“Design for Freedom from Disability”

(E/ME/MedE 105) a,b
A collaboration between
The California Institute of Technology
Rancho Los Amigos National Rehabilitation Center
ArtCenter College of Design

Winter, Spring Quarter 2018
(Caltech)
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<thead>
<tr>
<th>Name</th>
<th>email</th>
<th>concentration</th>
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E/ME/MedE 105 sign-up
Today

Introduction: What the class is about

(And what it’s not)

Video

https://breakthrough.caltech.edu/magazine/2017-mar/

Class Instructor Introductions

• Contents and Expectations
• Class Trips Rancho,
• Conferences
• Why I like This Class and Design in General
• Student’s introduction: Who I am? Why am I taking the class?
Caltech
Professor Ken Pickar
TA Meera Ramakrishnan

Classroom B 101 BBB

E-mail
Ken Pickar Pickar@caltech.edu
Meera Ramakrishnan mramakri@caltech.edu

Office Gates Thomas 208

Phone (626) 395 4185 (Ken) but email is usually better

Class site BBB101

Admin Asst Carolina Oseguera susta@caltech.edu

Availability: Anytime but no set hours (best to e-mail first)
We will have informal team reviews of progress to date periodically
Rancho Los Amigos National Rehabilitation Center

Andy E. Lin, MS, ATP
E-mail: andyelin@caltech.edu

Office: Powell – Booth 110 (Caltech)
        Emerging Tech Lab – CART (Rancho)

Phone: 562-546-2654 (text/voice)

Availability: By appointment only. On campus most Thursday afternoons before class.
              Skype / Google Hangouts offsite.
Ken Introduction

My Classes

• Product Development/Technology Management Courses
  – E/ME/MedE 105 Product design (Q2,3)
  – E 102 a,b Entrepreneurship
  – E/ME 103 Management of Technology (Q1)

• Other Caltech Resources
  Caltech Engineers for a Sustainable World
    http://www.its.caltech.edu/~esw

  Caltech Entrepreneur’s Club
    http://www.its.caltech.edu/~eclub

  Caltech Consulting Club
    http://consulting.caltech.edu/Caltech_Consulting_Club/Home.html

  – Tech Coast Angel Meetings (techcoastangels.com)
  – Pasadena Angels
Evolution of This Class

- Anything Products
- Developing World Guatemala
- Developing World India
- Design for Freedom from Disability
- ?
Ken Pickar

- PhD Low Temperature Physics, University of Pennsylvania
  - Thesis in Third Sound in Liquid Helium

- Bell Laboratories, Murray Hill, NJ 8 years
  - Member of the Technical Staff
  - Technical Area: Ion Implantation, Electron Beam Lithography, Plasma Etching, Thin Films, Semiconductor materials and devices
at Bell Labs

- The first ion implanted Charge Coupled Device,
- The first ion implanted picturephone targets,
- The first implanted damage gettering process,
- Electron Beam Lithography
Ken Pickar

- Bell Northern Research, Ottawa, CA 5 years
  - Manager of new technologies
  - Technical Areas: ion implantation, electron beam lithography, plasma etching, Displays, Audio
At Bell Northern

• The first all-dry etching semiconductor process (no wet chemistry)
  – sub 2-micron
  – CMOS

Liquid Crystal Displays
Thin Film Keyboards
Ken Pickar

- Bell Northern Research, Ottawa, CA 5 years
  - Manager of new technologies
  - Technical Areas: ion implantation, electron beam lithography, plasma etching, Displays, Audio
Ken Pickar

• GE Corporate R&D  9 years
  – R&D manager Electronics Research Laboratories
  – Technical Areas  Medical Physics, MRI, Ultrasound, Digital X-ray, Locomotive, Radar, Lighting, VLSI, Power electronics, CAD, Manufacturing
At GE
The Industry-leading MRI
GE Lighting

- Discharge lamps
- Power electronics
- LED lighting
Ken Pickar

- AlliedSignal (Honeywell) Corporation 5 Years
  - Senior Vice President Engineering and Technology
What have I been doing lately . . .

