

Fall 2019

# IE 203-001: Application of Computer Graphics in Industrial Engineering

Paul Ranky

Follow this and additional works at: <https://digitalcommons.njit.edu/mie-syllabi>

---

## Recommended Citation

Ranky, Paul, "IE 203-001: Application of Computer Graphics in Industrial Engineering" (2019). *Mechanical and Industrial Engineering Syllabi*. 19.

<https://digitalcommons.njit.edu/mie-syllabi/19>

This Syllabus is brought to you for free and open access by the NJIT Syllabi at Digital Commons @ NJIT. It has been accepted for inclusion in Mechanical and Industrial Engineering Syllabi by an authorized administrator of Digital Commons @ NJIT. For more information, please contact [digitalcommons@njit.edu](mailto:digitalcommons@njit.edu).

Ver. Fall 2019, Last update **August 13, 2019**. (Update history: August 4, 2019)

## Welcome to IE203: Application of Computer Graphics in Industrial Engineering ...

for Sustainable Lean & Green Visual Factory Management, Computer Networking, Object-oriented Thinking & Programming, Programming Computer Controlled Machines, Industrial Internet of Things (IIoT), Professional Communication, Graphical Documentation & Presentation Skills, and Others...

This is a combined Welcome Letter and Course Outline / Syllabus. Please read it carefully. Yes, it is long, but on the other hand you will find all essential course information here.

This semester we'll focus on Computer Graphics in IE with Lean, Visual and Sustainable **Green** product, process and service system examples. We are also going to discuss some very new methods and technologies too, such as the Industrial Internet of Things (IIoT) and how it relates to IE, and computer graphics in IE; our profession.

Please note, that this document might be updated during the semester. **PLEASE DO NOT PRINT THIS syllabus**; view it electronically. This is the 21st century... no need to cut more trees... let's be sustainable green!

If anything is unclear please contact me in class, or in person during office hours in my NJIT office, or by email anytime (see all contact information below). I typically respond to emails 7 days a week.

Please try to avoid asking trivial and factual questions that are clearly listed / answered here in the syllabus, or in the eLearning Pack material, or on NJIT's web pages; (Examples include the following: 'What is the deadline for Assignment k?', or, 'Do we have a class during Thanksgiving?'; Professor, where is your office? Professor when do you have your office hrs.?', and others). Please note, that I am treating you as responsible adults who are keen to learn. I try to teach you the latest and the best! In return, please try to focus on this course and learn the subject well. Thanks; this saves us all time so that we can spend it on value adding opportunities... meaning helping you to learn and prosper... I am sure we are on the same page...

**Please note, that attendance in this class is compulsory and follows the NJIT faculty and student body accepted UG attendance rules. These rules will be strictly enforced, therefore lateness or missing classes is not permitted.**

**According to NJIT regulations, if for any professional or medical reason you cannot attend a class you must email your instructor asap with the professional reason(s) explained. Also note, that some lab. classes cannot be repeated in this class, therefore if you cannot turn up on the scheduled date you'll miss that assignment! (All dates are announced in this syllabus.)**

**Thank you for your collaboration!**

A few words about ASQ. **ASQ** (American Society for Quality) Student Chapter at NJIT. ASQ is the largest quality society in the world. Join us, see, hear and network with professionals! We have our own NJIT ASQ Student Chapter, have weekly short meetings at NJIT, as well as almost every month a really nice technical meeting with a presentation and FREE dinner (usually in a VERY nice restaurant in Newark, or New York City). For the student membership Information PDF: [link here](#). More from your instructor, Dr. Ranky, the founding academic leader / member of the NJIT ASQ Student Chapter. The actual **ASQ Chapter Section 300 web site we are part of is here**. You can see here what meetings are scheduled for which days. Please consider joining ASQ because it will help your professional development. It is YOUR decision, NOT mine; it is NOT required. This opportunity with ASQ is a perfect fit for this course as well as for the IE, ME, EM professions as a whole. Throughout the semester we'll organize ASQ events and you'll be most welcome to attend them. Dr. Ranky will discuss and email these events in advance. Furthermore, every year we have NJIT ASQ Student Chapter leadership positions, that will help the chapter, enhance your leadership and management skills as well as look fantastic in your resume!

**Please Read This Syllabus!** It contains vital information about the course as well as all the Assignments, Homework and Grades! Without reading, understanding and following this syllabus you won't be able to get a good grade in this course. (Reading a set of rules and guidelines is part of every IE job. By reading this long and detailed syllabus you are preparing for this too!)

In every assignment in this course focus on this: What problems do you want to solve and how?

**Academic Integrity:** Please refer to NJIT's Academic Integrity web site that contains much information about strategies to promote academic integrity and avoid cheating on class work and exams (<http://integrity.njit.edu/>). Also, please refer to the Academic Integrity web site that contains much information about strategies to promote academic integrity and avoid cheating on classwork and exams. <http://integrity.njit.edu/index.html>. The "Best Practices" document developed and is published on the Provost's website (on the policies page).

During the 2008-2009 academic year, the NJIT Administration worked very closely with the Student Senate to enhance and improve NJIT's Honor Code. The Committee on Academic Affairs and the NJIT Faculty approved the Student Senate's recommendations developed from the findings of the University's Taskforce on the Honor Code. The approved document, "University Code on Academic Integrity" thus replaced the older Honors Code document.

All students are responsible for upholding the integrity of NJIT by reporting any violation of academic integrity to the Office of the Dean of Students. (<http://www.njit.edu/doss/>) The identity of the student filing the report remains anonymous. NJIT will continue to adapt its policies and procedures to make clear that academic dishonesty will not be tolerated at this institution.

**PLEASE save the TREES and be sustainably lean and green! Please DO NOT Print this syllabus. Use this web site to read it in this electronic format; it will be updated during the semester. Thank you!**

---

### Contact Information...

**Mailing Address: Paul G. Ranky, PhD**  
Full Tenured Professor  
Registered Chartered Professional Engineer

Member of the American Society for Quality (ASQ), Audit Division and Lean Enterprise / Advanced Manufacturing Division; New York / New Jersey ASQ Metropolitan Section Lean Six-sigma Special Interest Group co-founder  
 Also Member / past member of ASEE, IEEE, IEE, FEANI, SAE, PMI  
 Department of Mechanical and Industrial Engineering, and also Professor of IT/IS at NJIT  
 NJIT, University Heights, NJ 07102 -1982

You can email me at NJIT: [ranky@njit.edu](mailto:ranky@njit.edu) (Please note, that for reliability reasons I have added another email address: [paul.ranky.njit.edu@mac.com](mailto:paul.ranky.njit.edu@mac.com). Please use this and send again your email if you don't get an answer from me within **5 to 6 working days**. (Usually I respond within 12 hrs, 7 days a week.) I can read the [ranky@njit.edu](mailto:ranky@njit.edu) email, as well as the backup email [paul.ranky.njit.edu@mac.com](mailto:paul.ranky.njit.edu@mac.com) account over the Internet anywhere where I have Internet access, therefore even if I am away at a conference on NJIT business, or research we can be in touch, 7 days a week.)

Note, that my **office** is in NJIT ME Building room 310 at NJIT.

My **office hours** for the semester for this class will be Tuesdays between 5 and 6 pm, as well as after this class for 30 mins. I am also available on-line 7 days a week, most weekends included. Other office hrs. are also available by appointment. Pls. keep me informed of your progress by email, and I'll be happy to see you as soon as I can if you need help. As you can see, you can reach me easily and quickly.

Find out more about **the Professor's past and current research work and background** at (don't miss some of my best eco-friendly sustainable green diving and skiing pictures, 360 panoramas and other documents...): <http://www.cimwareukandusa.com/aboutpgr.htm>

Some examples with videos of our related new R&D work we have completed for the LSC (The Liberty Science Center in New Jersey). These are the web sites: <http://njit-lsc.njit.edu/pauldesign.html> and <http://njit-lsc.njit.edu/paulrobot.html>

Enjoy!

---

### Some really useful advice about the style of professional communication...

Often I get some truly friendly emails from my students... many of these include SMS-style text messages, 'buddy language', such as 'Hi Paul, how r you doin...', etc. This happens increasingly on Facebook too: 'Hi Paul, let's be friends!'

Whilst I am flattered by your friendly communication style, there is something I must bring to your attention. At NJIT it is not just my job to teach you analytical skills, but also professional courtesy and conduct so that you become successful in US and international industry.

For communication (emails) in my courses at NJIT you must observe the following:

- Address professors and staff appropriately (no informal language or first-name basis)
- If they have a PhD, call them Dr., or Professor; don't call them Mr., or Mrs., or Ms. To get a PhD is VERY HARD work... respect your professors for their hard work too. Thanks!
- Correct grammar (all capital letters are not acceptable, neither SMS abbreviations)

I hereby kindly inform you that these NJIT guidelines must be met in future electronic communication.

Thanks.

Also, please note this: it is important for me to know your correct

1. Last Name
2. First Name
3. email Address
4. web URL of your assignments. (Please note, that if you don't have a web page and haven't uploaded your assignments to your web page during the semester as required, then I cannot give you a pass grade in this class. Regarding 'I', or 'incomplete grade rules' please consult NJIT rules on the web. Thanks!)

Then I can look up your assignments on the web.

Please do not:

1. Change your name without letting me know
2. If you change your name, you also must change it in the NJIT system, else I cannot recognize your name change and therefore this results in zero grades
3. Do not use several different email addresses
4. Use the NJIT offered email address when you are communicating with me
5. Do not use an email address that responds to me with a 'Delivery to the following recipient failed permanently:' note because then I cannot communicate with you!

I know these are basic and elementary level things, and I hate to repeat myself, but please note, that the above mistakes happen several times in every semester and cause a lot of confusion and false claims and statements...Let's avoid this by communicating professionally. Thank you for reading and understanding this!

P.S.

Had I phrased my emails in a friendly SMS-style, or all in capital letters to my boss during my first job I would have been fired on the spot...

---

### A strong focus on creating "T-shaped people" who not only have a "deep technical education," but are also capable of "innovation, creativity, and entrepreneurial sense."

I am pleased to state, that we have been following this approach for the past 15 years at NJIT with my students...

The American Society of Engineering Educators Reports: Stanford's Engineering School Looks To Balance Traditional, Creative Approaches. Inside Higher Ed (May 14, 2010, Epstein) reports, "The undergraduate offerings at Stanford University's School of Engineering could be engaged in a tug of war." The program's current "emphasis on current state-of-the-art technical knowledge must be complemented with an openness to change," according to

James D. Plummer, the school's dean. "We need to teach our students to be lifelong learners, to be able to keep updating themselves to be the best they can possibly be throughout their careers," he said. But retaining accreditation is important, "so rather than giving up on the bean-counting basics" Plummer has focused on creating "T-shaped people" who not only have a "deep technical education," but are also capable in terms of "innovation, creativity, [and] entrepreneurial sense." The article details Stanford's program, and some of the differing views on it. Inside Higher Ed notes that, overall, curricula have become "more holistic" since ABET began implementing its Engineering Criteria 2000 standards.

This is an interesting site, worth visiting for planning purposes: <http://www.payscale.com>

**In this course we follow Computational Thinking (CT) principles.** CT is a problem solving process that includes a number of characteristics and dispositions. CT is essential to the development of engineering computer and other applications, but it can also be used to support problem solving across all disciplines, including the humanities, math, and science. Students who learn CT across the curriculum can begin to see a relationship between academic subjects, as well as between life inside and outside of the classroom.

This course provides an opportunity to experience some of the elements of CT, including:

**Decomposition:** Breaking down data, processes, or problems into smaller, manageable parts (often referred to as objects; as part of the object-oriented thinking paradigm),

**Pattern Recognition:** Observing patterns, trends, and regularities in data, and between objects,

**Abstraction:** Identifying the general principles that generate these patterns of data / objects, and

**Algorithm Design:** Developing the step by step instructions for solving problems.

In terms of applications of the above, we also focus on the following:

- Digital Workforce Productivity
- Intelligent Asset Optimization
- Enterprise Operational Intelligence
- Scalable Production Management

These are very important areas for your real-life / professional preparation as game changing professional engineers working in hi-tech US industry.

**More on what industry is looking for... (ref. Toyota)... Please read this ONLY if you want to become successful in USA and international industry...**

The **Toyota company-wide culture** is the key ingredient in its success. What can we learn of the "human systems" that Toyota put in place?

The Toyota "human systems" consistently support and sustain high levels of performance... and this is exactly what I reward in this class too... why? ...because I would like you to become successful...

These are some of the secrets that I as an educator share with Toyota... and I will try to teach you too in this class (if you allow me...):

1. Find competent, able, and willing employees / students,
2. Start training / educating and socializing your people / students as you hire them / teach them,
3. Establish and communicate key business performance indicators / assignments and grades, that reflect true progress at every level of your organization,
4. Train / educate your people / students to solve problems and continuously improve processes in their daily work / assignments,
5. Develop leaders who live and teach your company's / the class's philosophy, and
6. Reward top performance and offer help / office hrs, etc. to those who are struggling (this is reflected in the grade).

To illustrate this, there are some really interesting computer graphics in IE and design for manufacturing simulation videos here:

<http://www.solidworks.com/sw/resources/videos/fma-vibration-video.htm> to illustrate the above.

Also, suggest to read this, about **Visual Management**:

Visual management aims to make the situation easily understood merely by looking at it. The goal is to get as much information as possible with as little observation or time as possible. Visual management complements well with the idea of going to the real place ([Genchi Genbutsu](#)). It also intertwines closely with [5S](#). (More here: ref.: <http://www.allaboutlean.com/visual-management/>)

You have a GREAT opportunity (if you work hard and truly want to achieve your dreams...)

These are the facts:

*'The U.S. Labor Department's Bureau of Labor Statistics (BLS) calculates that for every dollar of value created in manufacturing, \$1.40 is created in associated sectors of the economy. Manufacturers account for roughly two-thirds of U.S. R&D expenditures, and employ more engineers and scientists than any other private-sector industry. The sector's goods make up more than half of U.S. exports and drive more net-wealth creation than any other part of the nation's economy.*

*But the skills gap holds back this important economic engine. Lacking adequate, if not superior supplies of human capital, and mired in a recession/slow-to-rebound economy, American manufacturing firms have focused on their survival and their shareholders, and sought the most expedient ways to address their talent shortages. And while many firms remain at the forefront of technology (think computers, medical devices, chemicals, machinery, aerospace, and military equipment), that lead is narrowing.*

*The nagging U.S. manufactured-goods trade deficit portends tougher times, unless it is reversed. In 2010, the nation ran an \$81 billion deficit in high-tech manufactured products alone. This was a reflection of the talent gap, as were the consequential 687,000 high-tech manufacturing jobs the U.S. labor market lost to overseas production. That's a 28 percent decrease in the base of talent capable of producing high-tech, high-value good.' (Ref.: The Manufacturing Executive Leadership Journal under the title '8 Steps for Closing the Skills Gap'. <http://www.gilcommunity.com/groups/manufacturingleadership>)*

**About Smart, Connected Products...**

Smart, connected products will help make people, materials, energy, and plant and equipment far more productive, and the repercussions for business processes will be felt throughout the economy. We will see a whole new era of "lean." Data flowing to and from products will allow product use and activities across the value chain to be streamlined in countless new ways.

Waste will be cut or eliminated. Sensors in products can identify the need for service before a component fails, reducing downtime. Or they can reveal that maintenance isn't yet necessary. An oil change, for instance, will take place only after oil contamination has hit a certain threshold, rather than according to a schedule. New data analytics will lead to previously unattainable efficiency improvements. Wasted capacity will be driven out. Because products will report on their location and use, we will be able to make the most of them. Smart, connected elevators, for example, can predict and act on user demand patterns, reducing wait times and electricity use. A building that once might have needed six elevators can provide better service with four.

Product-as-a-service models will allow customers to pay only for what they actually need. With data and connectivity, the sharing of assets (think cars or bikes) will become possible or easier than ever before. (Ref.: Harvard Business Review, October, 2015)

One of the key purposes of this course is to close this huge US skill gap to achieve the above goals.

**Let me share this with you: The 10 Principles of Learning** (ref.: <http://www.peloruslearning.com/the-10-principles-of-learning>)

1. Learners need to know where they are going and have a sense of progress towards their objectives.
2. The learning environment has to be one of trust, respect, openness and acceptance of differences.
3. Being aware of and owning the responsibility for learning lies with the learner. Others can only give information and support, and provide feedback.
4. Learners need to participate actively in the learning process.
5. Learning should be related to and use the learner's experience and knowledge.
6. Learning is not only a basic capability but also a group of skills which can be developed and/or learned.
7. Facts, concepts and skills are learned in different ways.
8. Getting ideas wrong can be a valuable aid to developing understanding.
9. For learning to be processed and assimilated, time must be allowed for reflection.
10. Effective learning depends on realistic, objective and constructive feedback

### Does higher education mean lower joy on the job?

American workers with a college degree are less likely than their counterparts with a high school diploma to feel enthusiastic about their jobs, and that's "bad for the U.S. economy," a new report says. (Ref.: Mary Beth Marklein, USA TODAY, July 13, 2013; Edited by Ranky; for the full article, please look up USA TODAY.)

A number of recent reports suggest that many college graduates are overqualified for their jobs. One, a study based on 2010 Labor Department data by the non-profit Center for College Affordability and Productivity, found that 41.7 million college graduates were in the labor force but only 28.6 million jobs required a college degree.

The Gallup report recommends "building a better pipeline between colleges and workplaces." Educators have a responsibility to help students play to their strengths.

"Something about college is taking people further away from doing what they're best at ... as opposed to bringing them closer to it".

The study defines employees as engaged with their jobs if their responses to various questions show they are "involved and enthusiastic about their work." They are not engaged if responses show they are satisfied with their workplaces but "not emotionally connected to them," and they are actively disengaged if they are "emotionally disconnected."

On average, 30% of American employees are engaged at work, but levels of engagement diverge when education was a factor.

Among details:

- Workers with a high school diploma or less were more likely to be engaged (33%) and college graduates were less likely (28%). Engagement rebounded slightly, to 30%, among workers with a postgraduate degree or postgraduate training -- perhaps because those students have found a particular passion, Busted speculates.
- More than half of all workers (52%) were not engaged in their jobs, including 48.2% of those with a high school diploma or less and 55% of college graduates.
- Workers with college degrees were less likely to be actively disengaged in their jobs (17%) than those who did not attend or finish college (19%).
- Americans across all levels of education were most likely to be engaged at work if they held a managerial position. Among college graduates, transportation workers were the least engaged (16%)
- Among managers or executives, those whose education ended in high school diploma or less were most engaged (41%).

Tom Bowling, vice president for student affairs at Frostburg State University in Frostburg, Md., says colleges should encourage students to explore their talents and passions.

Ranky's comment: ...well, this is why, in ALL of my classes every student can design his/her own assignments (based on a common set of analytical methods, that they have to learn in my classes as engineering students). This should trigger innovation, joy and excitement for accomplishing something REALLY useful for YOUR future!

### These are my key management principles I follow when I teach this class for you:

**1. I set clear goals and expectations regarding what we should accomplish in this class together.** I communicate this via the lectures in this class, via this web syllabus, the eBook, the videos you should see, as well as by being available by email typically 7 days a week, 14 hrs a day, as well as during the announced office hrs. at NJIT. I am trying to prepare you for the hi-tech industrial world. If anything is unclear, please read the syllabus first, and then ask me if it is still unclear. As you will see, I am communicating 'what, by when, where and why?'

**2. I am trying to be as approachable as I possibly can.** I have an open door (digital, as well as physical) policy. I answer emails typically 7 days a week, 14 hrs a day.

**3. I am trying to build positive work relations between you, your class mates, and myself.** This is your team, as well as my team. I provide support when needed without taking out your fun of discovering / creating something new and valuable... this is why I try to offer you solution ideas / guidance, versus actual solutions, that you can copy / paste as a machine. This way you'll learn more, and I can prepare you for real life better.

4. **I encourage opinions, ideas and open non-censored (but respectful) discussion.** I would like you to be problem solvers. I would like to create a culture of innovation in this class, even if we disagree occasionally. That is fine with me. It is part of the learning curve.
5. **I acknowledge quality work, but also express my opinion if I am unhappy with the quality of work you are producing in this class.** I would like you to be problem solvers and motivate you to do better all the time.
6. **I would like to see you having fun learning and discovering in this class.** Schooldays should be fun too!
7. **I would like to see you communicating effectively and professionally.** I hope I can encourage you to actively engage, participate and network in this class.
8. **I would like to see, that you are transparent in this class.** This is because this is key to building trust. (This is one reason why we'll document all assignments on the open web, that you create, maintain and control.)
9. **I would like to see, that you learn how to be an example by being a positive role model.**

## Content and Links

[Course Objectives](#)

[How to Set up Your Internet Webpage at NJIT?](#)

[NJIT Academic Calendar](#)

[IE203 Course Schedule and Assignment Deadlines](#)

[Assignment Requirements & Assessment Criteria](#)

[Assignment Architectural Support Information](#)

[Course Improvement and Quality Surveys](#)

**Course objectives:** Please note, that the course objectives fit into the IE Educational Objectives as defined by our Department, NJIT and ABET (the Accreditation Board of Engineering and Technology of the USA).

Every session of this course map develops and integrates one or more aspects of the IE program objectives into the course objectives. Almost every session of the IE203 course includes computer applications in the class lab., or students using their own computers with courseware, and some include laboratory exercises using real machines and real processes to deepen our knowledge of the subject.

### A summary of the IE educational objectives:

1. Program graduates use the fundamental principles and major areas of Industrial Engineering in their professional practice.
2. Program graduates are life-long learners, pursuing graduate education, and professional growth in Industrial Engineering and related fields.
3. Program graduates pursue diverse career paths and advance in a variety of industries.

Please note, that as in previous semesters we will specifically address visual factory management with eco-friendly, lean sustainable **GREEN** aspects of all of our system models and designs in this course. More on **Green Engineering**: <http://www.cimwareukandusa.com/All-Green/Ranky-GreenEngineering.html>

### A summary of the IE203 course objectives

- To provide an overall understanding of, and introduction to computer graphics and object-oriented interactive multimedia development and application methods in the industrial and systems engineering context for the purpose of designing lean, visual factories, visual / electronic product / process support systems, visual offices, and to understand various analytical IE methods.
- To introduce some basic terminology of computer graphics, interactive multimedia and the Internet with an IE focus.
- To develop the ability to apply mathematics, science and engineering in the computer graphics in IE context.
- To design/ develop and apply system modeling techniques in the IE context.
- To design and conduct laboratory experiments, as well as analyze and interpret data.
- To design systems, built of components and objects, performing a desired process for a set of defined customer requirements and needs.
- To understand the total quality rules and implications of computer graphics applications in IE and engineering in general (all assignments).
- To understand the concurrent / simultaneous engineering and PLM (Product Lifecycle Management) rules and implications of computer graphics applications in IE and engineering in general (all assignments).
- To understand the implications of computer networking and Internet applications in IE and in engineering in general (all assignments).
- To discuss various research and industrial case studies with the aid of interactive multimedia and Internet/ intranet programs as part of a library of Digital Educational Knowledge Assets (DEKA).
- To understand, evaluate, test, learn and apply some software packages, including Microsoft Office, Word, Powerpoint and Excel, as well as some of the basics of Adobe graphics and some digital video tools, Internet/ intranet and web authoring tools, professional 2D Drafting, 3D CAD, CAM and PLM (Product Lifecycle Management) software tools, and some IE oriented analysis packages that support computer graphics on desktop as well as Internet/ Intranet networked computers. (Note, that all software in this course is dealt with on a non-bias, cross-platform-basis and/or platform independent basis with strong emphasis on the Internet as an integrating platform).
- To understand some of the computer graphics and IE related system integration aspects.
- To design/ develop/ implement and validate an interactive multimedia presentation (web- oriented) on a specific area of Industrial Engineering with some advanced IE related computer graphics objects and features.
- To appreciate the power of computer graphics by analyzing the results of 3D simulation studies.
- To design/ develop some team integration, presentation, communication and documentation skills of complex engineering systems (all assignments and class presentations).

