MA-1601: EKG - ELECTROCARDIOGRAM FUNDAMENTALS

Cuyahoga Community College

Viewing: MA-1601 : EKG - Electrocardiogram Fundamentals

Board of Trustees:
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Academic Term:
Fall 2026

Subject Code
MA - Medical Assisting

Course Number:
1601

Title:
EKG - Electrocardiogram Fundamentals

Catalog Description:
This course prepares students for the Certified EKG Technician (CET) role by integrating foundational knowledge with practical skills in cardiac testing. Emphasis is placed on safety, compliance, and patient care, including HIPAA, infection control, and scope of practice. Students study rhythm analysis, arrhythmia recognition, and waveform interpretation while practicing EKG acquisition, stress testing, and Holter monitoring. The course also addresses emergency recognition, professional communication, and accurate documentation, ensuring graduates can support providers in delivering safe, effective cardiovascular care.

Credit Hour(s):
2

Lecture Hour(s):
1

Lab Hour(s):
3

Requisites

Prerequisite and Corequisite
Departmental approval.

Outcomes

Course Outcome(s):
Demonstrate adherence to Health Insurance Portability and Accountability Act (HIPAA) regulations.

Essential Learning Outcome Mapping:
Not Applicable: No Essential Learning Outcomes mapped. This course does not require application-level assignments that demonstrate mastery in any of the Essential Learning Outcomes.

Objective(s):
1. Identify core provisions of HIPAA Privacy, Security, and Enforcement Rules.
2. Demonstrate safeguarding of protected health information in written, verbal, and electronic forms.
3. Evaluate potential HIPAA breaches and implement corrective actions.

Course Outcome(s):
Implement infection control practices (e.g. OSHA, Universal Precautions).

Essential Learning Outcome Mapping:
Not Applicable: No Essential Learning Outcomes mapped. This course does not require application-level assignments that demonstrate mastery in any of the Essential Learning Outcomes.

Objective(s):

1. Describe standard and transmission-based precautions required in cardiac diagnostics.
2. Select and use appropriate personal protective equipment and perform hand hygiene.
3. Maintain a clean work environment, decontaminate equipment, and dispose of sharps in compliance with OSHA.

Course Outcome(s):

Practice within the established scope and uphold ethical standards.

Essential Learning Outcome Mapping:

Not Applicable: No Essential Learning Outcomes mapped. This course does not require application-level assignments that demonstrate mastery in any of the Essential Learning Outcomes.

Objective(s):

1. Explain permitted duties of the EKG technician under state and facility policy.
2. Demonstrate ability to distinguish tasks requiring referral or supervision and seek guidance as needed.
3. Apply the NHA Code of Ethics to resolve dilemmas and document care honestly.

Course Outcome(s):

Demonstrate effective communication with patients and members of the multidisciplinary health care team.

Essential Learning Outcome Mapping:

Not Applicable: No Essential Learning Outcomes mapped. This course does not require application-level assignments that demonstrate mastery in any of the Essential Learning Outcomes.

Objective(s):

1. Demonstrate ability to use therapeutic communication techniques to build rapport with patients.
2. Adapt communication to accommodate cultural, linguistic, developmental, and disability differences.
3. Demonstrate ability to convey accurate and timely information to health care team members using professional terminology.

Course Outcome(s):

Accurately obtain and interpret patient vital signs.

Essential Learning Outcome Mapping:

Not Applicable: No Essential Learning Outcomes mapped. This course does not require application-level assignments that demonstrate mastery in any of the Essential Learning Outcomes.

Objective(s):

1. Demonstrate ability to accurately measure temperature, pulse, respirations, blood pressure, and oxygen saturation using correct techniques.
2. Compare findings with normal ranges across the lifespan and identify deviations.
3. Respond appropriately to abnormal vital signs, including activation of emergency protocols.

Course Outcome(s):

Effectively instruct patients about preparation for and expectations during stress testing.

