

BMET Memorization Sheet

Print this and keep it beside you through the course and the labs. The CABT asks for the basics a first-year technician uses every day: normal values, safety limits, Ohm's law, unit conversions, what each device does, and which tool does which job. Every number on this sheet is fair game.

01 The exam itself

FACT	VALUE
Certifying body	AAMI Credentials Institute (ACI)
Questions	100 multiple choice
Time and rules	2 hours, closed book, no notes or phones
Calculator	An on-screen four-function calculator is provided; no calculator of your own
Delivery	Live remote proctoring year-round through Kryterion: webcam, microphone, quiet room, cleared desk
Eligibility	High school junior or above; no work experience and no degree required
Window to test	Six months from purchase to the test date
Results	Pass or fail on screen immediately, confirmed by email within 24 hours
Cut score	Not published; this course trains to 70% on the official-format test
Fee	2026 fee: \$220 member, \$270 non-member; non-refundable
Retake	\$190 member, \$240 non-member, after a 60-day wait
Validity	5 years, non-renewable; by then you qualify for the technician-level exam
Domain weights	Anatomy and Physiology 10%; Medical Devices as Related to Patient Care 23%; Safety in Healthcare 16%; Fundamentals of Electricity and Electronics 14%; Reasoning and Problem Solving 24%; Healthcare Information Technology 13%

Reasoning and Problem Solving plus Medical Devices as Related to Patient Care are 47% of the exam, nearly half the questions. For every device on this sheet be ready to say three things: what it does, what it measures or delivers, and which tool checks it.

02 Anatomy, physiology, and terminology

VITAL SIGN (ADULT, AT REST)	NORMAL RANGE	MEASURED BY
Heart rate	60 to 100 beats per minute; below 60 is bradycardia, above 100 is tachycardia	ECG monitor, pulse oximeter, NIBP module; verified with a patient simulator
Respiratory rate	12 to 20 breaths per minute	Monitor impedance channel, capnograph, counting the chest
Blood pressure	About 120/80 mmHg; MAP = diastolic + (systolic minus diastolic) / 3	NIBP cuff, arterial line and transducer; verified with an NIBP analyzer and a cuff leak test
Oxygen saturation (SpO2)	95 to 100%	Pulse oximeter, red light about 650 to 660 nm and infrared about 805 to 940 nm; verified with an SpO2 simulator or finger phantom

VITAL SIGN (ADULT, AT REST)	NORMAL RANGE	MEASURED BY
End-tidal carbon dioxide (EtCO ₂)	35 to 45 mmHg	Capnograph; verified with a known calibration gas and a gas analyzer
Temperature	37 C (98.6 F); fever above about 38 C	Electronic thermometer, monitor temperature probe, infrared; verified with a resistance box or reference thermometer at two points
Tidal volume	About 500 mL per breath at rest	Ventilator display, spirometer, gas flow analyzer

BODY SYSTEM	KEY ORGANS	WHAT IT DOES	WHAT YOUR DEVICES DO WITH IT
Circulatory	Heart, arteries, veins, capillaries, blood	Moves oxygen, nutrients, and waste	ECG records electrical activity; NIBP and arterial lines measure pressure; defibrillators restart rhythm
Respiratory	Nose, trachea, bronchi, lungs, alveoli, diaphragm	Takes in oxygen, gives off carbon dioxide	Ventilators move the gas, oximeters read oxygen carried, capnographs read CO₂ breathed out
Nervous	Brain, spinal cord, nerves	Senses, decides, and signals by small electrical pulses	Brain/muscle recorders capture those pulses; stimulators and TENS units supply them
Digestive	Mouth, esophagus, stomach, intestines, liver, pancreas	Breaks food down and absorbs it	Feeding pumps deliver formula, suction removes fluid, scopes let a clinician look inside
Urinary	Kidneys, ureters, bladder, urethra	Filters blood and makes urine	Dialysis machines replace the filtering; bladder scanners measure what is left behind
Endocrine	Pancreas, thyroid, adrenals, pituitary	Releases hormones that set metabolism and blood sugar	Glucose meters and insulin pumps work on this system
Musculoskeletal	Bones, joints, skeletal muscle, tendons	Holds the body up and moves it	Therapy stimulators, CPM machines, traction, beds and lifts
Integumentary	Skin, hair, nails	Barrier, temperature control, sensation	Every electrode, probe, and cuff touches it; skin prep, adhesives, pressure matter

Directional terms and word parts

- Anterior front, posterior back; superior above, inferior below; medial toward the midline, lateral away from it; proximal near the trunk, distal far from it; supine face up, prone face down
- Prefixes: brady- slow, tachy- fast, hyper- high or too much, hypo- low or too little, a- and an- without, dys- difficult or painful
- Roots: cardio heart, pulmo and pneumo lung, nephro and reno kidney, neuro nerve, gastro stomach, derm skin, hemo blood
- Suffixes: -itis inflammation, -ectomy surgical removal, -oscopy looking inside, -graphy the recording process, -gram the record itself, -emia a blood condition. Put them together: tachycardia is a fast heart and electrocardiography is the process that prints the electrocardiogram

HEART AND RHYTHM	WHAT TO REMEMBER
Four chambers	Right atrium/ventricle pump blood to the lungs; left atrium/ventricle pump it to the body; the left ventricle is thickest, working hardest
Valves	Tricuspid (right atrium to right ventricle), pulmonary (to the lungs), mitral (left atrium to left ventricle), aortic (to the body); keep flow one way
SA and AV nodes	SA node: the natural pacemaker in the right atrium, fires first and sets the rate. Flow path: body, right atrium, right ventricle, lungs, left atrium, left ventricle, body. AV node: the relay that delays the signal so the ventricles have time to fill before they squeeze
P, QRS, and T	P wave: the atria depolarizing, the small bump before the spike. QRS complex: the ventricles depolarizing, the tall spike; monitors count heart rate from it and defibrillators synchronize to it. T wave: the ventricles recovering after the beat

HEART AND RHYTHM	WHAT TO REMEMBER
Systole and diastole	Systole is the squeeze and the higher number; diastole is the refill and the lower number
Blood	Red cells carry oxygen on hemoglobin, white cells fight infection, platelets clot, plasma is the liquid that carries the rest

