

| <b>CCDS Exam Content Outline</b>  |            |
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| <b>1. Fundamentals of Electrophysiology and Electronics</b>   | <b>5%</b>  |
| 1.A. Anatomy and Physiology of the Heart and Conduction System  |            |
| 1.A.1. Basic anatomy (e.g., Bachman's bundle, RAA, RVOT, RV Septum, RVA, CS, cardiac veins, epicardial pacing)            |            |
| 1.A.2. Common congenital anomalies  |            |
| 1.B. Pathophysiology and Mechanisms of Action of Dysrhythmias   |            |
| 1.C. Electrophysiology of Dysrhythmias (e.g., recognition, management, treatment)   |            |
| 1.C.1. Re-entry circuits  |            |
| 1.C.2. Triggered arrhythmias  |            |
| 1.D. Pharmacology   |            |
| 1.D.1. Drug effects on device function (e.g., impact on pacing and defibrillation thresholds, impact on pacing frequency) |            |
| 1.D.2. Drug effects on cardiac rhythm and conduction  |            |
| 1.D.3. Anticoagulation  |            |
| 1.E. Electronics (e.g., sensing, stimulation, defibrillation)   |            |
| 1.E.1. Basic quantities (e.g., ampere, charge, ohm, volt, hertz)  |            |
| 1.E.2. Derived quantities (e.g., resistance, capacitance, battery capacity)   |            |
| 1.E.3. Relationships (e.g., Ohm's Law, power, energy)   |            |
| 1.E.4. Wave Forms   |            |
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| <b>2. Applied Science and Technology</b>  | <b>30%</b> |
| 2.A. Pulse Generators   |            |
| 2.A.1. Energy sources (e.g., battery chemistry and rationale)   |            |
| 2.A.2. Electronic circuit components; capacitors, resistors, diodes   |            |
| 2.A.3. Sensors (e.g., motion/accelerometer, MV, impedance [CLS])  |            |
| 2.A.4. Software (Firmware)  |            |
| 2.A.5. Charge time  |            |
| 2.B. Leads and Electrode Material   |            |
| 2.B.1. Insulation (e.g., silicone, urethanes, hybrids)  |            |
| 2.B.2. Conductors (e.g., composition coaxial, cable, coradial)  |            |
| 2.B.3. Connectors/Adapters (e.g., IS1, DF-1, DF4, LV-4)   |            |
| 2.B.4. Electrodes (e.g., active, passive, steroid elution, OTW, tip coating)  |            |
| 2.B.5. Quadripolar Pacing/Multipoint Pacing (MPP)   |            |

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| 2.B.6. Shock coil (e.g., integrated versus true bipolar)   |  |
| 2.C. Sensing   |  |
| 2.C.1. Cardiac signals (EMGs, sensing amplifiers, filters, slew rate, far field, cross-chamber)  |  |
| 2.C.2. Extracardiac signals (e.g., myopotentials, EMI)   |  |
| 2.D. Stimulation   |  |
| 2.D.1. Anode/Cathode stimulation   |  |
| 2.D.2. Stimulation/Defibrillation threshold  |  |
| 2.D.3. Acute to chronic shift  |  |
| 2.D.4. Ohm's law (e.g., calculation of current, voltage, impedance)  |  |
| 2.D.5. Application of strength duration curve, stimulation threshold, and the Wedensky effect  |  |
| 2.D.6. Power and energy  |  |
| 2.D.7. Diaphragmatic stim, vagal stim, and phrenic nerve stim  |  |
| 2.E. Timing Cycles   |  |
| 2.E.1. Single chamber  |  |
| 2.E.2. Dual chamber (e.g., ventricular based, atrial based, hybrid)  |  |
| 2.E.3. Rate modulation   |  |
| 2.E.4. CRT (Biventricular)   |  |
| 2.E.5. NBG code  |  |
| 2.E.6. Leadless devices timing cycle   |  |
| 2.F. Algorithms  |  |
| 2.F.1. Bradycardia/Tachycardia pacing therapy  |  |
| 2.F.2. Tachyarrhythmia detection   |  |
| 2.F.3. SVT discrimination  |  |
| 2.F.4. Antitachyarrhythmia pacing  |  |
| 2.F.5. CRT programming strategies (e.g., multi-point pacing, anodal stim, offset)  |  |
| 2.F.6. Physiologic pacing strategies (e.g., HIS, LBB pacing)   |  |
| 2.F.7. Algorithms for special situations (e.g., MRI)   |  |
| 2.F.8. Indication based device selection and programming   |  |
| 2.G. Defibrillation Concepts (e.g., R on T, high-frequency, upper limits, single versus dual-coil leads, thresholds, patient selection, therapy programming) |  |
| 2.G.1. S-ICD (e.g., limitations, selecting appropriate vector, screening and patient selection, recalls)   |  |
| 2.G.2. Wearable ICD  |  |

