MARQUETTE UNIVERSITY
COLLEGE OF ENGINEERING

ENGINEERING ACADEMIES FOR K-12 STUDENTS

SPRING 2012

The Marquette Engineering Outreach Program is excited to offer another season of workshops for K-12 students interested in learning about Engineering. The Office of Engineering Enrollment Management and Outreach seeks to enhance the mission of Marquette University and the College of Engineering by developing and preparing future Marquette engineers to be critical thinkers, problem solvers and leaders that will contribute to a global society.

To register for a Marquette Engineering Outreach Program, please visit:
http://www.marquette.edu/engineering/academies_register.shtml

All engineering academies have limits on class size, and applicants will be enrolled on a first-come, first-served basis. Waiting lists are started once a class reaches capacity. Instructions for submitting payment are provided on the online registration site.

For more about our programs, including current course availability, visit www.marquette.edu/engineering/academies.shtml

Saturday, February 4 **Time: 9am – 1pm**
Programming with Alice for 5th-8th Grade **Grades 5-8** **$50**

Alice is an innovative 3D computer programming environment that makes it easy to create an animation for telling a story, playing an interactive game or video to share. Alice is designed give students exposure to object-oriented programming. It allows students to learn fundamental programming concepts in the context of creating animated movies and simple video games. In Alice, 3D objects (e.g., people, animals, and vehicles) populate a virtual world and students create a program to animate the objects. Students use drag and drop graphic tiles to create a program, where instructions correspond to standard statements in a production oriented programming language (e.g., Java, C++, and C#). Alice allows students to see how their animation programs run, easily understanding the relationship between programming statements and behavior of objects in their animation. By manipulating the objects in their virtual world, students gain experience with all the programming constructs typically taught in an introductory Computer Engineering programming course. No prior programming experience is required to participate in this course. Learn more about Alice online at www.alice.org.

Saturday, February 18 **Time: 10am – 2pm** **NEW!**
STEMming Science with Becca: Phases of Matter & Simple Machines **Grades 4-6** **$40**

In this session of STEMming Science with Becca, students will explore how the three states of matter undergo many changes, or phases, to make up everything in the world around us – solids, liquids, and gasses. Students will put their brains to work to figure out how to make a marshmallow grow twice its size and watch as water boils - WITHOUT heating it! In the second half of the class, students will learn about simple machines: what makes them work, how they make everyday tasks easier, and how engineers use these simple machines when making bigger machines. Students will test their own center of gravity and discover how friction can make paper burn!

STEMming Science with Becca programs offer the opportunity for students to enjoy multiple classes with the same instructor throughout the year. Research shows that children are more likely to engage in an activity over time with the encouragement and guidance of a mentor. Participants are encouraged to register for multiple sessions with Becca, a College of Engineering undergraduate, as she leads the class on an exploration of a variety of science topics! See also – ***STEMming Science with Becca: Energy, Pollution and the Environment on March 24th.***

Saturday, March 3 **Time: 9am – 2pm**
Programming with ALICE for High School **Grades 9-12** **$60**

Students in the High School section of Programming with Alice will be introduced to object-oriented programming (*see description for Programming with Alice on February 4th*) but will have additional time to learn more advanced Alice programming techniques. This class will further explore the use of processes and functions to create and control characters and the use of multiple methods to make dynamic story scenes. Students will learn how variables, parameters and events are used to provide a range of options for how a scene and its characters will be illustrated. By manipulating the objects in their virtual world, students gain experience with all the programming constructs typically taught in an introductory Computer Engineering programming course. No prior programming experience is required to participate in this course. Learn more about Alice online at www.alice.org.

Saturday, March 10 **Time: 9am – 4pm**
3D CAD Mechanisms and Animation **Grades 8-12** **$70**

Learn how 3D computer-aided design (CAD) can be used to create a rotating engine model and animate a dogfight between 3D model of airplanes. Using student-created and instructor-provided 3D CAD models, the 3D CAD Mechanisms and Animation applications are taught to add motion to the models and make movies of the designs in action. CAD is an important industrial art extensively used in many applications, including automotive, shipbuilding, and aerospace industries, industrial and architectural design, prosthetics, and more! Engineers in all industries use 3D modeling and virtual simulations to test designs prior to production.

Saturday, March 17 **Time: 9am – 2pm**

The World of Biomedical Engineering: Nanobots, Knees and Neurons **Grades 7-12** **$60**

Did you know that people have created microscopic devices small enough to fit inside the cells of your body? Or that entire body parts are routinely swapped out with man-made replacements? Or that computers and robots have already been designed to connect directly to your body's nervous system? This course will introduce students to the amazing world of biomedical engineering through a series of discovery activities and hands-on experiences. Students will explore the human skeletal system and design a "replacement joint" that will be tested for durability. They will learn about the electrical nature of the human nervous system and see how electrical circuits operate. Finally, participants will explore how brainwaves can send signals and be interpreted using electroencephalography (EEG). The Spring session of The World of Biomedical Engineering will feature different activities from the Fall session. If you liked the Fall class, sign up for this one too!

Saturday, March 24 **Time: 10am – 2pm** **NEW!**

STEMming Science with Becca: Energy, Pollution and the Environment **Grades 4-6** **$40**

How do we clean the water from the oceans and lakes so that its safe enough for us to drink? In this session of STEMming Science with Becca, students will learn about "green" movements through demonstrations with solar panels, pollution clean-up, green houses, and many other activities. They will also discover how these concepts affect the planet and ways engineers use these concepts to provide a better living environment for society.