03 Electricity and electronics

FORMULA	STATEMENT	UNITS
Ohm's law	$V = I \times R$	Volts = amps x ohms
Solve for current	$I = V / R$	Amps = volts / ohms
Solve for resistance	$R = V / I$	Ohms = volts / amps
Power	$P = V \times I$	Watts = volts x amps
Power from current	$P = I^2 \times R$	Use it when you know current and resistance
Power from voltage	$P = V^2 / R$	Use it when you know voltage and resistance
Worked example	12 V across 4 ohms draws 3 A and burns 36 W	$12 / 4 = 3$; $12 \times 3 = 36$

PREFIX OR CONVERSION	VALUE
Prefixes	kilo is 1,000 times (1 kV = 1,000 V), milli is one thousandth (1 mA = 0.001 A), micro is one millionth (1 microamp = 0.000001 A)
Current and resistance ladders	1 A = 1,000 mA = 1,000,000 microamps (0.47 A is 470 mA); 1 kohm = 1,000 ohm; 1 Mohm = 1,000,000 ohm = 1,000 kohm

RESISTOR BAND	DIGIT OR MEANING
Color digits	Black 0, brown 1, red 2, orange 3, yellow 4, green 5, blue 6, violet 7, gray 8, white 9
First three bands	The first two bands are the first two digits; the third band is the multiplier, meaning how many zeros to add
Fourth band	Tolerance: gold 5%, silver 10%, no band 20%
Worked example	Brown, black, red, gold = 1, 0, add two zeros = 1,000 ohm plus or minus 5%. Measure out of circuit with power off; parallel parts pull the reading low

CIRCUIT	SERIES	PARALLEL
Current	The same through every part	Divides between branches, and the branch currents add up to the total
Voltage	Divides across the parts and the drops add up to the source	The same across every branch
Resistance	Add them: $R_{\text{total}} = R_1 + R_2 + R_3$	Total is lower than the smallest branch; for two, $(R_1 \times R_2) / (R_1 + R_2)$
One part opens	Everything stops, which is why a fuse goes in series	Only that branch stops and the rest keeps working, which is why wall outlets are wired in parallel

DC AND AC	WHAT TO REMEMBER
DC	Steady, one direction: batteries, power supply outputs, most circuit boards. Red lead is positive, black is negative
AC	Reverses direction many times a second: wall power. The United States uses 120 V at 60 Hz; much of the world uses 230 V at 50 Hz

RMS	The 120 V on the label is RMS , the effective value (DC voltage giving the same power); the waveform peaks near 170 V
Transformers	Change AC voltage (more turns on the output raises it, fewer lowers it) and can isolate a circuit; an isolation transformer has equal turns; does nothing on DC
Rectifier	Diodes turn AC into DC inside a power supply; a capacitor smooths the ripple

Components, symbols, and what they do

- **Battery:** provides **DC** power; symbol is alternating long/short lines, long line positive
- **Resistor:** limits current, drops voltage (ohms, watts); symbol is a zigzag or plain rectangle
- **Capacitor:** stores charge in farads, can hold a dangerous charge after power off, discharge before touching; symbol is two parallel plates, a curved plate meaning polarized
- **Inductor or coil:** stores energy in a magnetic field (henries), resists sudden current changes
- **Diode:** passes current one way, forward drop about 0.6 to 0.7 V, blocks backwards; symbol is a triangle into a bar, current flows the way it points; rays added make it an **LED**
- **LED:** needs about 1.8 to 3.3 V, always a series resistor, longer leg is the anode (positive)
- **Transistor:** switch or amplifier, a small signal on one leg controlling a larger current through the other two
- **Fuse:** one-time (a breaker resets instead), replace with the same current/voltage rating; symbol is a loop or an S between two terminals. Lamp symbol is a circle with an X or a loop inside
- **Switch and relay:** a switch makes or breaks a path, a relay is a switch moved by a coil for a small signal to control a big load; switch symbol is a line lifted from a contact
- **Ground:** three shrinking horizontal lines. Chassis ground: a small rake or hatched bracket. Signals flow left to right

WIRING

COLORS AND RULES

United States building and cord wiring	Black or red is hot, white is neutral, green or bare copper is ground
International device cords	Brown is live, blue is neutral, green with a yellow stripe is ground
DC leads	Red is positive, black is negative; on a battery the terminals are marked plus and minus
Wire gauge	AWG runs backwards: a lower number is thicker, carrying more current (14 AWG thicker than 18 AWG). Every cord entering a case needs a clamp or bushing so a pull lands on the case, not the conductors

BATTERY FACT

VOLTAGE PER CELL AND NOTES

Chemistries	Alkaline 1.5 V, single use; nickel metal hydride 1.2 V, rechargeable; lithium coin cell 3 V, holds memory/clock settings; lithium-ion 3.6 to 3.7 V, rechargeable, never crush, puncture, or fully drain; sealed lead-acid 2 V per cell (a 12 V block is six cells), common in infusion pumps, carts, and beds
Capacity and stacking	Capacity in amp-hours or milliamp-hours; runtime falls as a pack ages even though voltage looks fine. Cells in series add voltage, cells in parallel add capacity at the same voltage

Static and bare-board handling

- A static shock you can feel is roughly 3,000 V; as little as 100 V can quietly damage a chip with no spark you notice
- Wear a grounded wrist strap, work on a grounded mat, touch the chassis before touching a board
- Carry boards in antistatic bags, never a plastic tray or a shirt pocket
- Dry winter air makes **ESD** worse, humidity helps; hold boards by the edges, fingers off the connector pins

FAULT

WHAT YOU MEASURE

Open	Infinite resistance (the meter shows OL), no current flows, and the full source voltage appears across the break
Short	Near zero resistance, far too much current, heat, and a blown fuse or tripped breaker
High resistance joint	Current still flows, but the voltage drop across the joint is large and the joint runs warm

