



Dr. Eng. Infall Syafalni, S.T., M.Sc.

Teknik Elektro - STEI ITB

Intro Kuliah KU1202

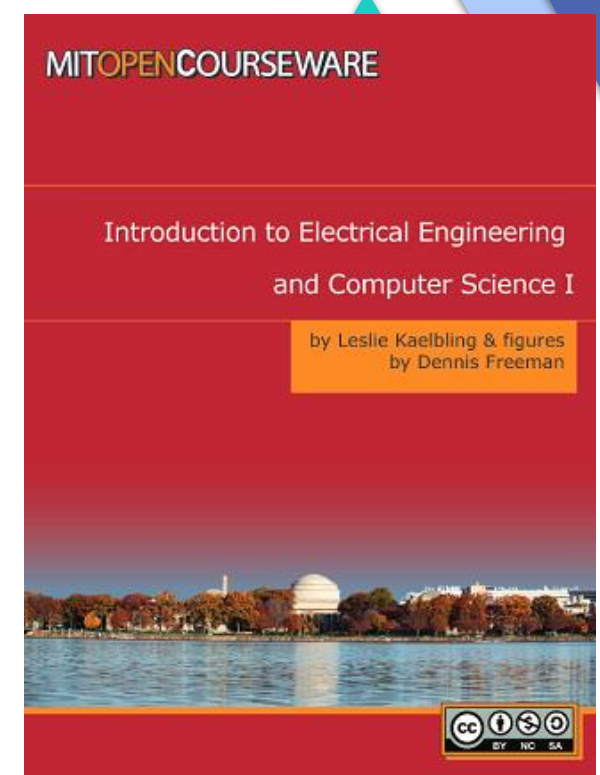
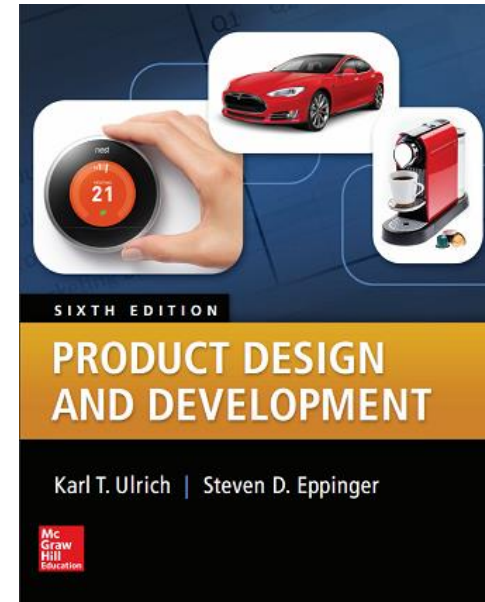
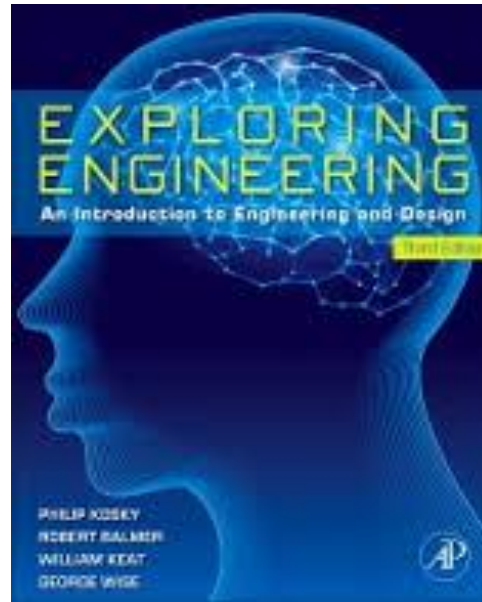
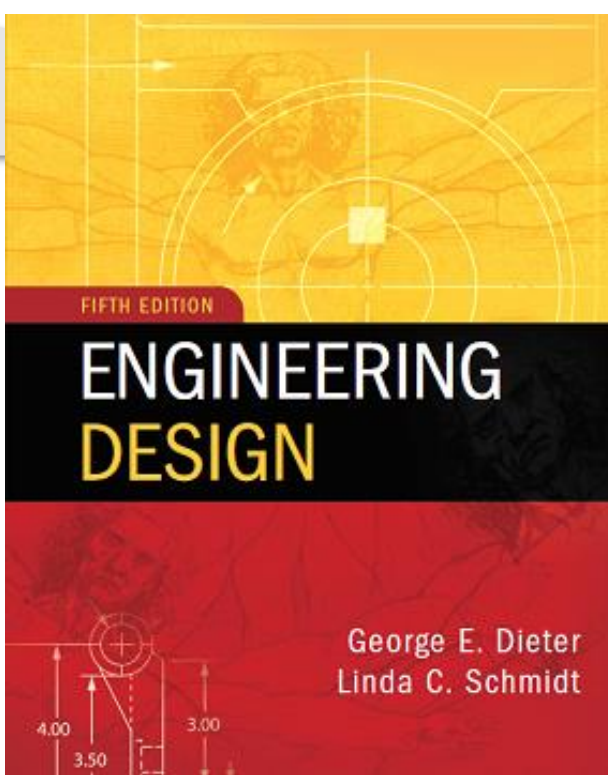
KU1202 – Pengantar Rekayasa dan Desain



