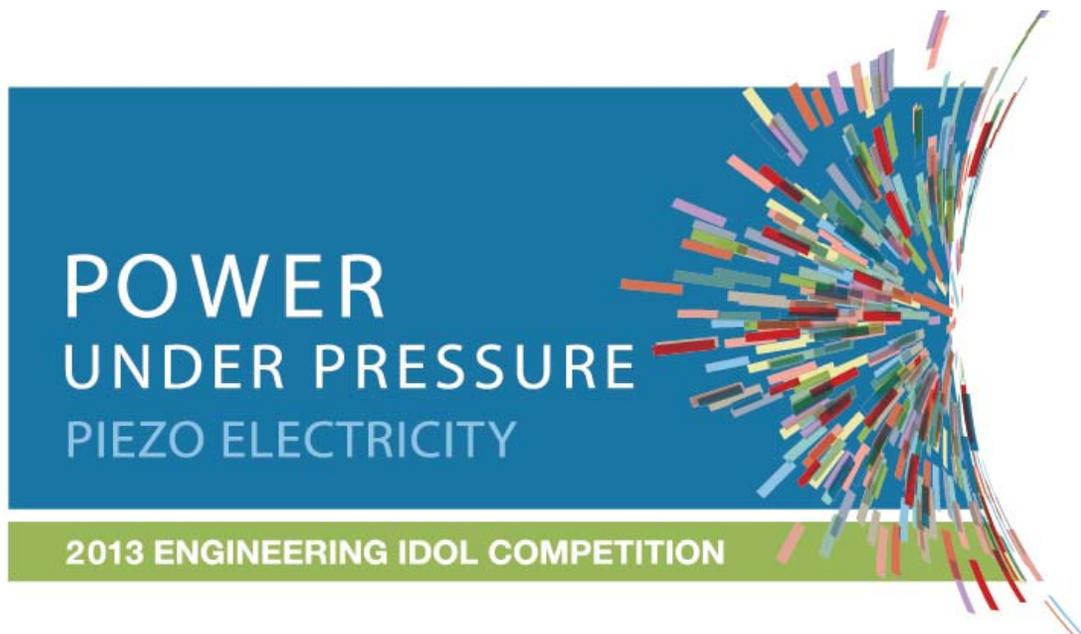


ENGINEERING IDOL
2013

Unveil – Piezoelectric Power!



Presented By: Professional Engineers Ontario
Etobicoke Chapter



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Introduction

The purpose of this document is to describe to you the elements of Engineering Idol. Do not be frustrated when you see a lack of specifics around how you should build your device or put your presentation together. If the answers were always known – there would not be a need for Engineers. Engineers tend to excel at projects when they get to define both what the solution will be and how it will be arrived at.

It is our hope that this exercise will give you an opportunity to experience the profession of Engineering.

Background

The Profession of Engineering continues to evolve. As pension plans and other benefits related to large corporations shrink, more Engineers will be attracted to the field of entrepreneurship as the risks associated with starting a small business will be perceived as smaller.

Those appreciative of the *creative* side of Engineering will have the edge. This is your chance to learn about a new technology and dream up new ways for it to be used in the world to better humanity.

While entrepreneurship requires business knowledge, this is not the focus of the Engineering Idol competition. Engineering Idol is a technical challenge – not a business plan. It probably takes *several hundred* good ideas before coming across one that would be *market feasible*. Do not let *marketability* hinder your creative side!

Your Role

Congratulations! You are a member of a talented, ambitious and innovative team of young Engineers interested in developing a new product. You have recently been introduced to the magic of the Piezoelectric Effect (“Piezo”) utilizing Piezo Crystals and have learned that these special materials generate electrical signals when compressed. Conversely, applying a current to them causes them to compress!

Engineering is more than math and science; it can also be creative, artistic and insightful. Your job is to experience what it is like to apply a technology in a revolutionary way to the world that has not been suggested before.

You have been invited to present your ideas to the investors at Ryerson University on Saturday, March 2nd, 2013. It is at this Trade Show that they will pick their favourite project and award \$400 to the first place team, \$300 for second place and \$200 for third place.