- To understand professional and ethical responsibility and to communicate effectively (all assignments and class presentations).
- To address societal issues by communicating IE via computer graphics applications (all sessions).
- To introduce, demonstrate and to some extent explain contemporary issues and the latest research areas and future trends in the field of computer graphics applications in IE.
- To encourage life-long learning, planning, knowledge creation, knowledge absorption and knowledge dissemination processes for the benefit of mankind (all sessions).
- To encourage environmentally friendly engineering problem solving methods for the simultaneous benefit of humanity, business, as well as Mother Earth (yes, it is possible to make money as well as simultaneously look after humanity and the environment...). This is referred to in Japanese as the 'monozukuri' approach to engineering problem solving. Well known Japanese, US, and European corporations all follow *monozukuri engineering* problem solving methods.
- To encourage, and to some extent develop innovation skills, adaptability skills, information management and communication skills using virtual tools and the Internet, relationship-building skills, and cultural understanding of global economies (all assignments).
- In this course we attempt to promote Toyota's lean and green manufacturing and *Genchi Genbutsu Engineering* philosophy. The Japanese phrase literally means the *actual part, the actual place*, but for one of the best design, industrial and manufacturing systems engineering companies in the world, it implies 'go and see the actual situation first hand to truly understand the current reality'. (This philosophy obviously focuses on educating well-rounded engineers who can reason in a wide range of spectrums, as well as dig as deep as necessary to find the best alternative solutions.) This goal is implemented in this course supported by several analytically founded and simultaneously practical laboratory and in-class mobile laboratory exercises (these are hands on tasks, such as disassembling computers and other devices, whilst modeling the processes, as well as focusing on quality, assembly, lean, 5S, and other methods and attributes), as well as virtual exercises by means of virtual factory tours using DVD videos, and other advanced 3D interactive multimedia resources.
- The 21st Century Engineer must simultaneously be an analytical, as well as practical **Sustainable Green Engineer**, a professional information searcher, an information and knowledge creator, as well as somebody who can reason over several different sets of information and then select the best possible solution path under constraints... not an easy task. In order to help this process, in this course we'll visit several world-class US, Japanese and European factories and design studios on DVD videos. We'll also rely on NJIT's vast and advanced electronic library, see some of the typical information searches and how the results can be evaluated. For our purposes, we'll use NJIT's SCOPUS electronic database. You can reach it via: [http://www.scopus.com.libdb.njit.edu:8888/scopus/home\\_url](http://www.scopus.com.libdb.njit.edu:8888/scopus/home_url), all you need is your UCID and password (as offered by NJIT to every NJIT student) to access this site.
- **SOCIAL NETWORKING and Video Conferencing:** During the semester, I will email you several links to short technical articles, that are really important for you to follow and understand what is going on in the world in our subject area. This is particularly important to some foreign students who are not used to get their news via the Internet. You suppose to read these articles and then discuss at least THREE (3) of them with at least one more member in your class, and then document your findings in your social networking part of EACH assignment. I would like to see that you are discussing the content of these articles. Usually in a semester I send out about 15 to 20 short and current articles to read. Through my editorial work with major journals I get hundreds of *just published* articles that I can choose from... I am looking for your about 200 word long executive summaries of the discussions you have done with one or more of your classmates on these articles via email, and/or video conferencing. These activities are all part of each assignment now and therefore should be documented in your web page, just as the rest of your assignments are. (All in one; nice object-oriented principle; not zillions of separate files please!) Please note, that this is a good definition of what an 'Executive Summary' is: From Wikipedia, the free encyclopedia  
*An executive summary, sometimes known as a management summary, is a short document or section of a document, produced for business purposes, that summarizes a longer report or proposal or a group of related reports in such a way that readers can rapidly become acquainted with a large body of material without having to read it all. It usually contains a brief statement of the problem or proposal covered in the major document(s), background information, concise analysis and main conclusions. It is intended as an aid to decision-making by managers and has been described as possibly the most important part of a business plan. They must be short and to the point. An executive summary differs from an abstract in that an abstract will usually be shorter and is intended to provide a neutral overview or orientation rather than being a condensed version of the full document. Abstracts are extensively used in academic research where the concept of the executive summary would be meaningless. "An abstract is a brief summarizing statement... read by parties who are trying to decide whether or not to read the main document", while "an executive summary, unlike an abstract, is a document in miniature that may be read in place of the longer document".*

According to NJIT's policies, in this course the **NJIT Honor Code** will be upheld, and violations will be brought to the immediate attention of the instructor, the Chair, and the Dean of Students if necessary. Also, students will be consulted by the instructor and must agree to any modifications or major deviations from the syllabus throughout the course of the semester.

Please note, that as part of this course we'll learn how to design simple web-pages and document your assignments over the web. This is an essential skill you'll have to learn to progress within the computer graphics for IE knowledge domain. You will also learn about lean visual factories, visual offices, graphical electronic support systems for products and processes throughout their entire product lifecycle, including lean, sustainable green manufacturing. These topics are essential for you as a professional engineer.

### The 'USA needs more practical engineers...' says Bertoline, dean and distinguished professor at Purdue University's College of Technology...

*The keynote topic was what was Gary Bertoline terms a "fatal flaw" in engineering higher education. The U.S. struggles to hire the people needed to fill technical positions. At least part of the problem: The engineering education system in this country has been built around scientifically oriented engineering curricula, producing theoretical engineers who have little knowledge of how to apply skills to real-world engineering jobs.*

*The problem grew out of a post-WWII mentality in which engineers thought if they didn't get their hands dirty, they would be taken more seriously as professionals like lawyers and doctors. The movement created curricula with a lot of math, a lot of science, and a lot of theoretical representation of how to go about solving problems; unfortunately, not a lot of practical knowledge about how to work in today's manufacturing industries.' More here:*  
<http://www.automationworld.com/operations/addressing-fatal-flaw-engineering-education?&spMailingID=6153877&spUserID=Nzq0Nzk5ODk2MQS2&spJobID=73661974&spReportId=NzM2NjE5NzQS1>

Ranky: My position on the above is very clear: we need a strong analytical foundation, as well as good practical engineering and management skills. I am pleased to state, that this course offers a good balance between some exciting analytical as well as practical engineering knowledge and skills. (It is interesting to see though, that based on 15 years of student evaluations and feedback on this subject, almost every semester at NJIT, about 5 percent of the students do not want ANY practical engineering knowledge to be taught, or learned, or practiced... and the rest, about 95 percent or so want more and welcome the balance provided...

**Some More, Useful Web-based Resources** (please note, that these links worked at the time of writing):

<https://edgfactor.com/home>

<http://www.sciencechannel.com/tv-shows/how-its-made>

<http://www.westernc.edu/maxandben/>

<http://www.dreamitdoitvirginia.com/index>

<http://www.toolingu.com/shortage/>

<http://theamericaninnovator.com/>

<http://manufacturing.gov/welcome.html>

<http://www.brookings.edu/research/interactives/2013/the-hidden-stem-economy>

<http://mckinseysociety.com/education-to-employment/report/>

<http://manufacturingskillsinstitute.org/>

<http://www.themanufacturinginstitute.org/>

<http://www.asminternational.org/foundation/about>

<http://www.nutsandboltsfoundation.org/>

<http://www.smeef.org/>

<http://www.usfirst.org/>

<https://www.nims-skills.org/web/nims/home>

Federal Reports on Manufacturing Skills: Capturing Competitive Advantage in Advanced Manufacturing (also look for the latest versions of this report if available):

[http://www.whitehouse.gov/sites/default/files/microsites/ostp/pcast\\_amp\\_steering\\_committee\\_report\\_final\\_july\\_17\\_2012.pdf](http://www.whitehouse.gov/sites/default/files/microsites/ostp/pcast_amp_steering_committee_report_final_july_17_2012.pdf)

<http://www.themanufacturinginstitute.org/Research/Facts-About-Manufacturing/Facts.aspx>

Advanced Manufacturing Competency Model

<https://www.careeronestop.org/COMPETENCYMODEL/competency-models/advanced-manufacturing.aspx>

PMMI Mechatronics Competency Model for Hybrid Manufacturing

<https://www.careeronestop.org/COMPETENCYMODEL/competency-models/mechatronics.aspx>

Manufacturing Skills Certifications: The Manufacturing Institute's Skills Certification Program:

<http://www.themanufacturinginstitute.org/Skills-Certification/Certifications/NAM-Endorsed-Certifications.aspx>

PMMI's Mechatronics Certification Program for Hybrid Manufacturers

<http://www.pmmi.org/Education/content.cfm?ItemNumber=1010>

### Interesting quotations about science and engineering: our profession...

"Scientists investigate that which already is. Engineers create that which has never been."

-- Albert Einstein

"Engineers like to solve problems. If there are no problems handily available, they will create their own problems."

"Normal people ... believe that if it ain't broke, don't fix it. Engineers believe that if it ain't broke, it doesn't have enough features yet."

-- Scott Adams, creator of Dilbert comic strip

"I think one problem we've had is that people who are smart and creative as engineers went into financial engineering."

-- Walter Isaacson, writer and biographer of Steve Jobs and Albert Einstein

"Scientists dream about doing great things. Engineers do them."

— James A. Michener, American author and Pulitzer Prize winner

"Engineer undergraduates should not be charged fees. They should receive grants, not student loans, and the government will get the money back long-term from increased exports."

"Engineering is treated with disdain, on the whole. It's considered to be rather boring and irrelevant, yet neither of those is true."

-- James Dyson, inventor and founder of the Dyson Co.

"I emphasize that virtually every engineering calculation is ultimately a failure calculation, because without a failure criterion against which to measure the calculated result, it is a meaningless number."

— Henry Petroski, author, and professor of civil engineering and history at Duke University

"You have teenagers thinking they're going to make millions as NBA stars when that's not realistic even for one percent of them. Becoming a scientist or engineer is."

-- Dean Kamen, inventor, founder of First Robotics Competition, past Design News Engineer of the Year



"The engineering is long gone in most PC companies. In the consumer electronics companies, they don't understand the software parts of it. And so you really can't make the products that you can make at Apple anywhere else right now."

— Steve Jobs, co-founder of Apple Inc.

"A good scientist is a person with original ideas. A good engineer is a person who makes a design that works with as few original ideas as possible. There are no prima donnas in engineering."

— Freeman Dyson, British-American theoretical physicist and mathematician

"I was always fascinated by engineering. Maybe it was an attempt to get my father's respect or interest, or maybe it was just a genetic love of technology, but I was always trying to build things."

— James Cameron, director

"A lot of people think in terms of people, emotions and feelings. That's more complicated. Engineering mentality makes it, in theory, a little easier."

-- Marc Andreessen, software engineer and co-author of Mosaic, the first widely used Web browser

"There's nothing I believe in more strongly than getting young people interested in science and engineering, for a better tomorrow, for all humankind."

— Bill Nye, science educator, television host, mechanical engineer

"With engineering, I view this year's failure as next year's opportunity to try it again. Failures are not something to be avoided. You want to have them happen as quickly as you can so you can make progress rapidly."

Gordon Moore, co-founder, chairman emeritus, Intel Corp.

"It's true that the original idea was mine, but what you see today is probably the work of tens of thousands of the world's best engineers, all concentrating on improving the product, reducing the cost, things of that sort."

— Jack Kilby, Nobel Prize winner, co-inventor of the integrated circuit

"Silicon Valley has some of the smartest engineers and technology business people in the world."

— Elon Musk, CEO and chief product architect, Tesla Motors

"Millions of people were inspired by the Apollo Program. I was 5 years old when I watched Apollo 11 unfold on television, and without any doubt it was a big contributor to my passions for science, engineering, and exploration."

-- Jeff Bezos, founder and CEO of Amazon.com

#### **More on USA Copyright Laws (as per NJIT's official statement):**

All members of the NJIT community are bound by [U.S. Copyright Law](#) when using NJIT computing resources. An important aspect of copyright law is the [fair use doctrine](#) which allows for limited reproduction of copyrighted works for various purposes such as criticism, comment, news reporting, teaching, scholarship, and research.

Copyright law does not permit the unauthorized distribution or sharing of copyrighted materials (e.g. music, movies, software, books, etc.) on computer networks. In particular, the illegal distribution of copyrighted materials via "peer to peer" file sharing techniques may subject users to criminal and civil penalties.

The [Digital Millennium Copyright Act \(DMCA\)](#), enacted in 1998, criminalizes distribution of technologies intended to circumvent measures that control access to copyrighted works. It also heightens penalties for copyright infringement on the Internet.

#### **Copyright Infringement**

Copyright infringement is the act of exercising, without permission or legal authority, one or more of the exclusive rights granted to the copyright owner under section 106 of the Copyright Act (Title 17 of the United States Code). These rights include the right to reproduce or distribute a copyrighted work. In the file-sharing context, downloading or uploading substantial parts of a copyrighted work without authority constitutes an infringement.

Current penalties for copyright infringement include civil and criminal penalties. In general, anyone found liable for civil copyright infringement may be ordered to pay either actual damages or "statutory" damages affixed at not less than \$750 and not more than \$30,000 per work infringed. For "willful" infringement, a court may award up to \$150,000 per work infringed. A court can, in its discretion, also assess costs and attorney's fees. For details, see Title 17, United States Code, Sections 504 and 505.

Willful copyright infringement can also result in criminal penalties, including imprisonment of up to five years and fines of up to \$250,000 per offense.

For more information, please see the Web site of the U.S. Copyright Office at [www.copyright.gov](http://www.copyright.gov), especially their FAQ's at [www.copyright.gov/help/faq/](http://www.copyright.gov/help/faq/).

#### **NJIT Policies on Copyright**

NJIT's [Acceptable Use Policy for Cyber Resources](#) requires all users to abide by copyright and trademark laws relating to the use of computing resources. Users shall not copy, disclose, modify, or transfer copyrighted materials. Exceptions are only granted under the fair use doctrine referenced above.

NJIT responds with haste to investigate all reported violations of copyright infringement through use of its computing resources. This includes reported violations of the Digital Millennium Copyright Act. Reported violations are investigated in conjunction with the Dean of Students Office and/or the Office of Human Resources.

Violation of these policies may result in a range of sanctions beginning with loss of certain computing privileges up to suspension or expulsion from the university for students and termination of employment for employees.

Additional information on copyright infringement and the steps NJIT takes for combating the unauthorized distribution of copyrighted materials is available at <http://ist.njit.edu/heoa2008/>.

#### **Legal Alternatives for Access to Copyrighted Music and Other Digital Materials**

The Office of Digital Learning and Technology Support maintains a website with a discussion of copyright issues and sources for legal access to copyrighted movies and other digital content. Please visit: <http://ist.njit.edu/music/music.php>.

## These are the Basic Rules on How To Set Up a web page at NJIT as a Student

**(Please note, that your web-page design represents a very important skill in terms of organizing and structuring your data objects on the Internet, helping you to become an object-oriented thinker, and also to learn professional, graphical documentation skills.)**

1. **PLEASE set up your own web page including your photo in the webpage**, use NJIT's FREE web server, or your company's, or your own, or other solutions that work... it is your choice what software you use, which service provider you chose, etc... **PLEASE submit ALL your assignments electronically**. Since I deal with typically over 1200 assignments every semester **ALL YOUR ASSIGNMENTS MUST BE** submitted electronically, meaning a URL in an email, pointing to a web page. If you do this over the web, it becomes very easy after Assignment 0... you may email me assignment 0 as an attached Word file, or PDF file, nevertheless you should put it onto your web site as soon as you have learned how to create a website. (I'll teach you how to design a webpage in the life class, else please rely on NJIT's IT web pages, or others. You chose the software and web services... just make sure, that the service can handle links, including links to .XLS (i.e. Excel) files (NOT embedded into PDFs pls.), since your spreadsheets will be in this format... NJIT's free server option has this, many others do NOT allow this. Every semester this creates trouble for some students, therefore pls. note this and make sure that all works fine!) Note, that some students create a simple content list and then attach every assignment in PDF, or MS Word... this is wrong practice. Please put the text into .HTML, the images into .JPG files and the spreadsheets into .XLS files. These are useful instructions in [PDF](#), on how to set up a simple web page for this class. (Please note, that since the web changes all the time, some of the screen prints in this document might look different at the time you read it.)
2. Another excellent approach to set up simple web pages is to use the FREE <http://www.weebly.com> site. Many students found this approach to be the simplest and best!
3. If your web page does not link due to a link error you get an automatic 0 grade for the assignment. Sorry, this is tough I know, but teaches you on how to pay attention to detail and the importance of testing your work before submitting it to me... pls. ask a colleague, classmate to test your page. IF you ask me to sign in with a password then that is zero grade too. Sorry, I do not do that. This still means that you can rework this assignment and submit it again with the 5th assignment together for a better than zero grade, assuming you have submitted the first time around on time...
4. **PLEASE do NOT use MS-Publisher as a web authoring tool**, since it has linking problems even within an entirely MS 'industry standard' (or non-standard?) environment... not to mention the internationally accepted Internet community... 'If they cannot see your web pages then why to bother at all...' therefore make sure that your web pages are being used for knowledge collection and knowledge management and therefore are accessible from anywhere in the world!
5. Please make sure that your URL works before you send me an email with a full length URL in it so that I can click on it and directly link to your assignment(s). Every semester I get 3-4 submissions that have link errors or even passworded sites... in such a case you get zero grade for the assignment and you can resubmit it with the LAST assignment in the entire course (not the last time submitted assignment as many students interpreted this rule in the past...). The best approach is to set up your own web page, and then copy-paste the requirements from this syllabus and then add every assignment to this URL as you develop your assignments. This way you won't miss any aspect of any assignment. Also, this will be an extremely valuable knowledge documentation method to learn and resource when you apply for a job! If you don't know how to set up a webpage pls. read these useful instructions in [PDF](#), on how to set up a simple web page for this class.
6. When you are done, you trigger my grading process by sending me an email with your URL in it. Again, **submit it on due date**, NOT earlier, NOT later pls. and therefore your email triggers my grading process. This helps my system a LOT! Thanks!

As an NJIT undergraduate, graduate, live and/ or Distance learning, or in other words eLearning Student, or hybrid course student you are *entitled to benefit of significant FREE computing resources*, meaning hardware, software, as well as on-line email, web-site storage space, and related Internet and NJIT intranet server services. The steps below intend to help you on how to set up a web page for documenting your assignments for this course. Please read and follow each step. Obviously if you already have a web page, either through work, or business, or otherwise, please feel free to use that, or the one you prefer. (All we want is for you to learn the method, and then put all your assignments on the web, learn how to manage your knowledge over the web, and then email your URL with your assignments to the instructor for grading). Note, that you can use any suitable web authoring software. NJIT has a few on free offer too.

### These are the steps to follow (as provided by NJIT's IT and Computing Services):

Hopefully all works... I'd like to see your beautiful webpages!

1. Visit: <http://csd.njit.edu/resources/webservices.php> (...note, that NJIT URLs change often...) and read the instructions for Home page Setup. If you don't understand the details offered, please contact NJIT Academic Computing at Tel: (973)-596-2900, and they'll take you through. (Note, that lines can be busy during peak times, such as at the beginning of the semester, or towards the end of the semester, therefore to sort this out the earlier the better!)
2. In class, the instructor will go through, step-by-step, in detail, on how to set up a simple web page with text, graphics and spreadsheets embedded. (Note, that the instructor focuses on methods, not the actual software tools.)
3. You should have an index.html file as your 'title page', because search engines will find you via the index.html file, and your hyper links to other files should be programmed passing through this index.html file.
4. Please make sure, that you create your index.html file in your public\_html directory and have all your other .html, .jpg, .xix, .mov, etc. files in the same directory, else you will have a 'path error', meaning that your files will not link when viewed by others over the Internet.
5. Last, but not least: **ALWAYS test your uploaded assignment** using your own, as well as somebody else's computer, to make sure, that everything works fine. (If you don't have a second, independent computer on the web, ask one of your classmates, or friends to check it for you, by sending him/her an email with a full URL in it, like this: <http://www.mycoursewebpage.edu>). Also note, that besides the class discussions (live class), the eLearning pack CDs have several examples on the architecture of simple and complex web-pages. All of these are in open source, please study them! We'll discuss some of this in class too!

## NJIT Academic Calendar

Please look up the accurate dates on the NJIT website.

**IE203 Course Schedule (PLEASE NOTE: Attendance and Active Participation is a requirement in this class during the Entire Semester):**

Pls. check the NJIT webpage for classroom allocations, or any changes. Also note, that possible minor changes to the schedule will be announced in class.

**1. Class: NJIT Week 1: Introduction and overview** of computer graphics in IE and this course. An explanation of the topics to be covered in the multimedia class / project presentations. An explanation of the syllabus and the assignments for the semester. Visual factory communication: the traditional vs. Internet-age methods and solutions. The visual factory defined in the IE context. Discussion: How visual information can help to improve quality, reduce cost, support operators and management, increase productivity, design, maintenance, production control, safety, service and many other processes. Concurrent Engineering, Lean Sustainable Green Manufacturing and PLM (Product Lifecycle Management). How do these disciplines fit together? What is the IE's role? (Virtual factory visits using DVD videos and interactive multimedia.) Class discussions.

Please read and study technical articles and resources, provided by the instructor, covering important aspects, such as: Visual Factory Management with Computer Graphics in IE: Lean Six-sigma and Monozukuri (also spelled as mono-zukuri). We'll discuss these key methods, tools and technologies as the best factories execute these methods in Europe, Japan, China, Korea, and in the USA. (Note, that I learned these critically important methods from GM, Denso, Toyota, Honda, BMW, Bentley, IBM, Mori-Seiki, Fanuc, Rolls-Royce, and others, and I am keen to teach them to you too!)

