

Ethics in Engineering and Research

Lecture #1

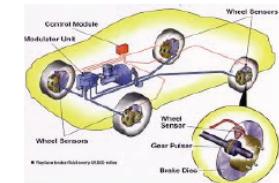
Professionalism for Graduate Students

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Professionalism, Postgraduate

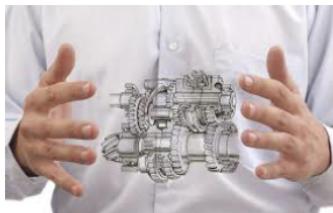
- Postgraduate = After BS or BEng
- Focus here: Professionalism *in* graduate school (during MS or PhD program)
- Enhanced professionalism *after* graduate school (i.e., on the job): *Standards higher*
 - Competence: Higher, impacts ability to act in a more ethical way (impact of competence on reducing adverse impacts in trade-offs):
Example: ABS design
 - Conduct: Higher maturity, higher expectations for MS or PhD: Example: “Dr. X”—need to meet standard implied by term



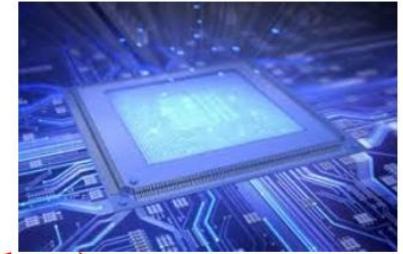
(ABS = Anti-lock Braking System, 防抱死制动系统)

Examples: MS/PhD on the job

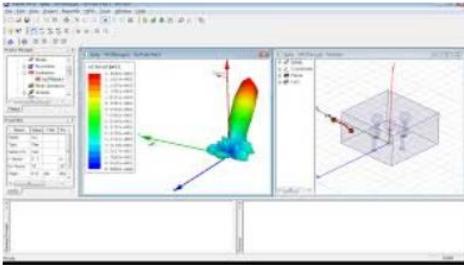
- Example 1: MS graduate expected to be a “*master of science*” in engineering. What does “**master**” mean?
 - Well-read, highly technical, knows whole-area
 - **Master=expert** in a field of study: co-workers perceive you that way, go to you for answers.
 - “She **knows everything** about that subject.”
 - “She is **at the cutting edge** of the technology in her field.”
- Conduct consistent with high competence
- Sometimes, ends up being a manager/boss (e.g., for BS & MS)



Non-academic career



- Example 2: PhD (Doctor of Philosophy)
Everything for MS plus expected to create new technologies (“first ever”) and “lead”
- What does “philosophy” mean in context of engineering?
 - “A deep+broad view of the field”
 - “Knows where technology has been, where it is going, broad impacts (market, society, enviro)”
- Conduct consistent with high competence
- Often a boss/leader (in company and nationally/internationally; for BS/MS/PhD)



Academic career

$$\left[-\frac{\hbar^2}{2m} \nabla^2 + V(\vec{r}) + \frac{e^2}{4\pi\epsilon_0} \sum_{k \neq j} \int \frac{|\phi_k(\vec{r}')|^2}{|\vec{r} - \vec{r}'|} d\tau' \right] \phi_j(\vec{r}) \\ - \frac{e^2}{4\pi\epsilon_0} \sum_{k \neq j} \int \frac{\phi_k^*(\vec{r}') \phi_j(\vec{r}')}{|\vec{r} - \vec{r}'|} d\tau' \phi_k(\vec{r}) = E_j \phi_j(\vec{r})$$

- Example 3: PhD (Doctor of Philosophy), Research program to create new math/ techniques/technologies (grad students), Teaching, and Service
- Levels, in the most of the countries
 - Assistant professor
 - Associate professor, with tenure
 - Full professor
- Conduct consistent with high competence
- *Set good example for students*

Engineering in non-engineering fields

- After MS or PhD in engineering...
- Medical School, MD (clinical or research)
- Law School, JD (patent law)
- MBA (after 5 yrs engineering practice?)
- Each of these has its own ethical and professional standards

