K TO 12 BASIC EDUCATION CURRICULUM
JUNIOR HIGH SCHOOL TECHNOLOGY AND LIVELIHOOD TRACK AND SENIOR HIGH SCHOOL – TECHNICAL-VOCATIONAL LIVELIHOOD TRACK
INDUSTRIAL ARTS – MECHATRONICS SERVICING NC II
(320 hours)

These are the specializations and their pre-requisites. These lists should be used as reference for curriculum maps.

AGRI-FISHERY ARTS

	Specialization	Number of Hours	Pre-requisite
1.	Agricultural Crops Production (NC I)	320 hours	
2.	Agricultural Crops Production (NC II) *updated based on TESDA Training Regulations published December 28, 2013*	640 hours	
3.	Agricultural Crops Production (NC III)	640 hours	Agricultural Crops Production (NC II)
4.	Animal Health Care Management (NC III)	320 hours	Animal Production (Poultry-Chicken) (NC II) or Animal Production (Ruminants) (NC II) or Animal Production (Swine) (NC II)
5.	Animal Production (Poultry-Chicken) (NC II) *updated based on TESDA Training Regulations published December 28, 2013*	320 hours	
6.	Animal Production (Large Ruminants) (NC II) *updated based on TESDA Training Regulations published December 28, 2013*	320 hours	
7.	Animal Production (Swine) (NC II) *updated based on TESDA Training Regulations published December 28, 2013*	320 hours	
8.	Aquaculture (NC II)	640 hours	
9.	Artificial Insemination (Large Ruminants) (NC II)	160 hours	Animal Production (Large Ruminants) (NC II)
10.	Artificial Insemination (Swine) (NC II)	160 hours	Animal Production (Swine) (NC II)
11.	Fish Capture (NC II)	640 hours	
12.	Fishing Gear Repair and Maintenance (NC III)	320 hours	
13.	Fish-Products Packaging (NC II)	320 hours	
14.	Fish Wharf Operation (NC I)	160 hours	
15.	Food Processing (NC II)	640 hours	
16.	Horticulture (NC III)	640 hours	Agricultural Crops Production (NC II)
17.	Landscape Installation and Maintenance (NC II)	320 hours	
18.	Organic Agriculture (NC II)	320 hours	
19.	Pest Management (NC II)	320 hours	
20.	Rice Machinery Operations (NC II)	320 hours	
21.	Rubber Processing (NC II)	320 hours	
22.	Rubber Production (NC II)	320 hours	
23.	Slaughtering Operations (Hog/Swine/Pig) (NC II)	160 hours	

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HOME ECONOMICS

	Specialization	Number of Hours	Pre-requisite
1.	Attractions and Theme Parks Operations with Ecotourism (NC II)	160 hours	
2.	Barbering (NC II)	320 hours	
3.	Bartending (NC II)	320 hours	
4.	Beauty/Nail Care (NC II)	160 hours	
5.	Bread and Pastry Production (NC II)	160 hours	
6.	Caregiving (NC II)	640 hours	
7.	Commercial Cooking (NC III)	320 hours	Cookery (NC II)
8.	Cookery (NC II)	320 hours	
9.	Dressmaking (NC II)	320 hours	
10.	Events Management Services (NC III)	320 hours	
11.	Fashion Design (Apparel) (NC III)	640 hours	Dressmaking (NC II) or Tailoring (NC II)
12.	Food and Beverage Services (NC II) *updated based on TESDA Training Regulations published December 28, 2013*	160 hours	
13.	Front Office Services (NC II)	160 hours	
14.	Hairdressing (NC II)	320 hours	
15.	Hairdressing (NC III)	640 hours	Hairdressing (NC II)
16.	Handicraft (Basketry, Macrame) (Non-NC)	160 hours	
17.	Handicraft (Fashion Accessories, Paper Craft) (Non-NC)	160 hours	
18.	Handicraft (Needlecraft) (Non-NC)	160 hours	
19.	Handicraft (Woodcraft, Leathercraft) (Non-NC)	160 hours	
20.	Housekeeping (NC II) *updated based on TESDA Training Regulations published December 28, 2013*	160 hours	
21.	Local Guiding Services (NC II)	160 hours	
22.	Tailoring (NC II)	320 hours	
23.	Tourism Promotion Services (NC II)	160 hours	
24.	Travel Services (NC II)	160 hours	
25.	Wellness Massage (NC II)	160 hours	

