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Electrical Engineering Patch

Sponsored by Marvell

Ignite your curiosity and foster your creativity as you learn about the exciting world of electrical engineering.

Follow this guide to earn this free patch, as GSNETX and Marvell hope to empower the next generation of female engineers.

Questions? Email program@gsnetx.org

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Complete the following requirements for your program grade level:

- Girl Scout Daisies & Brownies
  - Complete 3 Discover, 2 Connect, 1 Get Involved
- Girl Scout Juniors & Cadettes
  - Complete 4 Discover, 3 Connect, 2 Get Involved
- Girl Scout Senior & Ambassador
  - 5 Discover, 4 Connect, 3 Get Involved

Patch requirements are separated into 3 sections:

- Discover: Learn about electrical engineering concepts and the career in the field.
- Connect: Explore electrical engineering though interactive projects and real-world connections.
- Get Involved: Share your knowledge and lead activities to inspire others.

These activities may be completed as a troop, as a Juliette, or with family at home. Once girls have completed the patch requirements, please complete the online patch form found here. Only one entry per troop or Juliette is required. Be sure to tag @marvelltechnology and use the hashtag #MarvellGirlScoutsEE on social media when you get your patch!

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Discover

- Read a book or watch a documentary about a historical figure or pioneers in electrical engineering (e.g., Nikola Tesla, Thomas Edison, Edith Clarke).
- Learn basic electrical safety rules and demonstrate them with family or friends.
- Identify common electrical components (e.g., resistors, capacitors, LEDs) and explain their uses.
- Create an ad for a major engineering organization (e.g., IEEE) showing its role in electrical engineering.
- Build a simple circuit using a battery, wires, and a light bulb to demonstrate how electricity flows.
- Create a poster illustrating the flow of electricity through a home or device.
- Name 3-5 electronic devices and research how electricity powers them.
- Learn about renewable energy sources and how they generate electricity.
- Study the basics of how electricity is transmitted from power plants to homes.
- Find a diagram of an electrical circuit and label its parts (e.g., power source, switch, load).
- Learn 3-5 different ways electrical engineering impacts everyday life.
- Research 3 colleges or universities that offer electrical engineering or related programs.

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Connect

- Design and build a simple project, like a light-up greeting card or basic LED circuit. Share it with friends or family.
- Visit a science or technology museum with an electrical engineering exhibit.
- Tour a local electrical substation, power plant, or renewable energy facility with an adult.
- Attend a workshop or event at a STEM-focused camp or center to learn about electrical circuits and build a project.
- Learn about and experiment with conductive and non-conductive materials.
- Interview an electrical engineer or technician and ask about their career.
- Assemble a simple breadboard circuit and explain how it works to friends or family.
- Learn basic coding to control an LED or motor with a microcontroller like an Arduino.
- Participate in an online workshop or webinar related to electrical engineering or robotics.
- Create a bristlebot (toothbrush robot). Instructions found here

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Get Involved

- Interview an employee from an electrical engineering company (designer, engineer, technician, etc.).
- Create an educational video or presentation demonstrating how to build a simple circuit and explain its function.
- Build a project that incorporates electrical components (e.g., motorized toy, mini fan) and present it at a troop meeting or community event.
- Teach others about basic electrical safety rules through a short workshop or poster presentation.
- Design a poster showcasing the career paths in electrical engineering and why they are important.
- Create and share a project demonstrating renewable energy (e.g., a small solar-powered light).
- Launch a community challenge to build simple circuits at home or at a troop meeting.
- Research the impact of electrical engineering on sustainable development and share your findings.
- Demonstrate a more complex project such as a basic robot or automated light system using microcontrollers.

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Learn by Doing
Dasies and Brownies

- **Build a Simple Circuit:**
  - Use a battery, wires, and a light bulb to create a basic circuit. This hands-on activity helps them understand how electricity flows.
- **Light-Up Greeting Card:**
  - Create a greeting card with a simple LED circuit. This fun craft combines creativity with basic electrical concepts.
- **Conductive Playdough:**
  - Make playdough that conducts electricity and use it to light up an LED. This activity is both fun and educational.
- **Electricity Scavenger Hunt:**
  - Create a scavenger hunt where girls find and identify electrical devices around their home.
- **Story Time:**
  - Read a story about a famous electrical engineer or an exciting invention to spark their interest.
- **Engineering Journals:**
  - Have the girls keep a journal of their projects, experiments, and what they learn. This helps them reflect on their experiences and track their progress.
- **Show and Tell:**
  - Organize regular "show and tell" sessions where the girls can share their projects and discoveries with each other.
- **Guest Speakers:**
  - Invite female electrical engineers to speak to the girls about their careers and experiences. This can be done virtually if needed.