• Caltech 20 years
  – ME/E 105 Design
  – ME/E 103 Technology
  – E 102 Entrepreneurship

• Also Tech Coast Angels (Angel Network)

• Board of Directors (Company)
  – Level One (sold to Intel 1999)
  – Neustar (IPO 2005) NYSE
  – Ness Technologies NASDAQ
  – H2Scan (Private)
  – Butterfli
Ken Pickar

- **Board of Directors (non profit)**
  - Los Angeles Cleantech Incubator (LACI)
  - LA Regional Foodbank
  - Intelligent Mobility International
  - Chamber Orchestra of the South Bay
  - South Coast Botanical Garden

- **Academic**
  - UCLA Anderson Adjunct Faculty (GAP Program(2005))
  - Monash University, Melbourne, Australia, (Visiting Professor (2010))
Rancho Los Amigos

- Andy Lin
Rancho Los Amigos National Rehabilitation Center

LA County public hospital  Spinal Injury, Traumatic Brain Injury, Stroke, General Neurological Conditions, Gerontology and Reconstructive rehabilitation and services.

Approximately 3,000 inpatients annually and sees over 63,000 outpatients.

Racially and ethnically diverse

Mission - to provide each patient with superior medical and rehabilitation services in a culturally sensitive environment,

Many individuals live close to the facility for continuity of care, long after initial hospitalization.

Contribute as consumers, mentors, volunteers and workers enabling newly injured individuals to better transition to the community.
Andy E. Lin, MS, ATP

- Rehabilitation Engineer at Center for Applied Rehabilitation at Rancho Los Amigos
- 20+ years of experience in evaluating, designing, and customizing tech for people with disabilities
- Director of Emerging Technology Lab
  - Researching ways which new technologies (Virtual Reality, 3d printing, AR/VR, etc.) can be utilized by patients at Rancho
- Certified Assistive Technology Professional (RESNA)
- Smart Robotic Arm for Wheelchair (JPL)
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Andy E. Lin, MS, ATP
Meera Ramakrishnan

• Class TA
Friends of The Class

• Nora Ames
• Rudy Roy
• Andy Downard
• Mark Fuglevand
• Drora Shevy
• Amanda Van Deusen
• Dmitrii Estrin
• Barbara Beskind
• Diana Ugalde
• Eric Sorto
Purpose of Course

• To aid people with disabilities become more independent through understanding of Engineering, Human and Business contexts

• To study how product development is accomplished and to actually design a product through the early design stages

• To develop (interdisciplinary) team skills
My engineering classes are all business related but this mixture does not plow new ground at Caltech. . .
Old Caltech Tradition

(Robert) Millikan said . . . that he had observed that a good many Caltech graduates were going into Industry and . . .
Old Caltech Tradition

(Robert) Millikan said . . . that he had observed that a good many Caltech graduates were going into Industry and . . . they ought to know something about that.
Not the Purpose

• Formal Methods
  – Instead- Semi-quantitative, qualitative Analysis

• Product optimization algorithms

• To study the medical causes of disability

• To learn how to start a company
• Biggest challenge of class

• What to leave out
What are we doing this year?

Build on Success!
What are we doing this year?

Build on Success!

Continued
  – Alliance with Rancho and Caltech
What are we doing this year?

Build on Success!

Continued

– Alliance between Rancho and Caltech
– Rancho Patients as full idea drivers
– Full capstone – covers all important areas
What are we doing this year?

Build on Success!

Continued

– Alliance between Rancho and Caltech
– Rancho Patients as full idea drivers
– Multiple iterations
What are we doing this year?

Build on Success!

Continued
– Alliance between Rancho and Caltech
– Rancho Patients as full idea drivers
– Multiple iterations
– Wheelchair exercise- each student spends one day in a wheelchair on the Caltech campus- and describes their experience. . .
What are we doing this year?

Build on Success!