Essential Learning Outcome Mapping:

Not Applicable: No Essential Learning Outcomes mapped. This course does not require application-level assignments that demonstrate mastery in any of the Essential Learning Outcomes.

Objective(s):

1. Explain pre-test requirements such as fasting, medication, modifications, and attire.
2. Describe step by step what will occur during treadmill or pharmacologic stress tests.
3. Demonstrate ability to confirm patient understanding and address questions or concerns before the test.

Course Outcome(s):

Educate patients on use of ambulatory monitoring (e.g. Holter, event monitors) and verify their understanding.

Essential Learning Outcome Mapping:

Not Applicable: No Essential Learning Outcomes mapped. This course does not require application-level assignments that demonstrate mastery in any of the Essential Learning Outcomes.

Objective(s):

1. Demonstrate proper placement and care of ambulatory monitoring devices.
2. Provide written and verbal instructions for activity diary, electrode maintenance, and troubleshooting.
3. Assess patient comprehension through teach back and correct misconceptions.

Course Outcome(s):

Accurately utilize electronic medical records/electronic health records (EMR/EHR) to input patient information.

Essential Learning Outcome Mapping:

Not Applicable: No Essential Learning Outcomes mapped. This course does not require application-level assignments that demonstrate mastery in any of the Essential Learning Outcomes.

Objective(s):

1. Navigate EMR/EHR interface to locate appropriate fields for patient history, medication, vitals, and diagnostics.
2. Enter and upload completed EKG data accurately and securely.
3. Verify entries for completeness and correct errors following facility policies.

Course Outcome(s):

Detect and respond to signs and symptoms of cardiopulmonary compromise.

Essential Learning Outcome Mapping:

Not Applicable: No Essential Learning Outcomes mapped. This course does not require application-level assignments that demonstrate mastery in any of the Essential Learning Outcomes.

Objective(s):

1. Identify normal and abnormal vital sign parameters across the lifespan.
2. Detect early indications of syncope, chest pain, dyspnea, or unstable rhythms during testing.
3. Initiate emergency response, including basic life support and notification of the clinical team.
4. Document events and interventions promptly in the EMR.

Course Outcome(s):

Maintain EKG equipment (e.g. load paper, replace clips, disinfect machines and leads).

Essential Learning Outcome Mapping:

Not Applicable: No Essential Learning Outcomes mapped. This course does not require application-level assignments that demonstrate mastery in any of the Essential Learning Outcomes.

Objective(s):

1. Identify routine maintenance and cleaning requirements for the EKG machine, cables, and leads.
2. Load thermal paper, replace worn electrode clips, and inspect necessary supplies before each procedure.
3. Disinfect equipment after every use according to manufacturer instructions and facility infection control polices.

Course Outcome(s):

Verify EKG machine settings (speed, gain).

Essential Learning Outcome Mapping:

Not Applicable: No Essential Learning Outcomes mapped. This course does not require application-level assignments that demonstrate mastery in any of the Essential Learning Outcomes.

Objective(s):

1. Describe standard speed and gain settings for adult and pediatric tracings.
2. Demonstrate ability to adjust machine parameters to accommodate clinical orders or patient needs.
3. Demonstrate ability to confirm calibration accuracy by generating and interpreting the standardization mark before recording.

Course Outcome(s):

Prepare skin for electrode placement.

Essential Learning Outcome Mapping:

Not Applicable: No Essential Learning Outcomes mapped. This course does not require application-level assignments that demonstrate mastery in any of the Essential Learning Outcomes.

Objective(s):

1. Gather supplies required for optimal skin preparation.
2. Cleanse and gently abrade skin to reduce impedance and improve signal quality.
3. Assess skin integrity and adjust preparation techniques for sensitive or compromised areas.

Course Outcome(s):

Position patient for cardiac testing (3-,5-,12-lead, stress test, telemetry).