04 Math, measurement, and reasoning

CONVERSION	VALUE
Volume	1 L = 1,000 mL; 1 mL = 1 cubic centimeter
Mass and length	1 kg = 1,000 g = 2.2 lb; 1 inch = 2.54 cm
Pressure, airway	1 mmHg = 1.36 cmH ₂ O
Pressure, gas	1 psi = 51.7 mmHg; 1 atmosphere = 14.7 psi = 760 mmHg; 1 kPa = 7.5 mmHg
Temperature formulas	$F = C \times 9/5 + 32$; $C = (F \text{ minus } 32) \times 5/9$
Temperature anchors	37 C = 98.6 F; 0 C = 32 F; 100 C = 212 F
Flow rate	mL/h divided by 60 = mL/min, so 120 mL/h is 2 mL/min; a 30-minute collection doubled gives the hourly rate

ACCURACY MATH	RULE
Percent error	(measured minus expected) / expected x 100; keep the sign so you know which way it is off
Tolerance band	expected x percent; a 5% band on 40 mL is 2 mL, so 38 to 42 mL
Pass or fail	Pass when the size of the error is inside the band, ignoring the sign
Worked example	37 mL where 40 mL was expected: (37 minus 40) / 40 x 100 = -7.5%, which fails a 5% band. A pump set to 100 mL/h that delivers 103 mL is +3%, which passes
Accuracy and precision	Accuracy is how close to the truth; precision is how repeatable. A meter can be precisely wrong

ECG PAPER AND RATE	VALUE
Paper speed	25 mm/s is standard
Box sizes	A small box is 1 mm wide = 0.04 s; a large box is 5 mm wide = 0.2 s, so five small boxes make one large one
Height	1 mV of signal = 10 mm tall at normal gain
Rate from the boxes	300 / the large boxes between two R waves, or 1,500 / the small boxes. Four large boxes is 300 / 4 = 75 beats per minute
Six-second rule	Count the beats in a six-second strip and multiply by 10; the quickest way with an irregular rhythm

Reading instruments, graphs, and trends

- Get your eye level with the mark; looking down or up at a scale adds parallax error
- In a graduated cylinder read the bottom of the curved surface of the liquid, with the cylinder on a flat bench
- Read to the nearest printed graduation, then estimate one more digit; write down the units every time, and let the reading settle first
- Zero or tare the instrument before the first reading; a scale that was not zeroed is wrong by the same amount on every weight
- Read the axis labels and units before the shape of the line; a flat-looking curve can be a huge swing if the scale is small
- A value that creeps in the same direction across several scheduled inspections predicts a failure even while it is still inside tolerance
- In a specification table find the row for the model, then the column for the condition, then read the limit and its units; averages hide outliers, so one bad reading in ten still means one bad device

Flowcharts, narrowing it down, and documentation

- Flowchart shapes: oval start/end, rectangle a step, diamond a yes/no decision, arrows show the order
- Try the simplest, most common cause first: power, battery, connection, consumable, setting
- Change one thing at a time and recheck, so you know what fixed it
- Swap a suspected cable, probe, or accessory for a known-good one; that single test splits the problem in half
- Order: is the patient safe, what did the user see and do, is it the accessory, is it the device. If it works in another room, the fault is not in the device

- Service manual sections you will use: safety notices, specifications, theory of operation, setup and installation, scheduled maintenance procedure and interval, calibration, troubleshooting and error codes, parts list, schematics
- The IFU is written for the clinician, the service manual for you; both are controlled documents, so use the version matching the model and software
- A work order needs: asset identification number, the problem as reported, what you found, what you did, parts used, time spent, a clear pass/fail, your name and date
- If it is not written in the **CMMS** it did not happen; a device released without a documented safety test is a finding at the next survey

05 Safety in healthcare

CURRENT THROUGH THE BODY (60 HZ)		EFFECT	
1 mA		Threshold of perception	
5 mA		Accepted maximum harmless current	
10 to 20 mA		Let-go threshold: muscles clamp, cannot release the conductor	
50 mA		Pain, possible fainting, respiratory arrest	
100 to 300 mA		Ventricular fibrillation likely	
6 A and above		Sustained contraction and burns	
Microshock		10 microamps direct to the heart can cause fibrillation	
IEC 60601-1 LIMIT		NORMAL CONDITION	SINGLE FAULT CONDITION
Earth (ground) leakage		5 mA	10 mA
Touch (enclosure) current		100 microamps	500 microamps
Patient leakage, type B and type BF		100 microamps	500 microamps
Patient leakage, type CF		10 microamps	50 microamps
NFPA 99 AND FACILITY FACT		VALUE	
Ground resistance, chassis to the plug ground pin (NFPA 99)		0.5 ohm maximum for patient-care equipment	
Chassis (touch) leakage, cord-connected patient-care equipment (NFPA 99)		500 microamps in current editions; older editions used 300 or 100 microamps	
Patient care vicinity (NFPA 99)		About 6 ft (1.8 m) out from the bed or chair and 7.5 ft (2.3 m) up from the floor	
GFCI trip (NFPA 99 wet locations)		4 to 6 mA of imbalance between hot and neutral	
Hospital-grade receptacle		Marked with a green dot; checked for retention force and polarity	
Extension cords and cheater adapters		Never used with patient-care equipment; a three-prong to two-prong adapter defeats the ground	
Relocatable power taps		Only where allowed, rated, and secured; never daisy-chained	
Damaged cords and plugs		Remove from service: a cracked plug, missing ground pin, or pinched cord fails inspection on sight	
PROTECTION CLASS OR APPLIED-PART TYPE	WHAT IT MEANS		
Class I / Class II / internally powered	Class I: metal case grounded by a third-wire protective earth; ground continuity is the critical test. Class II: double insulated, no ground pin, marked with a square inside a square. Internally powered: runs on its own battery, isolated from the mains while unplugged		

PROTECTION CLASS OR APPLIED-PART TYPE	WHAT IT MEANS
Type B / BF / CF applied parts	Type B (stick figure): touches the body, not for cardiac connection. Type BF (stick figure in a box): body floating, isolated from earth. Type CF (heart in a box): cardiac floating, safe for a direct heart connection, tightest leakage limits
Defibrillation-proof	Adds the paddle symbol: the applied part survives a defibrillator discharge
Macroshock vs. microshock	Macroshock crosses the skin and takes milliamps to hurt; microshock bypasses the skin through a catheter or lead and needs only microamps