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| 2.H. Physiologic Monitors (Implantable) (e.g., implantable loop recorders)   |              |
| 2.I. Wearable Monitors   |              |
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| <b>3. Electrocardiography</b>  | <b>4%</b>    |
| 3.A. Electrocardiogram   |              |
| 3.A.1. Paced rhythms (e.g., normal pacing, location of pacing, RV outflow track, CRT, selective and non-selective HIS, left bundle branch pacing)  |              |
| 3.A.2. CIED malfunction  |              |
| 3.A.3. Pseudo-malfunction (e.g., upper rate behavior, AV hysteresis, pacing into physiologic non-capture, reverse mode switching, sleep mode)  |              |
| 3.A.4. ECG magnet application  |              |
| 3.A.5. ECG for challenging device interrogation  |              |
| 3.B. Recognition of Dysrhythmias (e.g., device mediated vs native dysrhythmias)  |              |
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| <b>4. Clinical Assessment</b>  | <b>3.5%</b>  |
| 4.A. History   |              |
| 4.A.1. Patient history (e.g., patient symptoms, past medical history, medication history, family history, occupation and lifestyle)  |              |
| 4.A.2. Device system history (e.g., patient response to device therapy, abandoned leads, original indication for implant, date/type of implant, previous implants, revisions and replacements) |              |
| 4.A.3. History of arrhythmia (e.g., rate versus rhythm control, pacer dependent or not, history of ventricular tachyarrhythmia, pacing burden/percentage trends)                               |              |
| 4.B. Physical Exam   |              |
| 4.C. Diagnostic Tests to Determine Underlying Pathology and Appropriate Device Selection   |              |
| 4.C.1. Invasive  |              |
| 4.C.2. Noninvasive   |              |
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| <b>5. Perioperative Practice/Clinical Practice</b>   | <b>22.5%</b> |
| 5.A. Indications for Device Therapy and Placement  |              |
| 5.A.1. Bradyarrhythmias  |              |
| 5.A.2. Tachyarrhythmias  |              |
| 5.A.3. Syncope/A-Fib (for ILRs)  |              |
| 5.A.4. Major pediatric indications   |              |