Essential Learning Outcome Mapping:

Not Applicable: No Essential Learning Outcomes mapped. This course does not require application-level assignments that demonstrate mastery in any of the Essential Learning Outcomes.

Objective(s):

1. Explain the rationale for specific positions required for different cardiac tests.
2. Demonstrate ability to safely position patients with special considerations such as amputations, respiratory issues, or late-term pregnancy.
3. Assist patients in maintaining the correct position throughout data acquisition.

Course Outcome(s):

Apply electrodes and attach leads for standard and specialized tests.

Essential Learning Outcome Mapping:

Not Applicable: No Essential Learning Outcomes mapped. This course does not require application-level assignments that demonstrate mastery in any of the Essential Learning Outcomes.

Objective(s):

1. Locate anatomical landmarks for accurate electrode placement.
2. Adapt placement techniques for right-sided, posterior, pediatric, or amputee configurations.
3. Attach leads securely and troubleshoot poor signal quality.

Course Outcome(s):

Verify that all leads were recorded.

Essential Learning Outcome Mapping:

Not Applicable: No Essential Learning Outcomes mapped. This course does not require application-level assignments that demonstrate mastery in any of the Essential Learning Outcomes.

Objective(s):

1. Assess tracing to confirm the presence of all required leads.
2. Identify and correct missing or improperly recorded leads.
3. Document verification of complete acquisition in the medical record.

Course Outcome(s):

Identify and resolve artifacts on the tracing.

Essential Learning Outcome Mapping:

Not Applicable: No Essential Learning Outcomes mapped. This course does not require application-level assignments that demonstrate mastery in any of the Essential Learning Outcomes.

Objective(s):

1. Recognize common artifacts such as wandering baseline, somatic tremor, and AC interference.
2. Determine underlying causes through systematic equipment and patient checks.
3. Implement corrective actions and obtain a clear tracing.

Course Outcome(s):

Mount a completed EKG tracing strip of the patient's chart.

Essential Learning Outcome Mapping:

Not Applicable: No Essential Learning Outcomes mapped. This course does not require application-level assignments that demonstrate mastery in any of the Essential Learning Outcomes.

Objective(s):

1. Select representative rhythm strip segments for interpretation.
2. Demonstrate ability to label tracings with patient identifiers, date, time, and calibration data.
3. Demonstrate ability to affix a strip to the chart or upload electronically according to facility protocol.

Course Outcome(s):

Assist in monitoring patient condition during stress testing.

Essential Learning Outcome Mapping:

Not Applicable: No Essential Learning Outcomes mapped. This course does not require application-level assignments that demonstrate mastery in any of the Essential Learning Outcomes.

Objective(s):

1. Demonstrate ability to continuously observe patient appearance, vital signs, and symptoms throughout the test.
2. Interpret telemetry and blood pressure changes that indicate intolerance.
3. Report concerning findings promptly to supervising personnel.

Course Outcome(s):

Provide and document interventions during complications encountered in stress testing.

Essential Learning Outcome Mapping:

Not Applicable: No Essential Learning Outcomes mapped. This course does not require application-level assignments that demonstrate mastery in any of the Essential Learning Outcomes.

Objective(s):

1. Recognize signs of cardiopulmonary compromise that require immediate action.
2. Initiate emergency response, including basic life support and oxygen administration.
3. Document the event, interventions, and patient outcome in the electronic medical record.

Course Outcome(s):

Calculate patient's heart rate from the EKG tracing.

Essential Learning Outcome Mapping:

Not Applicable: No Essential Learning Outcomes mapped. This course does not require application-level assignments that demonstrate mastery in any of the Essential Learning Outcomes.

Objective(s):

1. Identify formulas for maximum and target heart rates and units for EKG graph paper.
2. Calculate heart rate using the six-second, R to R interval, and sequence methods on sample tracings.
3. Verify calculations and document results in the medical record.

Course Outcome(s):

Determine the regularity of the patient's heart rhythm from the EKG tracing.