ELECTRICAL SAFETY TEST	ORDER AND NOTES
Full sequence	Visual and cord inspection, ground resistance, chassis leakage in each condition, then patient lead leakage; stop at the first failure and tag the device
Leakage conditions	Normal polarity, reversed polarity, open ground, open neutral; worst with the ground open
When to test	Incoming inspection, after any repair touching the power path or enclosure, and on the scheduled maintenance interval
Trending	Rising leakage or ground resistance means insulation or a cord is failing; compare to the last reading, not only the limit

Lockout/tagout and hazard communication

- **LOTO** steps in order: notify everyone affected, shut the equipment down, isolate the energy source, apply your own lock and tag, release stored energy, verify zero energy before you work
- Stored energy: charged capacitors, compressed gas, springs, hydraulic pressure, raised beds and tables, hot surfaces; one device often has several sources at once
- Verify zero energy with a meter or gauge; an indicator light that is out is not proof the circuit is dead. Only the person who placed a lock removes it, never someone else at shift change
- **GHS** pictograms: flame for flammable, flame over a circle for oxidizer, skull for acute toxicity, corrosion, exclamation mark for irritant, silhouette for a longer-term health hazard, gas cylinder, and environment
- The safety data sheet (**SDS**) for every chemical has 16 numbered sections and must be reachable by staff at any hour; sections you will actually open: 2 hazards, 4 first aid, 5 fire fighting, 7 handling and storage, 8 exposure controls and **PPE**
- **OSHA** requires the labels, **SDS** access, training, and records; cleaning wipes, solvents, battery electrolyte, and compressed gases all count

MEDICAL GAS	FACTS
Colors and uses (United States)	Oxygen (O2) green, for therapy; medical air yellow, ventilator driving gas; nitrous oxide blue, anesthesia; nitrogen black, surgical tools; carbon dioxide gray, insufflation; vacuum or suction white
Oxygen hazard	Supports combustion: no oil, grease, or tape on a fitting, no ignition source nearby
Full E cylinder	About 2,000 to 2,200 psi and about 660 liters of gas
Wall outlets	About 50 psi delivered to the device
Connections	Small cylinders use the pin index safety system (PISS), pipeline outlets use the diameter index safety system (DISS); each gas has its own pattern, no adapters or forcing
Handling	Cylinders chained or racked upright, caps on when not in use, full separated from empty, never free-standing on a cart
Zone valves	Labeled shutoff valves isolating the gas for one area; know their locations

Signs, symbols, and zones

- Ionizing radiation: the three-blade trefoil. Practice **ALARA**: keep exposure time short, stand back, use shielding, wear your dosimeter where the badge belongs
- Laser doors state the class and wavelength; eyewear must match that wavelength, not just be dark. Biohazard symbol marks regulated waste, sharps containers, specimen transport

- **MRI** zones I, II, III, IV run from public to the magnet room, always on even when nothing is scanning (no steel tools, oxygen cylinders, carts); **MR Safe**, **MR Conditional**, **MR Unsafe** labels say whether an item may enter, conditional meaning only under stated limits
- Oxygen in use signs mean no ignition sources. The book-and-hand symbol means consult the instructions; a triangle with an exclamation mark is a general warning

Infection control for the technician

- Hand hygiene first and last, every time, and again after gloves come off
- Standard precautions: treat every patient's blood and body fluids as infectious regardless of diagnosis
- **PPE** on: gown, mask, eye protection, gloves. Off: gloves, eye protection, gown, mask. An N95 respirator, fit tested, is for airborne precautions; a surgical mask is not the same
- Sharps go straight into the sharps container, never in a pocket, a tray, or regular trash
- Spaulding levels: critical items entering sterile tissue are sterilized; semi-critical items touching mucous membranes get high-level disinfection; non-critical items touching intact skin get low-level disinfection
- Clean a device before it reaches your bench, and clean it again before it returns to the floor

Device-specific hazards

- X-ray and **CT**: time, distance, and shielding; stand behind the barrier, wear the dosimeter, never hold a cassette by hand
- Defibrillator: the capacitor holds a lethal charge after charging; call clear, let nobody touch the bed, disarm or dump the charge into the analyzer before opening anything
- Electrosurgery (**ESU**): current returns through a pad, so a partly lifted return electrode concentrates current and burns the patient; check the pad, cable, and alarm
- Centrifuge: never open the lid while the rotor spins; inspect the rotor for cracks and corrosion, keep loads balanced
- Lasers: wavelength-matched eyewear for everyone in the room, door interlocks, no reflective instruments in the beam path
- Fire: **RACE** is rescue, alarm, confine, extinguish. **PASS** is pull, aim, squeeze, sweep. Classes: A ordinary combustibles, B flammable liquids, C energized electrical, K kitchen oils
- Mechanical: beds, tables, and lifts have pinch points and heavy moving parts; block them before reaching in, lift with your legs, get help for anything awkward

06 Medical devices and test equipment

DIAGNOSTIC DEVICE	WHAT IT DOES	A KEY CHECK
Otoscope	Lights and magnifies the ear canal	Lamp, battery or charger contacts, clean specula
Ophthalmoscope	Lights and focuses on the back of the eye	Lamp, lens detents, optics cleaned with lens tissue only
Thermometer	Reads temperature by thermistor probe, oral/axillary/rectal, or infrared ear/forehead; disposable single-use strip	Compare against a reference thermometer; probe type must match device
Scale	Weighs a patient standing, sitting, or in a bed	Zero empty; check with certified weights at low, middle, high load
Bladder scanner	Ultrasound measurement of urine volume left in the bladder	Probe surface, battery, stored reference check
EKG cart	Records the twelve-lead diagnostic tracing on paper or to the chart	Lead wires and cable continuity, paper and print quality, simulator tracing on every lead
Microscope	Magnifies specimens for the laboratory	Illumination, stage movement, clean objectives, no fingerprints
Centrifuge	Spins samples to separate them by density	Speed with a tachometer, timer accuracy, lid interlock, rotor condition

Normal values, the clinical device, and the verification tool for **ECG**, **NIBP**, **SpO2**, **EtCO2**, and temperature are on the anatomy vital-sign table above. Telemetry: verify with a simulator through the transmitter after checking signal strength and battery; a dropout is usually a dead battery or a coverage hole. Common false alarms: a loose or dried electrode reads as asystole or lead-off; a small cuff or a moving arm reads high; motion, poor perfusion, cold fingers, or nail polish upset **SpO2**; water in the **EtCO2** sample line; a temperature probe off the patient reads room air.