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| 5.B. Chronic Heart Failure   |  |
| 5.B.1. Systolic  |  |
| 5.B.2. Diastolic   |  |
| 5.B.3. Electrical dyssynchrony   |  |
| 5.B.4. Tachycardia mediated  |  |
| 5.B.5. Congenital  |  |
| 5.B.6. Pacing induced cardiomyopathy   |  |
| 5.B.7. Programming considerations with heart failure cardiac devices (e.g., LVADs, CardioMEMS, Cardiac Contractility Modulation [CCM]) |  |
| 5.C. Device and Feature Selection  |  |
| 5.C.1. Sinus node dysfunction (e.g., atrial bradyarrhythmia)   |  |
| 5.C.2. Atrioventricular block  |  |
| 5.C.3. Hemodynamics  |  |
| 5.C.4. Pacing for tachyarrhythmias   |  |
| 5.C.5. Atrial fibrillation   |  |
| 5.C.6. Neurocardiogenic syncope  |  |
| 5.C.7. MRI compatibility considerations  |  |
| 5.D. Surgical Technique  |  |
| 5.D.1. Patient preparation (e.g., informed consent, documentation, chart review)   |  |
| 5.D.2. Implantation  |  |
| 5.D.2.a. intraoperative testing  |  |
| 5.D.2.b. surgical procedure (e.g., lead placement)   |  |
| 5.D.2.c. sedation (e.g., IV analgesia, monitoring requirements)  |  |
| 5.D.2.d. DFT testing (e.g., yes/no, typical DFT versus upper limit of vulnerability)   |  |
| 5.D.2.e. subcutaneous  |  |
| 5.D.2.f. leadless pacemaker  |  |
| 5.D.2.g. venous access   |  |
| 5.D.2.h. coronary sinus canulation   |  |
| 5.D.2.i. device pouches/antibiotic envelopes   |  |
| 5.D.2.j. epicardial lead placement   |  |
| 5.D.2.k. optimal electrophysiologic LV lead placement sites (e.g., QLV, RVLV delay)  |  |
| 5.D.2.l. physiologic pacing sites  |  |
| 5.D.3. Lead/pulse generator removal/extraction   |  |

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| 5.D.3.a. tools for extraction (e.g., lead locking stylets, powered sheaths, snaring tools, bridge balloon, laser versus mechanical tools) |            |
| 5.E. Surgical Complications   |            |
| 5.E.1. Intraoperative   |            |
| 5.E.2. Postoperative  |            |
| 5.F. Pediatric Pacing (e.g., congenital anomalies/surgical issues)  |            |
| 5.G. End of Life Issues (e.g., defibrillator deactivation, pacing therapy withdrawal, cremation, device reuse) <i>[English exam Only]</i> |            |
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| <b>6. Safety</b>  | <b>3%</b>  |
| 6.A. Infection Control  |            |
| 6.B. Sterile Technique  |            |
| 6.C. Radiation Safety   |            |
| 6.D. Device EMI Interaction   |            |
| 6.E. Electrocautery   |            |
| 6.F. Other Electronic Devices   |            |
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| <b>7. Patient and Device Follow-Up Management</b>   | <b>28%</b> |
| 7.A. Assessment (e.g., history, appropriate physical exam)  |            |
| 7.B. Diagnostics  |            |
| 7.C. Programming  |            |
| 7.D. Device Assessment/Follow-up  |            |
| 7.D.1. Clinical (e.g., rhythm therapy, rate modulation, hemodynamics)   |            |
| 7.D.2. Technological (e.g., assessment of capture/sensing)  |            |
| 7.D.3. Natural history of pulse generators/leads (e.g., lead maturation, pulse generator longevity, ERI, EOL)                             |            |
| 7.D.4. Programming optimization   |            |
| 7.D.5. Sensing problems (e.g., oversensing, under-sensing, subcutaneous [SUBQ] devices)   |            |
| 7.D.6. Stimulation problems (e.g., failure to capture, anodal capture, phrenic nerve stimulation)   |            |
| 7.D.7. Device troubleshooting and optimization (e.g., patient device interactions, battery life management)                               |            |
| 7.D.8. Acute and chronic lead issues  |            |
| 7.D.9. Mode switch  |            |
| 7.D.10. Pacemaker syndrome (e.g., inappropriate programing)   |            |
| 7.D.11. Epicardial lead follow-up and management  |            |

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| 7.E. Pacing System Complications   |           |
| 7.F. Remote Monitoring   |           |
| 7.F.1. Cyber security  |           |
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| <b>8. Radiology</b>  | <b>4%</b> |
| 8.A. X-ray analysis  |           |
| 8.A.1. Implantation  |           |
| 8.A.2. Follow-up   |           |
| 8.B. Fluoroscopy (e.g., assessing lead placement, LV lead placement)                           |           |
| 8.C. CT scans (e.g., lead perforation, leads in the appropriate chambers, left persistent SVC) |           |
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