Introduction

- Time: Selasa (13:00) & Kamis (13:00)
- Place: CRCS / 9306
- Instructor: Dr. Eng. Infall Syafalni, S.T., M.Sc.
- Office: Labtek 8 Lantai 3
- Contact: Ms Teams: Infall Syafalni, Email: infall@itb.ac.id

References

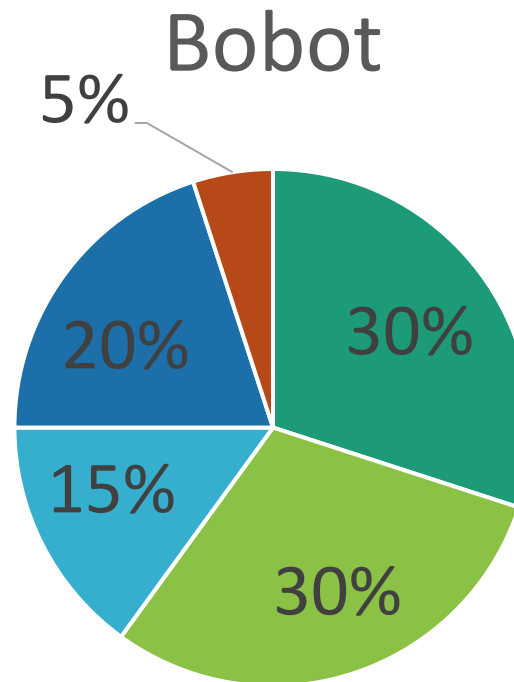


Text Book

- Introduction to Electrical Engineering and Computer Sciences I, MIT, 2011.
- George E. Dieter et. al., Engineering Design, McGrawHill, 2013.
- Karl T. Ulrich, Product Design and Development, McGrawHill, 2016.
- Philip Kosky et.al., Exploring Engineering: An Introduction to Engineering and Design, Academic Press, 2010.



Penilaian



- Presensi < 80%, tidak dapat mengikuti UAS.
- Jika melakukan kecurangan, nilai otomatis E.

