Robotics (Middle School)

Midland ISD | Academic Year: 2025–2026 | Length of Course: [1 Year] **Grades: 7-8**
Number of Credit Hours Middle School Elective **Prerequisite:** Elementary Competitive Robotics Experience Preferred

Course Description

In this hands-on elective, students become engineers, programmers, and innovators as they design, build, and compete with robots in the FIRST Robotics program. Working in collaborative teams, students apply STEM concepts to solve real-world challenges, using the engineering design process to create competition-ready robots. They will program autonomous and driver-controlled functions, analyze game rules and strategies, and document their work in a professional engineering notebook. Along the way, students will practice problem-solving, communication, and leadership skills, while demonstrating the FIRST Core Values of teamwork, inclusion, and innovation. The course culminates in participation in official robotics competitions, where students showcase their technical skills and creativity against teams from across the region. Middle school robotics is a great opportunity to prepare for engineering technology or robotics pathways in high school.

Course Objectives

By the end of this course, students will be able to:

Robotics Engineering & Programming	Apply engineering design principles to plan, build, and refine a competition-ready robot using the FIRST platform. Program autonomous and driver-controlled robot functions using appropriate programming environments (e.g., LEGO Spike Prime, EV3, or FTC programming tools). Integrate sensors, motors, and control systems to perform specific tasks aligned with competition game challenges. Test, troubleshoot, and optimize robot performance through iterative design cycles.

Competition Strategy & Game Analysis	Interpret the current season's FIRST challenge rules, scoring system, and field layout to develop a competitive game strategy. Break down complex competition tasks into achievable engineering and programming goals. Collaborate to create and adapt match strategies based on real-time performance and opponent analysis.
Teamwork, Communication, & Project Management	Work effectively in designated team roles (e.g., builder, programmer, driver, documenter, researcher) to achieve common goals. Use project management tools to plan timelines, assign responsibilities, and meet competition deadlines. Demonstrate professional communication skills during team meetings, design reviews, and competition judging interviews.
Innovation & Problem-Solving	Apply creative thinking to develop unique solutions that enhance robot functionality and efficiency. Use data from test runs and competition matches to make evidence-based improvements. Adapt designs quickly in response to unexpected challenges or rule clarifications.
Core Values & STEM Outreach	Demonstrate the FIRST Core Values: Discovery, Innovation, Impact, Inclusion, Teamwork, and Fun. Represent the team and school positively in competitions and community outreach events. Promote STEM awareness by sharing the robotics experience with peers, younger students, and community members.
Technical Documentation & Presentation	Maintain an engineering notebook or team portfolio that documents design decisions, testing results, and strategic changes. Prepare and deliver concise, organized presentations to judges that reflect both technical skill and teamwork.

Instructional Materials & Supplies (provided in sets)

- LEGO® Education SPIKE™ Prime or LEGO® MINDSTORMS® EV3 Core Sets (1 per team)
- FLL Challenge Set (field mat + mission models, updated annually)
- Extra LEGO Technic elements (beams, gears, axles, connectors)
- Official-sized FLL or FTC game field setup
- Table or rolling cart for FLL field
- Practice space with safe boundaries for FTC robots
- Measuring tools (tape measures, rulers, calipers)
- Engineering notebooks or binders (1 per team)
- Graph paper and pencils for design sketches
- Access to FIRST competition manuals and rule updates
- FIRST LEGO Lesson Plans

Course Outline

UNIT	TOPIC	APPROXIMATE TIME
Weeks 1–2	Overview of FIRST Robotics programs and Core Values Introduction to the current season's game challenge and rules Team role assignments (builder, programmer, driver, notebook manager, researcher, etc.) Safety training for tools and equipment	2 weeks
Weeks 3–4:	Analyzing game objectives and scoring opportunities Brainstorming and sketching robot concepts	2 weeks

	Selecting and prioritizing design features based on strategy Introduction to engineering notebook documentation	
Weeks 5–8	Assembling chassis and drive components Introduction to motors, sensors, and control systems Basic programming for movement and control Testing and refining drivetrain performance	2 weeks
Weeks 9–12	Designing and building game-specific manipulators (arms, claws, shooters, etc.) Integrating sensors for autonomous operation Refining programming for precision and reliability Mid-build design review and troubleshooting Full match scrimmages against other teams	2 weeks
Weeks 13–14:	Programming autonomous routines for scoring in the first 30 seconds Driver control practice with strategy adjustments Simulated match play in practice field Preparing for judging presentations, teamwork interview, and notebook review	2 weeks
Weeks 15–18	Simulated play Semester Project	2 weeks
Weeks 1–4:	Compete in local/regional qualifying events Analyze match performance and identify improvement areas Implement design or code changes between competitions	2 weeks

