

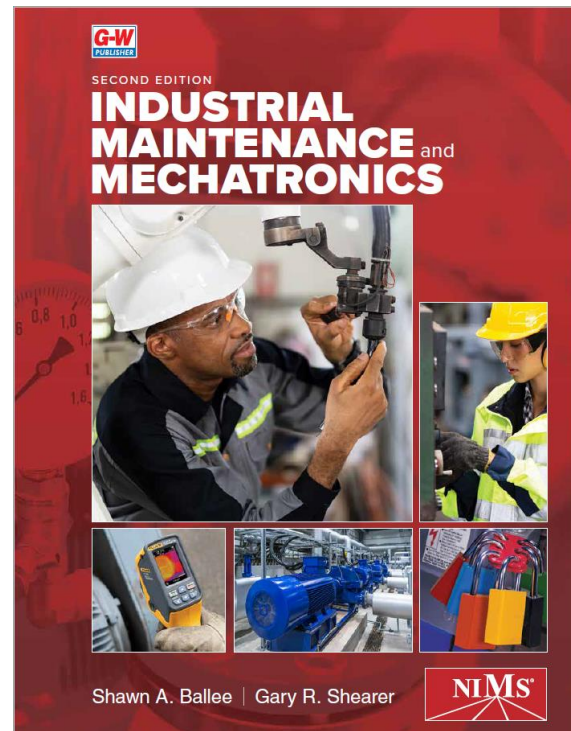


Correlation of
Industrial Maintenance and Mechatronics,
Shawn A. Ballee and Gary R. Shearer
 Goodheart-Willcox Publisher ©2024
 to
NIMS (National Institute for Metalworking Skills)
 Classic Credential:
Maintenance Operations

Industrial Maintenance and Mechatronics carries NIMS' exclusive endorsement and supports attainment of NIMS credentialing in Industrial Technology Maintenance (ITM).

The textbook is designed to work hand-in-glove with the NIMS *Standards for Industrial Technology Maintenance*. The standards-based learning package will help students pass the testing and performance requirements for NIMS credentialing.

The correlation below lists the standards for a specific NIMS Classic ITM Credential. The Classic ITM areas covered in *Industrial Maintenance and Mechatronics* include Maintenance Operations, Basic Mechanical Systems, Basic Hydraulic Systems, Basic Pneumatic Systems, Electrical Systems, Electronic Control Systems, Process Control Systems, and Maintenance Piping.



| Standards | G-W Content |
|---|---|
| Duty Title: 1.01. Adhere to safety, health, and environmental rules and regulations. | |
| Identify roles and responsibilities for safety, health, and environment. | Textbook: pg. 13, 24-28, 36-44, 70 |
| Adhere to OSHA, NIOSH, EPA, and other federal and state safety requirements for the workplace. | Textbook: pg. 18, 24-25, 43-44 |
| Identify and recognize common industrial hazards, per OSHA standards (including, ergonomics, laser safety, NFPA arc flash, confined space, gases and combustibles, steam and compressed air). | Textbook: pg. 24-26 |
| Define elements of a lockout/tagout (LOTO) program, describe the LOTO process, and test to ensure a zero energy state. | Textbook: pg. 28-32 Lab Workbook: Activity 2-1, Lockout/Tagout Procedure |