Essential Learning Outcome Mapping:

Not Applicable: No Essential Learning Outcomes mapped. This course does not require application-level assignments that demonstrate mastery in any of the Essential Learning Outcomes.

Objective(s):

1. Demonstrate ability to distinguish regular, regularly irregular, and irregular rhythms of tracings.
2. Measure R to R intervals across an entire strip to confirm rhythm regularity.
3. Demonstrate ability to record rhythm interpretation using correct terminology.

Course Outcome(s):

Measure EKG intervals and waveforms (PR interval, QRS duration, QT interval).

Essential Learning Outcome Mapping:

Not Applicable: No Essential Learning Outcomes mapped. This course does not require application-level assignments that demonstrate mastery in any of the Essential Learning Outcomes.

Objective(s):

1. Describe the electrical conduction events represented by PR, QRS, and QT.
2. Measure each interval accurately using graph paper calibration and calculate corrected QT when indicated.
3. Compare findings with normal ranges and flag abnormal values for provider review.

Course Outcome(s):

Inspect waveform characteristics (P waves, QRS complexes, ST segments, T waves) for symmetry, direction, and amplitude.

Essential Learning Outcome Mapping:

Not Applicable: No Essential Learning Outcomes mapped. This course does not require application-level assignments that demonstrate mastery in any of the Essential Learning Outcomes.

Objective(s):

1. Describe expected morphology for each waveform component.
2. Evaluate tracings for deviations for such as axis shift, ST elevation or depression, and peaked or inverted T waves.
3. Demonstrate ability to correlate abnormal morphology with possible electrolyte imbalances or cardiac pathology and report promptly.

Course Outcome(s):

Identify arrhythmias (sinus, atrial, ventricular, junctional, heart block) from the EKG tracing.

Essential Learning Outcome Mapping:

Not Applicable: No Essential Learning Outcomes mapped. This course does not require application-level assignments that demonstrate mastery in any of the Essential Learning Outcomes.

Objective(s):

1. Apply systematic rhythm interpretation criteria to classify arrhythmias.
2. Demonstrate ability to differentiate critical rhythms from benign variants and prioritize interventions.
3. Document arrhythmia findings clearly and notify the health care team according to facility policy.

Course Outcome(s):

Recognize pacemaker spikes on an EKG tracing.

Essential Learning Outcome Mapping:

Not Applicable: No Essential Learning Outcomes mapped. This course does not require application-level assignments that demonstrate mastery in any of the Essential Learning Outcomes.

Objective(s):

1. Describe the appearance and timing of atrial and ventricular pacemaker spikes.
2. Identify failure to capture, sense, or pace on tracings.
3. Demonstrate ability to communicate pacemaker-related abnormalities to the supervising clinician.

Course Outcome(s):

Identify ischemia, injury, and infarction on the EKG tracing.

Essential Learning Outcome Mapping:

Not Applicable: No Essential Learning Outcomes mapped. This course does not require application-level assignments that demonstrate mastery in any of the Essential Learning Outcomes.

Objective(s):

1. Detect subtle ST-segment and T-wave changes that indicate ischemia or injury.
2. Demonstrate ability to localize myocardial infarction by analyzing patterns in contiguous leads.
3. Initiate appropriate notification and emergency protocols when acute changes are observed.

Course Outcome(s):

Intervene promptly when life-threatening arrhythmias are identified.

Essential Learning Outcome Mapping:

Not Applicable: No Essential Learning Outcomes mapped. This course does not require application-level assignments that demonstrate mastery in any of the Essential Learning Outcomes.

Objective(s):

1. Demonstrate ability to list indications for activating the emergency response systems for ventricular tachycardia, ventricular fibrillation, or asystole.
2. Demonstrate immediate basic life support interventions, including CPR and AED use until advanced help arrives.
3. Document the event, interventions performed, and patient response in the electronic medical record.

Course Outcome(s):

Apply foundational knowledge of cardiac anatomy and physiology.