■ UTS ■ UAS ■ Tugas Mandiri ■ Tugas Besar ■ Presensi

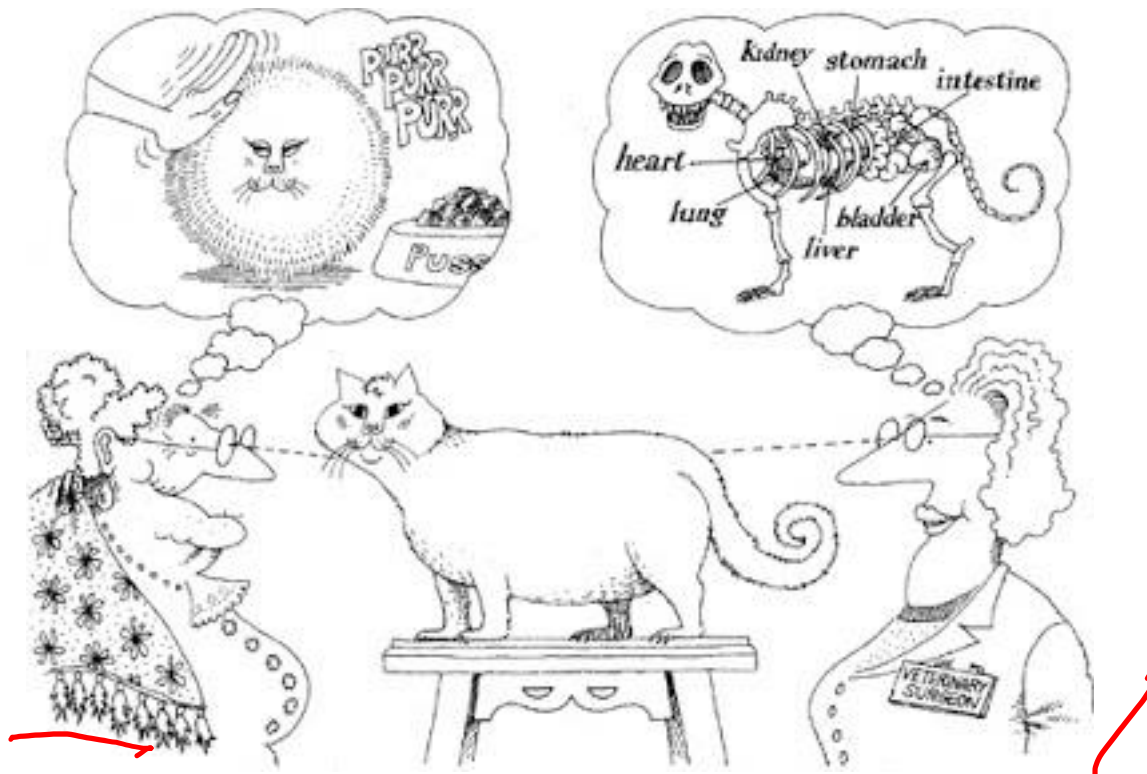


Tujuan

- Memberikan pengantar tentang ilmu rekayasa dan desain.
- Memberikan dasar-dasar keilmuan yang integratif dan penerapannya pada masalah rekayasa dan desain yang sederhana.
- Memberikan pemahaman dan pengalaman tentang bidang multidisiplin dan bekerja dalam tim.
- Memberikan motivasi untuk belajar pada tingkat yang lebih lanjut.
- Memberikan pengetahuan tentang isu kontemporer.

Tujuan

Rekayasa dan Desain: Pemahaman, pendekatan dan penekanan yang dapat berbeda dari sudut pandang bidang rekayasa tertentu



Bentuk Perkuliahan

Dibagi menjadi dua bagian:

1) Pengertian Rekayasa dan Desain

- Pengenalan peran rekayasa dan desain dalam masyarakat.
- Pengenalan profesi insinyur (engineering profession).
- Aspek-aspek rekayasa, elemen kunci dalam analisis rekayasa, langkah-langkah penyelesaian masalah.



Bentuk Perkuliahan

2) Pengantar Dasar-Dasar Rekayasa di STEI:

