

Principles of Applied Engineering YAG

Middle School Program Course | Single-Blocked | Full Year | 36 Weeks | Introduction to Robotics Emphasis

Course Framework: PAE = §127.391 Principles of Applied Engineering. The course provides an overview of engineering and technology systems, communication, safety, technology impacts, design and modeling, robotics/automation, electrical and mechanical systems, teamwork, and drafting. LEGO® Education SPIKE™ is used as a core instructional tool to provide accessible, hands-on applications of mechanisms, sensors, motors, coding, automation, prototype development, testing, and the engineering design process. CTE Employability Skills §127.15(d)(1) are integrated throughout. ACCESS may support engineering and robotics career awareness and future pathway exploration.

GP	Wks	Unit & Focus	Major Learning Tasks & Assessments	Integrated TEKS	Extension Activities
1	1–2	Unit 1 – What Is Engineering? Careers, Teams & Professional Skills	- Explore chemical, civil, electrical and mechanical engineering and how engineers solve problems - Compare engineering, science and technology careers and education/training pathways - Practice teamwork, communication, time management, responsibility and professional behavior - Introduce engineering notebooks and collaborative digital tools - Complete a short LEGO SPIKE team-building design task	- PAE1(A–E) - PAE2(A,E) - PAE3(A–B,F) §127.15(d)(1)	- ACCESS: engineering/robotics career awareness - Engineering career gallery - SPIKE team challenge
1	3–4	Unit 2 – Lab Safety, Measurement & Engineering Tools	- Master classroom/lab safety expectations and PPE terminology - Identify hazardous materials/wastes and appropriate disposal practices - Safely handle, maintain and store laboratory and robotics equipment - Use precision measuring instruments and consistent units - Measure and document LEGO SPIKE components and prototype dimensions	- PAE4(A–H) - PAE6(D) - PAE3(B)	- Safety assessment - Measurement lab - Tool/equipment care routine
1	5–7	Unit 3 – Technological Systems: Inputs, Processes, Outputs & Feedback	- Identify inputs, processes and outputs in everyday technological systems - Differentiate open and closed systems and explain system interactions - Use LEGO SPIKE motors and sensors to model input-process-output relationships - Create simple programs that respond to sensor input - Research an emerging technology and present its system components	- PAE2(B–D,F) - PAE3(A,D,F) - PAE7(A,D)	- SPIKE sensor lab - Systems diagram - Emerging technology mini-presentation
1	8–9	Unit 4 – Engineering Design Process & First Robotics Challenge	- Apply an engineering design process from problem definition through prototype testing - Identify criteria/constraints and use problem-solving techniques - Assess risks and benefits of possible solutions - Build/program a LEGO SPIKE solution to a defined classroom challenge - Document design decisions, tests and improvements in the engineering notebook	- PAE2(G) - PAE6(A,C,E) - PAE3(B) - PAE7(B)	- SPIKE design challenge - Design reflection - Prototype demonstration
2	10–12	Unit 5 – Mechanical Systems: Simple Machines, Gears & Motion	- Describe applications and careers in mechanical systems - Investigate force/motion through gears, wheels/axles, levers, pulleys and other mechanisms - Explore how gear choices affect speed, torque and robot movement - Design and test LEGO SPIKE mechanical mechanisms - Connect mechanical-system trends to robotics and automation	- PAE8(A–C) - PAE6(B–D) - PAE7(A,D)	- Gear/mechanism investigation - SPIKE mobility challenge - Mechanical career research
2	13–15	Unit 6 – Electrical Systems, Electronics, Sensors & Control	- Describe applications and careers in electrical systems - Apply basic electronic theory through circuits, motors, sensors and control - Investigate how sensors provide feedback to robotic systems - Program LEGO SPIKE systems using sensor conditions and motor outputs - Identify emerging trends in electrical systems, robotics and automation	- PAE8(A–D) - PAE7(A,C–D) - PAE2(C–D)	- Sensor-control challenge - Basic electronics activity - Electrical/robotics career spotlight