Continued

–Project Generation and choice Process
What are we doing this year?

Build on Success!

Continued

– Project Generation and choice Process
– Team Formation
What are we doing this year?

Build on Success!

Continued
– Project Generation and choice Process
– Team Formation
– Formal Engineering Concepts
What are we doing this year?

Build on Success!

Continued

– Project Generation and choice Process
– Team Formation
– Formal Engineering Concepts
– Inclusion of people who “touch the product”
What are we doing this year?

Build on Success!

Continued
–Projects for the disabled and the elderly
What are we doing this year?

Build on Success!

Continued
  – Attend outside conferences
What are we doing this year?

Strengthened

–More Design Iterations in Prototyping
What are we doing this year?

Strengthened
– More Product Testing
What are we doing this year?

Strengthened

–More Preparation for Commercialization
What are we doing this year?

Strengthened

– Consider Independent or SURF study in Summer to advance prototype to useful stage and transfer to Mfg
What are we doing this year?

Strengthened

– Have one or two Products emerge from this Class to introduce our solutions to market-place

– Work with manufacturers and market specialists, and factory assembly to build (initial product.
How will students interact?

• Lectures will be at Caltech, Rancho
• Students must attend (on-time attendance for full lecture required)
• Each team will meet separately at least once per week to work on HW assignment
• Team Communication: Suggest you use e-mail, Wiki and Skype, Google docs, Moodle, etc. Means are up to you.
• Class Communication: Lectures, e-mail, Postings
Supplementary Guest Lectures, Reading and Conferences

- Each student writes 1-2 pages on 2 of the Guest Lectures or Readings.
- Each student writes 1-2 pages on at least one of the conferences.
- For the above
  - What did you learn?
  - How can you apply your learning to your project?
Supplementary Guest Lectures, Reading and Conferences

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– For the above
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Class Attendance Expectations

• Lectures (PowerPoint) will be posted after the class

• You must attend lectures- PowerPoint bullets don’t contain
  – Background
  – Discussion
  – Q and A
  – Context

• All the students in the Class need “to be on the same page”
Class Attendance Expectations

• If you must unavoidably miss class, please e-mail Meera in advance
• Computers/phones off (no multi-tasking)

Decide whether you want to make commitment!
Class Attendance Expectations

• 2 Quarter Class

Decide whether you want to make commitment!
Team expectations

• You must fully participate
• No free rides
• Caltech Honor Code applies
• Teams will self-regulate and problems which do not resolve after discussion will be shared with TA and Instructor
Readings

• We are compiling a list of readings. They are designed to provoke thought. They don’t necessarily reflect the opinion of the instructor. Meera compiles list

• You are invited to contribute interesting, appropriate readings to our list
Mentorship and Shop Assistance

• Please contact Meera and John Van Deusen
  – ME Shop
  – 024 Spalding Laboratory
  – 626 395 4120
Presentation Format

- There will be continuous 10 min scheduled student HW presentations throughout the class
Presentation Format

Some advice
Presentation Format

Some advice
  – Don’t wing it, Don’t ramble, Rehearse
Presentation Format

Some advice

– Don’t wing it, Don’t ramble, Rehearse
– Rotate amongst team members
Presentation Format

Some advice
  – Don’t wing it, Don’t ramble, Rehearse
  – Rotate amongst team members
  – Don’t talk to the screen, don’t declaim
Presentation Format

Some advice

– Don’t wing it, Don’t ramble, Rehearse
– Rotate amongst team members
– Don’t talk to the screen, don’t declaim
– 10 minute time enforced
Presentation Format

Some advice

– Don’t wing it, Don’t ramble, Rehearse
– Rotate amongst team members
– Don’t talk to the screen, don’t declaim
– 10 minute time time enforced
– We can video if desired
Presentation Format

- E-mail PDF copies of presentation and accompanying paper *by noon* the day of your presentation

Most Important: *All Teams must do all assignments whether they present or not!*
Syllabus Team Highlights

Step
1. Form a team
2. Choose a project
3. Project approval
4. Architecture Approval
5. Midterm Presentation
6. Final presentations
Final gala presentation

• Best paper contest
  – $1000 to pursue project
• Invited Guests
• Poster session with prototypes
• Video
Conference 2016

NCART/RESNA 2016 Annual Conference

theme was "Promoting and Protecting Access to Assistive Technology."