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Your team realizes that successful Engineers in this field are innovative, communicate well, remain professional (even when under pressure), are highly skilled and prioritize well. You have already figured out that you need to convince the investors that your team has what it takes to design and implement the best project. Although you will have the opportunity to present and demonstrate one of your prototypes at the competition day, it is the *team* that will win the competition, rather than the *prototype* itself.



What You Need To Do

Piezo crystals have been studied for a long time and can be referenced in many applications online. Appendix 9 cites some of our favorite references on this topic.

You will need to decide the mode for which you want to design your Piezo.

Some examples of Piezo's used to *generate* an electric signal are as follows:

- Geological studies
- Microphones
- Vibration monitoring apparatus

Alternately, examples of Piezo's used to *convert* electrical inputs into micro movement are:

- Micro fluidic dispensing devices (ie. Medical applications)
- Electro spray devices
- Piezoworm Actuator
- Pressure regulation in micro pumps
- Precision motion control (i.e. Positioning lenses in microscopes)
- Ultrasound generation

The music industry uses Piezo crystals in large numbers for the production of sound or electrical signals in instruments, microphones and speaker systems.

In the transition from science to industrial use new applications for Piezo technology are opening up. For instance, the use of Piezo crystals as actuators in control systems makes them well suited for the emerging Nano industry.

Reduced computing costs and the ability of computers to analyze many inputs simultaneously has improved assessments in structural and oil field applications, medical applications and others all with the help of Piezo crystals transforming mechanical signals into digital computer inputs.

The duality of electro-to-mechanical-to-electrical conversion can be combined in transducers capable of both transmitting and receiving (sensing). Ultrasound diagnostic is an example where both piezo and inverse piezo effects are used – to transmit ultrasound signal (produced by applying electrical signal of frequency >20 kHz to a piezo) and sensing back the echo and converting it into electrical signal for digital imaging diagnostic.

Decide on how your Piezo crystal will be used in a new design to *improve life and serve the world*.

Pick your favorite idea and design* a prototype and learn how to build it.

Prepare a way to demonstrate your prototype to the judges and prepare a presentation that demonstrates how the world would benefit from your invention.



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There are some other details about the interim report and how the competition day works. The details on the Bare Bones Requirements and due dates are in Appendix 11. It refers to a Preliminary Report (which is used to make sure you are on track with the correct scope and are well on your way building your prototype) which is detailed in Appendix 2.

On competition day (Appendix 8), come prepared with your notes (so you can disclose them to the judges), the materials you require to build your prototype, as well as your presentation (Appendix 3) on a memory stick.

** Commercially available Piezo crystals are typically in the form of a small flat disc. If your design requires a specialized type of Piezo crystal, and you are having difficulty finding what you need, please contact us at Engineeringidol2013@gmail.com. Sensor Technologies has kindly offered to either help us find the Piezo you need, or, help us offer you an alternate way in which to present your idea.*

Building Your Prototype

The building of your prototype gives you the opportunity to demonstrate what your team has learned about the Piezoelectric effect and how it can be used to benefit the world.

On competition day, you will be required to assemble your Prototype. You are expected to bring your materials prepared for assembly along with your list of materials and receipts with the form in Appendix 5.

Basic hand tools and power tools will be available at the competition day. Please refer to Appendix 10 for details.

The Judging Criteria

Each project will be evaluated by the panel of 3 judges according to the following criteria: technology understanding, originality of application of technology, prototype, team cohesiveness, written report and oral presentation. Greatest emphasis will be placed on technology understanding, originality of application of technology and oral presentation, rather than the attractiveness of the prototype itself. The judges will be assessing the planning and execution of the project as well as how well the student team worked together to achieve its goal.

The main idea behind this challenge is your ability to 'think outside the box' to come up with a new application for an existing technology. Make your project demonstrate how your application can better or benefit society. Engineering will always be math and science, but the modern Engineer, serving the new disciplines of Engineering, needs to have imagination and fluid problem solving skills.