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INDUSTRIAL ARTS

	Specialization	Number of Hours	Pre-requisite
1.	Automotive Servicing (NC I) *updated based on TESDA Training Regulations published December 28, 2013*	640 hours	
2.	Automotive Servicing (NC II)	640 hours	Automotive Servicing (NC I)
3.	Carpentry (NC II)	640 hours	
4.	Carpentry (NC III)	320 hours	Carpentry (NC II)
5.	Construction Painting (NC II)	160 hours	
6.	Domestic Refrigeration and Air-conditioning (DOMRAC) Servicing (NC II)	640 hours	
7.	Driving (NC II)	160 hours	
8.	Electrical Installation and Maintenance (NC II)	640 hours	
9.	Electric Power Distribution Line Construction (NC II)	320 hours	Electrical Installation and Maintenance (NC II)
10.	Electronic Products Assembly and Servicing (NC II) *updated based on TESDA Training Regulations published December 28, 2013*	640 hours	
11.	Furniture Making (Finishing) (NC II)	640 hours	
12.	Instrumentation and Control Servicing (NC II)	320 hours	Electronic Products Assembly and Servicing (EPAS) (NC II)
13.	Gas Metal Arc Welding (GMAW) (NC II)	320 hours	Shielded Metal Arc Welding (SMAW) (NC II)
14.	Gas Tungsten Arc Welding (GTAW) (NC II)	320 hours	Shielded Metal Arc Welding (GMAW) (NC II)
15.	Machining (NC I)	640 hours	
16.	Machining (NC II)	640 hours	Machining (NC I)
17.	Masonry (NC II)	320 hours	
18.	Mechatronics Servicing (NC II)	320 hours	Electronic Products Assembly and Servicing (EPAS) (NC II)
19.	Motorcycle/Small Engine Servicing (NC II)	320 hours	
20.	Plumbing (NC I)	320 hours	
21.	Plumbing (NC II)	320 hours	Plumbing (NC I)
22.	Refrigeration and Air-Conditioning (Packaged Air-Conditioning Unit [PACU]/Commercial Refrigeration Equipment [CRE]) Servicing (NC III)	640 hours	Domestic Refrigeration and Air-conditioning (DOMRAC) Servicing (NC II)
23.	Shielded Metal Arc Welding (NC I)	320 hours	
24.	Shielded Metal Arc Welding (NC II)	320 hours	Shielded Metal Arc Welding (NC I)
25.	Tile Setting (NC II)	320 hours	
26.	Transmission Line Installation and Maintenance (NC II)	640 hours	Electrical Installation and Maintenance (NC II)

INFORMATION, COMMUNICATIONS AND TECHNOLOGY (ICT)

	Specialization	Number of Hours	Pre-requisite
1.	Animation (NC II)	320 hours	
2.	Broadband Installation (Fixed Wireless Systems) (NC II)	160 hours	Computer Systems Servicing (NC II)
3.	Computer Programming (.Net Technology) (NC III) *updated based on TESDA Training Regulations published December 28, 2013*	320 hours	
4.	Computer Programming (Java) (NC III) *updated based on TESDA Training Regulations published December 28, 2013*	320 hours	
5.	Computer Programming (Oracle Database) (NC III) *updated based on TESDA Training Regulations published December 28, 2013*	320 hours	
6.	Computer Systems Servicing (NC II) *updated based on TESDA Training Regulations published December 28, 2007*	640 hours	
7.	Contact Center Services (NC II)	320 hours	
8.	Illustration (NC II)	320 hours	
9.	Medical Transcription (NC II)	320 hours	
10.	Technical Drafting (NC II)	320 hours	
11.	Telecom OSP and Subscriber Line Installation (Copper Cable/POTS and DSL) (NC II)	320 hours	Computer Systems Servicing (NC II)
12.	Telecom OSP Installation (Fiber Optic Cable) (NC II)	160 hours	Computer Systems Servicing (NC II)

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INDUSTRIAL ARTS – MECHATRONICS SERVICING NC II
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Prerequisite: Electronics Product Assembly and Servicing NC II

Course Description:

This course is designed to enhance the knowledge, skills and attitudes of a learner on core competencies such as installation, configuration and adjustment of mechatronic devices in accordance with TESDA Training Regulations. Work Immersion is incorporated within the school year to enhance the learning experience of the learner in a workplace environment.