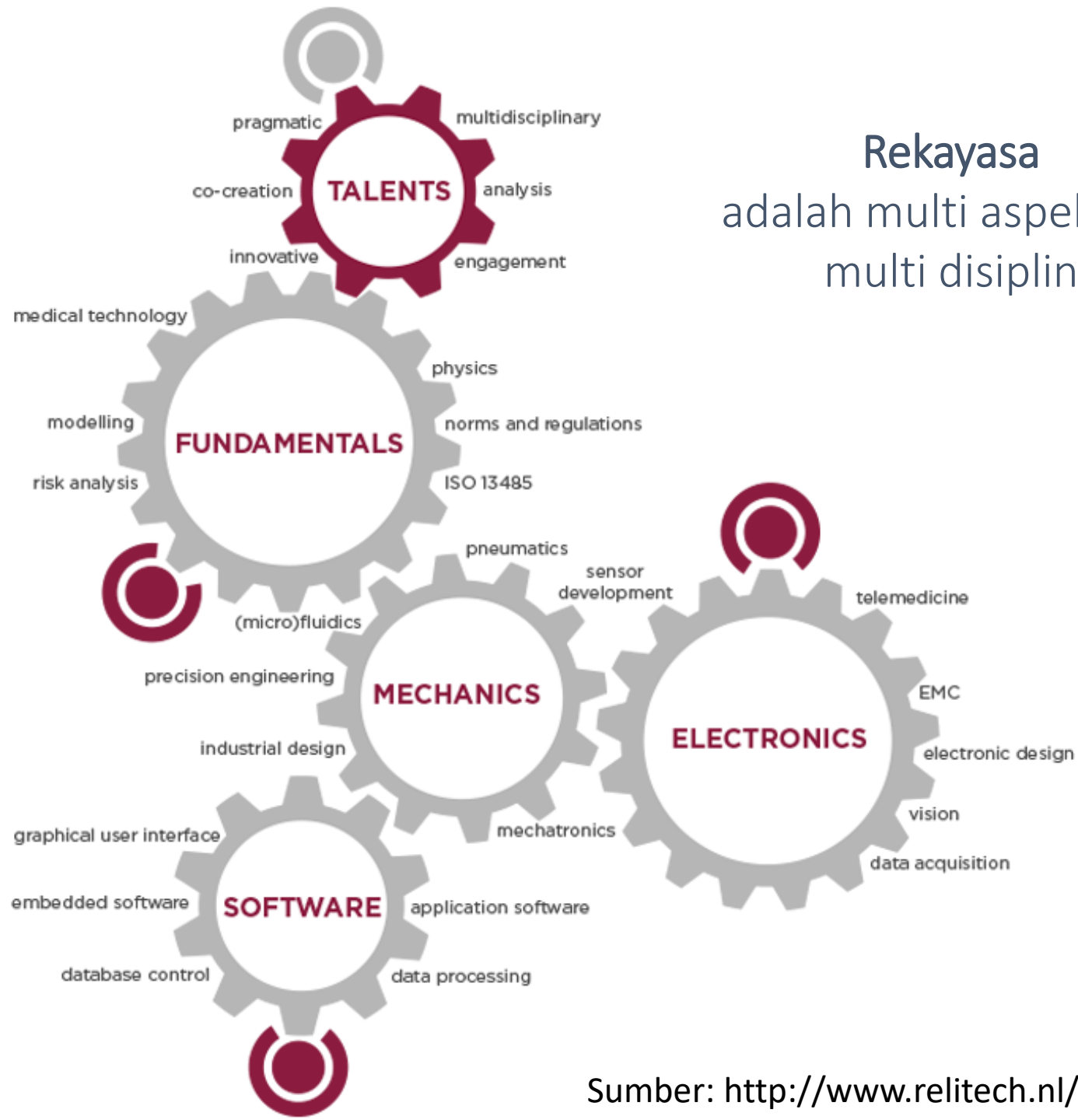
- Tugas Besar dan Kuliah Pengenalan 6 Prodi STEI

Luaran Bagian 1:

Pengertian Rekayasa dan Desain

- Mahasiswa memahami peran rekayasa dalam kehidupan sehari-hari
- Mahasiswa memahami peran rekayasawan dan interaksinya dengan profesi lainnya
- Mahasiswa memahami bahwa masalah rekayasa adalah multi aspek dan multidisiplin





Sumber: <http://www.relitech.nl/competences/>



Definition of Engineering

Engineering is the use of scientific principles to design and build machines, structures, and other items, including bridges, tunnels, roads, vehicles, and buildings.^[1] The discipline of engineering encompasses a broad range of more specialized fields of engineering, each with a more specific emphasis on particular areas of applied mathematics, applied science, and types of application.