Rehabilitation Engineering and Assistive Technology Association of North America

National Coalition For Assistive and Rehab Technology
RESNA 2017
Annual Conference
New Orleans
June 26 - 30
Conference 2018

Arlington, VA

July 13-15

http://www.resna.org/about/students
RESNA Conference

Student Design Competition

• Showcase creative and innovative assistive technology designs that help people with disabilities function more independently.
At conference

Student Design Competition

• Showcase creative and innovative assistive technology designs that help people with disabilities function more independently.

• Student teams represent a wide variety of disciplines including mechanical, electrical, and biomedical engineering; computer information science; architecture; and physical and occupational therapy.
• Semifinalist teams receive all-expense paid trip to Conference for final judging.
• Semifinalist teams receive all-expense paid trip to Conference for final judging.

• Student Design Competition deadlines for RESNA 2017 are:
  – Mid-April
Aging Into The Future will bring together tech companies, entrepreneurs, and innovators with experts in aging, service providers and older adults, to explore how technology and innovation can ease Mobility, enhance Social Connection, promote Health & Wellness, and empower Caregiving.

Aging into the Future will help redefine the way leaders from various sectors integrate technology to resolve challenges to create a stronger quality of life and future for older adults across the greater LA region.

Networking. Education. Inspiration. Integration.
AGING INTO THE FUTURE
2017

Two Caltech/ArtCenter teams present at “co-creation session”
March 2, 2018
Millenium Biltmore Hotel, Los Angeles
Other Important conferences

Ability.com LA March 24-26, 2017 LA Convention Center
(Caltech intersession!)

http://www.abilities.com/community/make-lemonade.html
Class Grading

• Grade or P/F (but whole team must be the same status)

• 20% HW, 20% Midterm, 35% Final Term Paper, 15% class participation, 10% Team contributor

• All grades are designed to assess knowledge of the design process, insight into market, and ingenuity/appropriateness in Design
What is the Course about??

• Engineering
  – Concept development
  – Design for X (Anticipatory design practices)
  – Prototyping
  – Prototyping
  – Prototyping

• Understanding customer
  – Without understanding of “customer” failure is guaranteed
Design for “X”

• Market – Characteristics of Customer
• Human Factors – Easy, safe effective to use
• Manufacturing – Can it be built
• Distribution – How does it get to the customer?
• Cost – can the customer afford it
• Reliability
• Sustainability (life cycle)
• Maintainability
• Testability
Example Manufacturing

• The objective is to take steps to eventually build and distribute useful products.
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• Manufacturers as lecturers and resources to advise on project designs.
Example Manufacturing

- The objective is to take steps to eventually build and distribute useful products.
- Manufacturers as lecturers and resources to advise on project designs.
- Idea is to design something in class which someone can make.
Form a Team

• There will be 6-8 teams
Form a Team

• There will be 6-8 teams
• Suggest teams of 4-5 (tops).
Form a Team

• There will be 6-8 teams
• Suggest teams of 4-5 (tops).
• On each team
  – Some Bases for choice of Team
    • Common recognition of attractiveness of the problem
    • Compatibility
    • Diversity
    • Dependability
Form a Team

• There will be 6-8 teams
• Suggest teams of 4-5 (tops).
• On each team
  – Some Bases for choice of Team
    • Common recognition of attractiveness of the problem
    • Compatibility
    • Diversity
    • Dependability
• Choose carefully- but decisions are reversible
Team Projects

Origin
– Ideas you bring yourself to class
Team Projects

Origin
– Ideas you bring yourself to class
– Ideas presented by Rancho during visit
Team Projects