CONTENT	CONTENT STANDARD	PERFORMANCE STANDARD	LEARNING COMPETENCIES	CODE
Introduction: 1. Core concepts in Mechatronics Servicing 2. Relevance of the course 3. Employment /business opportunities	The learner demonstrates an understanding of the basic concepts and underlying theories in Mechatronics Servicing.	The learner independently demonstrates an understanding of the core competency in Mechatronics servicing as prescribed by TESDA Training Regulations.	1. Explain core concepts in Mechatronic Servicing. 2. Discuss relevance of the course. 3. Explore opportunities for employment/business.	
PERSONAL ENTREPRENEURIAL COMPETENCIES AND SKILLS (PECS)				
1. Assessment of learner's Personal Competencies and Skills (PECS) vis-à-vis PECS of a practicing entrepreneur/employee in a province. 1.1 Characteristics 1.2 Attributes 1.3 Lifestyle 1.4 Skills 1.5 Traits 2. Analysis of PECS compared to the PECS of a practitioner 3. Strengthening and further development of one's PECS	The learner demonstrates an understanding of one's Personal Competencies and Skills (PECS) Mechatronics Servicing.	The learner independently creates a plan of action that strengthens/ further develops one's PECS in Mechatronics Servicing.	**LO 1. Develop and strengthen personal competencies and skills (PECS) needed in Mechatronics Servicing.** 1.1 Identify areas for improvement, development and growth. 1.2 Align one's PECS according to his/her business/career choice. 1.3 Create a plan of action that ensures success of his/her business/career choice.	**TLE_PECS9-12-00-1**

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CONTENT	CONTENT STANDARD	PERFORMANCE STANDARD	LEARNING COMPETENCIES	CODE
ENVIRONMENT AND MARKET (EM)				
1. Product Development 2. Key concepts of developing a product 3. Finding Value 4. Innovation 4.1 Unique Selling 4.2 Proposition (USP	The learner demonstrates an understanding of environment and market in Mechatronics servicing in one's town/municipality.	The learner independently creates a business vicinity map reflective of the potential Mechatronics Servicing market within the locality/town.	**LO 1. Develop a product/ service in Mechatronics Servicing.** 1. Identify what is of "Value" to the customer 2. Identify the customer. 3. Explain what makes a product unique and competitive. 4. Apply creative and innovative techniques to develop marketable product. 5. Employ a Unique Selling Proposition (USP) to the product/service.	**TLE_EM9-12-00-1**
1. Selecting a Business Idea 2. Key concepts in selecting a Business Idea 2.1 Criteria 2.2 Techniques			**LO 2. Select a business idea based on the criteria and techniques set.** 2.1 Enumerate various criteria and steps in selecting a business idea. 2.2 Apply the criteria/steps in selecting a viable business idea. 2.3 Determine a business idea based on the criteria/techniques set.	
1. Branding			**LO 3. Develop a brand for the product.** 3.1 Identify the benefits of having a good brand. 3.2 Enumerate recognizable brands in the town/province. 3.3 Enumerate the criteria for developing a brand. 3.4 Generate a clear appealing product brand.	

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CONTENT	CONTENT STANDARD	PERFORMANCE STANDARD	LEARNING COMPETENCIES	CODE
CORE COMPETENCIES				
LESSON 1: INSTALLING MECHATRONICS DEVICES (IMD)				
• Fundamentals of Mechatronics • Pneumatic Systems • Hydraulic Systems • Electrical Systems • Programmable Logic Control • Standard Schematic Diagrams	The learner demonstrates an understanding of the concepts and underlying principles of installing mechatronic devices.	The learner independently performs installation of mechatronic devices based on industry standards.	**LO 1. Read and interpret work instruction according to the installation job requirements.** 1.1 Apply communication skills to interpret work instructions according to established procedures. 1.2 Explain work signs, symbols, and conventions according to the set standards. 1.3 Explain work instructions and procedures according to the set standards.	**TLE_IAMES9-12-IMD-Ia-e-1**
• Mechatronics Devices - Compressor - Coolers - Receiver - Drier - Filter - Regulator with Pressure Gauge - Lubricator - Cylinders - Directional valves - Non-return valves - Flow control valves - Pressure control valves - Limit switches - Photo sensors - Proximity sensors - Relays - Magnetic contactors - Solenoid - Buzzers			**LO 2. Identify tools, equipment, testing devices and materials needed for installation** 2.1 Identify tools, equipment, and testing devices needed for installation according to work instruction. 2.2 Identify materials needed for installation according to work instruction. 2.3 Operate the function of tools and equipment types needed for installation according to the set standards. 2.4 Explain testing devices and instruments operations needed for installation according to the instruction manual.	**TLE_IAMES9-12-IMD-If-j-IIa-j-2**