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You will be required to design, build and demonstrate a model that will express your ideas on how your proposed system would work. In the case of very complicated or large scale designs, simplified prototypes should be prepared.

While the economics of bringing a new product to market (e.g. manufacturing, financing, distribution, marketing, etc) are equally important to the success or failure of a new product, we are not considering these aspects for the purpose of the competition.

We are allowing the judges the luxury of a jury-style deliberation. Their conversations and final deliberations will be left known only to themselves. Teams should not expect a detailed 'mark' for each element of the judging criteria.

We have asked the judges to appoint among themselves a commentator who will provide feedback for each team to be received at a later date. The feedback will be a summary of the judges' comments of the teams' strengths and weaknesses and will be forwarded to the schools after the event. It is our hope that each of the teams will find the feedback useful.

Judging is a very difficult role in Engineering Idol. It is recognized that every team puts in a lot of effort to accomplish a successful outcome. None of us envies the role of the judges having to pick among a group of excellent teams and we ask you to support them in this very difficult role. In the Engineering world, projects are awarded all the time to competitors for reasons that are never either disclosed or understood. That an element of 'judgment' is used and permitted by our judging panel reinforces that Engineering Idol is "an opportunity to experience the Profession of Engineering". That just means the good, the bad and the obscure.

The Competition Day

The competition day will be from about 9:00 a.m. to 4:30 p.m. on Saturday, March 2, 2013 at Ryerson University downtown (location given in Appendix 4). Members of PEO (Professional Engineers Ontario), many visitors to the school and local politicians will be in attendance. You are welcome to invite friends and family; however, they should realize you will be busy building your Prototype until about noon. We will be providing lunch for the team members and their teachers.

The judges will arrive after the competition day gets going. They will be interacting with the teams during the building of the prototypes.

The details of the agenda may change between now and March 2nd, however, the day will look similar to that listed in Appendix 8.

Please bring a sign for your work table to identify your school and/or the name of your engineering team.



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Safety

Your school's Supervising Teacher or Volunteer should be expected to help with keeping the building and testing of the designs safe during competition day.

Questions

Please forward questions to the Technical Team at engineeringidol2013@gmail.com.

The header of your Email should start with "**Eldol – School Name** –".

Notice

PEO, its employees, contractors and volunteers shall not be responsible for, and all contestants hereby release and forever discharge PEO, its employees, contractors and volunteers from any and all claims, suits and demands for any loss, damages or injury howsoever arising except of caused by the gross negligence of PEO, its employees, contractors and volunteers.



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Appendix 1: Team T-Shirt Form

Due January 14, 2013

School Name: _____

Supervising Teacher/Volunteer: _____ Size _____

Please indicate Size beside each name as S – M – L – XL – XXL

Names of Students (4 – 6 in total)

_____ Size _____

Please return (on or before the due date) to:

Richard@CDWEngineering.com



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Appendix 2: Preliminary Report Template

Due : Feb.1, 2013 (2 PAGES MAX plus sketch)

SCHOOL: _____

PROJECT TITLE: _____

PROJECT TEAM MEMBERS: NAMES / GRADE LEVEL

SUPERVISING TEACHER OR VOLUNTEER: _____

METHOD OF APPROACH: How team members were selected, how subject was researched, how responsibility was assigned, etc.

PURPOSE: what is the purpose of the device

TECHNOLOGY: how is the Piezo Technology used in the device

PROTOTYPE: what is the design of the device and how does it work

COMMENTS / SUGGESTIONS:

** Attach a sketch showing your proposed device along with a preliminary list of materials and their costs (Appendix 5 form) for the Prototype you plan to build on Competition Day.

SIGNATURE: _____
SUPERVISING TEACHER OR VOLUNTEER

DATE SUBMITTED: _____



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Appendix 3: Presentations and Demonstrations

If making a Power Point presentation on the competition day, presentations are to be submitted on USB Memory Sticks using MS PowerPoint 97 – 03 or equivalent.