*'Monozukuri' is a Japanese phrase, and it means eco-friendly, sustainable green design, lean and visual manufacturing and assembly for the purpose of reducing waste, helping the environment, the communities and in the long term increasing profits and product quality. This principle is based on the long-term thinking and logic, that societies will eventually realize the effects of pollution, toxicity and environmental degradation, and therefore customers will turn towards environmentally safe products. Then, this long-term investment pays off in a relatively short time, because those companies that ignore these policies and carry on deploying wasteful production methods disappear quickly.*

*Key principles we'll discuss with several examples:*

*Principle-1: Design and simulate in the digital domain, meaning on the screen first, before anything is built on the factory floor, following eco-friendly, 'monozukuri-focused' product, assembly system and factory design rules.*

*Principle-2: Design products for automated assembly, but start with mostly human operated assembly systems and gradually introduce the appropriate level of automation.*

*Principle-3: Management decisions should reflect long-term thinking, even if this means initially hard-to-accept financial returns.*

*Principle-4: Develop outstanding leaders who fully understand and support the company philosophy, and wisdom. (Note, that company mission statements in the 21st Century should include a sustainable, green design and manufacturing focus!)*

*Principle-5: Create a strong company culture that does not tolerate poor quality work and focuses on continuous improvement and waste reduction methods and tools. (Note, that by reducing waste at all levels the company becomes leaner, therefore more sustainable... )*

*Principle-6: Good leaders will spend time at all levels of the company to thoroughly understand all aspects of a decision ('genchi genbutsu').*

*Principle-7: Your company supply network plays a key part in designing products, processes and systems, therefore help them to continuously improve.*

*Principle-8: Decisions should be achieved by means of team consensus.*

*Principle-9: Design continuous process flow with built-in flexibility and agility to be able to produce several (e.g. 5-8, or even more) different product types on the same line.*

*Principle-10: Balancing the workload is essential to avoid high WIP (work – in –progress) and buffer size fluctuations ('heijunka').*

*Principle-11: The production control system should always focus on producing based on the market's needs, not the factory's maximum capacity .*

*Principle-12: Follow reusable, standardized processes. (This does not mean of course, that you shouldn't innovate and design new processes and continuously improve quality and sustainable lean and green processes.)*

*Principle-13: It is 'OK' to stop the line if the associate recognizes a quality issue that needs to be fixed immediately ('jidoka'). 'Jidoka' literally means machines with human intelligence. As an example think of a 'Smart' machine, such as an automated robotized inspection station with vision.*

*Principle-14: Technology used should be the 'appropriate, tested level of technology' versus the latest, for the sake of using the latest technology.*

*Principle-15: Design continuous improvement techniques, or Kaizen methods into every process .*

*Principle-16: Design products and processes in the digital domain first, to avoid MUDA, MURA, and MURI.*

- *MUDA MUDA means waste. It means many different types of waste, including: unbalanced workload, long waiting times and uncoordinated action plans between departments, as well as waste in terms of, "is the right man doing the right job?"*
- *MURA MURA means irregularity, or differences and variability caused by men. Are individual differences wider than normal? Is coordination between associates causing unnecessary irregularities? Is the workload evenly distributed? Are the peaks preventing associates and managers from performing their jobs properly? Is the workload and the type of work balanced in terms of skills, responsibilities and authority? Is proper training provided?*

- *MURI MURI means stress and strain. It reflects on problem areas such as: Is there a shortage of manpower? Is there an opportunity to simplify the operation unloading strain of the operators? Is there an opportunity to reduce organizational strain in the design and manufacturing office by organizing work and activities better? Is manpower and staffing acceptable? Is there a physical strain or ergonomics issue (e.g. posture, environmental pollution, and noise)?*

*Principle-17: Visual factory to support all sustainable, lean and green requirements.*

*Principle-18: Strive towards the wisdom of a learning organization through analysis and reflection ('hansei') and continuous improvement ('kansei').*

**About positive psychology principles, positive thinking, implemented as 'flow'...** (Note, that positive thinking is an essential skill for solving challenging problems. Industry all over the world needs excellent problem solving engineers. There are **millions of jobs** for these kind of engineers!)

Please note, that in this class we follow positive psychology principles, implemented as 'flow' (please see below). Positive psychology is the scientific study of the strengths that enable individuals and communities to thrive. The field is founded on the belief that people want to lead meaningful and fulfilling lives, to cultivate what is best within themselves, and to enhance their experiences of love, work, and play. (Ref.: [https://en.wikipedia.org/wiki/Positive\\_psychology](https://en.wikipedia.org/wiki/Positive_psychology)).

Positive psychology is "the scientific study of what makes life most worth living", or "the scientific study of positive human functioning and flourishing on multiple levels that include the biological, personal, relational, institutional, cultural, and global dimensions of life". Positive psychology is concerned with eudaimonia, "the good life", reflection about what holds the greatest value in life – the factors that contribute the most to a well-lived and fulfilling life.

Positive psychology began as a new domain of psychology in 1998 when Martin Seligman chose it as the theme for his term as president of the American Psychological Association. Mihaly Csikszentmihalyi (born in Hungary in 1934, Europe, emigrated to the USA at the age of 22) and Christopher Peterson are regarded as co-initiators of this development.

Csikszentmihalyi is noted for his work in the study of happiness and creativity, but is best known as the architect of the notion of flow and for his years of research and writing on the topic. He is the author of many books and over 120 articles or book chapters. Martin Seligman, former president of the American Psychological Association, described Csikszentmihalyi as the world's leading researcher on positive psychology. Csikszentmihalyi once said: "Repression is not the way to virtue. When people restrain themselves out of fear, their lives are by necessity diminished. Only through freely chosen discipline can life be enjoyed and still kept within the bounds of reason." His works are influential and are widely cited. (Ref.: [https://en.wikipedia.org/wiki/Mihaly\\_Csikszentmihalyi](https://en.wikipedia.org/wiki/Mihaly_Csikszentmihalyi)).

In Csikszentmihalyi's seminal work, *Flow: The Psychology of Optimal Experience*, he outlines his theory that people are happiest when they are in a state of flow – a state of concentration or complete absorption with the activity at hand and the situation. It is a state in which people are so involved in an activity that nothing else seems to matter.

The idea of flow is identical to the feeling of being in the zone or in the groove. The flow state is an optimal state of intrinsic motivation, where the person is fully immersed in what they are doing. This is a feeling everyone has at times, characterized by a feeling of great absorption, engagement, fulfillment, and skill—and during which temporal concerns (time, food, ego-self, etc.) are typically ignored.

In an interview with *Wired* magazine, Csikszentmihályi described flow as "being completely involved in an activity for its own sake. The ego falls away. Time flies. Every action, movement, and thought follows inevitably from the previous one, like playing jazz. Your whole being is involved, and you're using your skills to the utmost."

Csikszentmihalyi characterized nine component states of achieving flow including "challenge-skill balance, merging of action and awareness, clarity of goals, immediate and unambiguous feedback, concentration on the task at hand, paradox of control, transformation of time, loss of self-consciousness, and autotelic experience".

To achieve a flow state, a balance must be struck between the challenge of the task and the skill of the performer. If the task is too easy or too difficult, flow cannot occur. Both skill level and challenge level must be matched and high; if skill and challenge are low and matched, then apathy results. (Ref.: [https://en.wikipedia.org/wiki/Mihaly\\_Csikszentmihalyi](https://en.wikipedia.org/wiki/Mihaly_Csikszentmihalyi)).

**eLearning Pack Resources for this session:** Please review the entire contents of your customized eLearning Pack (available from the NJIT bookstore: labelled **Fall 2019 IE203**). Understand what the 4 collaborative companies do. You must know them, since you have to collaborate with them. Try to invent a new product / process, or service in the area of computer graphics in IE with a visual factory and sustainable green engineering focus.

In class we'll look at and analyze in detail several important videos and multimedia presentations. These will help you to create your own (virtual) enterprise (for this class).

Your instructor will help; don't worry, but it should be your invention. Then set up your own virtual company. This will be the 5th collaborating company. Please note, that the 3D eBook is a web compatible set of files in HTML (text) JPG for images .MOV for videos and .XLS, Excel for executable code.

We'll view videos and virtual factory tours in class, have practical labs., and then we'll discuss what we have seen and learned. All of these will help to learn about analytical methods as well as the real world, to develop your assignments, learn marketable knowledge, and get an excellent grade for this class. A win-win for all of us if you follow my advise!

**IMPORTANT: About Copyright:** Please note, that all eLearning Pack resources, including the CDs and DVDs are individual user licences only, therefore should NOT be uploaded by any student onto the web, or on a server, because that would be in conflict with international copyright laws.

Obviously you can use individual text bits, images, video clips, 3D objects, active code, etc. from these valuable resources, and if you do, reference them in your Bibliography section of your webpage (There are many examples for how to do this professionally in the Documentation sections of the 3D eBooks.) PLEASE

try to stay out of copyright infringement legal trouble! The USA, in particular, has a very strong legal system to enforce copyright laws on an international basis; and they do without any hesitation.

**2. Class: NJIT Week 2:** Internet - based methods and technologies for computer graphics in IE. Digital Educational Knowledge Assets. How to take digital photos, interactive videos for IE applications? Structural and system design issues with software demonstrations. Computer graphics objects and component libraries, image processing and image preparation for the web using professional software tools, and their application in IE. Laboratory exercises and demonstrations. Web - oriented computer graphics methods, designs and applications. **Web-design basics** and issues of knowledge management over the web and secure intranet servers in factories for IEs.

**eLearning Pack Resources for this session:** We'll learn the very basics on how to program the web. Also, we'll learn about computer and machine / robot networking using the Networking 3D eBook (in your eLearning Pack). Networking machines, robots and computers is essential for a factory with a future!

**3. Class: NJIT Week 3:** Internet and web-programming (cont.). The Internet and networking methods/technologies, standards. Computer networking and the Internet. Computer graphics standards, and objects. Industrial examples; research examples. Practical laboratory work in Internet programming. **Student presentations of Assignment 1 (see below).**

**eLearning Pack Resources for this session:** Please refer to your 3DeBook and videos in your eLearning Pack. Please note, that the 3D eBook is a web compatible set of files in HTML (text) JPG for images .MOV for videos and Excel for executable code. You'll also see some visio-drawn graphics in your eLearning Pack. Please note, that the additional videos in your eLearning Pack are rendered using the latest MPG4 standard. To play these you'll need QuickTime 7 or later FREE from teh Apple web site. (This is a cross platform compatible player.) Please review them all, because by doing so you'll understand better how industry works, and why we are studying this subject. Thanks!

**Assignment 1 is due: September 16, (10%): In class project plan presentations.** Based on your customized **IE 203 eLearning Pack**, available from the **NJIT Bookstore**, set up your own virtual company, invent a product/process that relates to the following theme: '**Visual Factory and Lean, Green, Sustainable IE: Computer Graphics in IE**' and give the class a 5 to 8 minute long presentation on what you are planning to accomplish in this class in this semester with your own company. This is a one page summary of your plans for your instructor, as well as a presentation to the class. You must hand in this single sheet summary after your presentation.

#### **About the next 10 to 15 years... and we / you must prepare for this HUGE change!**

In the next 10 to 15 years, factories and plants across industry sectors will be high-tech engines of mass customization, able to respond quickly and effectively to changing customer and market demands (yes, 'on-demand' everything, fast changes, zero defect, real-time feedback of every process step!).

In other words flexibility and agility are very important. (More here: MANUFACTURING LEADERSHIP COUNCIL, VISION 2030: THE FACTORY OF THE FUTURE, Sponsored by GE(USA), and Intel(USA). A Frost & Sullivan Research Paper, 2017-2018 (with Ranky edits and comments below)).

Highly automated and information-intensive, the factory of tomorrow will look like an integrated hardware and software system. (Imagine computers on wheels, and robots, that can solve difficult tasks...). This system will be fueled by vast quantities of information from every corner of the enterprise and beyond (yes, including the supply chain on a global basis), moderated by analytical systems that can identify and extract insights and opportunities from that information, and comprised of intelligent machines that learn, act, and work alongside highly skilled human beings (note: highly skilled and well paid!) in safe and collaborative environments.

Today's image of manufacturing as a dark, dirty, and unattractive place to work will give way to a bright and exciting new reality. This reality is in the early stages of formation today (and of course major leading companies have been working like this already for the past 10+ years!), as trends such as connectivity and networking, information and process digitization, advanced analytics and computing, and new models of production like CNC manufacturing, robotic assembly, 3D printing, and many others, take hold and play out.

The vision of the future is bright indeed, but it is one that has vast implications as well as challenges. As manufacturing becomes increasingly connected and information-intensive, every functional aspect of the enterprise is likely to be affected, from design, to manufacturing, demanufacturing, recycling, sustainable green processing, through supply chains, and extending to customer service and support.

Along the way, the skills people will need for industrial engineering and manufacturing jobs may require significant change. Many manufacturers will have to undertake significant cultural, organizational, and management changes if they are going to take advantage of the opportunities offered by the digital revolution.

Moreover, manufacturers will need to be confident that the high-tech, connected world in which they will be doing business will become more safe and secure (ref.: Industrial Internet of Things, IIoT).

They will also need to be sure that their intellectual capital, operations, and people will be protected. Increasingly, organizations becoming more reliant on automated decision making (yes, machine intelligent systems, rule-based expert systems, artificial Intelligence, Augmented reality, etc. are coming in a big way!) will need to be confident in the integrity of the information they use.

There will be multiple variations and differences in how digitization will apply in the many and varied sectors that make up the manufacturing industry.

The pace at which companies adopt and learn to use digital technologies effectively will also vary. Some will be slow to adapt and eventually disappear... some will become world leaders... it is a huge race in the jungle! But the broad trends evidenced will likely affect all (yes, including YOU!).

Please keep the above in mind when you set up your company.

#### **Assignment 1 outline:**

1. Your name,
2. class,
3. date,
4. eLearning Pack ID (take your eLearning Pack to class to show us your collaborative companies),
5. the 4 Collaborating Companies,
6. Your Company,
7. Your Project Title,
8. Executive Summary of your project, as well as

9. Your main office in the USA and your branch office in a foreign country (as specified for you by the instructor).

Please don't miss any of these items.

#### Explain Specifically:

1. What is your project?
2. What is the Computer Graphics in IE Content in your project?
3. How is your company (i.e. the 5th company) going to collaborate with the 4 eLearning Pack companies to create a lean, green and sustainable product, proces or service? (To get more insight on sustainable green challenges please watch Leonardo's excellent film here: <https://www.youtube.com/watch?v=90CkXVF-Q8M> )
4. How are you going to utilize computer graphics / Visual Factory Management, lean thinking in IE? (More on the HUGE business opportunities in VFM here: <http://www.engineering.com/AdvancedManufacturing/ArticleID/15442/Is-There-a-Technological-Solution-to-the-Manufacturing-Skills-Gap.aspx> ); millions of jobs in the USA and even more world-wide...
5. **In terms of green sustainability, please look up the following sites and videos:** <http://www.cimwareukandusa.com/All-Green/Ranky-GreenEngineering.html>  
In all assignments, please focus on sustainability, and in particular on green sustainability (i.e. toxic waste elimination, non-toxic production processes, green mobility, sustainable business practices, and others). These are very interesting videos, that you should watch to help to learn about this process: [https://www.youtube.com/watch?time\\_continue=1035&v=mMlmjXtnlXI](https://www.youtube.com/watch?time_continue=1035&v=mMlmjXtnlXI) Also, if you want to read more about this, suggest to look up one of my articles here: Ranky, P.G.: An Integrated Architecture, Methods and Some Tools for Enhancing Sustainable Enterprises and Systems. Article Published in Systems 2015, 3(2), 27-44; doi:10.3390/systems3020027; Abstract and Link to Full Article (FREE access) <http://www.mdpi.com/2079-8954/3/2/27>
6. **SOCIAL NETWORKING and Video Conferencing:** During the semester, I will email you several links to short technical articles, that are really important for you to follow and understand what is going on in the world in our subject area. This is particularly important to some foreign students who are not used to get their news via the Internet. You suppose to read these articles and then discuss at least THREE (3) of them with at least one more member in your class, and then document your findings in your social networking part of EACH assignment. I would like to see that you are discussing the content of these articles. Usually in a semester I send out about 15 to 20 short and current articles to read. Through my editorial work with major journals I get hundreds of *just published* articles that I can choose from... I am looking for your executive summaries of the discussions you have done with one or more of your classmates on these articles via email, and/or video conferencing. These activities are all part of each assignment now and therefore should be documented in your web page, just as the rest of your assignments are. (All in one; nice object-oriented principle; not zillions of separate files please!)

Prepare this in paper format for a standup presentation, or on your screen in Word, or PowerPoint, but as soon as you have your web page up on the Internet, put it up as Assignment 1. (You can add images, text, video clips, etc. after this to your webpage.)

**4. Class: NJIT Week 4: Process modeling** for IE-oriented graphics projects within a green manufacturing/ design database and total quality rapid prototyping framework. System analysis and design session. Student laboratory session: Digital Educational Knowledge Assets, computer graphics objects and their application in IE. Methods and software demonstrations on computer graphics in IE. Object oriented process modeling for IE in general. The Internet and networking methods/technologies. We'll use the Networking 3D eBook throughout th ecourse. Pls. take the DVD with you to class - from the eLearning Pack. (Course feedback and review questions).

**eLearning Pack Resources for this session:** Use the process modeling chapter and templates (Visio or Omnigraffle) in the textbook in the DVD.

**Assignment 2 (10%) Deadline: by October 7, 'My webpage' This is the way I'll document and knowledge manage my IE assignments, using Computer Graphics in IE methods and visual networking technologies over the web'**

**Assignment 2 outline:** All we need at this stage is a simple and working webpage architecture for your assignments. (You can extend it later.) The instructor will help you, nevertheless you have the freedom to develop this webpage the way YOU want it.

This will be useful for documenting your work, and also for learning a lot about object-oriented thinking and design. Furthermore, when you are applying for a job, this web page will be a great ambassador for you, promoting your wonderful achievements!

Focus on your goals, on your audience, the impressions you want to communicate about your company, on structuring your data, and preparing your data objects for the Internet. This is a very important skill, even if at a later stage you'll be working with professional IT staff to help you to create a web page for your company.

We focus here on simple solutions and color schemes, graphical and text objects, that work! We also learn about object-oriented thinking, analysis, design and management. (Later in this course we'll also learn about basic object-oriented programming skills.)

As part of this assignment, we also learn together how to take effective, good quality images with our smartphones, and also how to shoot simple videos with our smartphones, that can be used as web-objects for our web sites. Furthermore, we also learn simple digital image and video clip editing solutions.

Make sure, that you have a simple but effective opening page, where you indicate your name, the class, the instructor, the eLearning Pack ID, the collaborative companies (hyperlinked), your own photo (so that I can easily remember you! Very IMPORTANT!), and then a list of links to the Assignment pages in this class.

The instructor will help you to create web-standards, nevertheless you have the freedom to innovate and do your own thing, as long as it satisfies NJIT requirements and regulations. Please understand, that it is extremely important for you to learn knowledge management over the web, and this is why we are doing this. Have fun!

**SOCIAL NETWORKING and Video Conferencing:** During the semester, I will email you several links to short technical articles, that are really important for you to follow and understand what is going on in the world in our subject area. This is particularly important to some foreign students who are not used to get their news via the Internet. You suppose to read these articles and then discuss at least THREE (3) of them with at least one more member in your class, and then document your findings in your social networking part of EACH assignment. I would like to see that you are discussing the content of these articles. Usually in a semester I send out about 15 to 20 short and current articles to read. Through my editorial work with major journals I get hundreds of *just published* articles that I can choose from... I am looking for your executive summaries of the discussions you have done with one or more of your classmates on these articles via email, and/or video conferencing. These activities are all part of each assignment now and therefore should be documented in your web page, just as the rest of your assignments are. (All in one; nice object-oriented principle; not zillions of separate files please!)

In order to get familiar with some really useful sustainable green methods and tools, please look up and read my article here: Ranky, P.G.: An Integrated Architecture, Methods and Some Tools for Enhancing Sustainable Enterprises and Systems  
Article Published in Systems 2015, 3(2), 27-44; doi:10.3390/systems3020027; Received: 9 February 2015 / Revised: 14 April 2015 / Accepted: 24 April 2015 /

Published: 4 May 2015; Show/Hide Abstract and Link to Full Article (FREE access) <http://www.mdpi.com/2079-8954/3/2/27>

These are useful instructions in [PDF](#), on how to set up a simple web page for this class.

**5. Class: NJIT Week 5:** Process modeling cont. system analysis and design session. Networking 3DeBook and web-search for appropriate Digital Educational Knowledge Assets. Web oriented computer graphics methods, designs and applications. Web authoring methods. The demonstration, evaluation and case-based learning and reasoning-oriented application of various Microsoft, Adobe, Apple, Omni, etc. web authoring software packages.

**Assignment 3: (10%) Deadline: by October 21, 'My object-oriented process model: This is the way I will develop a Networked Visual Lean & Flexible Factory'**

**Assignment 3 outline:** All of this should be on the web by now:

- Based on the lectures and the object-oriented process models in the eBook and the templates, prepare a short 1 page description of your Ao process: What are you planning to achieve and how?, don't forget that you should be working with your collaborative companies, then
- show at least 3 layers of lower level diagrams (of selected objects): A1, A2, ...Ai, then A11, A12,... etc. and even for at least one process at the A111, A112, ... level.
- Besides the graphical objects, explain each of these processes in 3-4 sentences.

Use Visio or Omnigraffle, or othergood 2D drawing tools to draw these objects. (The templates are in your Networking 3D eBook in the DVD in the eLearning Pack.) Then save them in .JPG format and put them on to your webpage. Explain your models / process models with a few sentences each. Test your results using other computers over the web.

Please note, that it is extremely important for you to learn how to use a 2D drawing tool on your computer, and then to save your process steps, as objects, to communicate how your networked visual, lean and flexible factory can work in the real-world.

**SOCIAL NETWORKING and Video Conferencing:**During the semester, I will email you several links to short technical articles, that are really important for you to follow and understand what is going on in the world in our subject area. This is particularly important to some foreign students who are not used to get their news via the Internet. You suppose to read these articles and then discuss at least THREE (3) of them with at least one more member in your class, and then document your findings in your social networking part of EACH assignment. I would like to see that you are discussing the content of these articles. Usually in a semester I send out about 15 to 20 short and current articles to read. Through my editorial work with major journals I get hundreds of *just published* articles that I can choose from... I am looking for your executive summaries of the discussions you have done with one or more of your classmates on these articles via email, and/or video conferencing. These activities are all part of each assignment now and therefore should be documented in your web page, just as the rest of your assignments are. (All in one; nice object-oriented principle; not zillions of separate files please!)

**6. Class: NJIT Week 6: Analysis** methods and exercises using Visio and Excel programs. Interactive classroom exercises / virtual factory tours.

**eLearning Pack Resources for this session:** Use the eBook in the eLearning Pack.

**7. Class 7, NJIT Week 7, and 8: Analysis** and process modeling as an integrated system. Object-oriented analysis, and system design. Implementation examples using real-world examples. Excel programs for customer requirements analysis using computer graphics. Process modeling using computer graphics. Visio for PC users and OmniGraffle for Apple Mac users. Software lab. exercises: graphical programming. Interactive exercises / virtual factory tours on videos. Requirements analysis as an innovation method and engine for future product, process or service system design.

**eLearning Pack Resources for this session:** Use the eBook in the eLearning Pack.

**Assignment 4: (20%) Deadline: by November 4, 'My 22 visual models and Computer Graphics in IE designs'. This is a CRITICALLY IMPORTANT DEADLINE!**

**Assignment 4 outline:** All of this should be on the web by now: My visual models and graphic designs (based on 22 images you have created, based on this syllabus, as well as on what you have seen in the resources in the eLearn Pack. (Please do NOT copy-paste images for this assignment from the web because those do not carry any gradepoints for you; you must create new images expressing your own Computer Graphics in IE ideas!)

Please note, that this is another very important exercise towards developing your object-oriented thinking, analysis and design skills. It can also include some programming. Also, this assignment helps you to learn about graphical software tools, 2D drawing tools, image editing tools (such as Adobe's Photoshop), web-standards, organizing and structuring data objects, and presenting them at various levels to an audience. (Note, that it is an extremely important skill to adjust your presentation to different audiences, at different levels and settings.)

**SOCIAL NETWORKING and Video Conferencing:**During the semester, I will email you several links to short technical articles, that are really important for you to follow and understand what is going on in the world in our subject area. This is particularly important to some foreign students who are not used to get their news via the Internet. You suppose to read these articles and then discuss at least THREE (3) of them with at least one more member in your class, and then document your findings in your social networking part of EACH assignment. I would like to see that you are discussing the content of these articles. Usually in a semester I send out about 15 to 20 short and current articles to read. Through my editorial work with major journals I get hundreds of *just published* articles that I can choose from... I am looking for your executive summaries of the discussions you have done with one or more of your classmates on these articles via email, and/or video conferencing. These activities are all part of each assignment now and therefore should be documented in your web page, just as the rest of your assignments are. (All in one; nice object-oriented principle; not zillions of separate files please!)

