response, filters, Fourier series, and Fourier transforms. Lecture 3 hours per week.

E262 (ETR 261) Microprocessor Application I  90 Hours  4 Credits
Teaches the fundamentals of microprocessors including architecture, internal operations, memory, I/O devices machine level programming and interfacing. Emphasizes instrumentation and microprocessor. Part I of II. Lecture 3 hours + lab 3 hours, total 6 hours per week. Prerequisite: ETR 279.

E 267 (EGR 267) Engineering Analysis Tools  45 Hours  3 Credits
Covers topics in mathematics including calculus, differential equations, Laplace transforms, linear algebra, vector spaces, complex variables, discrete mathematics, data analysis and linear regression. Emphasizes engineering applications and the use of software tools, such as Matlab and Excel. Lecture 3 hours per week. Prerequisite: EGR 260.

E270 (ETR 270) Fundamentals of Computer Engineering  75 Hours  4 Credits
Covers the design and organization of digital systems, including number systems, Boolean algebra, logic gates, Karnaugh maps, combinational and sequential logic circuits, timing diagrams, and synchronous and asynchronous controllers. Introduces hardware description language (HDL) and assembly language programming. Lecture 3 hours + lab 2 hours, total 5 hours per week. Prerequisite: EGR 260 and EGR 125.

E273 (ETR 273) Computer Electronics I  75 Hours  3 Credits
Teaches principles of digital electronics and microprocessors to familiarize the student with typical circuits and methods used to interface computers and/or controllers with various I/O devices. Includes exposure to high level programming as well as assembly language routines. Lecture 2 hours + lab 3 hours, total 9 hours per week.

E277 (EGR 277) Digital Logic  45 Hours  3 Credits
Presents an introduction to digital logic, including such topics as number systems, Boolean algebra, minimization techniques, implementation of digital functions, sequential machines, state diagrams, state tables, and programmable logic devices. Lecture 3 hours per week.
E278 (EGR 278) Digital laboratory  
60 Hours 2 Credits  
Constructs digital logic circuits to verify analysis and design methods. Covers logic gates, combinational and sequential logic circuits, programmable logic devices, measurement techniques, and report writing. Laboratory 4 hours per week.

E279 (ETR 279) Digital Principles, Terminology and Applications  
90 Hours 4 Credits  
Studies digital principles, terminology and applications covering number systems, arithmetic, Boolean algebra, Karnaugh maps and advanced logic circuits. Includes the study and registers, encoding and decoding, and multiplexing; A/D, D/A, displays and others. Lecture 3 hours + lab 3 hours, total 6 hours per week.

H121-122 (HIS 121-122) United States History I-II  
45 Hours 3 Credits  
Surveys United States history from its beginning to the present. Lecture 3 hours per week.

H215 (HLT 295) Stress Management  
30 Hours 2 Credits  
Provides a basic understanding of stress and its physical, psychological, and social effects. Includes self-evaluation, sources of stress, and coping skills. Lecture 2 hours per week.

IND 181 World Class Manufacturing I  
45 Hours 3 Credits  
Studies the principles and applications of the globalization of industry. Emphasizes the fundamentals of interpersonal/team process, organization skills, total quality tools for continuous improvement, statistical process control, manufacturing resource planning and just-in-time. Lecture 3 hours per week. Prerequisite: ENG 05

ITE 140 Spreadsheet Software  
45 Hours 3 Credits  
Covers the use of spreadsheet software to create spreadsheets with formatted cells and cell ranges, control pages, multiple sheets, charts, and macros. Topics include typing and editing text in cells; entering data on multiple worksheets; working with formulas and functions; creating charts, pivot tables, and styles; inserting headers and footers; and filtering data. Covers MOS Excel objectives. Lecture 3 hours per week. Prerequisite(s): ITE 115 or ITE 119

ITE 171 UNIX I  
60 Hours 4 Credits  
Provides an introduction to UNIX operating systems. Teaches login procedures, file creation, UNIX file structure, input/output control, and the UNIX shell. Lecture 4 hours per week.

M113 (MEC 113) Materials and Processes of Industry  
60 Hours 3 Credits  
Studies industrial engineering materials and accompanying industrial processes. Investigates nature of materials structure and properties from a design standpoint, leading to a more intelligent selection of a material to fit the requirements of a part or product. Analyzes the effects of the various processes on materials, as well as the processes themselves, to ensure a logical and systematic procedure for selection of materials. Lecture 4 hours per week.

M131 (MEC 131) Mechanics I Statics  
45 Hours 3 Credits  
Teaches Newton's laws, resultants and equilibrium of force systems, trusses and frames, determination of centroids, and distributed loads and moments of inertia. Introduces dry friction and force systems in space. Lecture 3 hours per week.

M132 (MEC 132) Mechanics II Strength of Materials for Engineering Technology  
45 Hours 3 Credits  
Teaches the concepts of stress and strain. Provides an analysis of stresses and deformations in loaded members, connectors, shafts, beams, columns, and combined stress. Lecture 3 hours per week.

M163 (MTH 163) Precalculus I  
45 Hours 3 Credits  
Presents topics in college algebra, matrices and determinants, and algebraic, exponential, and logarithmic functions. Lecture 3 hours per week.

M165 (MTH 164) Precalculus II  
45 Hours 3 Credits  
Presents topics in trigonometry, analytic geometry, and sequences and series. Lecture 3 hours per week.

Last Revision: August 2012
P101 (PHI 101) Introduction to Philosophy

Introduces a broad spectrum of philosophical problems and perspectives, with an emphasis on the systematic questioning of basic assumptions about meaning, knowledge, reality, and values.
Lecture 3 hours per week.

P220 (PHI 220) Ethics

Provides a systematic study of representative ethical systems.
Lecture 3 hours per week.

P199 (PHY 199) Laboratory Physics

Laboratory component for PHY 201, General College Physics I.
Teaches fundamental principles of physics. Covers mechanics, wave phenomena, and selected topics in modern physics. Lab 3 hours per week.

Laboratory physics for Physics 201. Completion of this laboratory physics course plus successful completion of P221 and P222 with grades of C or better transfer to Thomas Nelson Community College as equivalent to PHY 201 General College Physics I.

P202 (PHY 202) General College Physics II

Teaches fundamental principles of physics. Covers mechanics, thermodynamics, wave phenomena, electricity and magnetism, and selected topics in modern physics. Lecture 3 hours + 3 lab hours, total 6 hours per week.

P241 (PHY 241) University Physics I

Teaches principles of classical and modern physics. Includes mechanics, wave phenomena, heat, electricity, magnetism, relativity, and nuclear physics. Lecture 3 hours + 3 lab hours, total 6 hours per week.
Prerequisite: M173 or M273.

P242 (PHY 241) University Physics II

Teaches principles of classical and modern physics. Includes mechanics, wave phenomena, heat, electricity, magnetism, relativity, and nuclear physics. Lecture 3 hours + 3 lab hours, total 6 hours per week.
Prerequisite: M174.

S100 (SDV 100) College Success Skills

Assists apprentices toward college success through information regarding effective study habits, career and academic planning, and other Thomas Nelson Community College resources. Includes English placement testing. Required for associate degree programs. Lecture 1 hour per week.

X316 Programmable Logic Controllers (See ELECTRICIAN)

Note: courses listed with two course codes, e.g., M270 (MTH 270), are taught by Thomas Nelson Community College or Tidewater Community College.