CONTENT	CONTENT STANDARD	PERFORMANCE STANDARD	LEARNING COMPETENCIES	CODE
- Indicating Lamps - Servo and stepper motor - Frequency drives - Transducer - Transmitter - PLC				
• Mechatronics safety • Pneumatic Circuits • Hydraulic Circuits • Electro-Pneumatic Circuits • Motor Control Circuits • PLC I/O Wiring			**LO 3. Install mechatronic devices** 3.1 Wear appropriate personal protective equipment in line with standard operating procedures. 3.2 Follow OHS policies and procedures for installation in line with the job requirements. 3.3 Install devices in accordance with manufacturer's instructions and requirements without damage to the surrounding place or environment. 3.4 Respond to unplanned events or conditions in accordance with established procedures.	**TLE_IAMES9-12-IMD-IIIa-j-IVa-c-3**
• I/O allocation • Testing Procedures • Inspection procedures • 5 S application • Reports and Documentations • Manual Instructions and Procedures • Components Specifications of Pneumatics and Hydraulics • Problem Solving in emergency situation			**LO 4. Conduct test on the installed mechatronic devices** 4.1 Perform final inspection in accordance with manufacturer's instruction. 4.2 Test devices in accordance with manufacturer's instruction. 4.3 Clear the work site of all debris and left safe in accordance with the workplace requirements. 4.4 Prepare report on installation and testing of equipment according to the set standard procedures/policies.	**TLE_IAMES9-12-IMD-IVc-j-4**

CONTENT	CONTENT STANDARD	PERFORMANCE STANDARD	LEARNING COMPETENCIES	CODE
LESSON 2: CONFIGURING AND ADJUSTING MECHATRONIC DEVICES (CAM)				
• Configuration Safety • Principles of Configuration	The learner demonstrates an understanding of configuring and adjusting mechatronic devices.	The learner independently performs configuration and adjusting mechatronic devices based on service manuals.	**LO 1. Read and interpret work instruction according to the configuration and adjustment job requirements.** 1.1 Apply communication skills to interpret work instructions according to established procedures. 1.2 Explain work signs, symbols, and conventions according to the set standards. 1.3 Explain work instructions and procedures according to the set standards.	**TLE_IAMES9-12-CAM-Ia-j-5**
• Mechatronics Devices • Tools, materials, equipment, and testing devices			**LO 2. Identify tools, equipment, testing devices, materials and PPE needed for configuration and adjustment.** 2.1 Identify materials needed for configuration and adjustment according to work instruction. 2.2 Operate the function of tools and equipment types needed for configuration and adjustment according to the set standards. 2.3 Explain testing devices and instruments operations needed for configuration and adjustment according to instruction manual. 2.4 Identify PPE needed for configuration and adjustment according to the work instructions. 2.5 Demonstrate the use of PPE needed for configuration and adjustment according to the set standards. 2.6 Explain the OHS needed for configuration and adjustment according to the work instructions.	**TLE_IAMES9-12-CAM-IIa-j-6**

CONTENT	CONTENT STANDARD	PERFORMANCE STANDARD	LEARNING COMPETENCIES	CODE
			2.7 Demonstrate OHS procedures and policies needed for configuration and adjustment according to the set standards. 2.8 Use the PPE in accordance with the OHS guidelines and policies.	
• Work Instructions and Principles • Configuration and adjustment Procedures • Use of test equipment / instruments • Components specification of pneumatics and hydraulics • Problem solving in emergency situation			**LO 3. Configure and adjust mechatronic devices.** 3.1 Wear appropriate personal protective equipment in line with standard operating procedures. 3.2 Observe OHS policies and procedures for configuration and adjustment in line with the job requirements. 3.3 Configure devices in accordance with manufacturer's instructions, requirements, and without damage to the surrounding place or environment. 3.4 Response to unplanned events or conditions in accordance with established procedures.	**TLE_IAMES9-12-CAM-IIIa-j-IVa-c-7**
• Testing Procedure • Inspection Procedure • 5 S application • Reports and Documentations • Manual Instructions and procedures • Components specification of pneumatics and hydraulics • Problem solving in emergency situations			**LO 4. Conduct test on the configured and adjusted mechatronic devices** 4.1 Perform final inspection in accordance with manufacturer's instruction. 4.2 Test devices in accordance with manufacturer's instruction. 4.3 Clear the work site of all debris and left safe in accordance with the workplace requirements. 4.4 Prepare report on configuration and adjustment of equipment according to the set standard procedures/policies.	**TLE_IAMES9-12-CAM-IVc-j-8**