1. definition of "engineering" from the Cambridge Academic Content Dictionary © Cambridge University

<https://dictionary.cambridge.org/dictionary/english/>

Hasil Rekayasa

• Building

- 2560 BC : Great Pyramid Giza, (230m wide, 146m height)
- 75 : Colosseum (80000 person)
- 220BC -1640 : Great Wall of China, (8800 km)
- 1887-1889 : Eiffel Tower (324m height)
- 2009 : Burj Khalifa (830m)

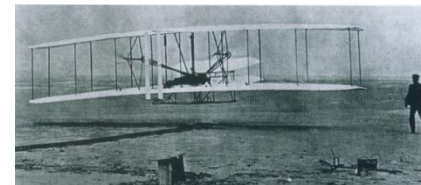
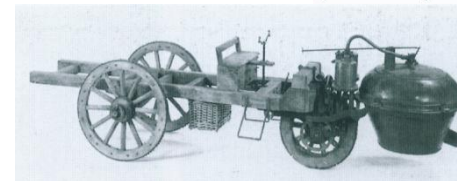
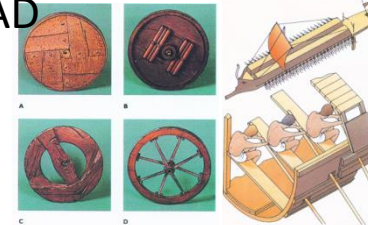


