Innovation and Leadership: Think out of box

Dr. Om Prakash Singh
Asst. Prof., School of Engineering, IIT Mandi
www.omprakashsingh.com
What is an Engineer?

• Engineering is the profession in which knowledge of the mathematical and natural sciences gained by study, experience, and practice is applied with judgement to develop ways to utilize, economically, the materials and forces of nature for the benefit of mankind.

• E.g. Trouble shooting, Energy conversion, health sciences, aerospace, transportation, manufacturing.

• In fact, almost every type of industry employs mechanical engineers!
Engineers make design and products

Interdisciplinary nature
Think out of box
Invention: key for survival

- Human race survived as it has continuously invented/innovated
- Species those who have not innovated became extinct.
- Only innovative companies survive
- Lost top spot: Microsoft, BlackBerry, and Nokia

- Invention is absolutely a good thing, but even without inventions, a country or company or an individual can still come out ahead.
- After all, Japan didn’t invent the car or the TV, but it certainly innovated on them and built world-leading companies and economies.
A movie on how technology determines who rules whom

- **Movie:** *Planet of the Apes (2001)*
- Entire movie is edited to 5 minutes
- Message from the movie:
  1. A technologically advanced society are the rulers over other species (here Apes rule Human being)
  2. Technology changes with time.
  3. After the movie, question will be asked.
Invention is the key for survival

Movie: Planet of the Apes
What will you study as an ME student?

- **Forces, motion, structures:** statics, dynamics, kinematics, mechanics of solids and fluids.
- **Energy:** thermodynamics, heat transfer
- **Materials:** materials engineering & processing, manufacturing.
- **Machines:** graphics, design, machine elements, controls.
- **Economics:** engineering economic analysis, cost engineering.
- **Human and Social Studies:** arts, humanities, social sciences, history, government, ethics, law.
- **Overall foundation:** math, physics, chemistry, biology, analysis skills, communication skills, computation skills.
Advance courses: CFD, FEA...

Convectional method of production

1. Design
2. Prototypes
3. Testing
4. Mass production

Computer Aided Engineering (CAE)

1. Design
2. CAE
3. Prototypes
4. Testing
5. Mass production

Optimization loop
Design Changes and cost
CFD applications

Combustion

External Aerodynamics of car

External Aerodynamics of bike

Tool cutting process

Dragonfly CFD simulation
CFD applications in buildings design

Solar collectors on roofs of industrial buildings
CFD in Biomedical application: Predicting breathing cycle*

Two time steps in an oxygen uptake simulation of a breathing cycle

Contours and path lines at an inhalation time step

*“Progress Towards a Medical Image through CFD Analysis Toolkit for Respiratory Function Assessment on a Clinical Time Scale”, The Pennsylvania State University, †Applied Research Laboratory, ‡Department of Mechanical Engineering, Department of Aerospace Engineering Drexel University, Department of Biomedical Engineering
Finite Element Analysis: medical implants
3D printing technology: Innovation in manufacturing
Recent news headlines on 3D printing technology

Now, 3D print a chocolate, courtesy Manipal Institute of Technology

3D printer that creates edible fruit

Amazon launches 3D printing store

How 3D Printing Is Revolutionizing Surgery
3D printed parts in space
Misuse of 3D printing technology: Making gun
3D printing machine by IIT Mandi students
A movie on how technology can save our life

• Movie: *Jurassic Park III*
• Entire movie is edited to 6 minutes
• Message from the movie:
  1. Any technologically developed has multiple usages (here a 3D printed part saves Human from Dinosaurs)
  2. Even though a technology developed keeping in mind an specific use, but it end in many other useful usages.
  3. E.g. mobile was developed to transfer wireless voice but today is used for internet, photos, videos, doing business etc.
Innovation is the key for survival
Options for an engineers

✅ Get a high paying job
  • Aerospace Engineer
  • Agricultural Engineer
  • Automotive Engineer
  • Biomedical Engineer
  • Chemical Engineer
  • Drafting and Design Engineer
  • Environmental Engineer
  • Geological Engineer
  • Marine Engineer
  • Petroleum Engineer
  • Software Engineer

✅ Be an entrepreneur

✅ उद्यमी, उद्योगपति

✅ You work for others

✅ Can you work for yourself, for your passion?
Definition of 'Entrepreneur'

“An individual who, rather than working as an employee, runs a small business and assumes all the risk and reward of a given business venture, idea, or good or service offered for sale. The entrepreneur is commonly seen as a business leader and innovator of new ideas and business processes.”
• Sachin Bansal, 32, a mere six years to build Flipkart, the country's best-known online retail brand.
• The IIT-Delhi alumnus started off with college friend Binny Bansal in a small flat in southeast Bangalore in 2007 with Rs 4 lakh.
• Started from selling books, now diversified many other areas such as electronics, household appliances etc...
Budget 2014: Startups & entrepreneurs get Rs 10,000 crore backup
IIT Mandi encourages you to become an entrepreneur

- Design innovation lab
- Incubation, mentorship, facilities
- Pre-incubation fellowship to graduating students who would like to spent time up to 1 year on campus
How India can become a developed nation?

• A student interview with APJ Abdul Kalam
• APJ Kalam ask students how India can become a developed nation?
• How? Any Idea?

Dreams
is not what you see in sleep
is the thing which doesn’t let you sleep

- A. P. J. Abdul Kalam
• How India can become a developed country?
• Oath for the Students
Say with me

I can do it
We can do it
India can do it
Life or death: it depends on you!

When broken from **INSIDE**, its life

When broken from **OUTSIDE**, its death

- Lots of external pressure: from peer group, teachers, employer, friends...
- If you give in to external pressure, you are finished.
- Always say from within, “I can do it”, “I’ll win”, “I’ll fight”...
- “Mann ke Jite Jeet, Mann ke Hare Haar”.
- If you think you will succeed, you will, its all in mind
What are the qualities of a leader?

- A journalist interview with APJ Abdul Kalam
- APJ Kalam was asked on what qualities a leader should possess?
- A leader should have vision, able to take risk, take his time together in success and failure.
- A leadership qualities can be developed with patience, practice...

The best brains of the nation may be found on the last benches of the classroom.
-APJ Abdul Kalam
Be a leader
You’re the future of India, we look towards you to solve our society problems
You are expected to learn how to fly soon else...
Else... we will help you to learn anyhow...

And don’t forget to flap (I can do it), your life depends on it
You have to dream before your dreams can come true.

~Kalam