Please note, that this is a good definition of what an 'Executive Summary' is: From Wikipedia, the free encyclopedia:

*An executive summary, sometimes known as a management summary, is a short document or section of a document, produced for business purposes, that summarizes a longer report or proposal or a group of related reports in such a way that readers can rapidly become acquainted with a large body of material without having to read it all. It usually contains a brief statement of the problem or proposal covered in the major document(s), background information, concise analysis and main conclusions. It is intended as an aid to decision-making by managers and has been described as possibly the most important part of a business plan. They must be short and to the point. An executive summary differs from an abstract in that an abstract will usually be shorter and is intended to provide a neutral overview or orientation rather than being a condensed version of the full document. Abstracts are extensively used in academic research where the concept of the executive summary would be meaningless. "An abstract is a brief summarizing statement... read by parties who are trying to decide whether or not to read the main document", while "an executive summary, unlike an abstract, is a document in miniature that may be read in place of the longer document".*

**PLEASE NOTE, that in order to make sure that nobody slips in this class, the rule is, that all students who wish to get an 'A' in this class, MUST submit their first 4 assignments by the above deadline.**

**Sustainable, green visual factory analysis:** Interactive classroom exercises / virtual factory tours on DVDs and solid model simulation model demonstrations. More on **Sustainable Green Engineering:** <http://www.cimwareukandusa.com/All-Green/Ranky-GreenEngineering.html>

The purpose of a visually designed, managed and controlled factory is that all aspects of the organization / factory, including the administrative workplace, the design offices, the factory floor, etc. are set-up with signs, labels, color-coded markings, images, optionally with video and/or multimedia screens, etc. so that everyone follows best practice processes. (Some very interesting examples on the web: <http://www.tableausoftware.com/learn/gallery>)

Properly designed visual factories support waste reduction, and therefore lean and often sustainable green goals too.

Static / dynamic visual factory signs, images, displays, etc. should communicate in a matter of seconds to perhaps a few minutes, what should be done, what is going on, understand correctly performed process, understand test procedures, and most importantly what is out of order, or out of place.

#### Your task:

In Visio (or using another good graphic software tool such as OmniGraffle on Apple), or any good quality computer graphics tool you like Photoshop, SolidWorks, or AutoCAD, or ProE, or other tools, draw high quality drawings with images (approx. 2000 x 1200 pixel, high resolution) covering the following areas. (Pls. make sure, that all drawings and all the images are copyright free, i.e. do not cut and paste from the web, but create your own drawings 100%: you can use image ideas from your eLearning Pack but you must acknowledge it professionally, like: 'Based on image Courtesy of Paul G Ranky' eLearning Pack, IE203', and also from this web site.

These are some of the examples we'll discuss in class in detail. They all represent important aspects of computer graphics in IE in terms of product, process or service system design. I have taken these images in the USA, Europe, and Asia. They are mostly in hi-def., therefore be patient as they download in full size. (The high resolution will enable you to analyze lots of aspects of these visual examples.)

Sample images are hyperlinked below:

[Image-1](#), [Image-2](#), [Image-3](#), [Image-4](#), [Image-5](#), [Image-6](#), [Image-7](#), [Image-8](#), [Image-9](#), [Image-10](#), [Image-11](#), [Image-12](#), [Image-13](#), [Image-14](#), [Image-15](#), [Image-16](#), [Image-17](#), [Image-18](#), [Image-19](#), [Image-20](#), [Image-21](#), [Image-22](#), [Image-23](#), [Image-24](#), [Image-25](#), [Image-26](#), [Image-27](#), [Image-28](#).

Also, I found this excellent website, that illustrates some of the challenges IEs (and others) are facing in terms of visual communications... <http://www.darkroastedblend.com/2008/08/hilarious-signage-part-11.html>

Having introduced the topic and the challenges, what you need to do is to create two novel examples for each item of the list below, totaling **22 drawings**:

#### Signs / posters / displays etc. , that:

- Show, that every tool, fixture, device, etc. has a place and everything is in its place (e.g. a tool rack in which tools have a designated place)
- Controls inventory, indicates performance (e.g. following lean concepts, a lean inventory sign, or display)
- Indicates non-conformances (e.g. an out of control situation)
- Indicates when help is needed (e.g. a display indicating what help is needed and where)
- A visual display, that informs employees in the area. For example, charts showing the monthly revenues of the company or a graphic depicting a certain type of quality issue that group members should be aware of.
- A visual control that is intended to actually control or guide the action of the production or administrative team members.
- What are our goals?
- What are our key measures?
- How is the factory performing in relation to those goals?
- What is preventing us from reaching our goals?
- How individual operator / associate efforts contribute toward success?

**eLearning Pack Resources for this session:** Use the DVD videos in your eLearning Pack, as well as the ones shown in class.

**9. Class 9 NJIT Week 9:** The demonstration, evaluation and case-based learning and reasoning-oriented application of various Microsoft, Adobe, Apple, Siemens, etc. and web authoring software packages. Spreadsheets and graphics. Student Internet and multimedia laboratory session. Factory communication: the traditional vs. Internet-age methods and solutions using computer graphics in IE. The visual factory as an opportunity for IEs.

**10. Class 10, NJIT Week 10: Product disassembly laboratory exercise, focusing on PLM, DFA, Process Failure Risk Analysis, process flow, lean aspects, and a 5S introduction (Sort, Set in order, Shine, Standardize, and Sustain).**

**eLearning Pack Resources for this session:** Use the eBook in the textbook DVD combo.

**11. Class: NJIT Week 11: Communication, Computer Networking, CAD/CAM/PLM computer graphics.** Communication methods. Computer networking basics. Integration methods and issues. Interactive multimedia development and validation/ quality control session and student presentations. Continuous assignment/ project improvement session based on team and class feedback. Lean and Six-Sigma concepts and examples. Computer Graphics in IE for material selection and support of CAD, CAD/CAM and Lean Factory manufacturing systems engineering. Computer graphics in network simulation and shopfloor networking. PLM as an innovation method and engine.



**Assignment 5: (10+10=20%) by November 18, 'Product Disassembly Laboratory Lean, Green Visual Factory Assignment (10%) with Computer Controlled Machine Programming, Following Object-oriented Principles / CNC (10%): Laboratory Report'**

**Assignment 6 outline: Option A or B: ASSEMBLY or DISASSEMBLY:** All of this should be on the web by now:

**OPTION A: DISASSEMBLY (i.e. taking things apart, object-by-object, module-by-module)**

1. Show your disassembly process steps and your DBOM (Disassembly Bill Of Material). Please note, that this is an extremely important skill to learn about real-world, physical objects, their identifiers, attributes, and processes. We will use this knowledge to model abstract objects too, when we perform simple, object-oriented programming exercises in this class.
2. Take photos and if you have a digital camera pls. take it to class.
3. Short 1 page description of your disassembly risk analysis goals, meaning 'How would you reduce the risk of damaging parts / objects, as you disassemble them?'
4. Explain the lab. What we did and why?
5. What have we learned?
6. Document the green, sustainable manufacturing / assembly / disassembly aspects, the requirements, the process, and the disassembly risks.
7. **SOCIAL NETWORKING and Video Conferencing:** During the semester, I will email you several links to short technical articles, that are really important for you to follow and understand what is going on in the world in our subject area. This is particularly important to some foreign students who are not used to get their news via the Internet. You suppose to read these articles and then discuss at least THREE (3) of them with at least one more member in your class, and then document your findings in your social networking part of EACH assignment. I would like to see that you are discussing the content of these articles. Usually in a semester I send out about 15 to 20 short and current articles to read. Through my editorial work with major journals I get hundreds of *just published* articles that I can choose from... I am looking for your executive summaries of the discussions you have done with one or more of your classmates on these articles via email, and/or video conferencing. These activities are all part of each assignment now and therefore should be documented in your web page, just as the rest of your assignments are. (All in one; nice object-oriented principle; not zillions of separate files please!)

**OPTION B: ASSEMBLY (i.e. putting things together, object-by-object, module-by-module)**

**Object/component-oriented problem solving exercise using modular, visual, lean methods with value stream mapping.**

The purpose of this activity is to learn about object/component-oriented problem solving methods, tools and technologies using modular, visual, lean methods, as well as creative, transferable problem solving processes.

**This is a very practical and useful problem solving porocess flow:**

1. Understand the problem, including it's boundaries
2. Brainstorm on how to solve the problem
3. Collect accurate data and structure the collected data set so that you can process it easily
4. Analyse the data collected
5. Identify the root cause of the problem. (A root cause is a factor that caused a nonconformance and should be permanently eliminated through process improvement. Root cause analysis is a collective term that describes a wide range of approaches, tools, and techniques used to uncover causes of problems.
6. Analyse the root cause. (More on 'root cause analysis', here: <http://asq.org/learn-about-quality/root-cause-analysis/overview/root-cause-approaches.html>)
7. Eliminate the problem
8. Implement a realistic and well-balanced, satisfactory solution. (Note: perfect solutions are rare nevertheless realistic solutions can be achieved in many cases.)

More on problem solving methods and tools here. (Note: engineers solve problems):

[https://scholar.google.com/scholar?q=problem+solving+solutions&hl=en&as\\_sdt=0&as\\_vis=1&oi=scholar&sa=X&ved=0ahUKEwj3iIDovNDOAhWFmR4KHWLdD\\_MQgQMILDAA](https://scholar.google.com/scholar?q=problem+solving+solutions&hl=en&as_sdt=0&as_vis=1&oi=scholar&sa=X&ved=0ahUKEwj3iIDovNDOAhWFmR4KHWLdD_MQgQMILDAA)

**In more detail, during this interactive exercise participants will learn about the following:**

1. Design simple products (e.g. models of mobility / transportation devices)
2. Design lean processes
3. Participate in a process
4. Evaluate processes with a quality focus
5. Evaluate processes with a design for assembly / disassembly / sustainable design / remanufacturing focus
6. Identify wastes that can be eliminated from the process, including the following wastes:
  - Transport
  - Inventory
  - Motion
  - Waiting
  - Over production
  - Over processing
  - Defects
  - Skills
7. Redesign the process to eliminate wastes
8. Redesign the process to improve quality
9. Measure time savings in redesigned process

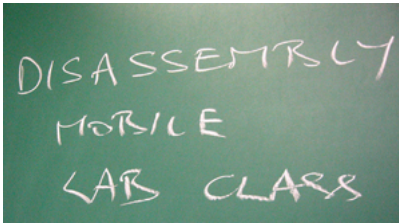
**There are three key tasks in each team. These being:**

1. Product / process design
2. Store / inventory management
3. Assembly / construction

Each member of the team shares the customer, as well as the quality engineer's role (i.e. every process step is real-time quality controlled for every customer requirement)

**12. Class: NJIT Week 12: Thanksgiving week: take home assignments; also prepare for Student Presentations:** Spreadsheets and web-enabled spreadsheets with computer graphics. 5S methods and practical applications for visual factories (Sort, Set in Order, Shine, Standardize, and Sustain). Interactive multimedia development and validation/ quality control session and student presentations. Continuous assignment/ project improvement session based on team and class feedback. (Course feedback and review questions).

Please click on the '**Disassembly Mobile Lab Class**' poster below for further details how we conduct this interactive laboratory exercise:



Please review our past [lab photos and video-clips](#), as well as these Disassembly Lab. pictures:

[IMG\\_2276-Ranky-IE203-F2007.jpg](#), [IMG\\_2277-Ranky-IE203-F2007.jpg](#), [IMG\\_2278-Ranky-IE203-F2007.jpg](#), [IMG\\_2279-Ranky-IE203-F2007.jpg](#), [IMG\\_2280-Ranky-IE203-F2007.jpg](#), [IMG\\_2281-Ranky-IE203-F2007.jpg](#), [IMG\\_2282-Ranky-IE203-F2007.jpg](#), [IMG\\_2285-Ranky-IE203-F2007.jpg](#), [IMG\\_2286-Ranky-IE203-F2007.jpg](#), [IMG\\_2287-Ranky-IE203-F2007.jpg](#), [IMG\\_2288-Ranky-IE203-F2007.jpg](#), [IMG\\_2289-Ranky-IE203-F2007.jpg](#), [IMG\\_2290-Ranky-IE203-F2007.jpg](#), [IMG\\_2291-Ranky-IE203-F2007.jpg](#), [IMG\\_2292-Ranky-IE203-F2007.jpg](#), [IMG\\_2293-Ranky-IE203-F2007.jpg](#), [IMG\\_2294-Ranky-IE203-F2007.jpg](#), [IMG\\_2295-Ranky-IE203-F2007.jpg](#), [IMG\\_2296-Ranky-IE203-F2007.jpg](#), [IMG\\_2297-Ranky-IE203-F2007.jpg](#), [IMG\\_2298-Ranky-IE203-F2007.jpg](#), [IMG\\_2300-Ranky-IE203-F2007.jpg](#), [IMG\\_2301-Ranky-IE203-F2007.jpg](#), [IMG\\_2302-Ranky-IE203-F2007.jpg](#), [IMG\\_2303-Ranky-IE203-F2007.jpg](#), [IMG\\_2304-Ranky-IE203-F2007.jpg](#), [IMG\\_2305-Ranky-IE203-F2007.jpg](#), [IMG\\_2306-Ranky-IE203-F2007.jpg](#), [IMG\\_2308-Ranky-IE203-F2007.jpg](#), [IMG\\_2309-Ranky-IE203-F2007.jpg](#), [IMG\\_2310-Ranky-IE203-F2007.jpg](#), [IMG\\_2311-Ranky-IE203-F2007.jpg](#), [IMG\\_2312-Ranky-IE203-F2007.jpg](#), [IMG\\_2313-Ranky-IE203-F2007.jpg](#), [IMG\\_2315-Ranky-IE203-F2007.jpg](#), [IMG\\_2316-Ranky-IE203-F2007.jpg](#), [IMG\\_2317-Ranky-IE203-F2007.jpg](#), [IMG\\_2318-Ranky-IE203-F2007.jpg](#), [IMG\\_2319-Ranky-IE203-F2007.jpg](#), [IMG\\_2320-Ranky-IE203-F2007.jpg](#), [IMG\\_2321-Ranky-IE203-F2007.jpg](#), [IMG\\_2322-Ranky-IE203-F2007.jpg](#), [IMG\\_2324-Ranky-IE203-F2007.jpg](#), [IMG\\_2325-Ranky-IE203-F2007.jpg](#), [IMG\\_2326-Ranky-IE203-F2007.jpg](#), [IMG\\_2327-Ranky-IE203-F2007.jpg](#), [IMG\\_2328-Ranky-IE203-F2007.jpg](#), [IMG\\_2329-Ranky-IE203-F2007.jpg](#), [IMG\\_2330-Ranky-IE203-F2007.jpg](#), [IMG\\_2331-Ranky-IE203-F2007.jpg](#), [IMG\\_2332-Ranky-IE203-F2007.jpg](#), [IMG\\_2333-Ranky-IE203-F2007.jpg](#), [IMG\\_2334-Ranky-IE203-F2007.jpg](#), [IMG\\_2335-Ranky-IE203-F2007.jpg](#), [IMG\\_2336-Ranky-IE203-F2007.jpg](#), [IMG\\_2337-Ranky-IE203-F2007.jpg](#), [IMG\\_2338-Ranky-IE203-F2007.jpg](#), [IMG\\_2339-Ranky-IE203-F2007.jpg](#), [IMG\\_2342-Ranky-IE203-F2007.jpg](#), [IMG\\_2343-Ranky-IE203-F2007.jpg](#), [IMG\\_2344-Ranky-IE203-F2007.jpg](#), [IMG\\_2345-Ranky-IE203-F2007.jpg](#), [IMG\\_2346-Ranky-IE203-F2007.jpg](#), [IMG\\_2347-Ranky-IE203-F2007.jpg](#), [IMG\\_2349-Ranky-IE203-F2007.jpg](#), [IMG\\_2350-Ranky-IE203-F2007.jpg](#), [IMG\\_2351-Ranky-IE203-F2007.jpg](#), [IMG\\_2352-Ranky-IE203-F2007.jpg](#), [IMG\\_2353-Ranky-IE203-F2007.jpg](#), [IMG\\_2354-Ranky-IE203-F2007.jpg](#), [IMG\\_2355-Ranky-IE203-F2007.jpg](#), [IMG\\_2356-Ranky-IE203-F2007.jpg](#), [IMG\\_2357-Ranky-IE203-F2007.jpg](#), [IMG\\_2358-Ranky-IE203-F2007.jpg](#), [IMG\\_2359-Ranky-IE203-F2007.jpg](#), [IMG\\_2360-Ranky-IE203-F2007.jpg](#), [IMG\\_2361-Ranky-IE203-F2007.jpg](#), [IMG\\_2362-Ranky-IE203-F2007.jpg](#), [IMG\\_2363-Ranky-IE203-F2007.jpg](#), [IMG\\_2364-Ranky-IE203-F2007.jpg](#), [IMG\\_2365-Ranky-IE203-F2007.jpg](#), [IMG\\_2366-Ranky-IE203-F2007.jpg](#), [IMG\\_2367-Ranky-IE203-F2007.jpg](#), [IMG\\_2368-Ranky-IE203-F2007.jpg](#), [IMG\\_2369-Ranky-IE203-F2007.jpg](#), [IMG\\_2370-Ranky-IE203-F2007.jpg](#), [IMG\\_2371-Ranky-IE203-F2007.jpg](#), [IMG\\_2372-Ranky-IE203-F2007.jpg](#), [IMG\\_2373-Ranky-IE203-F2007.jpg](#), [IMG\\_2374-Ranky-IE203-F2007.jpg](#), [IMG\\_2376-Ranky-IE203-F2007.jpg](#), [IMG\\_2377-Ranky-IE203-F2007.jpg](#), [IMG\\_2378-Ranky-IE203-F2007.jpg](#), [IMG\\_2379-Ranky-IE203-F2007.jpg](#)

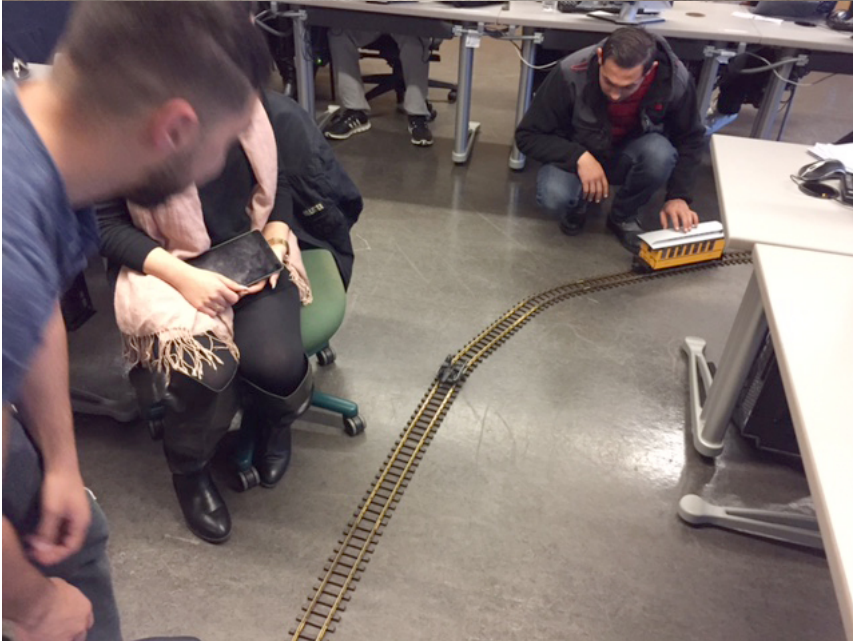
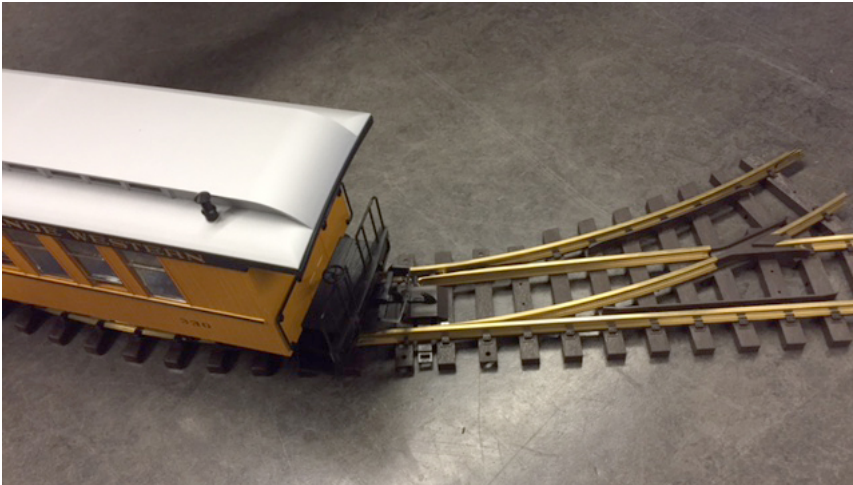
Please find below the links to the sample images of the **Object-oriented Disassembly Laboratory** exercise:

[Picture-1](#), [Picture-2](#), [Picture-3](#), [Picture-4](#), [Picture-5](#), [Picture-6](#), [Picture-7](#), [Picture-8](#), [Picture-9](#), [Picture-10](#), [Picture-11](#), [Picture-12](#), [Picture-13](#), [Picture-14](#), [Picture-15](#), [Picture-16](#), [Picture-17](#), [Picture-18](#), [Picture-19](#), [Picture-20](#), [Picture-21](#), [Picture-22](#), [Picture-23](#), [Picture-24](#), [Picture-25](#), [Picture-26](#), [Picture-27](#), [Picture-28](#), [Picture-29](#), [Picture-30](#), [Picture-31](#), [Picture-32](#), [Picture-33](#), [Picture-34](#), [Picture-35](#), [Picture-36](#), [Picture-37](#), [Picture-38](#), [Picture-39](#), [Picture-40](#), [Picture-41](#), [Picture-42](#), [Picture-43](#).

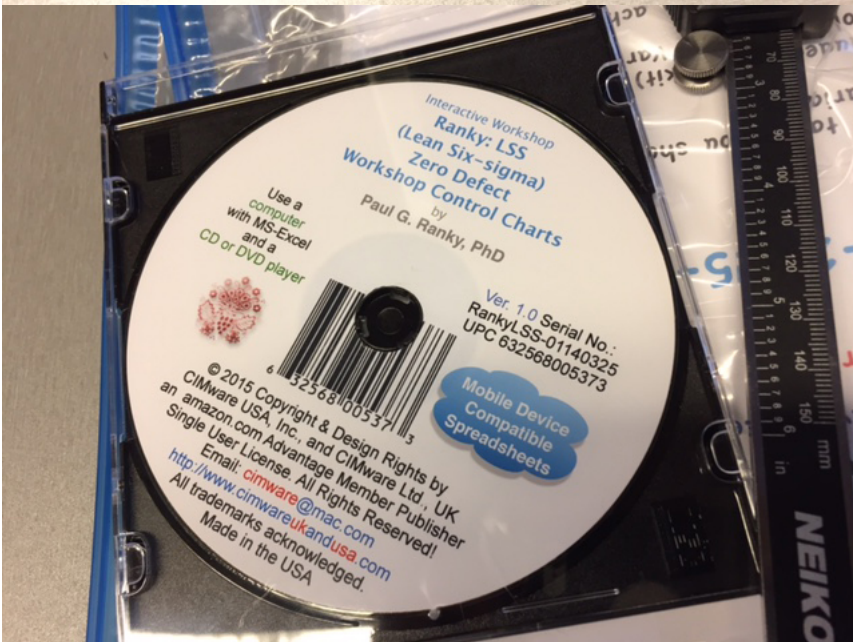
**Please review our zero-defect quality principles within a lean six-sigma framework interactive workshop / class images.**

As you can see from these pictures below, the students have to solve a real-world problem. Measure physical parameter values. Work with a spreadsheet and evaluate the results, object-by object. Also, they have to follow a systematic problem solving method. (This lab. is based on an interactive multimedia kit and physical objects, created by Dr. Ranky.)