1000 BC



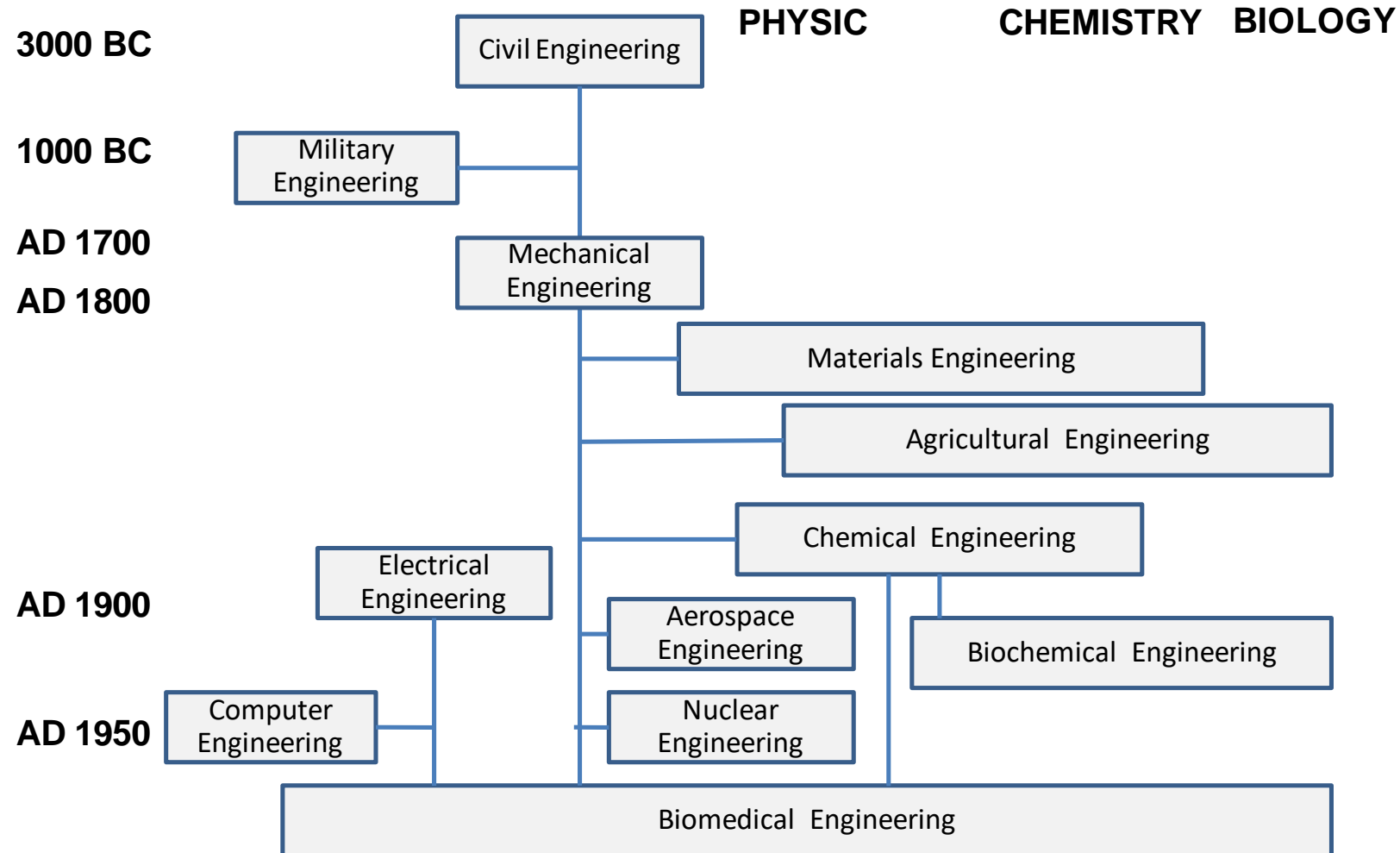
► Transport

- 3500-2000 BC : wheel (solid, spoked)
- 800 BC : Phoenician trireme
- 1769 : Steam engine (<10hp)
- 1903 : Powered Flight (37m, 12s)
- 1909 : Model T Ford (72kmh)
- 1981 : Space Shuttle (28000 kmh)



Perkembangan Disiplin Rekayasa

Holtzapple and Reece, 2003



TOP 20 ENGINEERING ACHIEVEMENTS OF THE 20TH CENTURY (NAE)

1. Electrification
2. Automobile
3. Airplane
4. Water Supply and Distribution
5. Electronics
6. Radio and Television
7. Agricultural Mechanization
8. Computers
9. Telephone
10. Air Conditioning and Refrigeration

11. Highways
12. Spacecraft
13. Internet
14. Imaging
15. Household Appliances
16. Health Technologies
17. Petroleum and Petrochemical Technologies
18. Laser and Fiber Optics
19. Nuclear Technologies
20. High-performance Materials



ENGINEERING CHALLENGES FOR THE 21ST CENTURY

(NATIONAL ACADEMY OF ENGINEERING)

1. Make solar energy economical
2. Provide energy from fusion
3. Develop carbon sequestration methods
4. Manage the nitrogen cycle
5. Provide access to clean water
6. Restore and improve urban infrastructure
7. Advance health informatics
8. Engineer better medicines
9. Reverse-engineer the brain
10. Prevent nuclear terror
11. Secure cyberspace
12. Enhance virtual reality
13. Advance personalized learning
14. Engineer the tools of scientific discovery

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



Rekayasa dan Rekayasawan

kata	bahasa	arti
<i>ingenerate</i>	Latin	Menciptakan
<i>ingenium</i>	Latin	Produk jenius, rancangan permesinan baru
Engineering	Inggris	Rekayasa
Engineer	Inggris	<ul style="list-style-type: none"> • Orang yang merancang benda-benda kreatif • Insinyur
<i>Ingenieur</i>	Perancis, Jerman, Spanyol, Belanda	
<i>Ingegenere</i>	Italy	

Engineering atau **Rekasaya**:

“rancangan dan analisis kreatif yang memanfaatkan energi, material, gerak dan informasi untuk melayani kebutuhan manusia dengan cara yang inovatif”

(Kosky *et al*, 2010)