Any inserted photographs in the presentation should be a minimum of 1.2 Megapixels, as the display screen is quite large.

Submit only one final version file on the USB to avoid the possibility of the incorrect version being used for the presentation.

There is only one rule with respect to the team presentations – all team members need to participate.

The purpose of the Presentation will be both to Demonstrate your invention and prototype but also explain how the future unit, if put into production, will benefit the world. The Presentation will be longer than in previous years just because there is no ‘testing’ phase to the competition. Teams will be using their Presentation time instead to include a Demonstration of their device.

The maximum presentation time for each group is 10 minutes plus questions.



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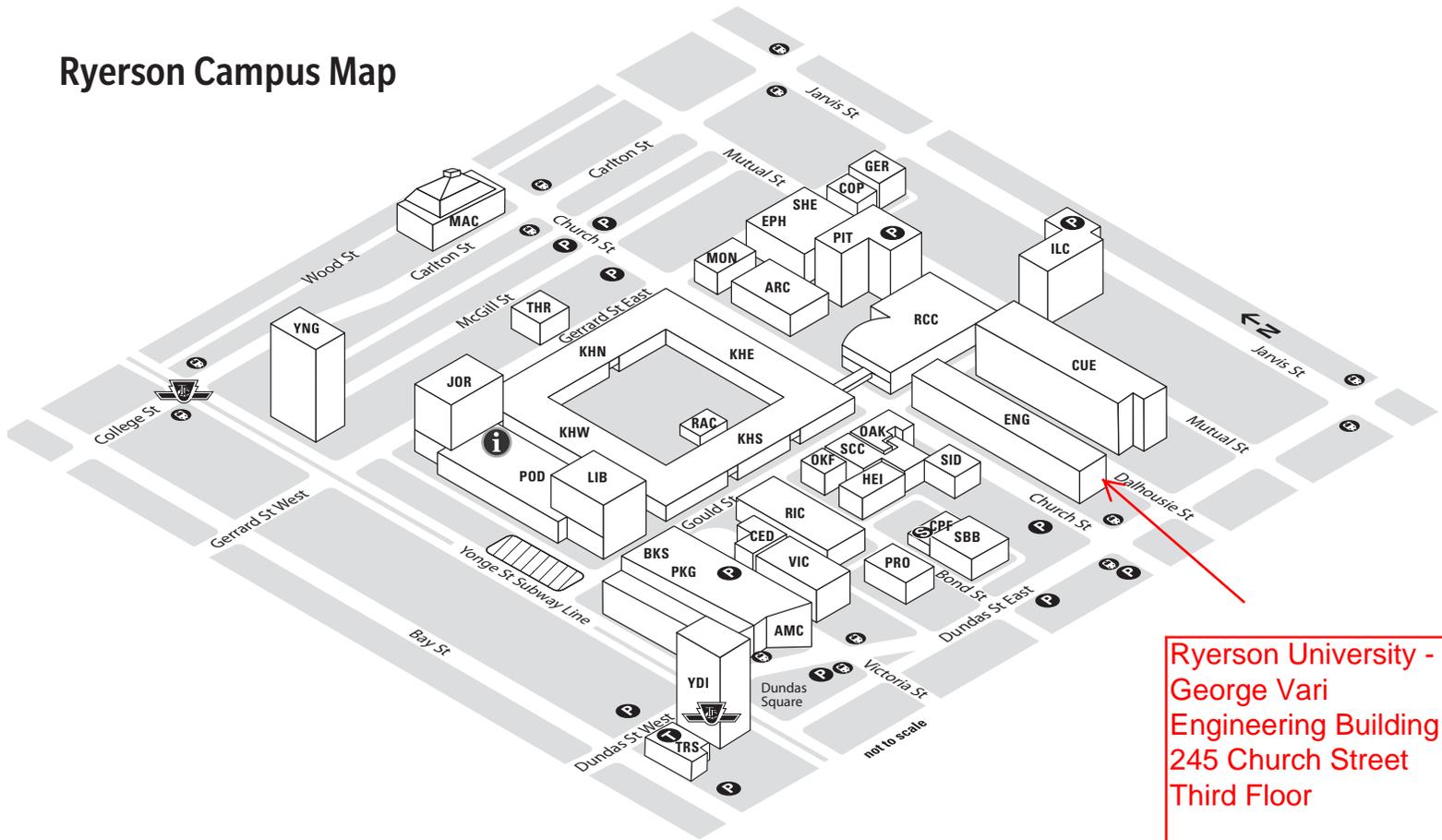