THERAPEUTIC DEVICE	WHAT IT DELIVERS	SETTINGS	THE MAINTENANCE CHECK
Large-volume infusion pump	Fluid or medication into a vein	Rate in mL/h, volume to be infused	Flow accuracy, occlusion pressure, alarms, battery runtime
Syringe pump	Very small, precise volumes from a syringe	Rate, syringe brand and size	Correct syringe profile, plunger grip, low-rate flow accuracy
PCA pump	A patient-pressed dose with lockouts	Dose, lockout interval, hourly limit	Lockout timing, key and lock security, dose history log
Feeding pump	Formula into the stomach or intestine	Rate and volume	Flow accuracy; connector deliberately incompatible with a vein line
Suction regulator	Negative pressure to remove fluid	Vacuum level, continuous or intermittent	Gauge accuracy against a reference, leak check, canister and filter
Defibrillator and AED	A measured shock to restart an organized rhythm	Energy in joules, synchronized or not, pacing on some units	Delivered energy, charge time, sync, battery, pads in date, self-test log
Patient warming and cooling	Warm or cool air or water to hold body temperature	Set temperature and a high limit	Temperature accuracy, over-temperature cutoff, filters, hose condition
Sequential compression device (SCD)	Timed squeeze on the legs to keep blood moving	Pressure and cycle time	Pressure accuracy, hose and sleeve leaks, cycle timing
Therapy equipment: TENS and CPM	TENS: pulses for pain. CPM: moves a joint through a set range	Pulse amplitude and rate; range of motion and speed	Output level, electrode and cable condition, range limits and the stop control

DEFIBRILLATOR NUMBER	VALUE
Biphasic adult shock	120 to 200 J, depending on the manufacturer's protocol
Monophasic adult shock	360 J
Pediatric settings	Lower and weight based, chosen by the clinician
Analyzer load	The analyzer presents a 50 ohm load, standing in for the patient's chest
Charge time	Timed from the charge button to the ready tone; a slow charge usually means an aging battery or capacitor
Synchronized mode	Times the shock to the QRS complex for an organized rhythm; a chaotic rhythm gets unsynchronized defibrillation. Compare delivered joules at low, middle, and maximum settings against tolerance

INFUSION NUMBER OR ALARM	MEANING
Rate	Programmed in mL/h; the pump moves the set volume per hour, not drops per minute
Volume to be infused (VTBI)	How much to give before the pump stops and alarms
Keep vein open (KVO)	A small trickle after the volume finishes so the line does not clot
Flow accuracy check	Collect into a graduated cylinder for 30 minutes and double it, or use an infusion analyzer; typical spec is plus or minus 5%
Occlusion alarm	Pressure above the threshold: a clamp left closed, a kink, or a blocked site

INFUSION NUMBER OR ALARM	MEANING	
Air-in-line alarm	The ultrasonic detector sees bubbles; purge the set on setup	
Free-flow protection	The set clamps itself when removed from the pump, so gravity cannot dump the bag into the patient	
HAND TOOL	THE JOB	THE MISUSE TO AVOID
Graduated cylinder	Measuring collected volume for a flow check	Reading it above eye level
Stopwatch	Timing a collection, a charge, or a cycle	Starting it late, which shortens the interval
Allen (hex) keys, metric and SAE	Socket-head screws on covers and shafts	Forcing a metric key into an SAE socket
Torque wrench	Tightening to a value in inch-pounds or newton-meters	Using it as a breaker bar, or guessing the value
Channel locks	Gripping large round fittings and nuts	Turning finished hardware with them; use a wrench
Needle-nose pliers	Reaching, bending, and holding small parts	Cutting hard wire with the tips
Diagonal cutters	Cutting wire and ties flush	Prying or twisting with them
Wire stripper	Removing insulation at the right gauge notch	Using a knife or wrong notch, nicking the copper
Vice grips	Clamping a part or a stuck fastener temporarily	Using them on good hardware as a wrench
Torx and security bits	Opening medical enclosures that are meant to stay closed to users	Driving a Torx screw with a flat blade
Nut drivers	Hex-head screws and standoffs in cases	Reaching for pliers, marking the hardware
TEST INSTRUMENT	WHAT IT VERIFIES	HOW TO USE IT
Digital multimeter (DMM)	Voltage, current, resistance, continuity	Volts with power on, amps in series with the circuit, ohms and continuity only with power off
Electrical safety analyzer	Ground resistance and leakage currents	Sequence: visual, ground resistance, chassis leakage in each fault condition, patient lead leakage
Patient simulator	Monitors and recorders, by producing ECG , SpO2 , respiration, NIBP , and temperature signals	Supplies signals, draws no current from the patient; tests the monitor, not patient-circuit safety
Defibrillator analyzer	Delivered energy, charge time, synchronization	Discharge into its 50 ohm load and compare joules at several settings
Infusion analyzer	Flow rate and occlusion pressure	Or a graduated cylinder and a stopwatch when no analyzer is free
Tachometer	Rotational speed in RPM	Optical or contact reading on a centrifuge or blower
Calibration weights	Scales	Certified weights at low, middle, high load; weights carry their own due date
Pressure meter or manometer	Cuffs, suction regulators, and gas regulators	Tee in at the patient connection to read what the patient would see

Every piece of test equipment carries its own calibration sticker and due date; check the sticker before you check the device.