| Standards | G-W Content |
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| Identify and explain how to select the appropriate personal protective equipment (eyes, head, breathing air apparatus, body, feet, hands, ears) for a job. | Textbook: pg. 13, 32–35 Lab Workbook: Activity 2-2, Personal Protective Equipment |
| Explain how to locate a material Safety Data Sheet (SDS) and describe how you interpret the information. | Textbook: pg. 24–27 |
| List and select proper fall protection for working at heights and using ladders, scaffolding, and lifts. | Textbook: pg. 37 |
| Identify and recognize hazardous situations and apply proper procedures (includes following guidelines to prevent spread of bloodborne pathogens, spill control, proper storage, handling, protection of equipment, first aid). | Textbook: pg. 28–32, 36–43 |
| Describe the process used to perform a job safety analysis. | Textbook: pg. 43 Lab Workbook: Activity 2-3, Job Safety Analysis |
| Explain the principles of 6S program (Sort, Sweep, Sanitize, Set-to-order, Sustain, Safety). | Textbook: pg. 43 |
| Identify fuel source and selection of correct extinguisher class. | Textbook: pg. 43 |
| Duty Title: 1.02. Operate a machine. | |
| Perform a safety checklist: Check equipment to make sure it is ready to come online. Check correct operation of safety devices. Check operation of machine interlocks. | Textbook: pg. 51–55 |
| Define machine malfunction. | Textbook: pg. 54 |
| Define standard operating procedures. | Textbook: pg. 54 |
| Work with operations to start and stop an operation. | Textbook: pg. 55–56 |
| Describe when a machine needs to be shut down. | Textbook: pg. 28, 32 |
| Explain lockout process and perform. | Textbook: pg. 28–32 |
| Duty Title: 1.03. Monitor a machine. | |
| Confirm with operator that machine is operating within specifications. | Textbook: pg. 51, 52, 54 |
| Use 5 senses to observe machine operation and vibration to determine if it is operating correctly and recognize symptoms of malfunctions. | Textbook: pg. 51, 52, 54, 143 |
| Evaluate operator use of correct operation procedure. | Textbook: pg. 54–55 |
| Look for leaks, dirt, and loose connections. | Textbook: pg. 51–54 |
| Read pressure gauges, flow meters, fluid levels, temperature gauges, voltages, and current. | Textbook: pg. 51, 54, 59, 61 |
| Use an HMI to monitor the machine. | Textbook: pg. 54 |

| Standards | G-W Content |
|---|---|
| Compare machine readings with machine documentation and performance specifications to determine if machine is performing within specifications. | Textbook: pg. 56 |
| Record machine operation history in a manual log or computer database. | Textbook: pg. 54–56 |
| Duty Title: 1.04. Interpret machine operation and maintenance documentation. | |
| Describe methods of storing machine operation and maintenance documentation so it is accessible to the maintenance technicians and operators. | Textbook: pg. 56 |
| Locate and interpret machine operation manuals, including identification of safety requirements and features, performance specifications, standard operating procedures, startup/shutdown procedures. | Textbook: pg. 54–56 Lab Workbook: Activity 3-1, Maintenance Planning |
| Locate and interpret spare parts lists, vendor sources, and maintenance procedures for a given machine. | Textbook: pg. 51 Lab Workbook: Activity 3-2, Spare Parts |
| Locate and interpret machine maintenance logs, computer-based and manual, for a given machine. | Textbook: pg. 56, Lab Workbook: Activity 3-1, Maintenance Planning |
| Locate and interpret machine operation history logs, computer-based and manual, for a given machine. | Textbook: pg. 55–56 |
| Locate and interpret machine operation history from an HMI database for a given machine. | Textbook: pg. 54 |
| Locate and interpret machine lubrication and preventive maintenance schedules from company or machine manufacturer documentation. | Textbook: pg. 59 |
| Duty Title: 1.05. Perform machine maintenance procedures. | |
| Define concept of total productive maintenance (TPM)—combination of preventive, predictive, and total company buy-in. | Textbook: pg. 63 |
| Explain benefits and limitations of preventive maintenance and predictive maintenance. | Textbook: pg. 59–61 |
| Identify and use company procedures to inform production personnel of maintenance to be done on a machine. | Textbook: pg. 56 |
| Describe use of CMMS (computer maintenance management system) system. | Textbook: pg. 56 |
| Determine when a work order is needed. | Textbook: pg. 56 |
| Identify and perform the steps to perform an unscheduled and planned maintenance procedure. | Textbook: pg. 56–58, 59–60 |
| Describe the concept of autonomous maintenance—wherein operator performs cleaning, basic adjustments, and preventive maintenance. | Textbook: pg. 54 |
| Describe elements of a comprehensive maintenance plan. | Textbook: pg. 51 |