Essential Learning Outcome Mapping:

Not Applicable: No Essential Learning Outcomes mapped. This course does not require application-level assignments that demonstrate mastery in any of the Essential Learning Outcomes.

Objective(s):

1. Identify the chambers, valves, and major vessels of the heart.
2. Describe the pathway of blood flow through the heart and correlate it was the phases of the cardiac cycle.
3. Explain the electrical conduction system sequence and relate it to the normal EKG waveforms.
4. Analyze the effects of autonomic nervous system stimulation on heart rate and contractility.

Course Outcome(s):

Recognize and manage emergencies related to cardiac testing.

Essential Learning Outcome Mapping:

Not Applicable: No Essential Learning Outcomes mapped. This course does not require application-level assignments that demonstrate mastery in any of the Essential Learning Outcomes.

Objective(s):

1. Identify signs and symptoms of syncope, chest pain, and abnormal vital signs during diagnostic procedures.
2. Assess patient status to determine severity and immediate needs.
3. Activate emergency response protocols under facility guidelines.
4. Document the event, interventions provided, and communication with the health team.

Course Outcome(s):

Perform cardiopulmonary resuscitation and basic life support.

Essential Learning Outcome Mapping:

Not Applicable: No Essential Learning Outcomes mapped. This course does not require application-level assignments that demonstrate mastery in any of the Essential Learning Outcomes.

Objective(s):

1. Demonstrate correct adult and pediatric CPR techniques, including compression rate, depth, and ventilation ratios.
2. Operate an automated external defibrillator safely and follow voice prompts.
3. Maintain airway patency using basic adjuncts and provide effective rescue breaths.
4. Evaluate the effectiveness of resuscitation effects and transfer care to advanced providers.

Methods of Evaluation:

1. Quizzes
2. Examinations
3. Laboratory Practicals
4. Case study analysis
5. Class participation

Course Content Outline:

1. Coronary Anatomy and Physiology
    a. Layers of the heart
    b. Walls
    c. Chambers
    d. Valves
    e. Vessels
    f. Coronary Circulation
        i. Systemic circulation
        ii. Pulmonary circulation

   g. Conduction System
   h. Cardiac Cycle
2. Electrophysiology
   a. Depolarization vs repolarization
   b. EKG waves and complexes
      i. P Wave
      ii. T Wave
      iii. QRS Complex
      iv. U Wave
   c. QRS nomenclature
      i. Q Wave
      ii. R Wave
      iii. S Wave
      iv. QS Wave
   d. EKG paper
      i. Small squares
      ii. Large squares
      iii. Time
      iv. Voltage
   e. Intervals
      i. PR Interval
      ii. QRS Interval
      iii. QT Interval
3. Lead Morphology and Placement
   a. Bipolar leads
   b. Augmented leads
   c. Precordial Leads
   d. Normal Deflections
   e. Lead placement
4. Technical Aspects of the EKG
   a. Safety
   b. Artifacts
      i. Electrical interference
      ii. Somatic tremor
      iii. Wandering baseline
      iv. Broken recording
   c. Troubleshooting
5. Calculating Heart Rate
   a. Methods for calculations
      i. 6-second strip
      ii. Memory method
      iii. Little block method
   b. Regularity Types
      i. Regular
      ii. Regular but interrupted
      iii. Irregular
      iv. Calculations depending on regularity types
6. Interpreting a Rhythm Strip
   a. Five steps to rhythm interpretation
      i. Locate QRS Complexes
      ii. Note regularity
      iii. Note heart rate
      iv. Locate P Waves
      v. Notate PR and QRS intervals
   b. Normal Sinus Rhythm
7. Arrhythmias
   a. Sinus Node
      i. Bradycardia
      ii. Tachycardia