Incoming inspection, in order

- Check the shipment against the packing slip and purchase order first
- Inspect physically for shipping damage, then confirm the model, serial number, and voltage rating

- Account for accessories, batteries, cords, and manuals; file the service manual and the **IFU**
- Assign an asset tag and create the record in the **CMMS** with model, serial, location, owner, and the maintenance schedule
- Perform the electrical safety test; record the numbers as the baseline
- Perform the function test from the manual; set configuration, alarm limits, and clock as the department wants
- Train the users or arrange the in-service, then release and document it

Scheduled maintenance (PM) and first checks, in order

- **PM** visual inspection: case, cord, plug, strain relief, connectors, labels, wheels, filters, anything missing
- Clean the device and its filters, inside and out as the manual allows
- Electrical safety test: ground resistance and leakage, compared against the limit and the previous reading
- Function and performance checks against the manual's tolerances, using calibrated test equipment
- Replace the consumables on the list: batteries, filters, seals, tubing, dated accessories
- Apply the inspection label with the date due; document results, parts, and time in the **CMMS**
- First checks: is it powered (plugged in, switch on, breaker set, battery charged, outlet live)
- Fuse or breaker on the device, and if a fuse blew, why; cables and connectors reseated, checked for bent pins, cuts, strain
- Swap the accessory, probe, or lead wire for a known-good one before opening the device
- User or device: watch the task performed the way the clinician does it
- Look up the error code, note the exact wording, restart only after recording the state
- Know when to stop: escalate to the vendor or a senior technician, and document everything either way

07 Healthcare IT

COMPUTER PART	WHAT IT DOES
Core components	CPU : processor that runs instructions, speed and cooling set performance. RAM : fast working memory, volatile, gone when power drops. GPU : draws the display, matters on imaging review workstations. Power supply: converts wall AC into the board's DC voltages; a failing one causes random reboots. Motherboard: the board everything plugs into, carrying the buses between parts
Storage, firmware, software, and peripherals	HDD : spinning magnetic drive with moving parts, clicking is its warning. SSD : solid-state, no moving parts, better on a cart that gets bumped. BIOS/UEFI : firmware that starts the machine and finds the boot device. Operating system and drivers: the operating system manages hardware and runs applications; drivers let it talk to one specific device, and wrong or missing drivers are the classic after-update failure. Printers: local by USB , network with its own IP address

CONNECTOR	WHERE YOU SEE IT
USB-A, USB-B, USB-C, micro-USB	Rectangular host, square-ish device, the reversible oval, small legacy plug on handhelds
HDMI and DisplayPort	Current digital video and audio to a monitor
VGA and DVI	Older video: VGA is analog with a blue fifteen-pin shell, DVI is the white digital connector
RJ45	The eight-pin network jack on Cat5e or Cat6 cable
Fiber	Glass strands for long runs and for electrical isolation between buildings
RS-232 serial, often on a DB9 shell	The nine-pin serial port still used to configure and pull data from medical devices

NETWORK TERM	MEANING
LAN and WAN	A LAN is one building or campus; a WAN links sites across distance
Switch	Connects wired devices inside a LAN and forwards traffic only to the port that needs it
Router and default gateway	A router joins networks; the default gateway is where a device sends traffic bound for another network

NETWORK TERM	MEANING
IP address and subnet mask	The address identifies the device; the mask says which part of it is the network
DHCP	Hands out addresses automatically; medical devices often get a reservation so the address never changes
DNS	Turns names into addresses; if an address works but the name does not, suspect DNS
Wi-Fi and Bluetooth	Wi-Fi: 2.4 GHz reaches farther, 5 GHz is faster with less interference, secured with WPA2 or WPA3 . Bluetooth: short-range pairing for probes, printers, handheld scanners
RFID and RTLS	Tags and readers that locate equipment; a real-time location system is how a hospital finds its pumps
VLAN and VPN	A VLAN is a logical network inside the switch; medical devices usually live on their own. A VPN is an encrypted tunnel, how a vendor reaches a device for remote service
IDF, MDF, racks, and patch panels	MDF is the building's core data room; IDF is the floor closet feeding the jacks. Rack units hold the gear; the patch panel is where every wall jack terminates and gets a short cable to a switch port
WMTS	Protected radio bands reserved for patient telemetry so consumer devices cannot step on them
COMMAND	WHAT IT TELLS YOU
ipconfig	The device's own IP address, subnet mask, and default gateway, which is where every network call starts
ping	Whether a destination answers, how long it takes, and how many packets were lost; ping the gateway first, then the server
Same subnet or not	With a /24 mask, devices sharing the first three numbers of the address are on the same subnet and can talk without a router

Privacy and security habits

- **HIPAA** protects **PHI**, any health information tied to a person: name, dates, identifiers, images, readings on a screen
- Minimum necessary: see and share only what the job requires, including a technician at a bedside
- The privacy rule governs who may see **PHI**; the security rule requires administrative, physical, and technical safeguards; a breach has reporting duties with deadlines
- The **EMR** is the patient's electronic chart; device integration pushes vitals and waveforms into it, so a wrong patient assignment becomes a charting error
- Wipe or destroy storage before a device leaves for trade-in, loan return, or disposal; a certificate of destruction or documented multi-pass overwrite (a **DoD** wipe) is the record
- No patient details in photos, texts, or work order notes, or on a screen in the background; an outside service company handling **PHI** signs a business associate agreement first
- Lock the screen every time you walk away, even for a minute at a nurse station
- Long passphrases, unique per system, with multi-factor authentication (**MFA**) wherever offered
- Phishing arrives as urgency plus a link: do not click, do not reply, report it as your facility asks
- Patch medical devices only on the vendor's validated schedule; an unapproved update can take a device out of service or spec
- No unknown **USB** drives in a clinical machine, and no personal drives for transferring device data
- Firewalls at the edge and a separate **VLAN** for devices that cannot be patched; least privilege on every account
- Report a suspected incident immediately, disconnect the device if told to, and do not try to clean it yourself

08 Your career

CREDENTIAL	WHAT IT IS FOR	WHEN YOU QUALIFY
CABT	Entry-level proof of fundamentals; the credential this course targets (exam facts above)	Now: high school junior or above, no experience required