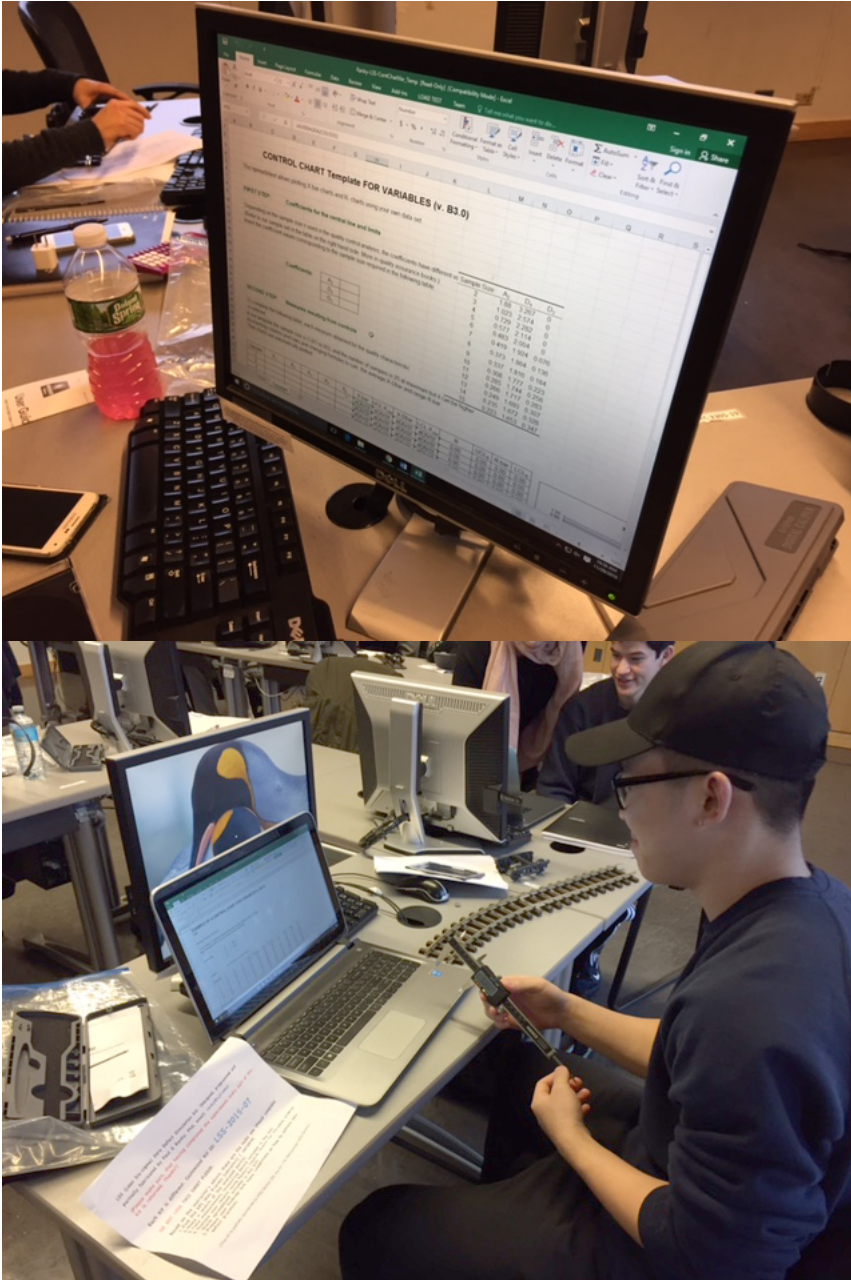
Please note, that this interactive workshop is supported by the ASQ (American Society for Quality) Section 300, New York, New Jersey Metropolitan Section and the ASQ NJIT Student Chapter (founding academic leader: Dr Ranky). It also helps us to understand more about object-oriented thinking, analysis, design and even programming.

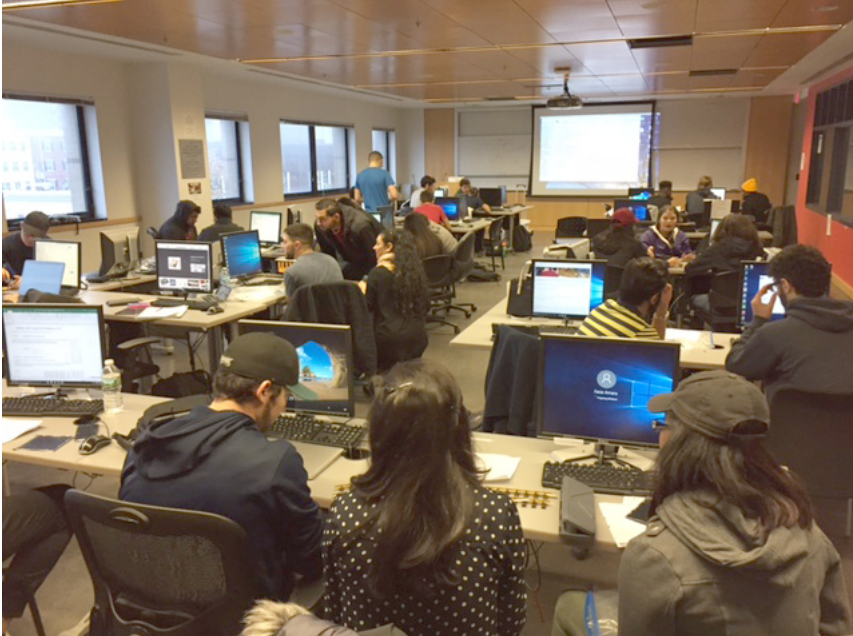




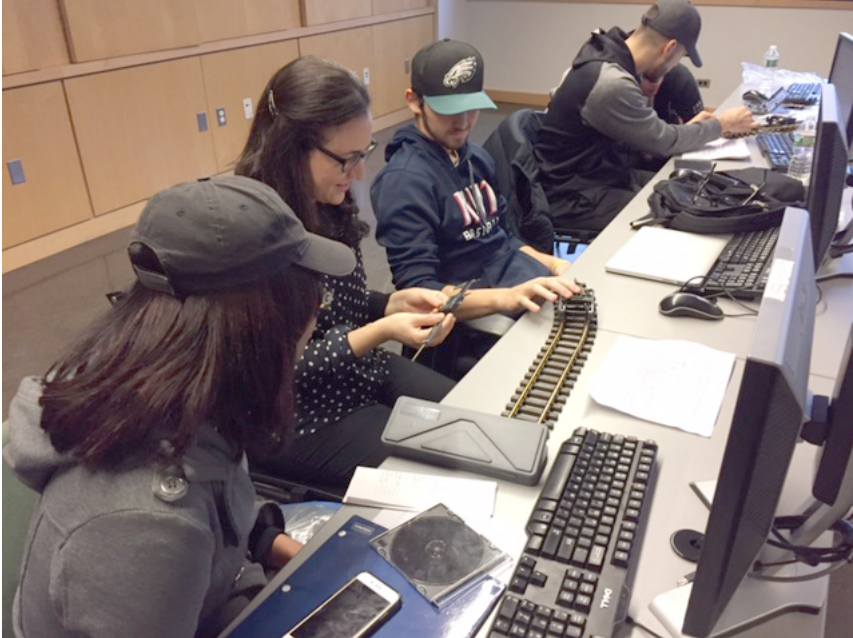






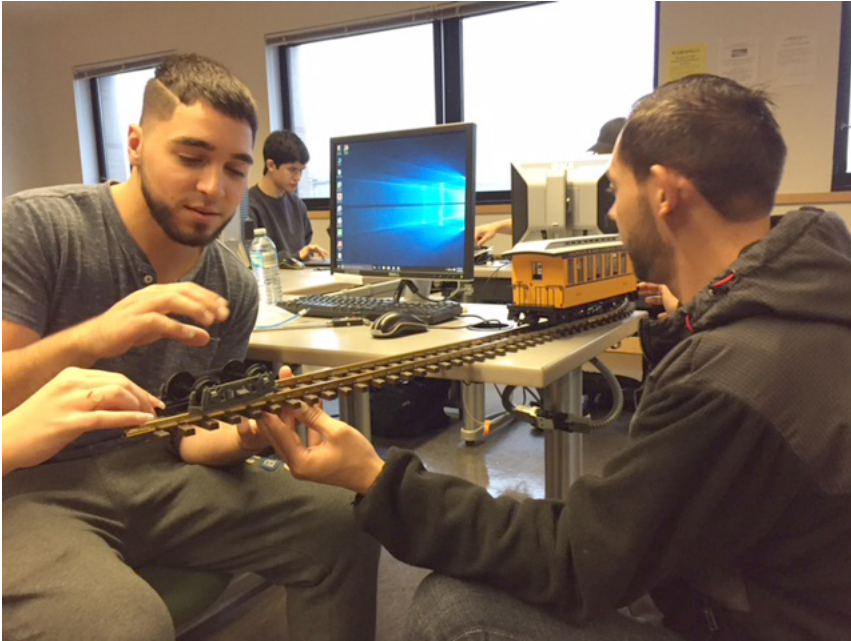


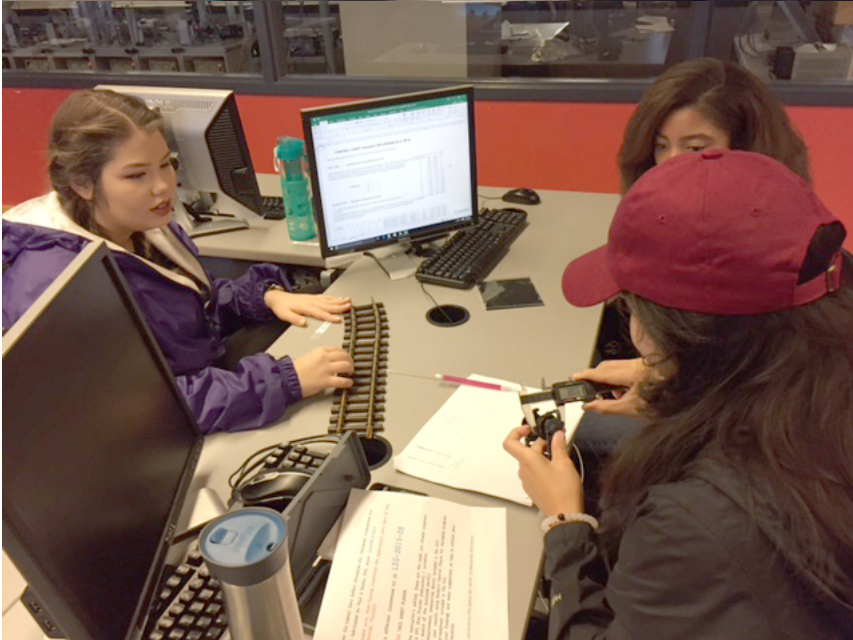


















**Some more student laboratory activity and ASQ event pictures in this class include the following:**





**Computer Controlled Machine Programming, Based on Object-oriented Principles: CNC laboratory preparation information:**

Please explore this site for some useful information on our computer controlled CNC machines and related object-oriented machine programming methods, tools and technologies. Haas Automation Inc. USA is kindly sponsoring us. Their machines are widely used by USA universities, as well as industry all around the world. (We have now access to our IME CNC machine, as well as to the NJIT Makerspace computer controlled machines. This modern facility enables us to learn more about object-oriented programming, testing, validation and even quality control.)

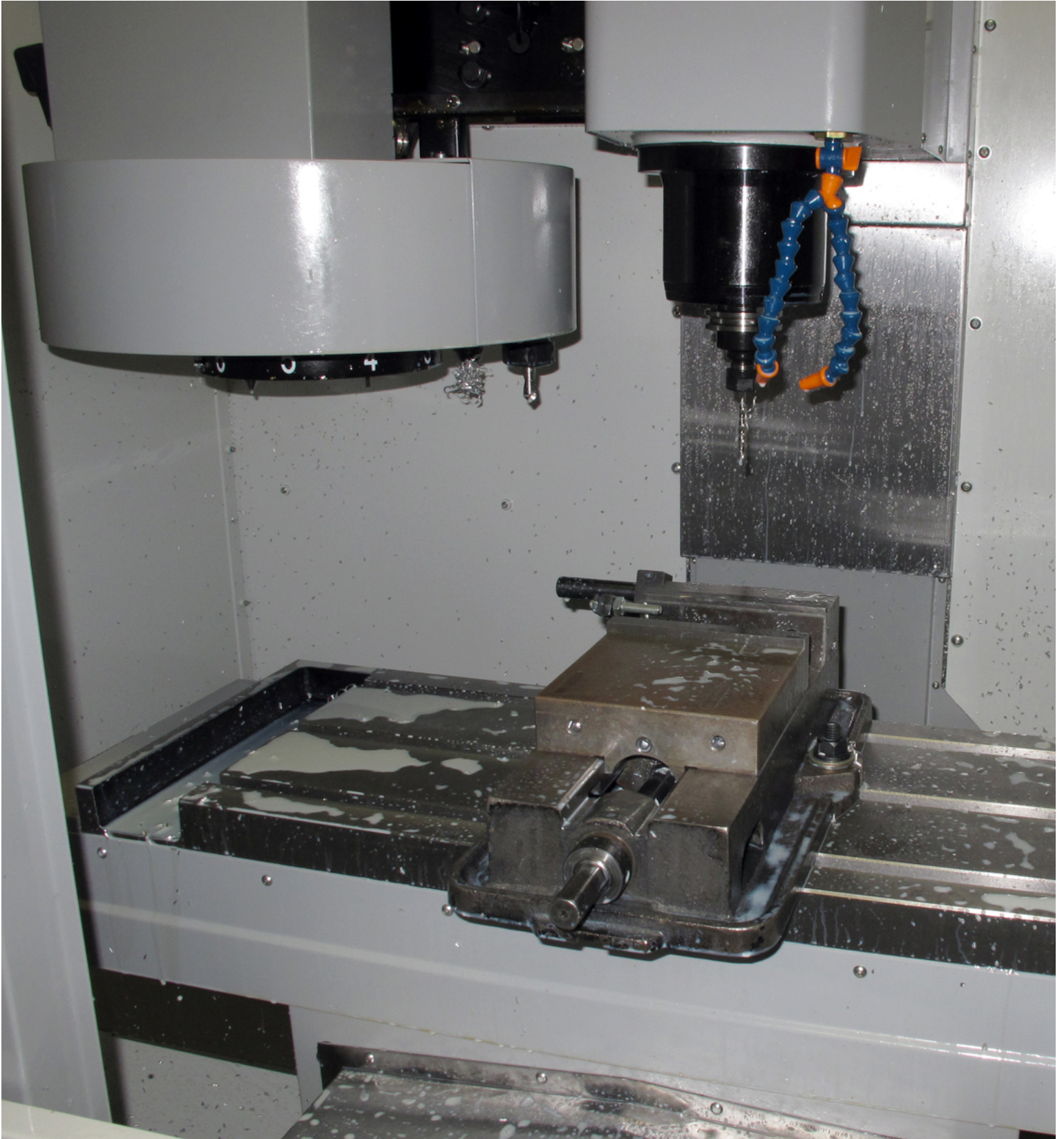
Our machines are similar to what you will see here:

<http://www.haascnc.com/home.asp#gsc.tab=0>

EXPLORE and enjoy!











**Computer Controlled Machine Programming, Based on Object-oriented Principles: CNC laboratory preparation information in the NJIT Makerspace:**

The **NJIT Makerspace** is a wonderful computer controlled \$11.6 million advanced machine laboratory for students, faculty and industry.

In this class we have access to this amazing lab., and can see, explore and **learn more about object-oriented computer controlled machine programming**, including testing our programs on advanced computers, integrated with machines, including: CNC milling, turning, EDM, waterjet cutting, computer controlled inspection and quality control, various 3D printing machines, and others. We also focus on visual factory management, computer graphics in IE, real-time, feedback controlled, flexible, lean, zero defect quality processes, on-demand product manufacturing, and all those wonderful principles we learn in this class. We can also see some advanced demonstrations in this lab.

The goal here is not to teach technology, for the sake of technology (that is a different class), but to use this amazing facility to **reinforce our object-oriented systems thinking approach, as well as use these machines to validate our computer programs with real, physical parts.**

Note, that this is a novel approach. Universities typically teach object-oriented (OO) thinking and programming to computing science and IT/IS (Information Technology / Information Systems) students, using computers only. In this class we are going a lot further. We don't just teach OO thinking and programming, but we do it with advanced computer integrated machines, like 3 axis and 5 axis CNC milling machines, 3 axis and 4 axis CNC lathes, 3 axis controlled waterjet cutters, 3D rapid prototyping machines / 3D printers, multi-axis CMMs, Co-ordinate Measuring Machines, with contact, as well as non-contact probes, and others. This is because our students in this class are industrial engineers who benefit enormously by understanding and following OO thinking and programming methods and skills.

In order to help our students to succeed in an advanced, global world, this is the time when we also introduce the **basic concepts of object-oriented Java programming, and Python programming with examples.** Students learn how to program simple engineering challenges in these well known and very popular OO languages. Then, we also compare them to what we have already learned when programming our advanced, multi-axis controlled machines, using OO

principles. This offers a full 360 view of OO thinking, analysis and design and prepares them for other classes, like simulation, and others, where they benefit of having gone through these problem solving challenges in this class.

Also note, that this facility is planning to offer **machine-operator certificates** to NJIT students, so that they can program, and run their programs / test their programs on these advanced computer controlled machines safely.

This class is also preparing you for this extra step, in case you want to take advantage of this wonderful opportunity! (Please note, that the reason for this is because **industry needs professional problem solving engineers, and the more 'well rounded' you are the more marketable you become** because you can analyze, design, program, and manage better. We don't want you to become machine operators, nevertheless we want you to see the big picture better, as well as be able to dig deeper and understand the details too... this is the concept of the 'T' shaped professional... pls. see my notes earlier.) The fact of the matter is, that the more you learn about these systems, a better engineer you become!

During these **active-participation focused labs**, we encourage you to ask any questions you have and be as active as you can. This is a great, active, case-based, problem-based learning opportunity!

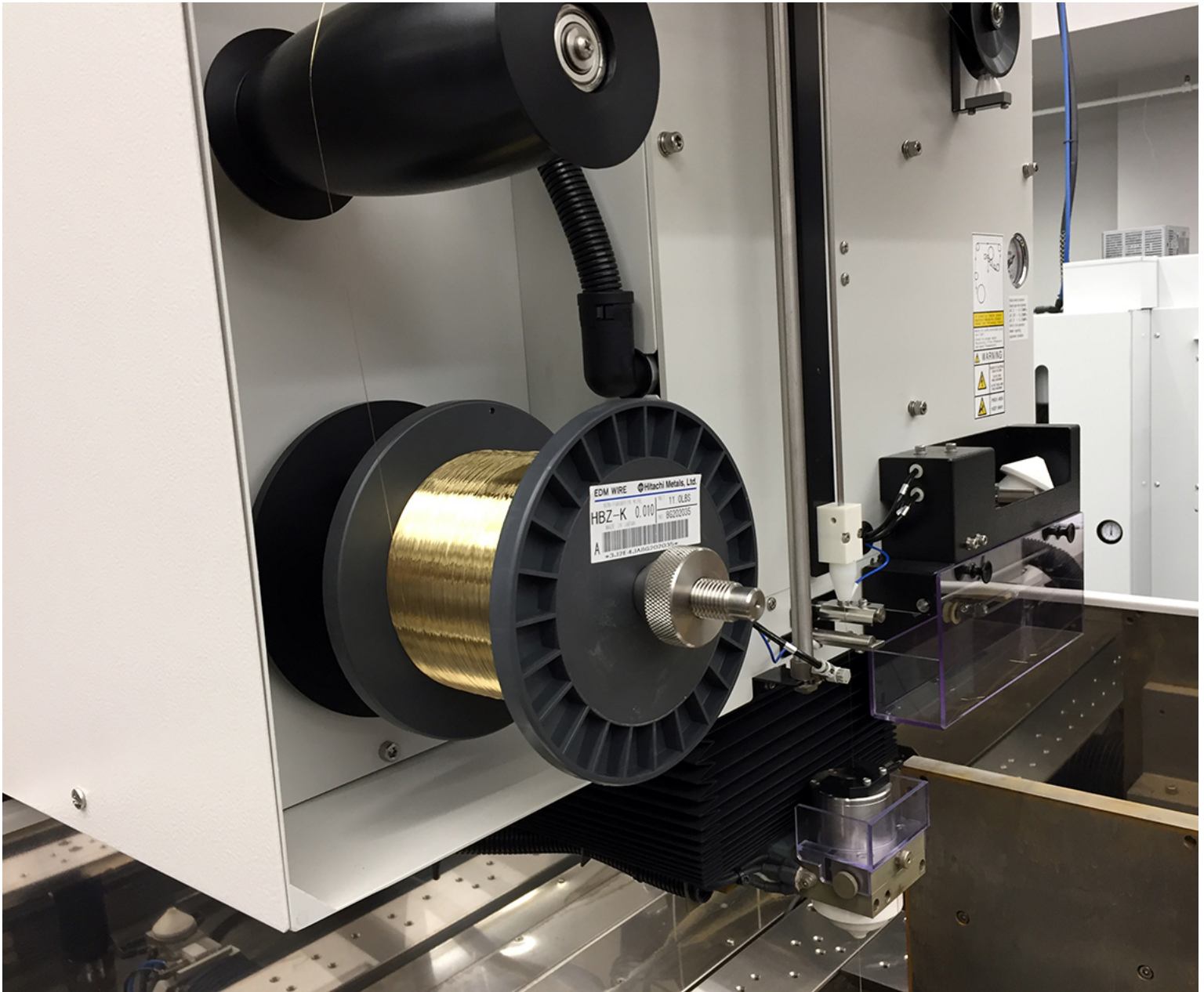
*(For your kind information, I spent over 35 years actively designing and programming advanced computer controlled cells and systems like these, with automated processing, material handling, real-time, computer controlled production control and logistics, dynamic scheduling, robotics, material storage and inspection, and yes, even 'object-oriented programming', that was part of my PhD research in the early 1970s, when object-oriented programming started in the computing world but nobody heard about it in engineering; my PhD was the first, researching and implementing / validating OO programming for entire Flexible Manufacturing Systems, representing a large group of computer controlled machines with all additional capabilities and facilities, like automated tool and part changing, automated material handling, on-demand dynamic scheduling, real-time changing production control systems, 100% part inspection, computer controlled storage, and others. I encourage you to ask any challenging and 'out-of-the-box thinking' hard questions you have during these labs. because we'll all learn from your questions.)*