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RESOURCES			METHODOLOGY	ASSESSMENT METHOD
TOOLS	**EQUIPMENT**	**MATERIALS**		
• Long-nosed pliers • Diagonal cutters • Standard screwdrivers • Phillips screwdrivers • Electrical pliers • Soldering iron • Adjustable wrench • Wire stripper • Crimping tool • Allen key wrench • Jeweller's screwdrivers • Combination wrench, metric • Combination wrench, English	• Multi-meters • Transmitters or transducers • Air compressor • Regulated power supplies • Cylinder actuator • Stepper motor • Servomotor • Variable frequency drive • Buzzers • Industrial panel switches • Indicating lamps • Directional solenoid valves • Filter-regulator-lubricator set • Pressure gage • Limit switches • Photoelectric switches • Proximity switches • Relays • Magnetic contactors • Timers • Counters • Desktop/Laptop PC • Safety helmet • Safety harness • Safety glasses/goggles • Ear plugs/Ear muffs • Gas mask • Face shield	• Learning elements activity sheets • Schematic diagrams • Component layout • Technical brochures • Technical references • Solder lead • Shielded cable • Terminal lugs • Terminal strips/Blocks • Cotton gloves • Plastic tubing • Quick-connect fittings • Electrical tape • Wire markers • Cable ties	• Lecture/Discussion • Demonstration • Project method • Experiment/simulation • Company visit • Multi-media • Competency-based • Dual training • Distance learning	• Written test • Practical test • Direct observation • Interview

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GLOSSARY

1.	Accelerometer	-	Device for measuring acceleration usually based on piezoelectric materials.
2.	Actuator	-	Mechanism for applying a force or displacement to a system and typically used as a word when talking about computer control. In a closed-loop control system, that part of the final control element that translates the control signal into action by the control device.
3.	Analog	-	Continuous, having to do with the real world.
4.	Assembler	-	A program that translates assembly language instructions into machine language instructions.
5.	Assembly Language	-	A machine oriented language in which mnemonics are used to represent each machine language instruction. Each CPU has its own specific assembly language.
6.	Automation	-	(1) The conversion to and implementation of procedures, processes, or equipment by automated means. (2) Industrial open- or closed-loop control systems in which the manual operation of controls is replaced by servo operation.
7.	Brushless Motor	-	DC motor that performs commutation through electronic means, as opposed to traditional mechanical means.
8.	Buzzer or Beeper	-	Audio signaling device, which may be mechanical, electromechanical, or piezoelectric.
9.	Calibration	-	Process of adjusting an instrument or compiling a deviation chart so that its reading can be correlated to the actual value being measured.
10.	CAM	-	Computer-Aided Manufacturing is the use of computer technology to generate data to control part or all of a manufacturing process.
11.	Commutator	-	Device for reversing the direction of current.
12.	Computer-Aided Design (CAD)	-	Use of high-resolution graphics in a wide range of design activities, allowing quick evaluation and modification of intent. It is commonly used to design architectural, mechanical and electrical engineering drawings.
13.	Configuration	-	A method for configuring an automation device or simulator for controlling mechatronic components of an automation system.
14.	Contingency management skills	-	Demonstration of appropriate personal management in responding to problems and irregularities when undertaking a work activity, such as, breakdowns, changes in routine unexpected or a typical results or outcomes.
15.	Conveyor	-	A horizontal, inclined or vertical device for moving or transporting bulk materials, packages, or objects in a path predetermined by the design of the device and having points of loading and discharge fixed, or selective.
16.	Cylinder	-	Commonly used for pneumatic drives. They are characterized by robust construction, a large range of types, simple installation and favorable performance.
17.	Cylinder actuator	-	A device that converts hydraulic power into useful mechanical work by means of a tight-fitting piston moving in a closed.
18.	DC chopper	-	Equipment that can be used as a dc transformer to step up or step down a fixed dc voltage. It can also be used for switching- mode voltage regulators and for transferring energy between two dc resources. However, harmonics are generated at the input and load side of the chopper, and these harmonics can be reduced by input and output filters.
19.	Demonstrate	-	Explaining while executing the tasks/activities.
20.	Digital-Analog converter (D/A Converter)	-	Takes a digital signal and converts it to a control-signal-level voltage of amperage.