Appendix 4: The Location for Competition Day

Ryerson University
George Vari Engineering and Computing Centre
245 Church Street
Toronto, Ontario

See map on following page

Ryerson Campus Map



Ryerson University -
George Vari
Engineering Building
245 Church Street
Third Floor

BUILDING CODE, NAME, STREET ADDRESS

- AMC** 10 Dundas Street East
 - ARC** Architecture Building, 325 Church Street
 - BKS** Bookstore, 17 Gould Street
 - CED** Heaslip House, The G. Raymond Chang School of Continuing Education, 297 Victoria Street
 - COP** Co-operative Education, 101 Gerrard Street East
 - CUE** 147 Dalhousie Street
 - CPF** Campus Facilities and Sustainability, 111 Bond Street
 - ENG** George Vari Engineering and Computing Centre, 245 Church Street
 - EPH** Eric Palin Hall, 87 Gerrard Street East
 - GER** Research/Graduate Studies, 111 Gerrard Street East
 - HEI** HEIDELBERG Centre – School of Graphic Communications Management, 125 Bond Street
 - ILC** International Living/Learning Centre, entrances at 133 Mutual Street and 240 Jarvis Street
 - JOR** Jorgenson Hall, 380 Victoria Street
 - KHE** Kerr Hall East, 340 Church Street/60 Gould Street
 - KHN** Kerr Hall North, 31/43 Gerrard Street East
 - KHS** Kerr Hall South, 40/50 Gould Street
 - KHW** Kerr Hall West, 379 Victoria Street
 - LIB** Library Building, 350 Victoria Street
 - MAC** Mattamy Athletic Centre, 50 Carlton Street
 - MON** Civil Engineering Building, 341 Church Street
 - OAK** Oakham House, 63 Gould Street
 - OKF** O’Keefe House, 137 Bond Street
 - PIT** Pitman Hall, 160 Mutual Street
 - PKG** Parking Garage, 300 Victoria Street
 - POD** Podium, 350 Victoria Street (area connecting Jorgenson Hall to the Library Building)
 - PRO** Projects Office, 112 Bond Street
 - RAC** Recreation and Athletics Centre, entrance through archway at 40 and 50 Gould Street
 - RCC** Rogers Communications Centre, 80 Gould Street
 - RIC** Ryerson Image Centre, 122 Bond Street
 - SBB** South Bond Building, 105 Bond Street
 - SCC** Student Campus Centre, 55 Gould Street
 - SHE** Sally Horsfall Eaton Centre for Studies in Community Health, 99 Gerrard Street East
 - SID** School of Interior Design, 302 Church Street
 - THR** Theatre School, 44/46 Gerrard Street East
 - TRS** Ted Rogers School of Management – 575 Bay Street (entrance at 55 Dundas Street West)
 - VIC** Victoria Building, 285 Victoria Street
 - YDI** Yonge-Dundas I, 1 Dundas Street West
 - YNG** 415 Yonge Street
-
-  Site of the future Student Learning Centre
 -  Undergraduate Admissions and Recruitment
 -  Direct underground access from the Ted Rogers School of Management to the Dundas Subway
 -  Security
 -  Parking
 -  TTC Subway stop
 -  TTC Streetcar stop