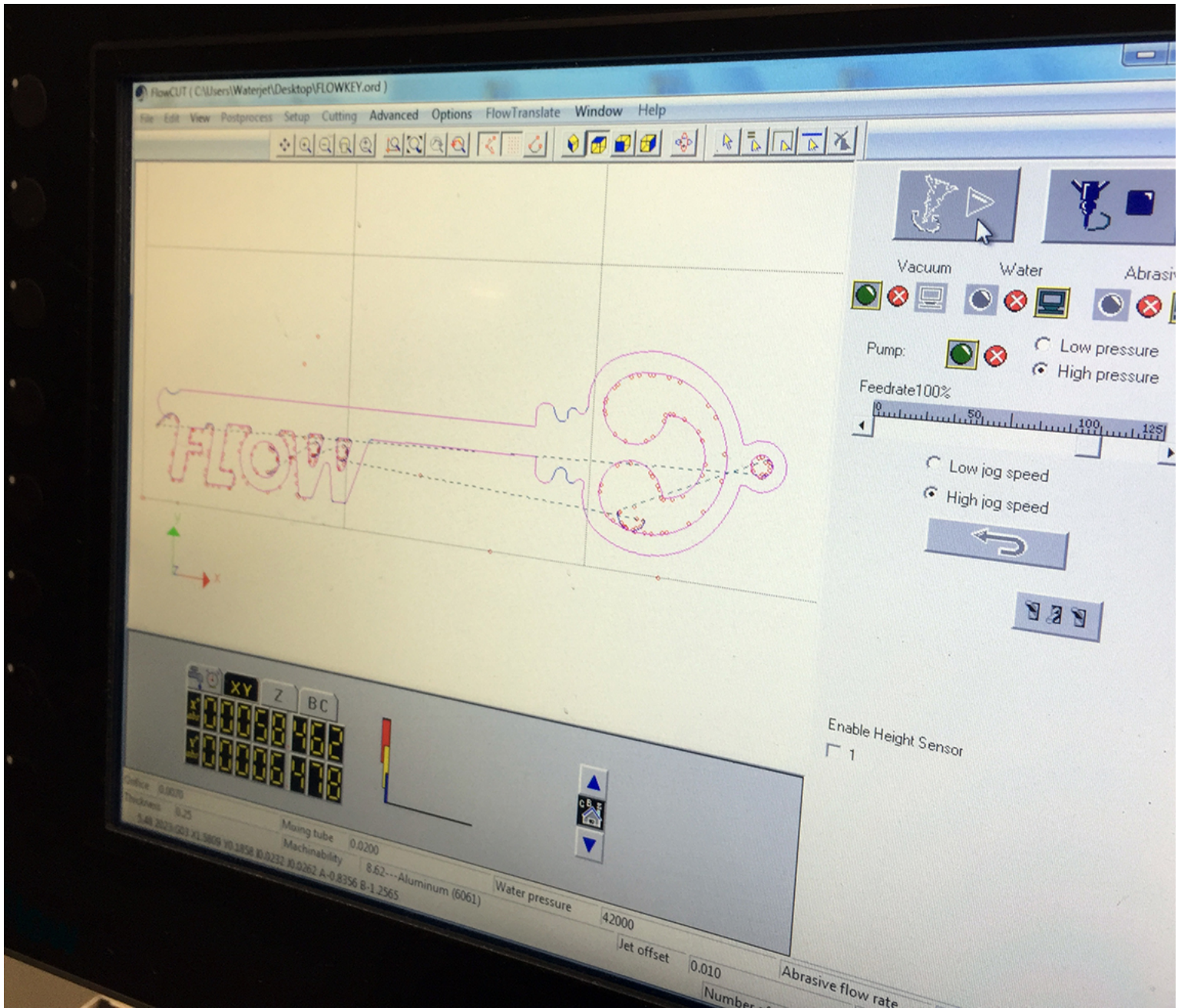
Please review some of the **pictures I took with one of my NJIT classes in this lab**. (Please note, that this lab. is continuously developing and evolving, therefore you can always see and learn new things here.):

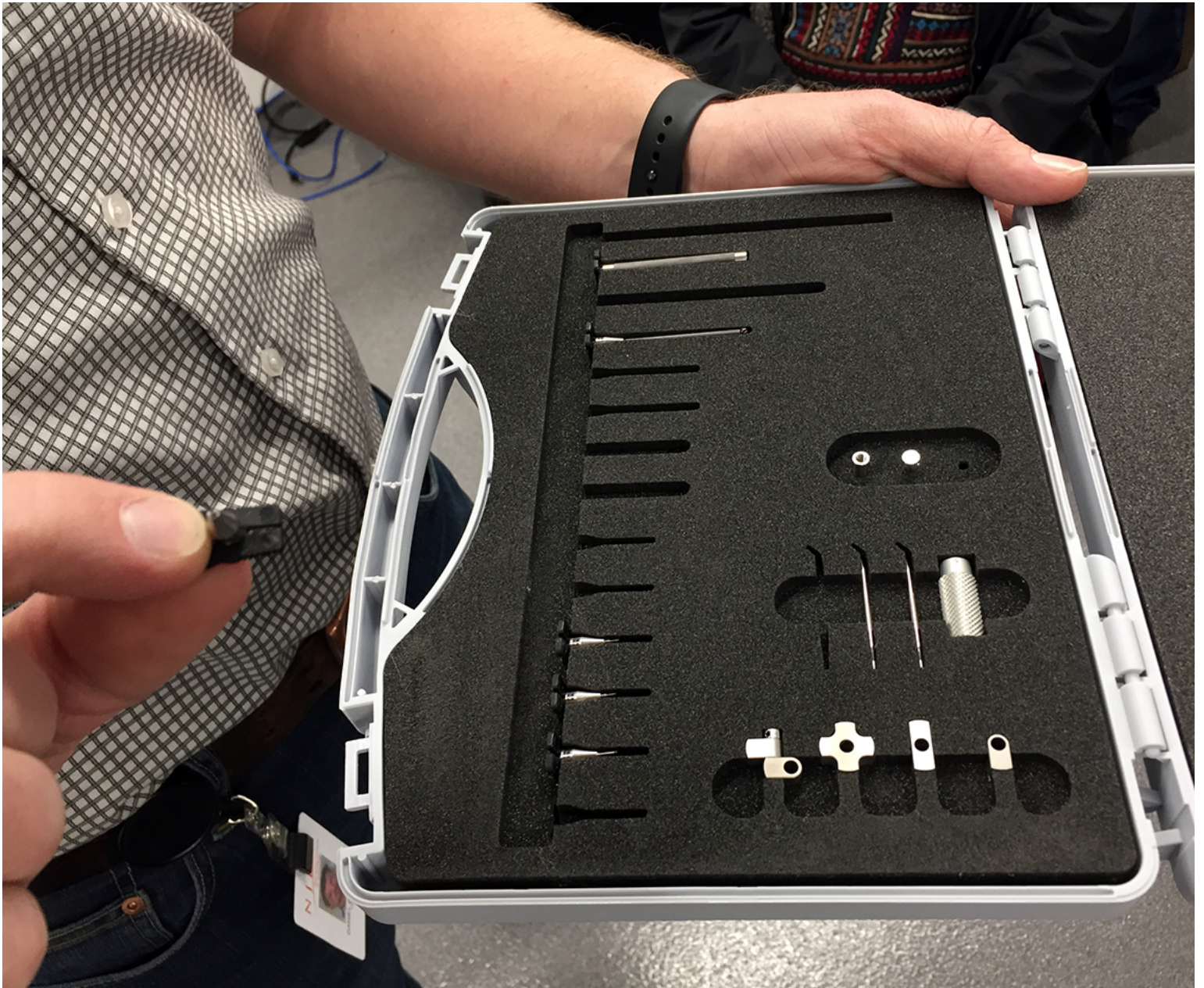


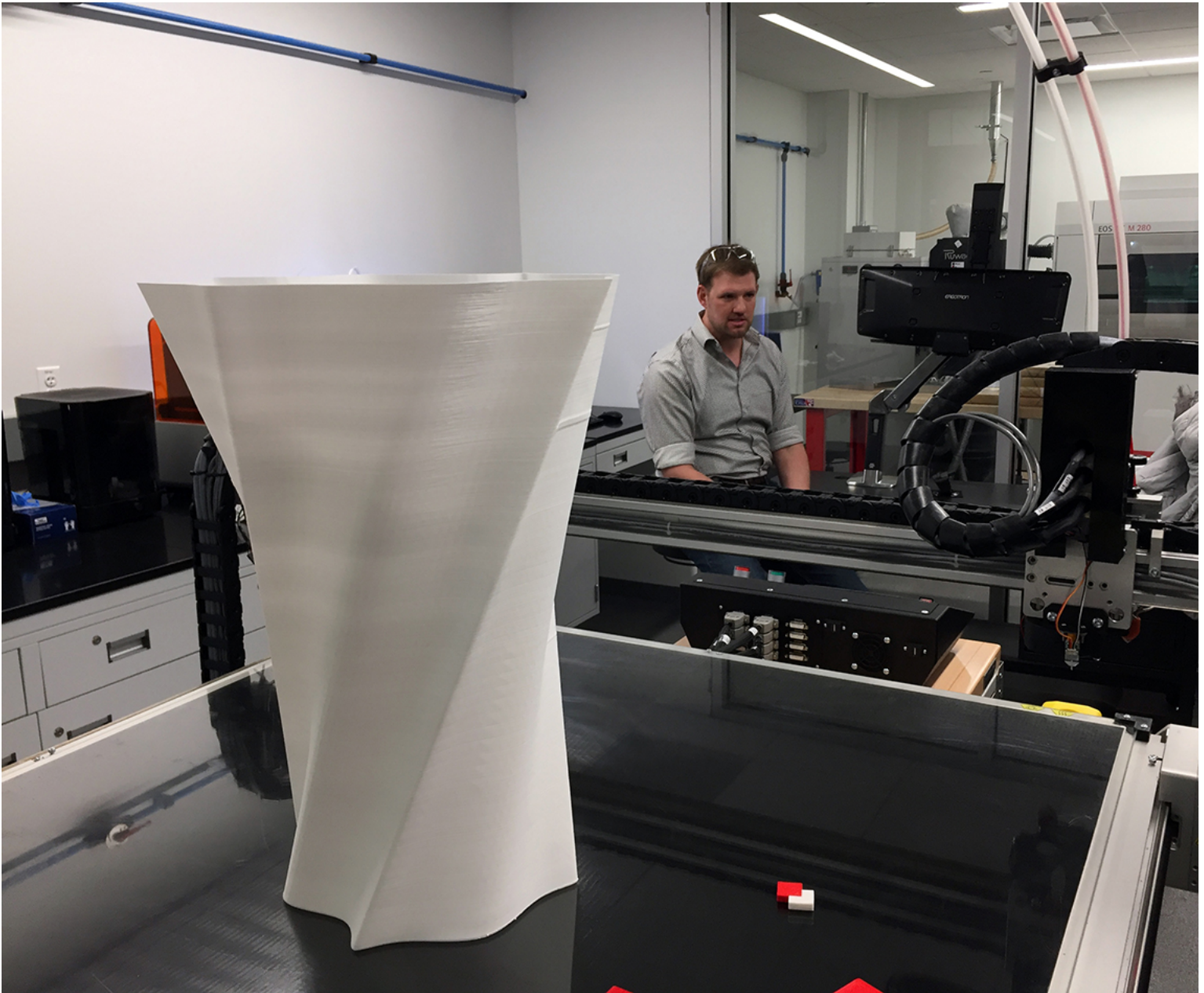








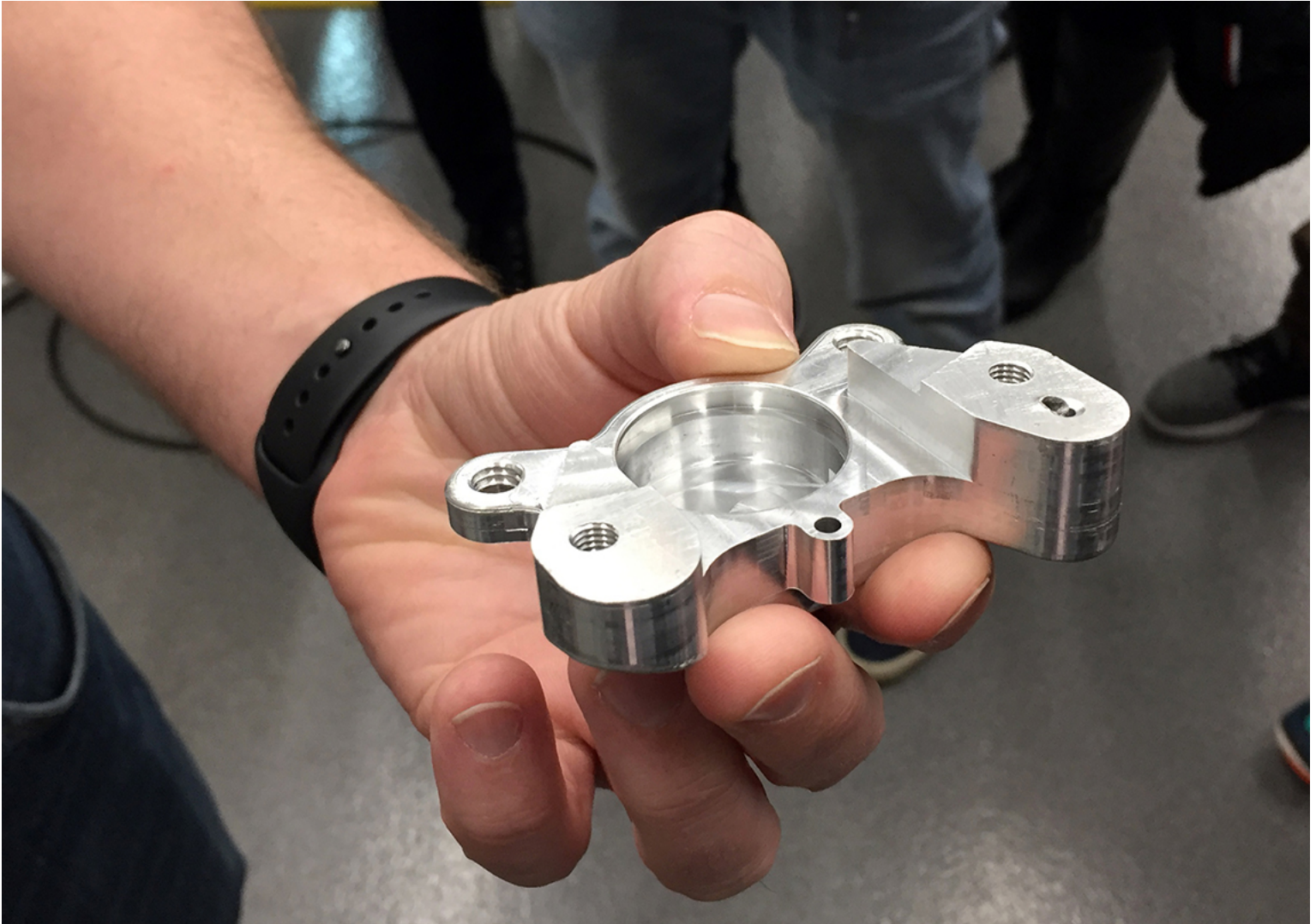












**Assignment 6: (30%) November 25, and December 2 and 9: Assessment of your Final website, also, communication skills and live presentations in class'.** Present the entire body of work you have created during this semester in this class. This presentation includes the object-oriented analysis, design, process modeling, visual objects, disassembly / assembly, computer controlled machine, EXCEL programming related exercises, and the object-oriented programs you have created / learned during our labs.

Please focus on new, innovative aspects, methods, tools and technologies you have mastered. Each student has max. 12 to 15 minutes to present (depending on time). Please do not miss your scheduled presentation time, else we'll have major scheduling problems. Thanks!

**For everybody: please make sure, that you email your final web site URL to the instructor for final assessment of your work you have accomplished in this class. Thanks!**

**Reminder:** As explained during the first week of classes, following USA National Academy of Sciences research-based suggestions, in this class we emphasize the following:

- **Intrapersonal competencies**, that involve self-management and the ability to regulate one's behavior and emotions to reach goals,
- **Interpersonal competencies**, that involve expressing information to others as well as interpreting others' messages and responding appropriately, and
- **Cognitive competencies**, that involve thinking, reasoning, and related STEM (Science, Technology, Engineering and Math), and experience-based skills you collect during our laboratory exercises, as well as in the real-world (in particular for those students who already have some work experience in the real-world).
- **Presenting to a variety of different audiences** (i.e. this is also a new ABET requirement: level, depth and breath)

(Ref.: Supporting Students' College Success: The Role of Assessment of Intrapersonal and Interpersonal Competencies, 262 pages | 6 x 9 | PAPERBACK, ISBN 978-0-309-45605-0 | DOI 10.17226/24697, THE NATIONAL ACADEMIES PRESS, 2016)

**The interactive multimedia project presentation** in front of the class and an Internet-linked computer, based on your web-pages, computer graphics, process models and requirements analysis models. (Imagine you talk to your Board of Directors in your virtual company, with the 4 eLearning Pack company directors and CTOs, who are naturally IEs, present.

These are some important rules to follow when you present:

**The fundamental idea behind communication is to:**

1. Take a picture/ video clip from your own head,



2. Explain it however you can,
3. Have your audience re-build the picture / video clip within their minds.

Whether the copy of the picture matches the original will depend on how well the message was conveyed. Ideally though the process should be interesting for the listener (and encourage them to stay awake) while building your credibility.

**During your presentation focus on the following:**

1. Introduce your project objectives
2. Discuss content you have created, based on your web page
3. Summarize your results and explain possible further work (as a truly lifelong learner...)

**About self confidence...**

Self-confidence is extremely important in almost every aspect of our lives. Often, many people who appear self-confident actually aren't. The difference is that they possess a set of skills they can use when needed to help to impress an audience. In this class, during the student presentations we'll discover and discuss techniques that can be used to project a level of professional (i.e. not arrogant) level of confidence that works in different circumstances, especially when you're in the hot seat with demanding team members, bosses and colleagues.

We all signal different levels of self-confidence in many ways: our facial expression, our body language, how we speak, how we structure our talk, and what we say. During the assessment of the interactive presentations you give to the class during the semester we are working together on tactics you can use to present yourself naturally, confidently, in a non-threatening, friendly-professional way, using both verbal and nonverbal techniques.

Whether you're presenting an assignment, or interviewing for a new job, discussing your performance appraisal, championing your project with a senior manager... or even dealing with a pushy salesperson, or an arrogant member of staff, or boss, you'll be up to the task. We'll focus on the following:

- Tips and tactics for making a strong first impression, in the first 15-30 seconds of your talk! (Yes, that short of time!)
- What to do when you're feeling intimidated in meetings and how to reduce this pressure by preparing well
- Advice for enhancing your nonverbal signals and reading those of the person in power (i.e. body language, and again body language... and preparation in advance)
- Methods to avoid "traps" that make you appear intimidated
- Advice for handling both planned conversations as well as "sneak attacks", "back stabbing" attempts, and others
- Steps to prepare for meetings with demanding people (i.e. controlling your nervousness, fending off sneak attacks, that demand immediate response when you don't have the information, and others).

Please note, that during these presentations, we also would like to use the opportunity to learn how to brainstorm. These are the basic rules:

1. Trigger ideas by explaining a challenge (but don't even hint ideas for solving the challenge)
2. No negative feedback from team members; stay positive and try to contribute
3. Focus on quality content versus quantity content / contributions by team members
4. Use each others' ideas as launchpads, to spin ideas off, to go deeper, to find a tangent
5. Encourage big thinking (a.k.a. as big dreamers are welcome! Any idea is a good idea however big or non-realistic it sounds)
6. Stop when the steam is beginning to run out
7. Select most associated ideas and document them for further decisions / analysis

**4. SOCIAL NETWORKING and Video Conferencing:** During the semester, I will email you several links to short technical articles, that are really important for you to follow and understand what is going on in the world in our subject area. This is particularly important to some foreign students who are not used to get their news via the Internet. You suppose to read these articles and then discuss at least THREE (3) of them with at least one more member in your class, and then document your findings in your social networking part of EACH assignment. I would like to see that you are discussing the content of these articles. Usually in a semester I send out about 15 to 20 short and current articles to read. Through my editorial work with major journals I get hundreds of *just published* articles that I can choose from... I am looking for your executive summaries of the discussions you have done with one or more of your classmates on these articles via email, and/or video conferencing. These activities are all part of each assignment now and therefore should be documented in your web page, just as the rest of your assignments are. (All in one; nice object-oriented principle; not zillions of separate files please!)

**Make sure you follow these rules:**

**1. Clarity of Interaction:** Both parties are responsible for understanding the message at hand. Even the most confident public speaker in the world could not succeed if their audience is asleep. But if the message is clear and concise then you're at least halfway there. When interacting with people you are trying to get a reaction from the audience.

**2. Confidence, correctness and command of your topic** are crucial to showing that you know what you are talking about. The audience's image of you will improve dramatically if they see confidence. During this process, it is also important to earn the listeners' trust, as well as demonstrate 'what's in it for them' by paying attention to you. By adjusting your presentation to the type of audience, it shows an extra effort to them, and genuine care on your part that you want them to understand the message.

**3. Communicate the listener's incentive right from the start.** Word choice is also important. Be aware of 'hot phrases' for your audience. Recent news or sensitive issues can throw them off unexpectedly. If they become defensive in the middle of what you're saying because of a poor word choice, it can be difficult to get them back on track.

**4. Keep in mind, that according to major studies, only:**

7% of communication is your word choice,  
38% is inflection and tone, and  
55% is non-verbal.

As Dustin York, assistant professor at Maryville University put it: 'Clearly, it is just as important what you do with your body as with your mouth and your brain.'

Clear and effective communication is essential during presentations, whether for board rooms full of executives, auditoriums at conferences, or classrooms full of students.

Verbal information is vital, but how we present that information can determine how much an audience remembers. Researchers Allan and Barbara Pease found that **83 percent of communication is nonverbal**, but I wanted to know what impact it had on audience recall.

I conducted an experiment with four identical university classes with a total of 80 students. Each class had a guest speaker who presented. Two of those presenters used effective nonverbal communication, while the others used poor nonverbal communication.

The interesting part was that this was more of an acting gig than a teaching gig. Each presentation was exactly the same, word for word. The PowerPoint was the same, and the presentation length was the same. The only difference was a few nonverbal tactics.

=====

Please note, that all of these are extremely important when interviewing too. Please consider this (Ref.: <https://job-interview-answers.com>):

**Interview Question:**

***Describe a situation when working with a team produced more successful results than if you had completed the project on your own.***

**This is another Behavioral Interview style of question. The Hiring Manager wants to learn more about your thought process, and how well you can form examples to answer this teamwork-related question. You will want to show your ability to solicit ideas from others, listen carefully, and persuade people to your point of view.**

"Well, throughout my career I've worked both independently and as a member of many teams. I have to say, though, that **collaborating with other people across departments** is always a good idea — specifically when it comes to brainstorming and **knowledge sharing**. When it's appropriate, I try to get outside perspectives on possible solutions. I did that a lot at Job 'ABC'. FOR EXAMPLE ... **and the OUTCOME was** a roughly 30% increase in cost-savings for the company, and a significant decrease in the time it took to complete the project."

"Would that type of experience be relevant to this job? ... **Great! ... So when do I start?** ..." 😊 (don't be afraid so throw some humor in if it's going well!)