21.	Effective workplace communication	-	Based on interpersonal, professional relationships that are developed through a keen awareness of courtesy, attentive listening, active participation and situation appropriate body language. . Effective workplace communication ensures that all the organizational objectives are achieved.
22.	Electro pneumatics	-	Control of pneumatic components by electrical impulses.
23.	Electro hydraulic valve	-	Valve that controls fluid flow through the function of solenoids.
24.	Ergonomics	-	Systematic application of knowledge about the psychological, physical, and social attributes of human beings in the design and use of all things which affect a person's working conditions: equipment and machinery, the work environment and layout, the job itself, training and the organization of work." (Human systems Inc).
25.	HMI	-	Human Machine Interface (HMI) - A software application (typically a Graphical User Interface or GUI) that present information to the operator about the state of a process, and to accept and implement the operators control instructions. It may also interpret the plant information and guide the interaction of the operator with the system. Also known as Man Machine Interface (MMI).
26.	Hydraulics	-	Uses liquids to transfer the energy.
27.	Installation	-	Aims to make students to know not only basic concepts of mechatronic but also difficulties of manufacturing an infinite design, basic techniques to assemble a movable robot and write a programming code.
28.	Ladder Diagram	-	Describes the program in graphic form. It was developed from the relay ladder but is structured in diagrammatic form. It is made up of two vertical lines of which the left one is connected to the voltage source and the right is earthed. The various current paths (rungs) run horizontally between the two (from left to right).
29.	Light-Emitting Diode (LED)	-	Diode that glows when current crosses it in a specific direction.
30.	Limit switch	-	Low-power snap-action device that opens or closes a contact, depending upon the position of mechanical part. Other limit switches are sensitive to pressure, temperature, liquid level, direction of rotation and so on.
31.	Liquid Crystal Display (LCD)	-	Run by a material that changes its color when a voltage is applied across.
32.	Magnetic contactor	-	A contactor is used like a switch. It is used to open and close the circuit it is in series with by electrically energizing and de-energizing the holding coil of the contactor. By having this adaptability the circuit can be remotely operated from a distance and the operator does not have to be in close proximity to the circuit. Contactors are used to remotely operate banks of lighting and of course the contactor is used for motor control. On contactors that control motors an additional overload block is added to the bottom side of the contactor to protect the motors if they get into an over load condition. The N.C. contacts in the overload block will open and the holding coil of the contactor will de-energize and drop the motor off line.
33.	Manual instructions	-	A manual usually accompanying a technical device andexplaining how to install or operate it.
34.	Materials	-	Consumable and non-consumable items that you need for particular activity.
35.	Mechatronic devices	-	Switches, relay, solenoid, power diode, power transistor, thyristor, gate controller switch, rectifier, chopper, transducer and others.
36.	Mechatronics	-	The field of integrating mechanical, electrical, and electronic design into a complete, coherent device.
37.	Multiplexer	-	Equipment that allows the transmission of multiple signals on the same line.
38.	Occupational Health and Safety	-	Concerned with protecting the safety, health, and welfare of people engaged in work or employment.
39.	Output modules	-	Conduct the signals of the central control unit to final control elements, which are actuated according to the task.
40.	Personal Protective Equipment	-	Clothing, equipment or substances designed to be worn by someone to protect them from risks of injury or illness.
41.	Photodiodes	-	A light-sensitive semiconductor diode.

42.	Photoelectric sensor, or photo eye	-	Device used to detect the distance, absence, or presence of an object by using a light transmitter, often infrared, and a photoelectric receiver. They are used extensively in industrial manufacturing. There are three different functional types: opposed (through beam), retro-reflective, and proximity-sensing (diffused).
43.	Photoelectric transducer	-	Makes use of the properties of a photo emissive cell or phototube. The phototube is a radiant energy device that controls its electron emission when exposed to incident light.
44.	PID control	-	Proportional plus Integral plus Derivative control is used in processes where the controlled variable is affected by long downtimes.
45.	Piezoelectric Crystal	-	Material possessing the properties of an electrical charge sponge.
46.	Pneumatics	-	Deals with the use of compressed air. It is a method to transfer energy from one point to another using actuators which are driven by fluids under pressure
47.	Programmable Logic Controller (PLC)	-	Class of industrially hardened devices that provides hardware interface for input sensors and output actuators. PLCs can be programmed using relay ladder logic to control the outputs based on input conditions and / or algorithms contained in the memory of the PLC.
48.	Proximity switch	-	Operated contactless and without an external mechanical actuating force.
49.	Relay	-	Electrical relay that offers a simple ON/OFF switching action in response to a control signal. When a current flows through the coil of wire a magnetic field is produced.
50.	Robotics	-	Study of the design and use of robots, particularly for their use in manufacturing and related processes.
51.	SCADA	-	Supervisory Control and Data Acquisition (SCADA) is a common process control application that collects data from sensors on the shop floor or in remote locations and sends them to a central computer for management and control.
52.	Sensors	-	Detector that measures a physical quantity and converts it into a signal which can be read by humans or by an instrument. Mostly sensors are used to sense light, sound, heat, pressure, images etc.
53.	Sequence control	-	Control of a series of machine movements, with the completion of one movement initiating the next. The extent of movements is typically not specified by numerical input data.
54.	Servo Motor	-	Electrical motor characterized by its ability to be infinitely rotationally positioned.
55.	Servomechanism	-	Automatic device for controlling large amounts of power by means of small amounts of power.
56.	Servomotor	-	Power-driven mechanism that supplements a primary control operated by a comparatively feeble force (as in a servomechanism).
57.	Simulation	-	Device, system, or computer program that represents certain features of the behavior of a physical or abstract system. Vendors of planning and scheduling, forecasting and demand management, and other types of decision-support systems make growing use of simulation to compare the consequences of alternative courses of action.
58.	Software	-	Entire set of programs, procedures, and related documentation associated with a computer.
59.	Solenoid	-	Coil with an iron core and moveable iron plunger. When the coil is energized, the plunger is attracted by the coil. It "pulls in", and this motion can be used to activate another mechanism. The solenoid shown in figure 4.2 (a), is used in many electrically activated devices such as valves, locks, punches and marking machines.
60.	Stepper Motor	-	Electrical motor characterized by rotating in small increments.
61.	Systems integration	-	Ability of computers, instrumentation, and equipment to share data or applications with other components in the same or other functional areas.
62.	Thermistors or thermal resistors	-	Semiconductor devices that behave as resistors with a high , usually negative, temperature coefficient of resistance.