Appendix 6 – 7: Not used

Appendix 8: Timetable for Competition Day - DRAFT

- 8:30 a.m. Registration and T-Shirt Distribution
- 9:00 a.m. Opening Ceremonies in Main Area
- 9:15 a.m. Students begin building device
- 10:00 a.m. Judges arrive and discuss projects with engineering teams
- 12:00 a.m. Lunch and Students prepare for their presentations
- 12:30 p.m. Demonstration and presentations start in Main Area
- 3:00 p.m. Judges will begin deliberations
- 3:05 p.m. Teams proceed to their workstations and discuss their design with the public
- 3:45 p.m. Presentation to students
- 4:00 p.m. Judges announce winners in the Main Area
- 4:10 p.m. Closing Ceremonies by a special guest speaker
- 4:20 p.m. Final Photos
- 4:30 p.m. End of Event



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Appendix 9: Reference Websites

www.sensortech.ca/site/ Engineering Idol is happy to have Sensor Technology Ltd as a sponsor of Engineering Idol this year. Sensor Technologies manufactures industrial Piezo crystals for the market and provides expertise in their use in many applications

<http://mmdl.mie.utoronto.ca/WEB/Welcome.html> Engineering Idol is happy to have the support of representatives from U of T's Mechanical Engineering department. On this link, videos of some of the most up to date applications of Piezo technology are demonstrated.



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Appendix 10: List of Tools Available on Competition Day

There will be a central tool table for your use. Available tools will include:

- wood saws (also usable for plastics) and metal hacksaws
- knives, screwdrivers, pliers, hammers, etc.
- basic electrical hand tools – wire strippers, diagonal cutters, soldering gun, electrical tape, needle-nose pliers, etc.
- multi-meter
- tape measures and set squares
- an electric drill with bits (metallic, plastic and wood) A supervisor will oversee the usage of all power tools.
- duct tape

You may bring simple hand tools such as scissors, screwdrivers, etc. You may request that additional tools be provided, by contacting Richard Weldon (below) before February 27, 2013.

Safety is paramount. Please do not bring any power tools without first receiving permission from Richard Weldon (below). Such tools must only be used at the Tool Table, under supervision and in compliance with the competition day safety rules.

Richard Weldon at Richard@CDWengineering.com



Appendix 11: Bare Bones Requirements

This quickly lists the “deliverables” required by your team just to make sure you do not forget anything!:

Monday, January 14, 2013, your *list of team members* submit their names and T-Shirt sizes. Make sure they are ordered by sending the order form to Richard Weldon, P.Eng. at Richard@CDWengineering.com. Appendix 1 includes the order form for reference. Teams also receive the links for their packages which officially ‘Unveils’ the Engineering Idol project.

Friday, February 1, 2013, your team will submit a *Preliminary Report* to Mrs. Linda Drisdelle P.Eng, 112 Princess Margaret Blvd., Etobicoke, ON M9B 2Z3 or engineeringidol2013@gmail.com. Appendix 2 gives an outline of what this report should contain. The report includes a sketch of your proposed design that you will attempt to build on competition day. The Preliminary Report allows our Technical Expert to confirm that all the teams are on the right track ahead of the competition day. If problems are detected, it gives the teams time to work through the issue to ensure everyone has a successful day at the competition.

Wednesday, February 6, 2013, Teams receive final approval regarding their concept design package. This just means that the Engineering Idol team feels you have an excellent chance at being successful in building your prototype on Competition Day.

Arrive on time on Competition Day (Saturday, March 2, 2013) at Ryerson University with your notes, team, materials and Prototype design. Please see Appendix 4 to be sure you know how to get to the competition. Be prepared to talk to the judges about your project. There is no reason to get nervous about the Competition Day – it is our hope that everyone is looking forward to it! We are looking forward to meeting all of you and hearing about your projects. It is likely that each team will discover they approached the problem very differently from the other teams. This is the wonderful thing about Engineering – there are no wrong solutions – they are all innovations!

Each team is allowed to spend up to \$125 on materials for their Prototype. Bring a complete list of materials, receipts along with the reimbursement form in Appendix 5 on competition day. You will be reimbursed during the day. One cheque will be issued; be sure you know to whom the cheque should be made out to. Your supervisor is required to sign off on the Materials and Cost Sheet to ensure it is accurate.