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Learn by Doing
Juniors and Seniors

- **Breadboard Basics:**
  - Assemble a simple breadboard circuit with an LED and a resistor. This introduces them to more advanced components and circuit design.
- **DIY Flashlight:**
  - Build a small flashlight using a battery, LED, and a switch. This project is practical and reinforces their understanding of circuits.
- **Conductive and Non-Conductive Materials:**
  - Experiment with different materials to see which ones conduct electricity. This hands-on activity teaches them about conductivity.
- **Engineering Challenges:**
  - Set up small challenges, like building the tallest tower using only certain materials, to encourage problem-solving and creativity.
- **Virtual Field Trip:**
  - Take a virtual tour of a power plant or an engineering lab to see real-world applications of what they're learning.
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Learn by Doing
Seniors and Ambassadors

- **Arduino Projects:**
  - Learn basic coding and create a project using an Arduino, such as a simple robot or an automated light system.
- **Renewable Energy Model:**
  - Build a small solar-powered device, like a solar-powered fan or light. This project combines electrical engineering with sustainability.
- **Complex Circuit Design:**
  - Design and build a more complex circuit that includes multiple components, such as switches, LEDs, and sensors.
- **Career Exploration:**
  - Research different career paths in electrical engineering and create a presentation or poster about what they find.
- **Innovation Challenge:**
  - Encourage the girls to come up with their own electrical engineering project ideas and present them to the group.
- **Engineering Journals:**
  - Have the girls keep a journal of their projects, experiments, and what they learn. This helps them reflect on their experiences and track their progress.
- **Show and Tell:**
  - Organize regular "show and tell" sessions where the girls can share their projects and discoveries with each other.
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Resource Links & Recommendations

Historical Book Recommendations

- Rosie Revere, Engineer by Andrea Beaty
- Women in Science: 50 Fearless Pioneers Who Changed the World by Rachel Ignotofsky (includes women in electrical engineering)
- The Electric War: Edison, Tesla, Westinghouse, and the Race to Light the World by Mike Winchell
- Hidden Figures by Margot Lee Shetterly (young readers' edition)
- Who Was Nikola Tesla? by Jim Gigliotti
- The Boy Who Harnessed the Wind by William Kamkwamba and Bryan Mealer (young readers' edition)

Historical Movies or Documentaries

- The Current War (2017)
- Tesla (2020)
- Engineering Pioneers: The Women Who Made an Impact (documentary series)
- Inventing Tomorrow (2018) – a documentary about young scientists and engineers
- The Secret Life of Machines (1988-1993) – a classic show explaining how everyday devices work

Fictional Books and Movies

- Nick and Tesla Series by Bob Pflugfelder – a series about twin siblings who create gadgets and solve mysteries.
- Ada Twist, Scientist by Andrea Beaty
- The Wild Robot by Peter Brown (for imaginative exploration of technology and robotics)
- Wall-E (2008) – highlights engineering themes and sustainability.
- Meet the Robinsons (2007) – engineering and innovation are central themes

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Educational Resources & Companies

IEEE TryEngineering

- Offers lesson plans, interactive activities, and design challenges tailored for pre-university students. Great for learning about circuits, power sources, and basic electrical principles.
- Website: tryengineering.org

Khan Academy (Electricity and Circuits)

- Comprehensive video lessons and exercises covering voltage, current, resistance, Ohm's Law, and series/parallel circuits. Useful for Junior to Ambassador-level scouts.
- Website: Khan Academy Circuits

Snap Circuits and Kits

- Hands-on kits to create working models of electronic circuits. The projects range from simple lights and buzzers for younger scouts to more complex alarms and radios for older scouts.
- Website: Elenco Snap Circuits

Adafruit Learning System

- Includes tutorials for projects using microcontrollers like the Arduino or Raspberry Pi. These are suitable for advanced projects for Seniors and Ambassadors, with step-by-step coding guides and videos.
- Website: Adafruit Learning

LittleBits Electronic Kits

- Modular electronic building blocks that snap together to create circuits without soldering. Ideal for a fun, exploratory approach to learning about how circuits work.
- Website: LittleBits

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Women & Pioneers in Electrical Engineering

Hedy Lamarr

- Known not just for her Hollywood fame but also for co-inventing frequency-hopping spread spectrum technology, which laid the groundwork for WiFi, GPS, and Bluetooth.
- Resource: Watch the documentary Bombshell: The Hedy Lamarr Story (2017).

Edith Clarke

- A pioneer in electrical engineering and the first woman to teach this subject at a university. Known for her work on circuit analysis.
- Book Reference: Edith Clarke: Engineering Pioneer by Rachel Swaby in Headstrong: 52 Women Who Changed Science—and the World.

Dr. Shirley Ann Jackson

- Conducted breakthrough scientific research in telecommunications that helped create technologies like the touch-tone phone and fiber optic cables.
- Interview Resource: Look up videos and articles that share insights about her career and impact on engineering.

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STEM Organizations & Ambassadors

Society of Women Engineers (SWE)

- Offers outreach programs, webinars, and events specifically aimed at encouraging girls to pursue careers in engineering.
- Website: SWE

IF/THEN Initiative

- Aimed at promoting women in STEM as role models and offering a database of profiles, videos, and educational resources.
- Website: IF/THEN Ambassadors

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STEM Organizations & Ambassadors

Tinkercad

- A free online platform for building and simulating electrical circuits and 3D designs. Ideal for visual learners and scouts who want to experiment with circuits without physical components.
- Website: Tinkercad

MIT App Inventor

- A simple, intuitive platform for building Android apps. This can be tied to microcontroller projects where girls learn to control physical devices with a custom app.
- Website: MIT App Inventor

Additional Video Recommendations

“How Stuff Works: Electricity” by Discovery Education

- Videos explaining the basics of electrical circuits, power generation, and the functioning of various electronic devices.

YouTube Channels:

- ElectroBOOM: Engaging videos that make learning about electrical engineering fun (suitable for older scouts).
- Mark Rober: Former NASA engineer with fun and educational projects that include engineering principles.