=====

Nonverbal communication includes a number of elements, so I manipulated only five elements:

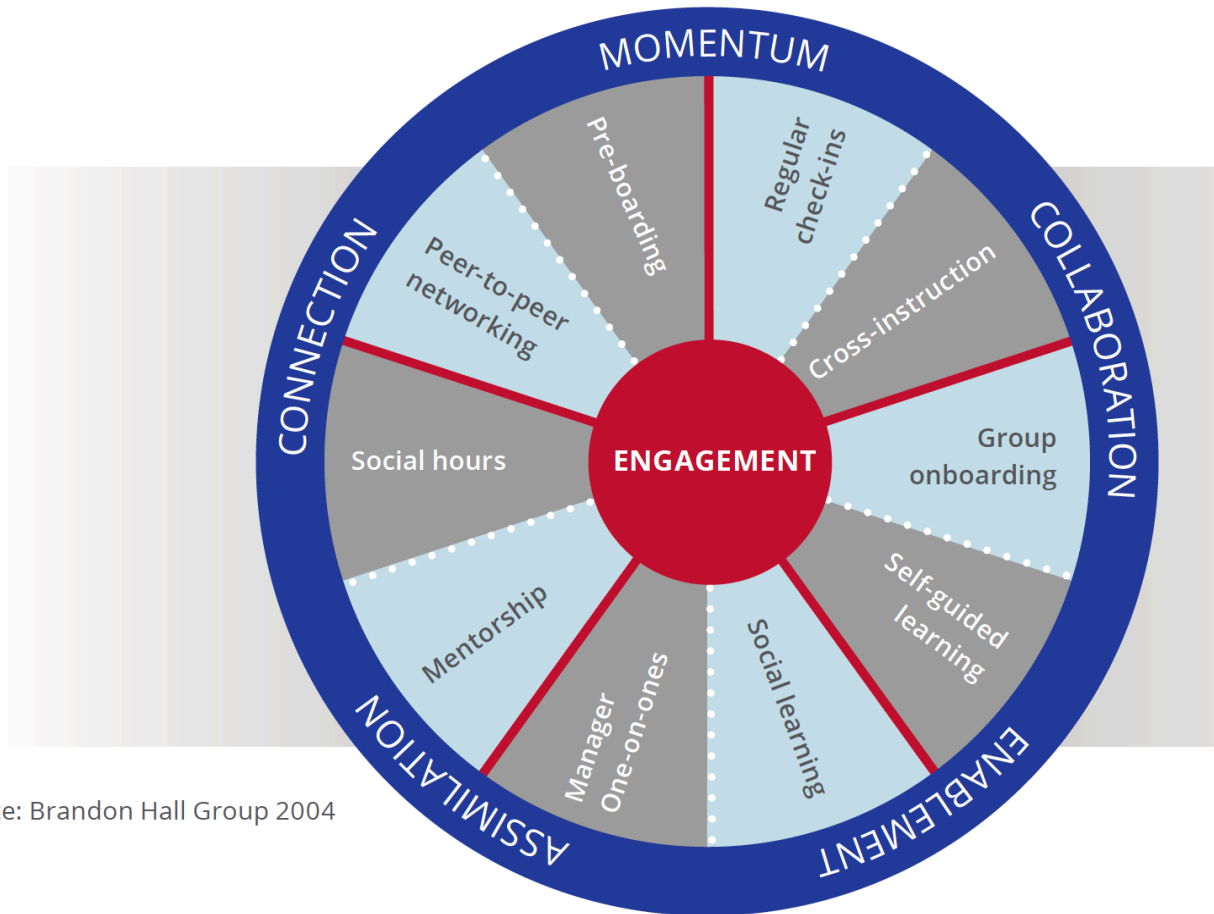
- 1. Eye contact.** The effective nonverbal instructor tried to make eye contact with each student throughout the presentation; the poor nonverbal instructor looked at the PowerPoint and minimally glanced at the students.
- 2. Voice fluctuation.** The effective nonverbal instructor varied his vocal pattern throughout the presentation; the poor nonverbal instructor kept a moderately monotonous vocal range.
- 3. Position in the room.** The effective nonverbal instructor used a PowerPoint clicker and walked around the front of the room; the poor nonverbal instructor stood behind a podium and used the desktop computer mouse to navigate the PowerPoint.
- 4. Facial expressions.** The effective nonverbal instructor used a variety of enthusiastic facial expressions; the poor nonverbal instructor kept a moderately flat expression.
- 5. Hand gestures.** The effective nonverbal instructor continually showed the palms of his hands during gestures; the poor nonverbal instructor kept his hands on the surface of the podium.

See below the seven elements on how to improve communication skills (ref.: [https://alison.com/tag/business-communication?utm\\_campaign=2070\\_personaldevelopmentcampaign\\_communication&utm\\_source=outbound+marketing&utm\\_medium=email](https://alison.com/tag/business-communication?utm_campaign=2070_personaldevelopmentcampaign_communication&utm_source=outbound+marketing&utm_medium=email))



The image below focuses on an effective onboarding model.  
This represents essential communication skills when a new member joins a team.

# Brandon Hall Group High-Performance Onboarding Model



Source: Brandon Hall Group 2004

**eLearning Pack Resources for this session:** Use the eBook. Also use the videos in the eLearning Pack.

#### 14 and 15. Class/Student Presentations:

**Project Presentations:** Interactive multimedia development and validation/ quality control session and student presentations. Continuous assignment/ project improvement sessions based on team and class feedback. (Course feedback and review questions).

**Final Assignment submission, including ALL reworks! Including the EXCEL statistical data analysis with graphics exercises, as well as your object-oriented programs.**

BONUS OPPORTUNITY for Extra 10% for the entire course:

**Optionally (for extra 10%) conduct a Video Conferencing (VC) session using SKYPE, or whatever other software (e.g. iChat / Facetime) you wish to use** (free over the web) VC with one of your classmates and discuss each others' assignments / work. Try to create a collaborative sustainable green quality audit team spirit and document your findings... This is what you should document professionally (pls. note, that if you don't document this session as below, then I cannot give you the extra grade points; sorry):

1. What was the purpose of the video-conferencing session?
2. What software did you use for VC and how? (Must include 3-4 screen prints of the VC session as a proof.)
3. What did you discuss and achieve during the VC session? (Offer a script of your discussions in professional English, not in 'hej dude whatsapp' language...)
4. How do you like this video-conferencing approach for collaborative problem solving?
5. What were the main challenges?
6. What worked well, and what did not, and why?
7. In comparison to a face-to-face visit, versus VC, what is the estimated carbon footprint saving to the environment? How did you calculate this result? (Hint: search the web, there are some really useful carbon footprint calculators for free!)
8. What are **Green Engineering** benefits of using VC? More on **Green Engineering**: <http://www.cimwareukandusa.com/All-Green/Ranky-GreenEngineering.html>

**eLearning Pack Resources for this session:** Use the eLearning Pack and the software access provided by NJIT.

**11.59 pm, December 11, 2019 = ABSOLUTELY THE LAST DAY TO SUBMIT any assignments! All submissions MUST be electronic = by email / with a web URL in it.**

### Assignment Requirements & Assessment Criteria:

Please make sure that you understand the assessment criteria. When completing the assignments for this course you'll be continuously assessed on the following aspects (please see again our course [objectives above](#)).

### Generic Assignment Architectural Support

Based on class and team discussions, interactive multimedia CD-ROMs, DVD videos, labwork, traditional published papers and web articles, etc. prepare ALL assignments in an electronic format (over the web), with text, computer generated diagrams, and images, active code, etc. that in generic terms cover the following:

1. Title of the assignment: **Assignment i: You have to invent a new product / process/ or service in the context of our focus this semester and computer graphics in IE. Then you have to set up your own virtual company, and collaborate with the 4 eLearning Pack companies using IE methods.** As an example, the process modeling assignment is about creating a System Model and Design Diagrams following an object-oriented process modeling method, illustrating the process of collaboration between your company and the 4 eLearning virtual companies. Your goal is to put your new product / process / service on the market. The eLearning Packs and the class lectures will give you all the resources you need for all assignments and the final.
2. Your name, class, date, eLearning Pack IDs, the collaborative companies involved (each learning pack has at least 4 collaborative companies that you should study and incorporate their services into the object-oriented system model you create).
3. If you have done the work in a team, list all team members, state who has done what and submit SEPARATE ASSIGNMENTS clearly reflecting YOUR contribution to the entire team's effort. NOTE again, that we cannot grade teams. We grade individual students working (preferably) in teams! We encourage teamwork, as far as the methods and the discussions go, nevertheless each student must submit his/ her assignments individually.
4. DO NOT DUPLICATE sheets, or any other work in assignments, claiming that your team mate has done it. Again, please note, that you should collaborate on methods and in terms of discussing data and results, BUT EACH of you MUST submit a separate assignment that YOU have CREATED for THIS Class! NO DUPLICATION PLEASE, and do NOT copy paste from the web; You'll shoot yourself in the foot! Give credit to all references, pictures, figures, video clips, etc.
5. Note, that each Assignment must have a section on the Objectives you have set.
6. You should also have a Description & Solution/ Documentation of the problem. In each assignment you should have a **Green Engineering** focus. More on **Green Engineering**: <http://www.cimwareukandusa.com/All-Green/Ranky-GreenEngineering.html>
7. Add a Summary - explaining what you have accomplished of the set goals and how!
8. Don't forget your social networking part (in every assignment!)
9. Furthermore you should include a Bibliography & References section. In terms of assignment documentation structure, please follow the sample generic structure provided in the eLearning Pack eBooks for this class.

**Lateness, unless there is an acceptable professional reason is NOT tolerated! Please don't be late!**

According to NJIT's policies, in this course the NJIT Honor Code will be upheld, and that any violations will be brought to the immediate attention of the Dean of Students. Also, students will be consulted with by the instructor and must agree to any modifications or deviations from the syllabus throughout the course of the semester.

### IMPORTANT Schedule and Due Dates:

1. The total course duration follows NJIT's typical 15 week schedule; all class schedule and due dates as above.
2. Students will be required to complete each assignment as individuals. They are encouraged to work in teams to understand the methods, but each assignment has to be done by an individual student using the customized learning packs available from the NJIT bookstore.
3. Each assignment has to be posted on the student's own web page over the web, or CD-ROM/DVD-ROM in Internet compatible format (i.e. text in .HTML, images in .JPG, movies in .AVI, or .MOV, Excel spreadsheets in .XLS format).
4. No team web pages are accepted. NO duplicates of web pages are accepted. EVERY student must develop his/ her own customized assignments and document his/her work on his/her web page!
5. Grade "A" for this class requires min. 90% total. (Achievable maximum with the 10% extra bonus assignment = 110%)

### PLEASE VIRUS CHECK EVERY POSTED FILE!

**IMPORTANT ground rules** on improving assignments during semester, and after end the end of semester, after having received your grade:

- In accordance with NJIT regulations, I allow you to improve your assignments during the semester. The best approach for all of us is if you complete your assignments (as specified above) on time, then I email you a grade for your assignment, and then if you can improve it, you email the URL again, and hopefully I can give you a better grade at this point of time.
- This is a very popular feature of this class because this learning process brings the best out of you. (Remember, your success is my success too!)
- The problem starts, when there are too many students and they carry on re-submitting their assignments more than once during the semester. I typically cannot cope with this workload... I see this, because I keep a record of your assignment grade changes. (Consider the numbers: I often have 100+ students in a semester, each working on 6 assignments, that is 600 assignments, and with re-submits typically around 1200 assignments per semester; you see my point...).
- Also, because of semester end time constraints, the last assignment cannot be re-submitted.
- Even more important: once you have received your grade the only way you can improve that grade is if you re-take the course. This is because if I allow you to do extra work between the end of semester and graduation / commencement, than I should offer this to every one of my students... because I treat every one of you EQUALLY!
- If you want an 'A' please make sure, that you follow the deadlines as above, and submit every one of the assignments, with every question, problem answered.

... and to make sure, that we all remember... the NJIT Grade Scale:

90-100 = A  
 85-89 = B+  
 80-84 = B  
 75-79 = C+  
 70-74 = C  
 60-69 = D  
 0-59 = F

### Course Improvement and Quality Surveys During the Delivery of the Course

Please note, that the purpose of all of my surveys is Continuous Quality Improvement.

#### IE203 Computer Graphics in IE Course Analysis for Quality Improvement Purposes

1. Did you read the course syllabus on the web? [yes] [no]
2. Is it clear what we are trying to achieve together? [yes] [no]  
If [no], what is not clear?
3. Do you like your customized eLearning Pack with 3D eBooks and DVD videos? [yes] [no]  
Explain why?
4. Do you like the fact that the instructor asked each individual in the class what their personnel interests were? [yes] [no]
5. Do you like the fact that the instructor offered additional reading and learning resources? [yes] [no]
6. Do you think it is important to understand lean production control methods and graphics in the IE context? [yes] [no]
7. Do you think it is important to understand industrial collaboration methods in the IE context? [yes] [no]
8. Do you think it is important to understand process modeling methods in the IE context? [yes] [no]
9. Do you think it is important to understand requirements analysis and risk analysis methods in the IE context? [yes] [no]
10. Do you think it is important to understand and learn how to set up and program web pages in the IE context? [yes] [no]
11. Do you think it is important to learn spreadsheet programming methods in the IE context? [yes] [no]
12. Based on what you have seen and learned from the course during the first 4 weeks, which topic areas do you rate as 'most important' in this course?
13. Based on what you have seen and learned from the course during the first 4 weeks, which topic areas do you rate as 'least important' in this course?
14. Did you like the interactive labs. in this class? Pls. explain why?
15. Do you have a suggestion? Please explain. (Your input is very important for us. We follow a continuous quality improvement process. Your input will help us to improve.)

**Result:** During the past 14 years, based on over 540 inputs, over 95% of the answers offered by the students approved the above by indicating 'yes'. Students in this class like the fact, that the learning packs are customized, and that they have significant multimedia, web and active code content. Sometimes students feel, that there is too much to learn in this class, but years later they indicate in their emails, that 'Professor, I am using in my work everything we learned in IE203...' Nobody rated any of the topics to be 'least important'. In terms of needs / new requirements, the class has emphasized the importance of web-programming, web graphics, spreadsheet programming, CAD, and real laboratory activities (besides computer labs.), therefore these activities and subject areas have been increased during the 2012 to 2019 time period.

#### Informal Quality Feedback Form (Ranky)

Please review the following topics for this class by rating each topic between 0 to 10 (0 = meaning not important / poor quality and 10 = extremely important / excellent!). This feedback form will help your instructor to maximize quality satisfaction.

1. Web-based syllabus (... OK it is long, but is it helpful? Did you read it?):

Over 90% stated yes, and rated it very high (8-10) ('Typical response: ... it is long, but has all the detail...')

2. eLearning Pack with DVDs and 3D interactive eBooks. (Do you prefer interactive, full color learning resources, or static, black & white traditional printed books?):

100% stated yes, prefer the interactive eBooks versus the traditional printed textbook. Some asked for a printed version too (pls. note, that every eBook can be printed from a browser if you have the money for the ink... some are over 800 pages long...obviously interactive active code, videos, spreadsheet cannot be enjoyed on paper...)

3. Visual factory and computer graphics in IE focus on how to find and reduce waste to become leaner:

Over 95% stated yes, and rated 10

4. Object-oriented information system models and process modeling:

Over 90% stated yes, and rated this very high (8- 10) (Some felt, that the Visio software tool was difficult to use and that we should explore other graphics software tools too; agree...)

5. CORA: QFD (Quality Function Deployment); Requirements Analysis

Over 90% stated yes, and rated this very high (8-10). Many felt, that after the disassembly laboratory this method, process modeling and requirements analysis became much clearer. Action: we'll do more labs in the future, combining analytical as well as practical activities and skills.

6. Real world challenges and examples on DVDs, based on virtual factory and R&D tours:

Over 95% stated yes, and rated this very high (8-10), claiming, that practical real-world challenges and demonstrations were very valuable because they could see several US and international factories in many different industries on DVDs. (Note, that before, during and after the DVDs we analyzed and discussed contents in detail.)

7. PFRA: Process Failure Risk Analysis:

Over 90% stated yes, and rated it very high, and claimed, that it became clear after the disassembly laboratory (which follows the analysis class of discussing the process risk analysis method).

8. How the learned methods and tools fit together, and how we can integrate them for specific computer graphics in IE applications:

Over 80% stated yes, and rated this high, between 7- 10. Which is very good, considering, that most students don't understand the real-world of corporate America at this stage yet.

9. Laboratory classes / demos: Over 95% stated yes, laboratories are very important, and asked for more practical laboratory content (something we should do more / improve for next semester; subject to funding...)

-Web design lab. (with Mr. Solano, TA): Very important lab, but some felt, that it should have been explained better. (We'll improve on web design issues.)

-Spreadsheet development lab. (with Mr. Solano, TA): Very important lab, most felt, that it was very good. (We'll carry on with this lab next semester.)

-Computer graphics software tools lab. (Ranky, as well as Mr. Solano, TA): Very important lab, but some felt, that we should have more software demos and software content, and that the Departmental Computing Laboratory was out-of-date (agreed; we'll have to improve in this area with new laboratory development; funding hopefully on the way...).

-Computer disassembly lab. (with Ranky): Very important lab, over 90% felt, that it was excellent, and that they have learned a lot. (This became even more evident during the presentations of excellent web-based lab-reports with pictures, text, process models, requirements analysis models, risk analysis models and even some video clips over the web.)

-Humanoid robot lab. (with Ranky): It was the most popular lab., 100% felt, that it was excellent, very interesting, lots of fun... (We'll have to do more of this in the future).

10. Any hot topics you think we should cover in the future? Please list and explain.

Some felt, that the assignments were sometimes a bit complex (they need more explanation, agreed). Also, most students want more practical labs., more software tools to learn, better computer labs, more practical laboratories where they can work with real devices, machines, robots. They would like to work with more humanoid robots and how they can be integrated into our society in the future... (All agreed... we are working on these new labs; subject to funding...)

---

### Student Feedback Section...

*Dear Professor Ranky,*

*I just wanted to thank you again for the wonderful and informative semester. You have allowed me to gain a more well rounded perspective on a variety of topics including communication in a professional setting as well as guides in future working expectations. The class has been one of my favorite at my education here and really opened my eyes motivating me for my future degree and career choices. I look forward to having you in my future Masters studies at NJIT.*

*Thank you and I appreciate your efforts,  
Daniel*

---

*Thank you for being a very inspirational professor. I really appreciated that you were so able to confidently share your personal stories and life lessons in order for all of us to realize the importance of this class. I took all of your advice to heart and it truly opened my eyes about the industry and how beneficial Industrial Engineering is for the whole world. Sarah*

---

*Dear Professor Paul Ranky,*

*I wanted you to know that it was a pleasure and an honor for me to take you as my IE 203 Professor this semester. I am very happy that your class was the first IE class I took in my IE major and by that, you inspired me more to study and become a professional Industrial Engineer. I really had a great opportunity taking your class, and I learned a lot from you. And thank you for that wonderful semester I really appreciate it. I hope you have a great winter break and happy holidays.*

*Sincerely,  
Anthony*

*Good afternoon professor Ranky, I have finished and finalized both subjects (IE 655 & IE673). I would like to thank you for a wonderful experience. This is my last semester in NJIT, I will be graduating after this semester with my undergrad. I'm very grateful I had the opportunity to take your master level courses. My first class with you was IE 203 and that helped me get an internship with the Office of Homeland Security, hence I made sure to take few more classes with you. Thank you very much for your knowledge, I firmly believe this will help me in my career a lot. Wish you Merry Christmas and a happy new year.*

**Summary of Course Modifications and Improvements (2002-2017)** based on student surveys and feedback (organized by the instructor, using forms shown above, as well as informal discussions), and semester end surveys (organized by NJIT, using the standard NJIT course evaluation forms):

- **Student Surveys:** Based on the 2002 student survey, all requests were implemented, and the assignments were explained better. (One of the challenges here is, that most students have never seen a real company working with advanced computer controlled machinery and systems. Also, most of the students have no concept of object-oriented (OO) thinking, analysis, design and programming. Some students, a very small portion, do not want to do anything with OO programming, or even simple web-page design... therefore these crucially important aspects must be introduced carefully and gradually at this level to convince them, that these skills make them a lot more marketable.)
- The web-based assignment documentation requirement was moved from Assignment 1 to Assignments 2 and 3. Object-oriented thinking was explained better using real-world examples, as well as computer programs and programming exercises. Most students have asked for more programming exercises and this is most welcome, and will be introduced as of Fall 2018.
- A step-by-step note was put up on the web on: 'How to set up web pages at NJIT as a student', and in 2002, 2003, 2004 and 2005 assistance was offered for this activity by one of Dr. Ranky's graduate RAs)
- Based on the 2002 - 2017 surveys the real-world hands-on laboratory content has been increased. More computer demonstrations and activities were offered too. The NJIT Makerspace will be available to all of our students and this is a wonderful opportunity for all of us!
- Based on the 2016 survey, for 2017, more visual factory, digital design and digital manufacturing, object-oriented thinking, analysis, design, programming, CAD/CAM and PLM (Product Lifecycle Management) content has been added, coupled with practical laboratory work in real-world IE process / robotics and machining labs, in the classroom, using kits, as well as in computer labs.
- Based on the 2017 surveys it is clear, that students would like to use more software tools, and participate more in practical laboratory sessions. They also like humanoid robots / collaborative robots (a tested and validated concept in this class with the help of outside vendors), and how these devices will shape our society in the future. (We'll try to do more of all these in the future, subject to lab. funding...)
- More product disassembly, and CNC lab-related activities were added (2009-2017) and with the NJIT Makerspace, this opportunity will be further increased.
- **Student Feedback:** I have to admit, that student feedbacks like the above and this makes me VERY HAPPY:

*Professor Ranky, It was a great semester and Guess what...I am very thankful to the material learned in ur class because i am working with one of the company that wants their factory to have a Visual Managment phase... So after all I will be using your dvd's very often.*

*Thanks, Akin*

*Hello Professor,*

*Here I have attached the last assignment, which I presented today in class, I have made the proper corrections and I hope it is all correct by now (excel and the process chart), if there is any other correction that you think should be made, please let me know and I will be more than glad to do so.  
<http://www.wix.com/douglasbakal/ie203>*

*I have also attached a link about Fernando de Noronha, the Brazilian island which I mentioned before.  
<http://www.noronha.com.br/site/inicio.php>, the page is initially in portuguese, but you can change language at the top right. Beautiful place very well preserved.*

*Thank you professor for the transferred knowledge through out the semester. You gave me a lot of info on a subject that will be very important for my life. Thank you again.*

*Best regards,  
Douglas*

*Hello Dr. Ranky,*

*It was a great pleasure being a part of your class. The knowledge and experiences you have shared with us was a first. Thank you for inviting me to the ASQ dinner. I have definitely met very important people that I am looking to keep in touch with. I hope to see you again on campus and I will come to you for advice. Have a safe and great holiday!!*

*Regards,  
Mehmet*

*Professor,*

*Attached is the link to my website. I have dedicated a lot of time and I am very proud of the work I have learned and done. This has been the most enjoyable assignment that I have worked on this semester. Thank you for the lesson and I hope you have a great winter break.*

*Regards,  
Caroline*



---

Good Afternoon Prof Ranky,

I wanted to thank you for caring about your student's future. You showed a lot passion for your craft and inspired a lot of optimism among those who were smart enough to pay attention in class. I had a blast frankly. I look forward to see you next semester in Total Quality Management classes. Enjoy your holidays, Thank you once again.

