

**The Apprentice School –  
Newport News Shipbuilding –  
4101 Washington Avenue  
Newport News, Virginia 23607**

**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 Northrop Grumman Shipbuilding - Newport News. 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 Northrop Grumman Shipbuilding - Newport News 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 NGSB 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 in 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 company's quality program. Includes specific topics to include 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 NGSB.

**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 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.

**P221 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**  
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.

## **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 per 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**  
Includes introduction to basic electricity, voltage, current, resistance and power, series and parallel circuits, meter use and design, analysis of electrical circuits including mesh analysis, superposition and Thevenin's Theorem.

**X312 Applied Theory II: AC Concepts**      **96 Hours**      **5 Credits**  
Introduction to Capacitors, Inductors, and Magnetic Circuits. Uses general sinusoidal waveform format (complex, rectangular, polar and phasor) to analyze AC networks consisting of inductors, capacitors, and resistors. Series-parallel circuits solved using mesh, superposition, Thevenin's and Norton's theorems.  
Prerequisite: X311

**X313 Applied Theory III: Polyphase Systems and Controls**  
**120 Hours**      **6 Credits**  
Continues AC theory concepts including resonance, filters, AC power, polyphase systems and transformers. Introduction principles and applications of DC and AC motors. Introduces DC and AC electromechanical controls and devices including schematic symbols, wiring diagrams and schematic diagrams, relays and contractors, motor overload devices, time delay circuitry, reduced voltage starting methods, deceleration methods, and provides the knowledge needed to test and troubleshoot complex electromechanical control systems.  
Prerequisites: X311 and X312

**X314 Static Controls**      **150 Hours**      **7 Credits**  
Exposes the student to the concepts needed to test and troubleshoot electronic systems. Includes principles and application of diodes, junction transistors, field effect transistors, silicon controlled rectifiers, and integrated circuits. Applications include power supplies, amplifiers, oscillators, SCR and TRIAC motor controls, and fiber optics. Additional topics include frequency effects, tuned amplifier circuits, and regulated power supplies.  
Prerequisites: X311 and X312.

**X315 Digital Electronics**      **44 Hours**      **2 Credits**  
Introduces the concepts of digital logic circuitry to prepare the student to operate, test and troubleshoot digital control systems. This course introduces digital logic concepts, devices, and circuitry. Course objectives include numbering systems, logic gates, Boolean algebra, encoders, decoders, multiplexers, flip-flops, counters, registers, arithmetic circuits, memories, and an introduction to microprocessors.

**X316 Programmable Logic Controllers**      **44 Hours**      **2 Credits**  
Provides instruction and hands-on training in the programming, hookup, and troubleshooting of Programmable Logic Controllers (PLC). Specific training is provided on ladder logic programming, input/output instructions, internal relays, timers, counters, subroutines, and sequencers. Special emphasis is placed on program design and retrofitting electromechanical systems. Students train on Allen-Bradley MicroLogix PLCs and use industry standard RSLogix programming software.  
Prerequisite: X313

## **HEATING & AIR CONDITIONING WORKER**

**ALL ELECTRICAL THEORY COURSES**  
(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, 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, vessel geometry, parts of a vessel, table of offsets, welding symbols, and structural joint numbering systems.

**X112 Hull Construction II**      **18 Hours**      **1 Credit**

Develops an advanced understanding of safe and efficient shipbuilding manufacturing practices enabling apprentices to assume increased leadership responsibilities in the ship fitter trade. Includes shipyard safety basic body lines, molded lines and offsets, material grouping and compartmentation, interpretation of drawing details, cross reference drawings, erect and set makeup, and photogrammetry.

## **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 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 activators.

## **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 metalcasting including its history and the design parameters to apply for optimum consistent production of quality metalcastings in the Foundry. It is an in depth study of each of the interconnected processes of metalcasting 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 NGNN 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)**

### **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.

## **OUTSIDE MACHINIST**

### **X431 Machinery Installation Theory 40 Hours 3 Credits**

Includes an introduction to blueprints, information on shop machines and portable machines, the care and handling of machines and the safety requirements for working with rotating machinery. The second part of the class is intended to give a basic overview of how the major shipboard systems work. These systems include: main propulsion, diesel generators, hydraulics, navigation, weapons, catapults, arresting gear, elevators, optics, and air conditioning/refrigeration.