| Standards | G-W Content |
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| Describe methods of eliminating unplanned maintenance events. | Textbook: pg. 58–61 |
| Describe types of planned and unplanned maintenance procedures. | Textbook: pg. 56–63 |
| Explain how to read, interpret, and resolve work order. | Textbook: pg. 56–57 |
| Duty Title: 1.06. Perform preventive maintenance. | |
| Describe a preventive maintenance procedure given machine documentation. | Textbook: pg. 59–61 |
| Identify types of preventive maintenance: changing oil, checking fluid levels, tightening machine, changing filters, checking gaskets, and replacing certain components on a predetermined basis. | Textbook: pg. 59–61 Lab Workbook: Activity 3-1, Maintenance Planning |
| Identify and remove sources of contamination, select best methods of cleaning machine based upon continuous improvement principle. | Textbook: pg. 59, 175, 305–306 |
| Duty Title: 1.07. Perform predictive maintenance. | |
| Describe basic elements and benefits of a predictive maintenance plan. | Textbook: pg. 61–62 |
| Identify types of predictive maintenance methods and their applications using basic senses (hearing, feeling, etc.) and inspection techniques: vibration analysis, thermography, oil analysis, acoustic analysis, motor current analysis. | Textbook: pg. 61–62, 142, 149–150 |
| Perform predictive maintenance. | Textbook: pg. 61 |
| Duty Title: 1.08. Introduction to technical drawings. | |
| Read and interpret technical drawings of parts and assemblies with tolerances and basic GD&T. | Textbook: pg. 116–118, 120–126 Lab Workbook: Activity 6-1, Mechanical Assembly |
| Identify line types and basic symbology. | Textbook: pg. 118–121, 126–128, 131–133 Lab Workbook: Activity 6-1, Mechanical Assembly Lab Workbook: Activity 6-2, Print Reading Lab Workbook: Activity 6-3, Electrical Diagrams |
| Identify multi-view drawings of cylindrical and prismatic-shaped parts. | Textbook: pg. 117–121 |
| Perform metric and English dimension conversions. | Textbook: pg. 925, 931, 932 Lab Workbook: Activity 6-2, Print Reading |
| Identify dimension lines for linear, circular, and angular dimensions. | Textbook: pg. 121 |
| Identify title blocks. | Textbook: pg. 117 Lab Workbook: Activity 6-2, Print Reading |
| Identify feature sizes using a drawing scale. | Textbook: pg. 117 Lab Workbook: Activity 6-2, Print Reading |

| Standards | G-W Content |
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| Identify GD&T feature control frames. | Textbook: pg. 124 Lab Workbook: Activity 6-2, Print Reading |
| Identify standard dimensional tolerance. | Textbook: pg. 123–125 Lab Workbook: Activity 6-2, Print Reading |
| Identify GD&T tolerances for form orientation, location. | Textbook: pg. 123–125 |
| Identify assembly drawings. | Textbook: pg. 122, 134–135 Lab Workbook: Activity 6-1, Mechanical Assembly |
| Identify assembly tolerances, interference fit concept. | Textbook: pg. 122–123, Lab Workbook: Activity 6-2, Print Reading |
| Identify maximum material condition symbols. | Textbook: pg. 124 |
| Identify sectional cutaway views. | Textbook: pg. 120 |
| Identify threaded and non-threaded fastener specifications. | Textbook: pg. 97 |
| Identify a type of fastener given a sample. | Textbook: pg. 98–110 Lab Workbook: Activity 5-1, Threaded and Non-Threaded Fasteners |
| Identify and select a fastener for a given application. | Textbook: pg. 98–110 Lab Workbook: Activity 5-1, Threaded and Non-Threaded Fasteners |
| Identify sizes and types of washers, pins, nuts, locking devices. | Textbook: pg. 101–102, 105–108, 110 |
| Duty Title: 1.09. Selection and safe use of proper hand tools for a task. | |
| Describe basic hand tool safety rules and application for use as defined by OSHA standards. | Textbook: pg. 70 |
| Identify concepts of how a fastener works, force, torque, dynamic and static torques, press fits, assembly tolerances. | Textbook: pg. 98, 105, 122–123, 191 |
| Identify proper fastener selection (select proper fasteners to assemble parts). | Textbook: pg. 98–110 Lab Workbook: Activity 5-1, Threaded and Non-Threaded Fasteners |
| Select and use screw and nut drivers, straight, Phillips, and hex. | Textbook: pg. 73–74, 75–77 |
| Select and use fixed wrenches: box, open end, etc. | Textbook: pg. 71–74 |
| Select and use Allen/hex key wrenches. | Textbook: pg. 73–74 |
| Select and use ratchet wrenches. | Textbook: pg. 73 |
| Select and use a click-type torque wrench. | Textbook: pg. 72–73 |
| Select and properly use pullers. | Textbook: pg. 81 |
| Select and use pliers, clamps, and mallets. | Textbook: pg. 77–78, 80–81 |
| Select and use pneumatic powered torque wrenches. | Textbook: pg. 72–73 |