Regards,  
Joseph

---

Hello,

I wanted to thank you for providing us with such great knowledge in your class. I learned so much about industrial engineering and about being a professional in the industry. I was just having a conversation with a fellow student regarding how much we have benefited from this class and how we can apply our knowledge to maximize our opportunities. .... I just wanted you to know how much I appreciate you insight and all you help you have provided us.

Thank You  
Tooba

---

I hope everything is to the right standings, and I would like to thank you for a great semester. Your class was very insightful to me since I was in the process of becoming an IE student.

Once again Thank you  
Wesley

---

Thank you for a wonderful and enlightening semester. I really appreciated our talks during and outside of the class room. You have helped me gain a good grasp and a stable footing on the foundation of Industrial engineering as well as how to better myself professionally. I haven taken what you told me to heart and will strive to provide more "substance" from now on in all my endeavors.  
Thank you again Professor.  
Christopher

---

*Hello Professor Ranky,*

*Below is the link for my webpage for the class of IE203 with all the course assignments complete.  
Thank you very much for everything that you taught us in this course.*

*<https://sites.google.com/a/njit.edu/jab28/home>*

*Sincerely,*

*Jaime*

---

*Dear Professor Ranky,*

*I hope you doing well, here is the link for my completed website for fall 2011. I really enjoyed you class and it was very intresting. I will try to implement these skill you taught me in the real world. Thank you professor and have a nice and safe holiday.  
<http://dl.dropbox.com/u/45580252/ie203MuhammadBalalwebsite/Home.html>*

*Thank You,*

*Muhammad*

---

Your class was a pleasure this semester, I think everything we talked about was necessary and insightful.

Thank you and enjoy the break!

Walid

---

I also want to thank you for all that you have taught us during this semester, I know that the knowledge and experience will benefit me greatly in the future. I honestly came into this class not knowing anything about IE. But I'm glad that as the semester went on, I really enjoyed this class and really gained a lot of knowledge that made me think differently in many situations in life.

I hope you enjoy your winter break Professor!

Thank you again,

Jannah

---

Thanks a lot. This class was really useful as I've learnt a lot.

Thanks  
Varsha

---

Dr Ranky,

It was very pleasure to take your class this semester. I really enjoyed your class and your way of giving advices. Hopefully I will take your master classes later. Thanks for this wonderful semester.

Suzy

---

*'Dr. Ranky, I could finally breath after checking my grades. The material provided is so phenomenal, that though at times one would have questioned if I will be EVER using this information in real life, I realized this time to time that the material is about topics I didn't know, things that I might not have given a thought otherwise, and things I would have not learnt until and unless I were lucky as you to meet the people and visit places that you did just to prepare this course. You truly own all the credit for the hardwork and success of your students. I am looking forward to the TQM class. Happy a wonderful Christmas and a good luck on swimming with sharks. I've heard of your passion for swimming/diving and hope to see your exciting videos next year, Usman;*

---

*Thank you for your teaching it was a great experience for me and everything that I have learned I am going to utilize it in my professional life. I hope that we cab see and that you can be my professor again, thank you again for everything  
Rahadames*

*Thank you for a rewarding semester,*

Ryan

---

Thank you for everything you taught us this semester.  
Everything was very meaningful for my career.

Best regards,

Amanda

---

Thank you for all of your help this semester and helping me become a better student. The knowledge i learned in this class will be useful through my engineering life time. Thank you for helping me better myself this class was truly helpful.

Happy Holidays,

Darling

---

I enjoyed being in your class very much and am quite thankful for the learning opportunities this semester. I hope that I can continue to learn from you over the next few years. Just from this class alone, I feel more confident in my choice to become an Industrial Engineer. Thank you for doing what you do and I look forward to working with you in ASQ.

Avery

---

*Dear Dr. Paul G. Ranky,*

*Please see the URL to all my assignments for this course. It was nice having you with all the great resources in this class. Please keep up this great work. Hope to hear from you soon.*

*Regards, Moses*

---

*Hello Professor Ranky, I'd like to say once again that I really enjoyed your course and know that the material you taught us will be very handy during our futures as IE's. Once again, I'm sorry if at any point throughout the term we as a class gave you the impression that we weren't fascinated with the material. I hope that my presentation yesterday showed that wasn't the case. Thanks for your time -Akash*

---

*Gustavo Truyol here, I'm sending you the assignment page with all the assignment (PLM included). I learned a lot in your class, I hope to take any other of your classes in the future.*

*I am still using CORA, FRMA. Every time I use it it works! If there are updated versions please let me know. I see now how revolutionize was the concept when you first put it out. Now years later there are some similar items, but not as equal in my view. Thank you. Ivan*

*A1. I really enjoyed the contents of IE 203, we gained knowledge of a little bit of each course that lie ahead such as Work Measurement and Standards, Quality Control, and other courses. Yes, the final project helped me with communication skills when I had to present to top managers during my summer internship. This project also helped me write a informative and straight to the point PowerPoint. Yes, all of these aspects have been very useful in my professional career, I was really confused at what tasks I would need to complete a work but this course has clarified Industrial Engineering for me. More disassembly projects during the semester would improve future IE's quality assurance and lean factories skills.*

A2. Yes, the lecture by itself was very interesting and informative, I can't say this about many courses. The lecture was quite long but the information given was worthwhile and eye opening into the IE profession. The only suggestion for improvement is that the book was not used as often. I used the CD-ROM provided with the book and never opened the regular book. I was wondering if the book was eliminated would it affect the course in anyway because you get the same valuable chapters on the CD-ROM.

A3. I believe the professor's flexible availability was proven helpful, when you need help completing the hardest part of the course, starting a web page. You had prompt and positive responses to any questions asked and provided much feedback.

Thanks for a great experience! ----- by Andrea Kimborough (NJIT IE203 Class 2005). Emailed by Andrea to me on November 5, 2007 in response to one of my **Continuous Quality Assessment and Lifelong Learning surveys I conduct after every semester.** ( Please note, that more responses are available on file, for every semester, anonymously hand written by the students):

**More responses (after every semester this course is run):**

Q1. How did you like the contents of IE203, Computer Graphics in IE (the course I taught to you): Can you use the contents taught in industry? In particular do you find web page design with graphics, visual, lean factories, process modeling, requirements analysis, risk-analysis, presentation and comms. skills useful in your profession? PLEASE explain briefly why and how... Any suggestions for improvement?

*The value of IE 203 is not realized until you apply the methodology in your first internship/or full time position. It was the foundation for my first internship and I believe it to be the foundation for Industrial Engineering. It is 100% useful to my profession! Lean, Kaizen, 5s, etc. save companies millions of dollars if used properly.*

Q2. Did you like the delivery and learning resources of the course?... with interactive multimedia 3D eBooks, videos, spreadsheets, etc. Do you think, that the lifelong learning emphasis in the course was important? Any suggestions for improvement?

*Suggestions for improvement at this point would be hard for me to say only cause I took the course 4 years ago. The course was effective enough to have left a perfect imprint in my mind. The multimedia portion of the course was a new learning method for me at the time, and a very effective one. Everything was visually pleasing and arranged in a very friendly manner, which was very important to me because I am a visual learner. If something isn't visually pleasing, it's either hard for me to absorb the information, or I loose interest.*

Q3: Course management quality: Do you think, that the instructor's email and home telephone availability during weekdays as well as weekends is important? OR, the instructor should only be available during lecture hrs and office hrs at NJIT, and by email during official weekday hrs. Any suggestions for improvement?

*I feel communication by email is very effective because it saves both parties time. If I really needed to see you, I would email or call you to make an appointment, otherwise, I prefer email. I prefer a professor who checks their email regularly and replies accordingly. **Hanisha (IE203)***

Q1. How did you like the contents of IE203, Computer Graphics in IE (the course I taught to you): Can you use the contents taught in industry? In particular do you find web page design with graphics, visual, lean factories, process modeling, requirements analysis, risk-analysis, presentation and comms. skills useful in your profession? PLEASE explain briefly why and how... Any suggestions for improvement?

A1: I noticed that most industries follow risk analysis . Also, the material provided me with a better understanding on subjects such as: project management (RAM and Work Breakdown Structure), human factors (list the problems and improve the product), inventory management, etc. An example of a good designed website is the orca computer website, in the VSE section they offer video of their visual simulation (offering the video of simulation)

Q2. Did you like the delivery and learning resources of the course?...with interactive multimedia 3D eBooks, videos, spreadsheets, etc. Do you think, that the lifelong learning emphasis in the course was important? Any suggestions for improvement?

A2: The part that I liked the most was the visual material, such as, the video on manufacturing, especially the difference between companies (The mini-cooper assembly and the Ford assembly). The only suggestion is that there weren't any references to the DVD content in the book(the book didn't noted the additional material and info that was on the DVD)

Q3: Course management quality: Do you think, that the instructor's email and home telephone availability during weekdays as well as weekends is important? OR, the instructor should only be available during lecture hrs and office hrs at NJIT, and by email during official weekday hrs. Any suggestions for improvement?

A3: Contacting with the instructor during the weekdays and weekends helped to improve my work, I really appreciated that whenever I sent an email, the instructor would answer me in less than an hour. I didn't have any phone conversation, since, it would've been a little hard for me to ask or understand material involving graphics and visual images, even a table is hard to explain over the phone. Personally, I prefer email because I could show the actual work and give time for the instructor to give feedback

Best regards,  
**Gustavo**, and other IE203 students

---

### And one more thing...

I have found this on the web. I think this is a good farewell for you. (Credits: Grant Cardone, Founder and CEO, Grant Cardone Sales Training, USA):

### **Are your actions leading you to success or failure? Try emulating the 5 characteristics of successful people to achieve long-lasting success.**

Because I never trusted my talents, my looks or my luck, and had no connections, I studied what successful people did and tried to mimic it. Then I studied what unsuccessful people did and tried to avoid it. While there are many things that seem to differentiate those who are successful from those who aren't, I've noticed one simple difference that stands out the most—successful people are more willing. What exactly are they more willing to do than others? Here are five key activities they are more willing to do:

#### **1. They Go to Work to Prosper, Not Just to Work**

Those who are more successful go to work to get something accomplished. They work to make their dreams a reality, not just to get their eight hours in. They have a drive, even a greediness or self-centered push to get something done. There are millions of people who go to work every day, yet few put themselves in a position or mindset to prosper. Unsuccessful people approach their work with a more limiting mindset. They often refer to work in a negative way. For example, they'll say "the daily grind" or "my life as a drone." They typically complain as opposed to looking at work as a means to an end, to create a life of abundance. Work—the passion for it, the creation of it, your contribution and what you learn from others—is what leads to goals being met and dreams becoming reality.

#### **2. They Exercise Incredible Drive**

The most successful people I know are driven, and they push and shove until the job is done and targets are hit, and then they go again. They're able to stay focused on getting results. They keep doing the hard things long after others are only doing what's comfortable. Unsuccessful people appear to spend a lot of time in emotions and considerations that cause them to stop or settle and then rationalize how these feelings should be satisfied. What they don't seem to understand is this mechanism of drive is a muscle that can be developed by practicing nonconformance with society's definitions of success.

#### **3. They Never Make Excuses**

Regardless of how many excuses they make, successful people know that it will not change the outcome. Even justified excuses will not make a project or person successful. When things go wrong, the successful person sees it as an opportunity, not an insurmountable hurdle. Unsuccessful people spend a lot of time making excuses, blaming the economy, the customer, prices or competition. Even if the "excuses" are all true, it won't improve the outcome, and successful people know this. No matter how justified you are, never make an excuse for any outcome.

#### **4. They Focus on Their Goals Daily**

Successful people are always focused on success. For instance, the first thing I do every morning is write down my goals—I've been doing this for years. It's my experience that if I can stay focused on what I want, I will get it no matter how absurd the goal. Make the things you want and haven't yet accomplished so real in your mind that they become real in your world. Less successful people seem to allow anything to drift into their environments—they aren't controlling what they focus on. The average American consumes four hours of TV and Internet per day and writes their goals down once a year. Every day presents an opportunity to set and reach goals regardless of how large or small they are.

#### **5. They Are Willing to Fail**

The old saying, "no risk, no reward" really applies to those who are successful. These people go for it almost with a willingness to fail. Of course, they aren't interested in failing, but they know that if they don't put themselves in a position to fail, they'll never create the ability to win. At some point in life, you'll have to go for it or you'll live the rest of your life regretting not doing so.

Unsuccessful people play it safe. They don't speak up or offer ideas because they operate from a place of fear. They're afraid to fail because they're overly concerned with the judgment of others so they do the minimum and try to "fly under the radar." Never be afraid of failure because behind every mistake is an opportunity to learn.

Begin to willingly do these five things, and you'll soon see how things change for the better in your business and life. Because doing what others refuse to do will give you the edge you need to find the success you want.

**In our course we put a lot of emphasis on lean production methods and the role of IEs. The basic idea of the Toyota Production System (TPS) based on Toyota's definitions is the following:**

"TPS is a sequence of operations with an objective of improving productivity by reducing unnecessary, unreasonable and uneven activities, thus decreasing our production costs."

**Quality is Built into the Production Process**

We are engaged in the automotive industry, and it is our mission to provide a trouble-free car to the customer. To do that, it's necessary to manufacture products that meet the design quality requirements, and this drives the need for quality checks. Conventionally, finished products were checked by a quality inspector, and then sent to the subsequent production process; however, no matter how much you evaluate the quality of a product that has been already manufactured, this will never lead to manufacturing products of good quality. If the quality inspector performs a sampling-inspection and declares the products to be good, but of one them is found to be defective, if we put ourselves in our customers' place, there's no way we would say "It can't be helped, it's only one in a thousand."

All products are subjected to a hundred percent inspection in some form or another. This is where the elimination of a dedicated full-time quality inspectors, and the concept of "build quality in the production process" was born. Which means completely assuring quality in every single process step where it can only send a good product to the next process. The inspection should be done inside the process and defective products are removed on the spot.

Despite these efforts, sometimes a defect will be discovered in a subsequent process. If this happens, they immediately contact the preceding process, and the department stops the production process, root cause is investigated, and countermeasures implemented. Without prompt response, defective products will continue to be produced. In addition, it is necessary that the process that produced them must do the rework of defective product. Keeping silent just because it's a minor flaw should never happen. Letting the next process do the rework without notifying the preceding process is unacceptable. This may result in the production of more defective products. The rework must be done by the department that produced the defective product.

**Quality is the True Value of Improvement**

To build products of good quality is a priority more than anything else for our manufacturing industry. No matter how many products you produce, if they are of poor quality, then customers will not buy them. Even if you reduce the production costs, if you can't sell them, there will be a loss.

In the case of automobiles, safety is especially important. We would fail our social responsibility if we bring products to the market where we "cut corners", or made the excuse of "we had our hands full", or "we made it cost less". This can turn out to be fatal for a company.

In short, ensuring the quality is the first thing that must be considered. You are giving priority to a less important thing when you make little of it for some other reasons.

Let's consider what kind of work does the term "quality assurance work" refers to.

Unlike in the past, when the intuition of the operator or the degree of skill played greater role, today each process is segmented, and less specialization of skills are needed. A standard operating procedure in each production process is part of quality assurance.

Standard work must be designed to ensure the required quality. If there is unevenness among the processes, checking process by visual observation or gauge must be incorporated into the standard operating procedure as a single process.

If defects are still produced under these conditions, then it is either because the standard operating procedures are not followed, or because there is some defect in machinery, equipment, molds, or tools. Let us discuss people not following the standard procedures.

Sometimes people say things like, "When we tried reducing labor, defects increased" or "We reduced too many people, which shows up in our product quality."

As we explained earlier, looking at it from the concept of the TPS, this is putting the cart before the horse, and it should never happen.

By looking at what kind of issues take place, they can be broadly divided into the two categories:

(A) Omitting or forgetting some of the necessary procedures, under the impression that the work that must be completed in a shorter time. In other words, rather than eliminating unnecessary activity, they end up cutting corners instead.

(B) Since we previously had surplus of time allotted; creating intermediate stock and rework were possible. The labor reductions have exposed our quality defects.

The case of (A) is commonly encountered in assembly work done on conveyor lines. This mistake occurs because the line was not stopped to avoid delaying the production process. In the labor reduction activities, people are well taught about the importance of stopping the line. The first thing to teach a new person is how to stop the line.

By stopping the line, we can find out about the imbalance between the amount of work assigned to each person, and discover facts for the elimination of unnecessary activity. It is also possible to solve the fundamental cause of the delay.

If people omit some work because there is not sufficient time allotted, it may be because they think the line must never be stopped. The supervisor is responsible to make sure that people understand that passing a complete product to the next process is more important, even if it requires stopping the line.

There is no need to obsess over line speed or Takt time. It's important to clarify that "Takt time and the number of people are unrelated." The person is doing all that is required at their own pace, so a cycle of work is completed.

If they don't finish within the Takt time, the line may be stopped until it is completed. Making sure that work fits within the takt time requires completely different measures, and that's the job of managers, supervisors, and technicians.

For instance, if a person requires 70 seconds to finish from process one to process five, while takt is 60 seconds, they would exceed takt by 10 seconds. There should be no need to explain that we must never omit those 10 seconds. The people should do their work normally, and the line should stop for 10 second intervals every time to make products with good quality.

It's the job of the supervisors and the technicians to implement improvements to make sure that any person can finish the processes within 60 seconds working at a normal pace. By cutting down unnecessary activities or reducing the distance they walk, with improvement, there would be no need to stop the line.

If you try to eliminate the line stop without improving the working process, this will naturally result in a lower quality of products; this must be strictly avoided.

In the case B, by reducing the number of people and inventory, we see that many defectives were produced frequently. These were reworked within the production process rather than solving the root cause.

A following process fixes the defect caused by a preceding process without giving feedback. For example, there is a mismatch with the tapped hole due to a design problem. You fix it with the correct screw holes in your process.

Because the problem is managed, the root cause remains unsolved. The additional labor and inventory for these makeshift repairs increase the cost. When these problems are made obvious because of labor reduction process, it is a chance to improve.

Supervisors and technicians must return the defective products to their respective departments. They should visit the preceding process to pursue the root causes behind these defects, and solve them starting with understanding the root cause.

This can be compared to taking pain medication for chronic appendicitis, instead you decide to get surgery and fully recover.

This concept also applies to solving the defects caused by machines, equipment, molds, and jigs, which we have described earlier. If we find that the equipment is causing a defect, it is important that we stop the line immediately and to identify and eliminate the root cause.

If we end up doing in-process readjustments on our own just because the maintenance department wouldn't respond after we contact them, we may start to fix the problem within our own production process, and this imperceptibly becomes a part of the regular process.

We shouldn't stop with a single written request or a single phone call. We must keep taking measures patiently until we get a product of perfect quality.

Defects and Inspection - Let's think about why sending out a defective product is unacceptable. If the assembly line which is the final process of production, sends out defective products, then it is highly possibility that a defective product might reach the customer.

This is unacceptable, because this affects the trustworthiness of the company and the credibility of the product, more than anything else. Normally, defects are discovered by inspection and reworked before they are sold to the customer. The more the company is determined not to put a defective product on the market, the stricter their inspection becomes, and thus the more frequent rework needed. This only increases your cost.

The extra inspections done is work that does not result in any value being added to the product. Manufacturing can build gauges into their jigs and fixtures an automatic inspection process that reduces the possibility defective products being used (this is called poka-yoke). This is done to ensure that every single product is of good quality.

We believe that the readjustment should be regarded as work that should not have existed from the beginning. The more people you need for inspection and rework outside of the process, the lower value-added ratio in the plant becomes, and the more the costs will increase.

You cannot say, "This product is expensive because we test it 10 times". This will not be accepted in the market. Work that does not add value is just an unnecessary activity. It is something that should be eliminated from the beginning.

Even if you omit the unnecessary activity within the direct work process and achieve some labor reduction, if you produce defective products, then inspection and rework increase the labor requirements. If you consider this from the point of view of cost reduction, the result may come out even, or even a loss; this result is far from the original purpose.

For this reason, we think in the following manner:

The inspections outside the process as well as rework are both unnecessary activity. We want to eliminate them as much as possible. Inspection should be the minimum necessary, and no rework required. And you inevitably reduce labor.

It is important to be aware that large labor reductions are possible by eliminating inspection and rework operations, as you strive for improvements.

The in-process inspection should be considered as follows:

It is necessary for the people to check the quality of products they made, namely the 100% in-process inspection. We regard the subsequent production process as the customer, so not a single bad product should be released.

It's important to be creative with all the various aspects of inspection methods. In addition to visual inspection or gauge inspection, "Poka-yoke (error-proofing)" must also be considered.

As for lot production such as that using high-speed automated presses, we accumulate say 50 or 100 pieces over the chute, and inspect the first and last piece. If they are both good, they go ahead and get transferred to the pallets. If there is a defect with the last piece, examine from which piece the failure began to occur, get rid of them, and you must take measures to prevent such defects from happening in the future. This is a type of total inspection. Even in a fast, quick production process, you should not think that you can conduct only sampling inspections.

It is important to build in the quality within the production process.

The Goal of the Inspector - Let's approach the concept of "inspections performed by an inspector."

The job of an inspector is the determination of whether a product is defective. They sometimes think that is enough to just pass the results back to the previous step.

This is not enough. The inspector should be responsible for doing on-site analysis why the failure occurred, and as much as possible, for determining the cause, and stop the reoccurrence of this problem.

They should not merely be an inspector who performs a of pass or fail test. Instead, inspector must be a teacher who explains what was wrong and teach you so as not to repeat the same mistake.

For example, if a matter that came up was a mistake during parts assembly, the cause might not be just as simple as "I was careless".

There might have been many various causes, for example: the parts were not lined up in their assembly order, the line stop button, or the call button was too far away, or the work instruction information was difficult to read.

Without identifying these causes and taking the appropriate action, failures will not be reduced. The purpose of the inspector's work is not to toss out the defective product but to reduce them to zero. Their work is evaluated on fulfilling this task.

Poka-Yoke (error-proofing) - During a production process, to build in high quality, we must think about which points the people need to check, which places do they have to measure, or when do need to replace cutting tools.

Devise ways of using jigs and fixtures so that products sent from the previous step are checked spontaneously. This means that you incorporate poka-yoke (error-proofing) within the production process to discover defects.

It is important to standardize poka-yoke to make sure that even if people are replaced, stable quality is produced.

Even the most careful people sometimes can make inadvertently mistakes, especially when they measure while performing other tasks, or doing the check by following a checklist.

That's why it's important to devise a mechanism that spontaneously eliminates defective products, operational errors, injuries or any other problems, even without a person paying attention to everything. The automatic discovery of any shortcomings, that is "poka-yoke."

To explain the mechanism of "poka-yoke" a little more specifically,

- A mechanism where products cannot be mounted in jigs when there is an operational error.
- A mechanism where the machine will not start when there is a problem with the product.
- A mechanism where the machine will not start when there is an operational error.
- A mechanism to automatically correct operational errors before proceeding with production.
- A mechanism to detect problems made in the preceding process.
- If some work is left incomplete, the next step will not start.

Mechanisms other than these can also be considered.

The following can be thought of as poka-yoke methods.

1. Signs... visualize the fault with lamps and color coding to make it easier to be discovered.
2. Jigs... devise a jig so that it won't accept different products, or it doesn't operate when there is a mounting mistake, etc.
3. Autonomation... to stop the machine when a problem happens during manufacturing.

This is sometimes not counted as "poka-yoke."

Poka-yoke is an extremely important part of building in quality during the production processes. The aim is reducing problems to zero. To achieve this aim, it's important to think of methods like those mentioned above, and to find the places that are easiest to grasp, as well as those with minimum loss, when establishing "poka-yoke."

---