Gears Educational Systems, LLC
GEARS-EDS . . . technology education in a box
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An Example Engineering and Technology Program of Studies

Designing and Building a Competitive Machine

A Suggested Program Timetable for 16-26 weeks

Wk	Engineering Class Lectures/Demos	CAD/Eng Drawing	Lab Work	Assignment	Instructor/Manager	Milestones
	Notebook Requirement Explained Geometry Review Measuring mass, weight and density	Sketching and mockups 3 view theory	Shop safety and organization of materials/ Supplies	Create a notebook/web page or slide show folder to contain all documentation.	Prepare Lecture and lesson plan objectives.	Each student has a 2", 3 ring binder, Class and lab facilities are inventoried and in order.
	GEARS –IDS Engineering Resources Identified and explained Mechanical Advantage, Simple Machines and Levers	Drawing tools or work station	Using tools safely Taps and dies	Complete the Geometry Worksheets	Demonstrate GEARS-IDS Components Create storage and organization systems	Define Competitive Machine Games Students can solve area, perimeter and volume problems
	Engineering Class Lectures/Demos	**CAD**	**Lab Work**	**Assignment**	**Instructor/ Manager**	**Milestones**
	The engineering process Algebra Review Measuring speed and acceleration	Intro to CAD Drawing lines and objects Electronic symbols	Build a Motor Dynamometer Using the GEARS-IDS Kit	Measure personal horse power and create a personal efficiency evaluation spreadsheet	Develop Grading Criteria and rubrics Develop engineering challenge or game Ideas.	Game Defined Game Rules Playing field designed. Students can solve mechanical advantage problems
	Electric Motor	Generating	Measure and	Create the playing	Prepare the	Playing field

	Theory Newton's Laws Measuring force and torque	3D Solids	graph motor torque and RPM	field and game materials.	fabrication area	constructed Students know order of operations and can solve basic algebra problems
	Engineering Constraints Work, Power and Energy	Assigning GEARS-IDS Components to be drawn. Create virtual kit of parts	Gear trains Chains and pulleys	Build a mobile robot chassis	Create Motor, Battery and Pneumatics demo's	Game Rules Published Students can compute their own power output
	Battery specifications and capacity Measuring Current, voltage and resistance.	Continue drawing components	Using a Multimeter	Discharge and plot AA battery discharge curve. Calculate total energy output	Create testing and demonstration modules for batteries	Students have completed mobile chassis Students can solve basic force problems
	Electro Magnetism and Motors Evaluating DC circuits using Ohm's Law	Blocking: virtual "Mock ups" with 3D solids	Build a Fixed Magnet DC motor	Basic Electronics work sheet completed	Create Electronics storage and battery Charging Stations	Students can measure voltage, amperage, resistance and motor torque
	Pneumatics Force and Pressure Boyle's Law Controlling actuators	Draw the Pneumatic Component symbols	Test and evaluate a pneumatic module	Create and/or use a spread sheet to calculate pneumatic system performance		Mobile chassis engineered and Modeled in 3D. Students can use Ohm's law to solve simple circuit problems
	Disassemble and analyze Servo Gear system. Measure Servo Torque.	Model additional required mechanisms for game playing machine.	Wiring connectors and soldering/	Using digital communication and visualization tools to document the engineering process in your notebook	Create awards for winners	Functional or scoring components engineered and parts drawn. Student's can use Boyles law to solve basic pneumatic problems
	Engineering	**CAD**	**Lab Work**	**Assignment**	**Instructor/Man**	**Milestones**

	Class Lectures/Demos				**ager**	
	Structural considerations using the kit components. Stress vs Strain and strength of materials	Model additional required mechanisms	Stress Strain worksheet	Reconfigure the servo. For 360 rotation. PWM Theory	Prepare materials for servo reconfiguring	Engineering drawings completed and in notebooks Students can solve torque problems
	Forces and Friction Velocity and Acceleration	Determine weights/volume and density	Newtons Cart Experiments Friction experiments	Velocity, acceleration worksheets	Prepare materials for Newton's Cart Lab	Students produce stress strain graphs of a tested material
	Wiring, batteries, motors and control systems	Dimensioning and detailing drawings	Create Schematic diagram of the electronic control system	Breadboard and operate the control system/sensors /speed controllers	Create control system breadboard for demonstration and lab work	Students can measure and calculate the acceleration of real world objects
	Controls system basics. Sensors and programming	Pneumatic schematics				Mobile Chassis and control systems operational Students can calculate the coefficient of friction
	WORK WEEK	WORK WEEK	WORK WEEK	WORK WEEK	WORK WEEK	WORK WEEK
	WORK WEEK	WORK WEEK	WORK WEEK	WORK WEEK	WORK WEEK	Machine built ready for test and debugging
	Competition Week	Competition Week	Competition Week	Students provide written and graphic commentary demonstrating what the learned and are able to do. Machines are analyzed and students describe design revisions	Take video and or pictures of the competition and the competitors	Students review and evaluate each others notebooks
	Deconstruct Machine and	Organize and complete	Organize and complete	Turn in completed notebooks	Provide visual examples of a	GEARS-IDS kits inventoried

	Complete kit inventory and storage	assembly drawings and working drawings	notebooks		high quality notebook as a "Benchmark"	and organized. Note books completed
	Engineering Class Lectures/Demos	**Graphics**	**Lab Work**	**Assignment**	**Instructor/Manager**	**Milestones**
9	Demonstrate and explain the process of creating a presentation outline or storyboard Demonstrate and explain presentation software	Presentation Software	Internet and Library Topic research Create an outline	Create a digital presentation about an academic *(Science, math, technology, history etc.)* topic that can be used by an elementary or jr. high school teacher to help teach an academic subject. Choose Subject	Provide Demonstrations and examples of the quality and scope of the expected deliverables	Create or obtain an example of a high quality presentation that will serve as a benchmark for student performance All students choose a subject
10	Demonstrate and explain Digital Imaging using scanners and digital cameras	Digital Imaging Software	Creating and collecting Images Internet and Library Topic research continues	Create a digital presentation about an academic topic that can be used by an elementary or jr. high school teacher to help teach an academic subject Choose and inventory images	Provide Demonstrations and examples of the quality and scope of the expected deliverables	All images and artwork are collected and reviewed.
11	Work Week	Work Week	Work Week	Work Week	Presentation grading rubric is developed. Presentations should clearly demonstrate what a child knows and is able to do.	Slide shows are completed and presented to the class. These presentations are then collected and burned to discs and distributed to elementary and secondary teachers throughout the district.