| Standards | G-W Content |
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| Select and use electric powered hand tools: drills, torque wrenches, and screwdrivers. | Textbook: pg. 84–89 |
| Select and use methods to protect parts and components during handling and storage. | Textbook: pg. 89 |
| Assemble parts using threaded fasteners (bolts and machine screws), washers and nuts. | Textbook: pg. 98–103, 105–106 |
| Assemble parts using pins (clevis, taper, dowel, spring, roll, shear). | Textbook: pg. 106–108 |
| Assemble parts using keys, clips, snap rings, and tie wraps. | Textbook: pg. 108–110 |
| Tighten parts using correct bolt pattern sequence. | Textbook: pg. 99, 101 |
| Duty Title: 1.10. Move, handle and store materials and equipment | |
| Describe and demonstrate rigging safety including load capacity. | Textbook: pg. 160–162, 170, Lab Workbook: Activity 8-1, Calculating Center of Gravity Lab Workbook: Activity 8-2, Planning a Lift Lab Workbook: Activity 8-3, Lifting Component Specifications Lab Workbook: Activity 8-4, Center of Gravity |
| Inspect a hoist and determine if it is safe to use. | Textbook: pg. 173–175 |
| Use manual and powered hoists using cantilevered and gantry configurations. | Textbook: pg. 173–175 |
| Determine and calculate center of gravity for load balance. | Textbook: pg. 175–176 Lab Workbook: Activity 8-1, Calculating Center of Gravity Lab Workbook: Activity 8-4, Center of Gravity |
| Determine proper use of eyebolts for lifting parts. | Textbook: pg. 171 |
| Explain and use basic rigging techniques and types of slings, come-a-longs, blocking, chaining to lift a load. | Textbook: pg. 160–175 Lab Workbook: Activity 8-2, Planning a Lift Lab Workbook: Activity 8-5, Knots for Lifting |
| Describe basic concepts of force, center of gravity, force vectors, rated load, crush force (load charts). | Textbook: pg. 162, 177, 190–191 Lab Workbook: Activity 8-1, Calculating Center of Gravity Lab Workbook: Activity 8-4, Center of Gravity |
| Use a manual pry bar and truck to move a load. | Textbook: pg. 160 |
| Use a hydraulic jack to lift a load. | Textbook: pg. 160 |
| Use a dolly to move a load. | Textbook: pg. 160 |
| Use proper containment methods to store a component. | Textbook: pg. 163, 175–176 |
| Handle parts using proper contamination prevention methods. | Textbook: pg. 175–176 |

| Standards | G-W Content |
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| Inspect components for contamination and take corrective action. | Textbook: pg. 175–176 |
| Duty Title: 1.11. Systems troubleshooting methodologies | |
| Describe and apply methodologies to isolate problems to a particular sub-system; 5 why, fishbone, flowcharts, half-split method, etc. | Textbook: pg. 152–154 Lab Workbook: Activity 7-1, Applied Troubleshooting Methods |
| Describe and apply effective interpersonal skills to interact with production personnel, vendors, and colleagues. | Textbook: pg. 143–144 Lab Workbook: Activity 7-1, Applied Troubleshooting Methods |
| Apply effective observation and interview strategies to validate the problem and determine the most effective troubleshooting strategy. | Textbook: pg. 143–145 Lab Workbook: Activity 7-1, Applied Troubleshooting Methods |
| Analyze production information, maintenance and operation documents to assist in troubleshooting a malfunction. | Textbook: pg. 54–56, 144, 148 |