CREDENTIAL	WHAT IT IS FOR	WHEN YOU QUALIFY
CBET	The working technician's credential, named in most job postings	Candidate: an associate degree in electronics/technology/science, a United States military BMET program, or two years of full-time BMET work (five years to finish). Full certification: that degree plus two years of BMET work, the military program plus two years, or four years of BMET work alone. 165 questions, 3 hours, May and November, \$410 member/\$460 non-member, recertified every 3 years
CRES	The imaging specialist: radiography, fluoroscopy, and the high-voltage side of the shop	After experience in imaging service. Also 165 questions in 3 hours
CHTM	The management credential: budgets, staff, regulations, and program strategy	After experience leading a healthcare technology management program

Where the jobs are

- Hospital in-house **HTM**, a mixed bench and the most common first job; independent service organization (**ISO**), contract service across facilities with more travel; manufacturer field service (**OEM**), one product line with factory parts, tools, and training; military and government; clinics, surgery centers, and dialysis, small fleets where you are often the only technician.

Your first ninety days

- Shadow everyone you can and write down what you see; the hospital's own habits are not in any manual
- Learn the **CMMS** the first week: open, update, close a work order, and find the equipment history
- Document everything you touch, including calls that turned out to be nothing
- Ask before you guess, especially near a patient; nobody is upset about a question, everybody remembers a mistake
- Do the safety habits every time until boring: hand hygiene, the visual check, the safety test, the label, the record
- Keep a notebook of error codes, part numbers, and who to call; record the exact wording of a code and what the device was doing

09 Acronyms

Every acronym used in this course, 104 in all. In lessons and on this sheet, hover over an acronym for the short version; click it, or click one below, for the longer explanation.

ACRONYM	STANDS FOR	MEANING
AAMI	Association for the Advancement of Medical Instrumentation	The standards body for medical equipment and the sponsor of the technician credentials.
AC	Alternating current	Power that reverses direction many times a second; wall power is AC.
ACI	AAMI Credentials Institute	The body inside AAMI that writes and administers the certification exams.
AED	Automated external defibrillator	A defibrillator that reads the rhythm itself and advises a shock only when one will help.
ALARA	As low as reasonably achievable	The radiation safety principle: keep every dose as small as the work allows.
AV	Atrioventricular	The node that relays the signal between the upper and lower chambers of the heart.
AWG	American wire gauge	The numbering system for wire thickness, where a lower number means a thicker wire.
BF	Body floating (applied part)	An applied part isolated from earth, safe on the body but not for a direct heart connection.
BIOS	Basic input output system	The firmware that starts a computer and hands control to the operating system.
BMET	Biomedical equipment technician	The person who inspects, repairs, and verifies the medical equipment a hospital uses.
CABT	Certified Associate in Biomedical Technology	The entry-level ACI credential: 100 questions, 2 hours, remote proctored, no experience required.
CBET	Certified Biomedical Equipment Technician	The technician-level credential: full certification needs a qualifying degree or program plus two years of work, or four years of work alone.
CF	Cardiac floating (applied part)	The applied-part type rated for a direct connection to the heart, with the tightest leakage limits.

ACRONYM	STANDS FOR	MEANING
CHTM	Certified Healthcare Technology Manager	The ACI credential for people who run an equipment program rather than work the bench.
CMMS	Computerized maintenance management system	The database that holds every asset, work order, maintenance schedule, and repair record.
CO2	Carbon dioxide	The gas the body gives off as waste; measured in exhaled breath by a capnograph.
COM	Common	The multimeter jack the black test lead stays in for every measurement.
CPM	Continuous passive motion	A machine that moves a joint slowly through a set range after surgery.
CPR	Cardiopulmonary resuscitation	Chest compressions and rescue breathing that keep blood moving until an organized rhythm returns.
CPU	Central processing unit	The processor that executes the instructions in a computer.
CRES	Certified Radiology Equipment Specialist	The ACI credential for imaging equipment: radiography, fluoroscopy, and high-voltage systems.
CT	Computed tomography	An imaging scanner that takes many X-ray views and builds cross-section images.
DB9	Nine-pin D-subminiature connector	The nine-pin D-shaped plug that carries a serial connection on older equipment.
DC	Direct current	Current that flows steadily in one direction, as from a battery or a power supply output.
DHCP	Dynamic Host Configuration Protocol	The service that hands out IP addresses automatically when a device joins a network.
DISS	Diameter index safety system	Gas-specific threaded fittings that keep the wrong gas from being connected to a pipeline outlet.
DMM	Digital multimeter	The handheld meter that reads voltage, current, resistance, and continuity.
DNS	Domain Name System	The service that turns a name into an IP address.
DoD	Department of Defense	Its data-wiping specification became the common name for a multi-pass overwrite of a drive.
DVI	Digital Visual Interface	An older digital video connector, usually a white plug with a wide pin field.
ECG	Electrocardiogram or electrocardiography	The recording of the heart's electrical activity through electrodes on the skin.
EEG	Electroencephalogram or electroencephalography	The recording of the brain's electrical activity through electrodes on the scalp.
EKG	Electrocardiogram	Another spelling of the heart tracing, from the German form of the word.
EMR	Electronic medical record	The patient's electronic chart, where device readings and clinician notes live together.
ESD	Electrostatic discharge	The static spark that can destroy a chip you cannot see any damage on.
ESU	Electrosurgical unit	The generator that cuts and seals tissue with high-frequency current during surgery.
EtCO2	End-tidal carbon dioxide	The carbon dioxide measured at the end of a breath, normally 35 to 45 mmHg.
GFCI	Ground fault circuit interrupter	A receptacle or breaker that cuts power when current leaks out of the intended path.
GHS	Globally Harmonized System of classification and labelling of chemicals	The international scheme behind the chemical pictograms and the sixteen-section safety data sheet.
GPU	Graphics processing unit	The processor that draws the display, and the part that matters on imaging workstations.
HDD	Hard disk drive	Storage built around spinning magnetic platters and a moving head.
HDMI	High-Definition Multimedia Interface	The common digital connector that carries video and audio on one cable.
HIPAA	Health Insurance Portability and Accountability Act	The US law that sets the rules for protecting patient health information.
HIV	Human immunodeficiency virus	One of the three bloodborne viruses the exposure rules are written around.
HL7	Health Level Seven	The long-standing messaging standard that carries patient and clinical data between hospital systems.
HTM	Healthcare technology management	The modern name for the department and the discipline that manages medical equipment.
IDF	Intermediate distribution frame	A floor or wing data closet that feeds the wall jacks around it.
IEC	International Electrotechnical Commission	The body behind IEC 60601-1, the safety standard medical electrical equipment is built to.
IFU	Instructions for use	The manufacturer's manual written for the clinician who operates the device.
IP	Internet Protocol address	The numeric address that identifies a device on a network.
ISO	Independent service organization	A third-party company that services equipment under contract instead of the hospital or the maker.
IT	Information technology	The computers, networks, and software side of the hospital, and the department that runs it.
KVO	Keep vein open	A very slow infusion rate that keeps a line from clotting after the main dose finishes.
LAN	Local area network	The network inside one building or campus.
LED	Light-emitting diode	A diode that gives off light when current passes through it the right way.
LOTO	Lockout and tagout	Locking an energy source off and tagging it so nobody can start the equipment while you work.
MAP	Mean arterial pressure	The average pressure in the arteries over a heartbeat, estimated from the two cuff numbers.
MDF	Main distribution frame	The building's core data room, where the floor closets and the outside circuits come together.
MFA	Multi-factor authentication	Proving who you are with two different kinds of evidence, not just a password.
MR	Magnetic resonance	The labeling prefix for whether an item may enter a magnet room: safe, conditional, or unsafe.
MRI	Magnetic resonance imaging	Imaging that uses a very strong magnet instead of radiation, and the magnet is always on.
NFPA	National Fire Protection Association	The body behind NFPA 99, the health care facilities code that sets the in-hospital electrical limits.
NIBP	Non-invasive blood pressure	Blood pressure measured with an inflating cuff rather than a catheter in an artery.