iii. Arrhythmia
iv. Arrest
v. Block

b. Atrial
i. Atrial Tachycardia
ii. Pacemaker Tachycardia
iii. Premature Atrial Contraction
iv. Paroxysmal Atrial Tachycardia
v. Atrial Flutter
vi. Atrial Fibrillation
vii. Supraventricular Tachycardia

c. AV Junction
i. Premature Junctional Complexes
ii. Junctional Bradycardia
iii. Accelerated Junctional Rhythm
iv. Junctional Tachycardia

d. Ventricular
i. Premature Ventricular Contractions
ii. Agonal Rhythm (Dying heart)
iii. Idioventricular Rhythm
iv. Accelerated Idioventricular Rhythm
v. Ventricular Tachycardia
vi. Wolff-Parkinson-White Syndrome
vii. Torsades de Pointes
viii. Ventricular Fibrillation
ix. Asystole
x. Pacemaker Rhythm

e. AV Blocks
i. Degrees of Block
1. First Degree
2. Mobitz I Second Degree- Wenckebach
3. Mobitz II Second Degree 2:1 AV Block
4. Third Degree AV Block- Complete Heart Block

f. Myocardial Infarction
i. Definition of MI
ii. Symptoms of MI
iii. Changes in EKG with MI
iv. Areas of Infarct
v. EKG Complications of MI

Religious Accommodation

Before reviewing the course schedule, students should carefully review the following religious accommodation policy and other required instructional policies:

Religious Accommodation:

Students seeking an accommodation for absences permitted under Ohio's Testing Your Faith Act must provide the instructor with written notice of the specific dates for which the student requires an accommodation and must do so not later than fourteen (14) days after the first day of instruction. Please submit requests for accommodations at this link: https://portal2.tri-c.edu/ReligiousAccommodation/ Religious Accommodation Form. Students with questions about their religious accommodations under Ohio's Testing Your Faith Act may contact the College's Office of General Counsel and Legal Services by phone at 216.987.4856 or via email at legal@tri-c.edu.

Other Required Instructional Policies:

https://www.tri-c.edu/student-resources/curriculum/documents/syllabus-part-b.pdf

Weekly Schedule

	Topics
Week 1	Course foundations Cardiac anatomy and physiology
Week 2	Course foundations Cardiac anatomy and physiology
Week 3	Safety, Compliance and Patient Care
Week 4	Safety, Compliance and Patient Care
Week 5	Vital Signs and Emergency Response
Week 6	Vital Signs and Emergency Respons
Week 7	EKG Acquisition – Basics
Week 8	EKG Acquisition – Basics
Week 9	Midterm
Week 10	Specialized Testing & Monitoring
Week 11	Specialized Testing & Monitoring
Week 12	EKG Analysis and Interpretation
Week 13	EKG Analysis and Interpretation
Week 14	Clinical Application & Review
Week 15	Clinical Application & Review
Week 16	Final Examination

The Course Schedule is subject to change due to pedagogical needs, instructor discretion, parts of term, and unexpected events.

Required/Recommended Readings

NHA EKG Study Guide and Practice Exams

Resources for the Instructor

Procter, D., & Adams, A. (2023). *Kinn's the medical assistant*, Elsevier.

Ellis, K.M., (2016). *EKG plain and simple*, Pearson.

Thalor, M. (2022). *The only EKG book you'll ever need*, Lippincott Williams and Wilkins.

NEDU LLC, NurseEdu.com. *EKG ECG Interpretation Made Easy: An Illustrated Guide for Students to Easily Learn How to read & Interpret ECG Strips*. NEDU LLC, NurseEdu.com, 2021.

National Heathcareer Association, (2017) . *NHA certified test plan*. https://info.nhanow.com/hubfs/Test%20Plans/nha_2017-cet-test-plan.pdf

Additional Resources for the Instructor

National Healthcareer Association (2025). *Accredited CET (EKG) certification for your training program.* Accredited CET (EKG) Certification for Your Training Program | NHA (https://www.nhanow.com/train-educate/professions/ekg-technician/). 2025.

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