### **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 activators, and system troubleshooting.

## **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. Includes the principles necessary to interpret and apply information from various types of blueprints, schedules, data sheets, charts, procedures, and other job related documents. Includes compartment and access plans, deck and wall coverings, painting 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. Describes the function and use of hand and mechanically operated trade tools used on various insulation compositions, application and installation, and safe work practices while working with hazardous materials.

#### **PIPEFITTER**

**X421 Introduction to Pipefitting** **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 pipefitting. 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, ship 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)

**X112 Hull Construction Theory II**  
(See HEAVY METAL FABRICATOR)

#### **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.

#### **WELDING EQUIPMENT REPAIRER**

**X111 Hull Construction Theory I**  
(See HEAVY METAL FABRICATOR)

**ALL ELECTRICAL THEORY COURSES**  
(See ELECTRICIAN)

## Advanced Programs

### **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 = 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 = 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.

### **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, developing these competencies 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 connectors, 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.

**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 computer 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 5 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.

**ITN 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.

**M173 (MTH 173) Calculus with Analytic Geometry I** 60 Hours 4 Credits  
Presents the calculus of algebraic and trigonometric functions including the study of limits, continuity, derivatives, differentials, and an introduction to integration which includes definite and indefinite integrals. Analytic geometry is integrated into this course as are applications of the derivative and definite integral. Lecture 4 hours per week.

**M174 (MTH 174) Calculus with Analytic Geometry II** 60 Hours 4 Credits  
Continues the study of analytic geometry and the calculus of algebraic and transcendental functions including rectangular, polar, and parametric graphing, indefinite and definite integrals, methods of integration, and power series along with their applications. Lecture 4 hours per week.  
Prerequisite: M173 or equivalent.

**M270 (MTH 270) Applied Calculus** 45 Hours 3 Credits  
Introduces limits, continuity, differentiation and integration of algebraic and transcendental functions, techniques of integration, and partial differentiation. Lecture 3 hours per week.

**M277 (MTH 277) Vector Calculus** 60 Hours 4 Credits  
Presents vector valued functions, partial derivatives, multiple integrals, and topics from the calculus of vectors. Lecture 4 hours per week.  
Prerequisite: M174 or equivalent.

**M279 (MTH 279) Ordinary Differential Equations** 60 Hours 4 Credits  
Introduces ordinary differential equations. Includes first order differential equations, second and higher order ordinary differential equations with applications. Lecture 4 hours per week.

**N236 Marine Engineering** 30 hours 2 credits  
Explores the use and integration of various engineering disciplines and energy requirements in the study of nuclear propulsion for utilizing pressurized water reactor systems. Topics include fluid mechanics, heat transfer, first law of thermodynamics, and the use of steam tables to solve condenser, steam generating unit, turbine, pump, and condenser problems. Introduction to atomic structure, binding energy, nuclear fission and fusion, decay heat and radiation, and shielding are studied.

**N237 Naval Architecture** 60 hours 4 Credits  
Understand through application the equations and procedures employed in the design of a ship's hull form and drive train. The study will address the development of lines drawings and the associated tables of offsets and the further application of these items in calculating, in part, displacements, hull form coefficients, centers of gravity, resistances, speed, and power requirements.

**N250 Introduction to Marine Engineering and Naval Architecture** 60 hours 3 Credits  
Studies steam tables and rankine cycle. Learn about nuclear power generations and pressurized water reactors. Study hull characteristics, transverse stability, and longitudinal stability. Learn how to calculate the speed and power of a vessel. Learn how to calculate and draw shear and moment diagrams for a vessel.

**0233 Shipbuilding Operations** 30 Hours 2 Credits  
Introduces best business practices implemented in design, engineering, and construction planning. Topics include process excellence, lean manufacturing, concept of operations, fleet support systems, strategic and business planning, the modern shipbuilding process, marketing, construction planning and control, contracts and pricing, health and safety, financial reporting, project management, tiger teams, production control, carrier overhaul, and opportunity for improvement procedures. (Previously taught as 0232 Shipbuilding Operations)

**P101 (PHI 101) Introduction to Philosophy** 45 Hours 3 Credits  
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** 45 Hours 3 Credits  
Provides a systematic study of representative ethical systems. Lecture 3 hours per week.

**P199 (PHY 199) Laboratory Physics** 45 Hours 1 Credit  
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**      **90 Hours 4 Credits**

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**      **60 hours 4 credits**

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**      **60 hours 4 credits**

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**      **8 Hours 1Credit**

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.

**X315 Digital Electronics**      **(See ELECTRICIAN)**

**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.