Weeks 5–6	For FLL: Research, design, and present an innovation project related to the season's theme For FTC: Implement advanced programming techniques (sensors, autonomous navigation, vision processing if applicable)	2 weeks
Weeks 7–8:	Plan and participate in STEM outreach activities for school/community Mentor or demonstrate robotics for younger students or clubs	2 weeks
Weeks 9–10: Post-Season Skill Development	Explore advanced mechanical concepts (gear ratios, torque, stability) Learn advanced coding tools (loops, conditional logic, sensor fusion)	2 weeks
Weeks 11–12	Off-Season Design Challenge Mini in-class competition with modified rules or custom field Focus on creativity, rapid prototyping, and problem-solving	2 weeks
Weeks 13–14	Career & STEM Connections- research STEM careers and report out Guest speakers from engineering, technology, and robotics careers Connections to high school robotics, engineering, and CTE pathways	2 weeks
Weeks 15–18	Reflection and Portfolio Completion Finalize engineering notebooks and digital portfolios	2 weeks

	Self-assessment and peer feedback on teamwork, technical skills, and Core Values End-of-year showcase for parents and community Semester Project/s	

Grading Breakdown

Major assignments are those that allow you to demonstrate mastery of the course objectives. Minor assignments include skill checks, quizzes, homework, and other short assessments that contribute to your overall understanding of the course material.

Category	Percentage
Major Assignments(Tests, Projects)	60%
Minor Assignments (Quizzes / Skills Checks)	40%
Semester Exam / Project	15%

Grade Scale: A = 90–100 | B = 80–89 | C = 70–79 | F = < 70

Semester grades include a grade for each of the three six-week periods and an exam or project that is weighted 15% of the overall semester grade.

Classroom Expectations

- Be on time, prepared, and respectful
- Follow safety protocols (PPE, tools, etc.)

- Use tech when instructed
- Ask questions and engage actively

Attendance & Participation

Attendance is mandatory. You must:

- Attend scheduled classes and labs
- Make up missed work with 1 school day allowed for each excused absence

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Late Work & Make-Up Policy

- Students are allowed one day of make-up time for each day of absence
- Late assignment penalties:
  - 1 School Day Late- Maximum Grade of 90
  - 2 School Days Late- Maximum grade of 80
  - 3-5 School Days Late- Maximum grade of 70
- Missed assessments must be rescheduled

Academic Integrity

Cheating or plagiarism is not tolerated. First offense may result in a zero and parent contact. Further violations follow district policy.

Competitive FIRST Robotics Involvement

Students enrolled in middle school robotics are expected to participate in or contribute to campus FIRST Robotics Competitive Teams:

- ***Description***: Students design, build, and program robots to compete in official FIRST Robotics challenges, applying teamwork, strategy, and STEM skills. ***Activities:*** Teams meet regularly to develop designs, refine code, practice driving, and prepare for competitions.
- ***Requirements:*** Attend and participate in at least one event in the fall and spring.
- **Events:** All events are held locally, unless a team qualifies for Area or beyond. Students do not go on overnight trips with the exception of qualifying for World Robotics.

Parental consent is required for students to participate before or after school or on Saturdays in competitive robotics. Parents must complete this form prior to participation outside of the regular class period.

Permission Form

Safety & Equipment Use

- Always follow safety instructions and wear the required PPE
- Eye and face protection is required when grinding, cutting or in situations where debris may be in the air.
- Report damaged tools/equipment immediately
- Violation of safety protocols may result in removal from the lab and disciplinary action

Schoolwide Systems of Communication

- Progress reports sent every 3 weeks if grade is below 70.
- Grades available in Skyward
- Please email or call with questions or concerns

Acknowledgment of Understanding

Please return this signed page by [Date].

Student Name: ______________________________ **Signature:** ________________________

Class Period: ______________________________ **Date:** ____________________________

Parent/Guardian Name: ____________________________

Signature: ________________________

Preferred Parent Contact (Email/Phone): ___________________________

Parent Email: __________________________________ **Parent Cell:** __________________

See www.midlandisd.net/cte for the annual public notification of nondiscrimination.