63.	Thermocouple	-	Consists of pair of dissimilar metal wires joined together at one end (sensing, or hot, junction) and terminated at the other end (reference, or cold, junction) which is maintained at a known constant temperature (reference temperature).
64.	Thermocouple	-	Device that creates a voltage subject to a given temperature.
65.	Thyristor	-	Electronic device similar to a transistor switch. It has four layers and can only be switched on, it cannot be switched off. Circuits can be used to switch off a thyristor but the most simple arrangement is to let the current fall to zero which arises when used with an AC supply.
66.	Time-delay relays	-	Control relays that have a delayed switching action. The time delay is usually adjustable and can be initiated when a current flows through the relay coil or when it ceases to flow through the coil.
67.	Transducer	-	Device that changes a quantity to another quantity. It has a few elements which are able to change a signal quantity to another signal quantity, for example it changes the pressure to the displacement, the displacement to the electrical movement force and others. In other words, transducer is a device that relates the electrical to the non-electrical. Translates physical parameters to electrical signals acceptable by the acquisition system. Some typical parameters include temperature, pressure, acceleration, weight displacement and velocity. Electrical quantities, such as voltage, resistance or frequency also may be measured directly. Sensor is a part of transducer.
68.	Unplanned events	-	Unexpected not purposefully caused event which occurs suddenly and causes injury or loss
69.	Work instructions	-	Document containing detailed instructions that specify exactly what steps to follow or to carry-out.
70.	Workplace communication	-	Process of exchanging information, both verbal and non-verbal, within an organization. An organization may consist of employees from different parts of the society.
71.	Workplace environment	-	Place or a shop where work is done.

K TO 12 BASIC EDUCATION CURRICULUM
JUNIOR HIGH SCHOOL TECHNOLOGY AND LIVELIHOOD TRACK AND SENIOR HIGH SCHOOL – TECHNICAL-VOCATIONAL LIVELIHOOD TRACK
INDUSTRIAL ARTS – MECHATRONICS SERVICING NC II
(320 hours)

CODE BOOK LEGEND
Sample: **TLE_IAMES9-12-IMD-Ia-e-1**

LEGEND		SAMPLE	
First Entry	Learning Area and Strand/ Subject or Specialization	Technology and Livelihood Education_Industrial Arts Mechatronics Servicing	**TLE_IA MES9-12**
	Grade Level	9/10/11/12	
Uppercase Letter/s	Domain/ Content/ Component/ Topic	Installing Mechatronics Devices	**IMD**
			-
Roman Numeral **Zero if no specific Quarter*	Quarter	First Quarter	**I**
Lower case letter/s **Put an en-dash (-) in between letters to indicate more than a specific week*	Week	Week one to five	**a-e**
			-
Arabic Number	Competency	Read and interpret work instruction according to the installation job requirements.	**1**

DOMAIN/COMPONENT	CODE
Installing Mechatronics Devices	IMD
Configuring and Adjusting Mechatronic Devices	CAM

Technology-Livelihood Education and Technical-Vocational Track specializations may be taken between Grades 9 to 12.

Schools may offer specializations from the four strands as long as the minimum number of hours for each specialization is met.

Please refer to the sample Curriculum Map on the next page for the number of semesters per Industrial Arts specialization and those that have pre-requisites. Curriculum Maps may be modified according to specializations offered by a school.