MD = Doctor of Medicine

JD = Juris Doctor

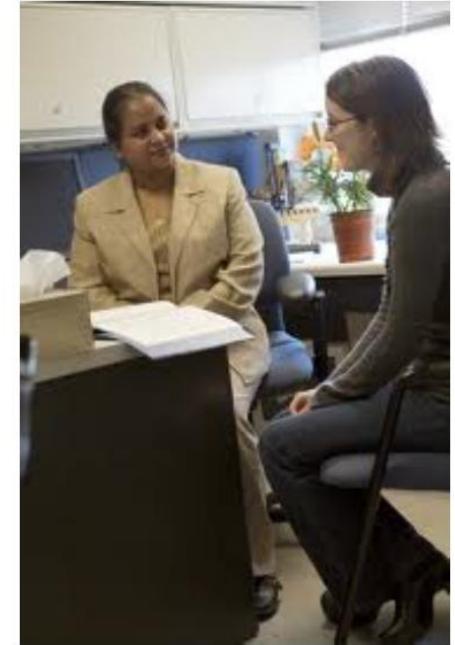


Professionalism in Engineering Graduate School

- Get to know your professional environment
 - SUSTech Campus
 - Orientation for graduate students
 - Study EE web site of faculty in your area, and web sites of faculty teaching the classes you will take
- Course choice (≥ 3 classes/semester)
 - Do not take the easy way out! Challenge yourself with tough classes/professors, variety
 - Talk to students, faculty to get help choosing



- **Finding an advisor**
 - Talk to grad students about it (get the “scoop”)
 - Hands-on/hands-off? Junior/senior?
 - Match: experimental/theorist/mix?
 - Match research objectives/directions to your interests
 - Match personality?
 - Funding (often a key issue)
 - How to contact a professor??? If taking class with them, after class? Email? Stop by office?



Give your advisor confidence in you

- Offer to do a mini-research project to show your skills, or s/he may give you and initial problem
- For the problem, research literature, think deeply, find solutions on your own and be prepared to show logic of your work (e.g., why you discarded one solution in favor of another), be prepared to say what the next steps are
- Go far beyond expectations
- Challenge your advisor (politely)
- **Build trust** (if no progress this week explain why, keep open communications)
- **Advisor – create a life-long relationship** - Friends, recommendation letters, help with career

Professional behavior in class

- **Prepare for each class** (read ahead, and not just the textbook/handouts, generally do not ask the professor how to prepare/what to read)
- **Go to all classes** (You are responsible for everything said!).
 - Be on time or early
 - Grad students do not skip class.
- **Participate**, answer/ask questions (no question is stupid, except for the following)

"Stupid" Questions

Those questions that have already been answered, but the asker wasn't listening or paying attention.

Questions that can be answered with a scant amount of research and less than a minute of time.

Questions of which the answer should be painfully obvious to any person with a pulse who has lived on this earth for more than a decade.

Written assignments

- Do assignments early so have time for questions (no last-minute questions – that is unprofessional).
- “Good enough = A” in grad school. But, do not aim for “doing just good enough.” Aim for higher than an A: Do more than is asked of you (e.g., run one more simulation, investigate a different idea—with a bit of effort your assignment can be impressive).
- Policy on working together – get it clarified, then give credit to others if you work with them. Serious ethical issues here ([more later](#))

The Rules

- EE Graduate Student Handbook
- Know it!
- Your responsibility to **plan and track your progress** toward your degree, and make sure requirements are fulfilled (not your faculty advisor's responsibility)
- If some rules not clear ask the staff first
- To pick committees (PhD Qualifier, Candidacy, exam committees) you work with your advisor

MS (< 2 years after BS)

- Non-thesis (relatively rare)
- Thesis
 - Classes (to make you expert), but more...
 - Research starts when arrive at low-level, do much in summer, then for another 1.5 semesters
 - Write it up (paper?). “Defend” it (15min talk, follow up by questions)
 - Work closely with advisor (research supervisor)
- Professionalism: Independence in assessing literature, addressing problems without having your “advisor hold your hand”, prof. communications

PhD (about 5 years after BS)

- Independence much higher, **work a lot! Be a scholar**
 - PhD Qualifying Examination (prepare well)
 - Classes (variety, do not get a PhD on As)
 - Learn to self-learn; read voraciously; read top people/ top papers (but no “gods” in academia); seminars; create intellectual environment (with colleagues)
 - PhD Candidacy Examination (deep literature treatment, definite progress, research plan)
 - Dissertation research (core activity, >1yr post cand.)
 - Sometimes multitask on problems; search for elegant ideas/solutions
 - Final defense (professional at Professor level)
- **Publishable work** (creative, new, significance as measured by impact on field and practice). Need proper literature assessment to argue novelty.

Source

- Some of the points in these slides came from:

“PhD Research: Elements of Excellence,”
Prof. Ness B. Shroff, Dept. Electrical and
Computer Engineering, The Ohio State
University

Discussion

1. What is your targeted goal/achievement at the end of the graduate program?
2. What professionalism do you want to pursue after the graduate program? How will your achievement in graduate program help to build your professionalism and career?