

Massachusetts CTE Teacher Testing Program Electricity Content Outline

Written and Performance Exam General Overview

- The intent of this exam is to assess the candidate's ability to teach the skills found in the Massachusetts Technical Education Framework.
- The written exam is a state-developed exam aligned to the frameworks which can be accessed [here](#). The performance exam is a NOCTI-developed teacher test and has been determined by DESE to align to the state frameworks.
- Many questions and tasks require a synthesis of knowledge based on experience in the field and may not be found in any book.
- Use this exam outline and the Massachusetts Technical Education Framework to focus your preparation for the exams.
- Candidates are encouraged to prepare for their written exam by reviewing textbooks and reference material which have been listed as part of this exam outline. These resources can be found using online search tools, online vendors, and websites.

Written Exam – Under Revision

- Number of Questions: 100
- Administration Time: 3 hours
- Passing Score: 70.0%
- Administration Method: Remote Proctored Online Testing Session

Written Exam Content Coverage

4% **Basic Low Voltage Wiring**

- Identify the components of fire and security alarm systems.
- Identify and install Class 1, 2, and 3 low voltage systems.
- Prepare, install, and terminate low voltage cable.

17% **Concepts of Electrical Theory**

- Compare and distinguish between conductors and insulators.
- Explain the relationship between voltage, current, and resistance.
- Define the units of measurement that are used to measure the properties of electricity.
- Calculate and apply an unknown value by using Ohm's law formula.

2% **Elementary Use of Luminaires and Luminaire Controls**

- Classify luminaires by layout, location, fixture type, and type of service.
- Demonstrate and state the functions and rating of single-pole, double pole, three-way, four-way, and dimmer switches.

11% Fundamentals of Conductors and Cables

- Identify and use insulation types according to conditions and applications.
- Read and identify markings conductors.
- Select electrical conductors for specific applications.
- Demonstrate how to size conductors for a load.
- Describe the different conductors.
- Secure and support cables.

1% Fundamentals of Grounding and Bonding

- Size the equipment grounding conductor for raceways and equipment.

5% Fundamentals of Motor and Motor Controls

- Describe the operating principles of motor and motor controls.
- Describe manual, automatic and semi-automatic control circuits.

6% Health & Safety

- Identify, describe and apply health and safety regulations that apply to specific tasks and jobs. Students must complete a safety credential program, e.g., Occupational Safety and Health Administration 10, CareerSage and ServSafe.
- Identify, describe and demonstrate the effective use of Safety Data Sheets (SDS).
- Locate emergency equipment, first aid kit, SDS information directories and emergency action/response plan/escape routes in your lab, shop and classroom, including labels and signage that follow OSHA Hazard Communication Program (HAZCOM), eyewash stations, shower facilities, sinks, fire extinguishers, fire blankets, telephone, master power switches and emergency exits.
- Demonstrate the safe use, storage, and maintenance of every piece of equipment in the lab, shop and classroom, e.g., the OSHA Lockout/Tagout Program (LOTO).
- Describe safety practices and procedures to be followed when working with and around electricity, e.g., ground fault circuit interrupter (GFCI) and frayed wiring.

21% MA Electrical Code (MEC) and Code of MA Regulations MGL and (CMR)

- Demonstrate how to navigate the MEC book.
- Identify and summarize the MGL's and CMR's as they apply to the electrical trade.
- Determine conductor requirements.
- Describe the purpose of ground-fault circuit interrupters (GFCI) and arc-fault circuit interrupters (AFCI) and indicate where they must be installed.

15% Power and Distribution of Electricity

- Describe how to determine electric service requirements for dwellings.
- Calculate and size service-entrance equipment.
- Install main disconnect switches, panelboards, and overcurrent protection devices.
- Select the most suitable overcurrent device for the application.
- Compute transformer sizes for various applications.
- Identify power transformer connections.
- Calculate and install overcurrent protection for transformers.

11% Raceways, Boxes and Fittings

- Select various types and sizes of raceways, fittings, and supports.
- Perform the proper methods of bending raceway.
- Cut, ream and thread raceways.
- Install raceways and fittings on various surfaces.
- Explain how boxes are selected and installed.

3% Reading Technical Drawings and Blueprints

- Describe the basic layout of a set of prints as well as the importance of the accompanying job specifications document.
- Identify and define basic print terms, abbreviations, line types, symbols and notes.

4% Tools, Electrical Test Equipment and Techniques in Fastening Objects

- Explain and demonstrate the use of and type of anchors.
- Perform measurement of current.
- Perform measurement of voltage.
- Perform measurement of resistance.

Written Exam Reference Materials (Reference Current Edition)

- **Designing Electrical Systems** by James Stallcup (American Technical Publishers)
- **National Electrical Code** with Massachusetts Amendments (National Fire Protection Association Publishers)
- **Delmar Standard Textbook On Electricity** by Herman (Delmar Press)
- **American Electricians Handbook** by Croft and Summers (McGraw-Hill)
- **Official OSHA Construction Safety Handbook** by JJ Keller & Associates, Inc.

Materials Needed for the Written Exam

- Candidates must have the most current National Electrical Code Book (NEC) available.
- A four-function calculator is included in the online testing system. No other calculators are permitted.
- Scrap paper and pencil/pen are permitted.

Written Exam Sample Items

Each question on the exam consists of one incomplete sentence or question followed by four choices. Some items reference an image or diagram. A few sample items are included below; the correct answer is designated with an asterisk (*).

The general lighting load for dwellings expressed in volt-amperes per square foot is _____ volt-ampere(s).

- a. 1/4
- b. 1/2
- c. 3 (*)
- d. 4

If the reactive volt-amperes on an A.C. circuit is 12 kva and the true power is 16 kw, what is the value of the apparent power supplied in kva?

- a. 20 kva (*)
- b. 24 kva
- c. 28 kva
- d. 32 kva

NOCTI Performance Exam

- Administration Time: 3 hours and 20 minutes
- NOCTI Criterion-Referenced Cut Score/Passing Score: 93.2%
- Administration Method: Onsite at a DESE approved Massachusetts Area Testing Center (MATC) location. Candidates must register and schedule their exam session through NOCTI.

Performance Exam Content Coverage

33% Bend Conduit

Participant will safely install boxes onto the wall, and use proper bending and cutting techniques to install conduit.

43% Switching and GFCI Receptacle in a Residential Setting

Participant will properly mount boxes, install wiring and devices, and complete the job in a neat operational manner following safety standards.

24% Install Two Smoke Alarms in a Commercial Setting

Participant will properly install interconnected components to operate correctly following safety standards.

Performance Exam Requirements

Candidate Supplied

Candidates must bring all appropriate Personal Protective Equipment (PPE), attire/uniform, and any other safety items as is routinely expected to be used by an employee in the related industry. If the candidate does not bring what is needed to safely complete all jobs on the exam as required in the workplace, the testing session will need to be rescheduled at the candidate's expense.

- Candidates are permitted to use their own equipment (e.g., tool pouch or trade tools)

Site Supplied

Additional equipment and supplies needed to complete the jobs on the performance test will be provided by the testing site.

Performance Exam Site Requirements

Testing sites may have individual requirements based on location and any relevant and current guidance from the Center for Disease Control and Prevention (CDC).