ACRONYM	STANDS FOR	MEANING
O2	Oxygen	The gas patients need, piped in green-coded lines in the United States.
OEM	Original equipment manufacturer	The company that built the device, and the source of its factory parts and training.
OSHA	Occupational Safety and Health Administration	The US agency whose rules protect workers, including technicians at a hospital bench.
PASS	Pull, aim, squeeze, sweep	How to use a fire extinguisher: pull the pin, aim low, squeeze, sweep across the base.
PCA	Patient-controlled analgesia	A pump that lets the patient press a button for a pain dose inside programmed limits.
PDF	Portable document format	The fixed-layout file that service manuals and instructions for use are distributed in.
PHI	Protected health information	Any health information that can be tied back to a person.
PISS	Pin index safety system	The pin-and-hole pattern that keeps a small gas cylinder from accepting the wrong yoke.
PM	Preventive maintenance	The scheduled inspection, testing, and service a device gets before it fails.
PPE	Personal protective equipment	The gown, mask, eye protection, and gloves that stand between you and an exposure.
QR	Quick response code	The square two-dimensional barcode on asset tags and labels that a phone camera can read.
QRS	QRS complex	The tall spike on a heart tracing, made by the lower chambers firing.
RACE	Rescue, alarm, confine, extinguish	What to do when you find a fire in a hospital, in order.
RAM	Random access memory	A computer's fast working memory, and it is volatile: content is lost when power drops.
RFID	Radio frequency identification	Tags read by radio, used to identify and track equipment and supplies.
RJ45	Registered jack 45	The eight-pin network plug on the end of an Ethernet cable.
RMS	Root mean square	The effective value (the DC voltage that would deliver the same power) of an alternating voltage or current.
RPM	Revolutions per minute	How fast something turns; the number a tachometer reads on a centrifuge or a blower.
RS-232	Recommended Standard 232 (serial communication)	The old serial standard still used to configure medical devices and pull their stored data.
RTLS	Real-time location system	The system that tells a hospital where its mobile equipment actually is.
SA	Sinoatrial	The heart's own pacemaker node, in the upper right chamber.
SAE	Society of Automotive Engineers	The fractional-inch sizing on hand tools, as opposed to metric sizing.
SCD	Sequential compression device	Sleeves that squeeze the legs in a timed cycle to keep blood from pooling.
SDS	Safety data sheet	The sixteen-section document that describes a chemical's hazards and what to do about them.
SpO2	Peripheral oxygen saturation	The percentage of hemoglobin carrying oxygen, measured with a light probe, normally 95 to 100%.
SSD	Solid-state drive	Storage with no moving parts: faster, quieter, and far better on a cart that gets bumped.
SSID	Service set identifier	The name a wireless network broadcasts so that devices know what to join.
STAR	Situation, task, action, result	A way to answer an interview question so the story has a point.
TENS	Transcutaneous electrical nerve stimulation	Small electrical pulses through skin electrodes to reduce pain.
UEFI	Unified Extensible Firmware Interface	The modern replacement for a computer's startup firmware.
UPS	Uninterruptible power supply	Batteries and an inverter that carry equipment through a power interruption.
USB	Universal Serial Bus	The connector family that carries data and power to nearly every peripheral.
VGA	Video Graphics Array	The old analog video connector, a blue fifteen-pin plug with thumbscrews.
VLAN	Virtual local area network	A separate logical network inside the same switches, used to keep device traffic apart.
VPN	Virtual private network	An encrypted tunnel across an untrusted network, and the proper way in for remote service.
VTBI	Volume to be infused	The total volume a pump is told to deliver before it stops and alarms.
WAN	Wide area network	The network that links separate sites across distance.
Wi-Fi	Wireless networking (the certification brand for the wireless standards)	The radio network that carries wireless devices onto the hospital network.
WMTS	Wireless Medical Telemetry Service	Radio bands reserved for patient telemetry so consumer devices cannot interfere.
WPA2	Wi-Fi Protected Access 2	The long-standing wireless security standard, still widely used and acceptable.
WPA3	Wi-Fi Protected Access 3	The current wireless security standard, with a stronger handshake than the version before it.