2	16–17	Unit 7 – Drafting, Sketching & Digital Design for Robotics	• Develop ideas through sketching and computer-aided design/drafting • Create and modify drawings; store/retrieve geometry • Apply appropriate line types, 2-D single views, orthographic multi-view drawings and ANSI dimensioning • Create pictorial and section-view representations and examine standard thread design • Produce a drawing package for a LEGO SPIKE robot or attachment	• PAE3(C–E) • PAE10(A–I)	• Robot drawing package • CAD/sketching activity • Portfolio artifact
2	18	Semester 1 Exam – Principles of Applied Engineering	• Cumulative written/performance assessment • Engineering design, systems, safety, robotics, mechanical/electrical and drafting application • Engineering notebook/portfolio review	• Cumulative: PAE1–8, PAE10 • §127.15(d)(1)	• Targeted review/remediation
3	19–21	Unit 8 – Technology, Society & the Future of Robotics	• Analyze how technology affects individuals, societies, cultures, economies and environments • Connect technological development to historical events • Explain how/why technology progresses and predict possible future changes • Investigate benefits, risks and unintended consequences of robotics and automation • Research emerging robotics technologies and communicate findings	• PAE5(A–D) • PAE2(F) • PAE7(D) • PAE3(A,D,F)	• Robotics impact debate • Future technology forecast • Research presentation
3	22–24	Unit 9 – Materials, Testing & Prototype Improvement	• Identify chemical, mechanical and physical properties of engineering materials • Compare testing methods and select materials for design needs • Use consistent measurements to test prototype performance • Apply risk/benefit analysis and iterative problem solving • Modify LEGO SPIKE robot structures/attachments based on test evidence	• PAE6(B–E) • PAE4(H) • PAE3(B,D)	• Materials investigation • Prototype test report • Redesign challenge
3	25–27	Unit 10 – Robotics, Automation & Process Control Challenge	• Describe applications of robotics, process control and automation systems • Apply design concepts to a multi-step robotics/automation problem • Explore careers and emerging trends in robotics, automation and process control • Program LEGO SPIKE sensors, motors and control logic to complete an autonomous task • Use engineering documentation and testing data to improve reliability	• PAE7(A–D) • PAE2(B–G) • PAE3(A–B,D–F) • PAE6(A,C–E)	• Autonomous SPIKE challenge • Robotics career connection • Testing/data log
4	28–31	Unit 11 – Comprehensive Team Robotics Engineering Project	• Work in engineering teams and rotate project roles • Apply the design process and use decision/design matrices to select solutions • Use collaborative strategies and conflict resolution to make team decisions • Maintain a shared engineering notebook and develop/test a LEGO SPIKE model • Integrate mechanical, electrical, sensor, programming, measurement and documentation skills	• PAE9(A–E) • PAE2(G) • PAE6(A–E) • PAE7–8 • PAE3(B,F)	• Team robotics project • Design matrix • Peer/team review
4	32–33	Unit 12 – Robotics Project Testing, Refinement & Technical Communication	• Test the comprehensive robot against defined performance criteria • Analyze setbacks, troubleshoot problems and refine the design • Develop visualization media, drawings and portfolio evidence • Build consensus around final design changes • Prepare a clear written, verbal and visual technical presentation	• PAE9(C–F) • PAE3(A–F) • PAE6(C,E)	• Performance trials • Troubleshooting/refinement • Presentation rehearsal
4	34–35	Unit 13 – Engineering Portfolio, Careers & Robotics Showcase Preparation	• Finalize engineering notebook and paper/digital portfolio • Select representative sketches, drawings, code, data and project evidence • Revisit engineering/robotics career pathways and emerging technologies • Explain personal strengths, interests and future engineering pathway options • Prepare comprehensive team project presentation and demonstration	• PAE2(E–F) • PAE3(A–F) • PAE7(C–D) • PAE8(B–C) • PAE9(F) • PAE1(A–E)	• ACCESS: future pathway exploration • Portfolio review • Showcase preparation
4	36	Semester 2 Exam & Engineering/Robotics Showcase	• Cumulative written/performance assessment • Comprehensive engineering design and robotics application • Team LEGO SPIKE project demonstration, portfolio and reflection	• Cumulative: PAE1–10 • §127.15(d)(1)	• Family/stakeholder showcase

Principles of Applied Engineering TEKS Coverage Checklist

Coverage verification: All 10 Principles of Applied Engineering strands and every student expectation are intentionally addressed. LEGO SPIKE is used as the primary hands-on robotics platform while the full engineering, communication, safety, technology, systems, design, teamwork, and drafting standards remain represented.

Strand	Student Expectations	YAG Placement	Coverage
PAE1	A–E	Units 1, 13; reinforced throughout	100%
PAE2	A–G	Units 1, 3–4, 8, 10–11, 13	100%
PAE3	A–F	Units 1, 3, 7–10, 12–13	100%
PAE4	A–H	Units 2 and 9; reinforced throughout lab work	100%
PAE5	A–D	Unit 8	100%
PAE6	A–E	Units 2, 4–5, 9–12	100%
PAE7	A–D	Units 3–6, 8, 10–11, 13	100%
PAE8	A–D	Units 5–6, 11, 13	100%
PAE9	A–F	Units 11–13	100%
PAE10	A–I	Unit 7; reinforced through project documentation	100%
CTE Employability	§127.15(d)(1)	Integrated throughout	100%

Implementation Notes

- LEGO Education SPIKE should function as an instructional platform for applying the TEKS, not as a separate robotics curriculum. Students should connect each build or coding task to engineering systems, design, measurement, communication, safety, technology, and career concepts.
- The sequence intentionally begins with highly guided LEGO SPIKE experiences and progresses toward autonomous challenges and a comprehensive team engineering project. Students should have repeated opportunities to build, program, test, troubleshoot, redesign, and communicate solutions.
- Engineering notebooks and portfolios should be maintained throughout the course. Evidence may include sketches, CAD/digital designs, measurements, photographs, code or pseudocode, test data, decision matrices, research, reflections, and presentation materials.
- Robotics receives additional emphasis through PAE7 while mechanical and electrical systems in PAE8 are intentionally taught through robot mechanisms, motors, sensors, control, and basic electronics. The drafting standards in PAE10 remain explicitly taught rather than being replaced by robotics activities.
- Weeks 18 and 36 are reserved for cumulative semester exams. No instructional unit crosses the semester boundary, and no calendar-specific dates are included.