Origin
- Ideas you bring yourself to class
- Ideas presented by Rancho during visit
- Your own observations at Rancho. These will be seen next Thurs.
- Past papers – particularly last year
Team Projects

Origin
– You will have the opportunity to choose your first, second and third choices
Team Projects

Origin

– Over (next) week-end you will have the opportunity to choose your first, second and third choices
– Teams will be chosen to give you one of your choices
Team Projects

Origin

– Over (next) week-end you will have the opportunity to choose your first, second and third choices
– Teams chosen to give you one of your choices
– If ideas turn out to be non-viable they can be changed
Team Projects

Remember
Team Projects

Remember

The essence of this class is iteration.
Team Projects

Remember

The essence of this class is iteration.

Rapid Iteration
Team Projects

Remember

The essence of this class is iteration.

Rapid Iteration

Fast and approximate beats slow and exact!
Team Projects

We will email a list of ideas to you
By the end of next week
Summary: Formation of Teams

• Read through problem statements
Summary: Formation of Teams

• Read through problem statements
• Consider ideas for products
Summary: Formation of Teams

- Read through problem statements
- Consider ideas for products
- Consider rules of the road
  - Is it interesting to you?
Summary: Formation of Teams

- Read through problem statements
- Consider ideas for products
- Consider rules of the road
  - Is it interesting to you?
  - Is it doable?
Summary: Formation of Teams

• Read through problem statements
• Consider ideas for products
• Consider rules of the road
  – Is it interesting to you?
  – Is it doable?
  – Does it matter?
Summary: Formation of Teams

• Read through problem statements
• Consider ideas for products
• Consider rules of the road
  – Is it interesting to you?
  – Is it doable?
  – Does it matter?
• Choices are reversible
Ask Also- Is it beautiful??

Art + Tech: The Prosthetic Imaginary

The Beauty of Design
What is beauty in this context?

• Are there rules?
Why can design be beautiful?

• Creative
  – An object or body of work that didn’t exist before
Why can design be beautiful?

• Creative
  – An object or body of work that didn’t exist before
  – Sometimes a set of rules that didn’t exist before
Why can design be beautiful?

Elegant

• Can express the solution to a complex need clearly and concisely
Why can design be beautiful?

- Evolving
  Often iterative improvement
Why can design be beautiful?

- Evolving
  Often iterative improvement
Why can design be beautiful?

- Evolving
  Can be super-iterative improvement
Why can design be beautiful?

• Cooperative
  – Can require the collaborative efforts of a diverse set of people
Why can design be beautiful?

- (Can be) Original way of doing things
Why can design be beautiful?

- (Can be) Original way of doing things
- Measurable
Fighting air helps
Some Caltech examples. . .

- Castality forearm prostheses
Crutches for stairs in Guatemala

- Integral design
  - Single static piece
- Foam, not rubber, arm rest
- Easily adjustable
- 4 points of contact
- Easy to Manufacture
Stair climbing crutches
Wheelchair

¿Qué puede hacer para su cariño una bicicleta vieja?

Diríamos un mundo de posibilidades...
ITM Wheelchair
...tenemos un asiento para Ud.
IMI Wheelchair

- Made from Bicycle parts
- 300 Distributed in Guatemala through partnership
Some “Great” ideas now being worked on

- Hemiplegic Wheelchair
- Door opener
- Charging electric wheelchair
- Carry ons
- Anti-shake pen
- Pressure pad
It’s not all beautiful

Bad Design equals Bad Art

• Hurt the user
• Hard to use
• Use is obscure
• Overly complex
• Pleases designer and no one else
Question

What is the most beautiful product you ever used?
Summary: Formation of Teams

• Read through problem statements
• Consider ideas for products
• Consider rules of the road
  – Is it interesting to you?
  – Is it doable?
  – Does it matter?
• Choices are reversible

There will be some “adjustments” by the management
Let’s get to know each other

• Three questions
  – Who are you?
  – Why am I taking this Class?
  – One unusual thing about myself. . .