K TO 12 BASIC EDUCATION CURRICULUM
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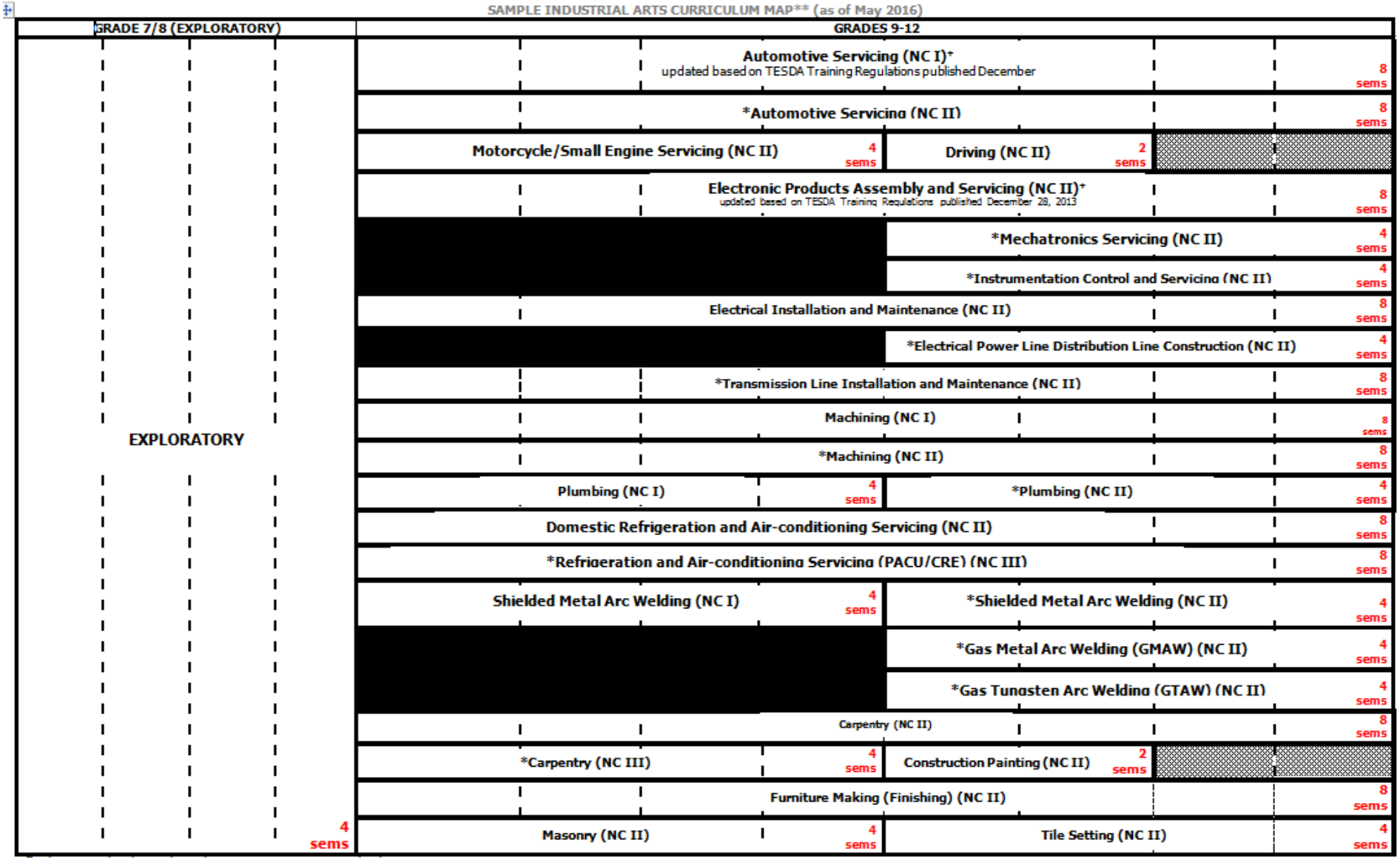
SAMPLE INDUSTRIAL ARTS CURRICULUM MAP** (as of May 2016)



* Please note that these subjects have pre-requisites mentioned in the CG.
\+ CG updated based on new Training Regulations of TESDA.
Other specializations with no prerequisites may be taken up during these semesters.
Pre-requisites of the subjects to the right should be taken up during these semesters.

****This is just a sample. Schools make their own curriculum maps considering the specializations to be offered. Subjects may be taken up at any point during Grades 9-12.**

Reference:

Technical Education and Skills Development Authority-Qualification Standards Office. *Training Regulations for Mechatronics Servicing NC II.* Taguig City, Philippines: TESDA, 2015.