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Friday, March 30 **Time: 6-8pm** **NEW!**

Family Engineering **Grades K-4th & families** **$20/family**

Family Engineering is an informal engineering education program that actively engages elementary-aged children and their families in fun, hands-on, engineering activities and challenges. Children may attend a Family Engineering event with a parent, grandparent, aunt, uncle, mentor or other important adult in their lives. **The whole family is invited – older siblings too!** Research shows a significant improvement in children's self-confidence and learning skills when families are more actively engaged in their learning. By showing interest and exploring engineering with their children, parent and other caregivers can positively influence a child's attitude about engineering, as well as encourage their children to consider a possible career in engineering. Increasing parent's and children's awareness, appreciation and understanding of engineering will open their eyes to the significant impact of engineering in their daily lives, and to the tremendous career opportunities available in engineering around the globe.

Saturday, March 31 **Time: 9am – 2pm**

LEGO Mindstorms NXT Robotics Workshop **Grades 5-8** **$60**

Students will be introduced to the world of robotics by designing, building, and programming LEGO Mindsotrms NXT robots. Students work in pairs to "teach" their robots to perform specific tasks using a combination of external sensors and internal programming instructions using NXT 2.0 software. In this workshop format, students new to the NXT will receive introductory lessons and guidance while those more experienced with the NXT can work on advanced and independent projects of their choice. Prior experience with robotics is NOT required – all learners are welcome! To see more about the LEGO Mindstorms NXT, visit http://mindstorms.lego.com.

Saturday, April 14 **Time: 9am – 2pm**

iHeels **Grades 7-12 (girls only)** **$60**

Almost everything in our world has been touched in one way or another by an engineer. This iHeels (Inspiring Hands-on Engineering Experiences with Ladies of STEM) workshop will give young ladies a chance to experience the fun, challenge and excitement of engineering. They will explore what engineers do and the many career paths a female engineer can take — paths you probably never even considered! Girls will work together to learn how engineers work to solve today's problems through hands-on activities focused on the Engineering Design Process and may involve structures, electrical circuits, environmental impacts, computers, even the chemistry of making lotion! Female engineering instructors lead the group, and students will leave with more confidence in problem solving, design and analysis of solutions, and know that an engineering career can lead to amazing opportunities for women! This class will feature NEW activities so don't worry if you have attended a previous iHeels class.

Saturday, April 21 **Time: 9am – 4pm**

Programming LEGO Mindstorms NXT using RobotC **Grades 7-12** **$70**

Students will learn how to create LEGO Mindstorms NXT programs using RobotC. They will see immediate results of their work as the NXT robotic machines complete the programmed tasks. RobotC is one of the major computer programming languages that can be used with LEGO Mindstorms NXT, TETRIX and VEX robotics. RobotC is a C-based programming language with an easy-to-use development environment. RobotC provides a higher level of detail control and allows a wider range of NXT based machine functionality than graphical programming languages used in Introductory Robotics classes (*see LEGO Mindstorms NXT Robotics Workshop on March 31st*). Prior experience with LEGO Mindstorms NXT is recommended for this course. See RobotC programmed robots online at www.robotc.net/community/projects.

Scientists investigate that which already is; Engineers create that which has never been.
- Albert Einstein

April 21, 28, May 5 **Time: 10am – 2pm**

Stop Action: Bring your LEGOS to Life! **Grades 3-6** **$130**

Students bring their LEGOS to life while exploring and experimenting with Stop Motion Animation techniques using point-and-shoot digital cameras. 3 Saturdays of filming results in a video produced by the class in which they animate LEGO characters and flying machines. Participants will write the screenplay and scripts, design and build background sets to complete their LEGO worlds, and shoot the action! Students learn about the basics of animation such as timing movement, creating backgrounds, lighting and animating. Make sure to bring your own LEGO people and other creations!!!! This course will be led by professional animator Tim Decker - an experienced animator having worked on TV shows such as Teenage Mutant Ninja Turtles, Alvin and the Chipmunks and The Simpsons. All students will receive a DVD with a copy of the movie a few weeks after the last class. This class filled quickly in October 2011, and we are happy to be offering another session during Spring 2012!

Saturday, May 5 **Time: 9am – 4pm**

SUPER-CHARGED LEGO Mindstorms NXT Robotics Workshop **Grades 5-8** **$70**

How can we use Bluetooth technology for communication from a laptop computer to the LEGO Mindstorms NXT robots? How do we facilitate communication between multiple NXT robots? In this class, students learn how to use some of the more advanced functions available for the NXT robots. Students will be introduced to methods of using more than 4 sensors per robot! Functions and logic will be programmed and applied to NXT robots for autonomous and teleoperated (remote-control) action. Prior experience with LEGO Mindstorms NXT is required for participation in this course. To see more about the LEGO Mindstorms NXT, visit http://mindstorms.lego.com.

Saturday, May 12 **Time: 9am – 4pm** **NEW!**

Mobile Robots Rule! **Grades 7-12** **$70**

Did you know that the first mobile robots were developed during World War II as flying bombs programmed to detonate within a specified range of its target? Today, mobile robots are the focus of a great deal of research to improve our abilities to inspect pipes, search for earthquake survivors, help protect soldiers from explosive devices and many other tasks. They also appear as consumer products, for entertainment or to perform household tasks like vacuum, gardening and some other common chores. How do they do that? Students will learn some of the answers to this question through the exploration of wheeled, tracked, two legged (humanoid) and six legged mobile robots. Many robots will be studied and tested through hands-on operation to assist students in developing an understanding of the sensing and control functions used for mobile robots!

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