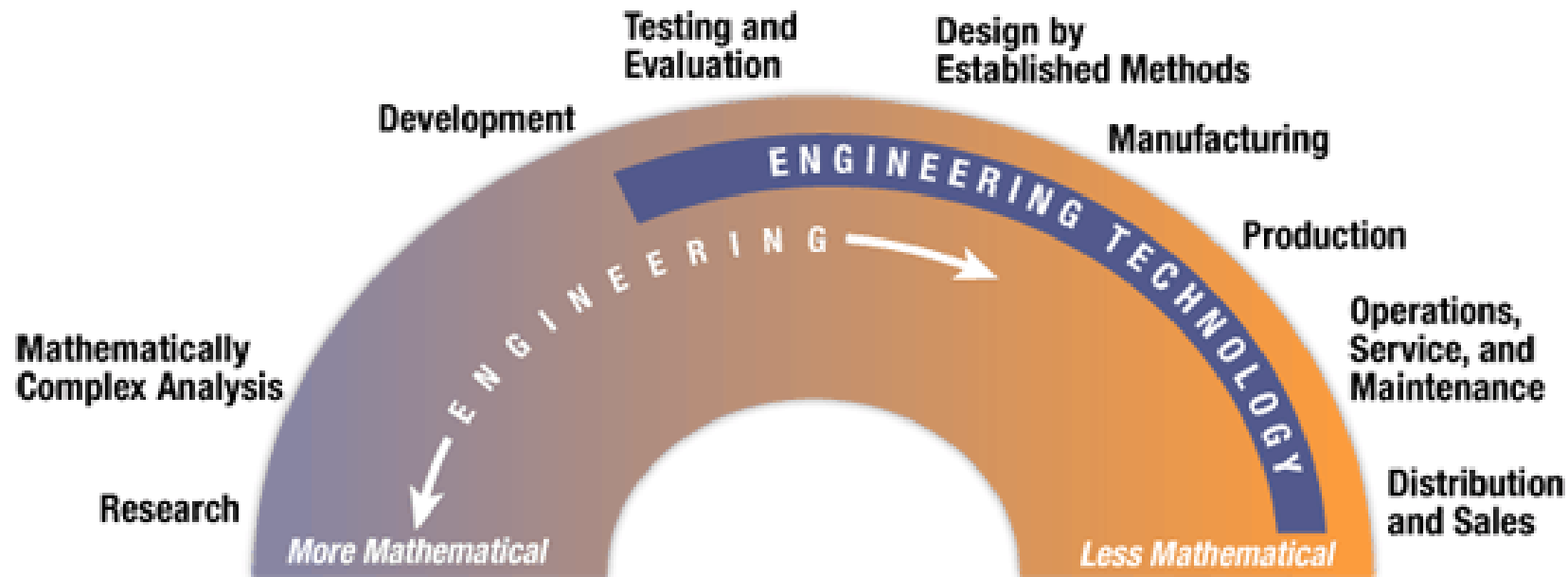


Peran Rekayasa dalam Teknologi

- Latin : *technología*:
 - téchnē : an 'art', 'skill' or 'craft'
 - logía : the study of something, or the branch of knowledge of a discipline.
- UU 18 Tahun 2002 Sisnas Iptek
 - Teknologi adalah cara atau metode serta proses atau produk yang dihasilkan dari penerapan dan pemanfaatan dari berbagai disiplin ilmu pengetahuan yang menghasilkan nilai bagi pemenuhan kebutuhan, kelangsungan dan peningkatan mutu kehidupan manusia.

*Technology is a **perfect fusion** of Arts, Science, Engineering, Economics and Business*





Engineering vs Engineering Technology

<u>Engineering</u>	<u>Engineering Technology</u>
Planning	Doing
Researching new ideas	Applying existing "state of the art"
Innovating	Implementing
Concept-oriented	Application-oriented
Theoretical	Practical and "hands-on"
Calculus based	Algebra based
Develop new processes	Apply new processes
Open-ended and futuristic	Specific and current
Required for registration as P.E. in all states	Required for registration as P.E. in most states
Can require period of internship due to emphasis on fundamentals and theory	Usually ready to work due to emphasis on current practice in industry
Graduate studies widely available	Graduate studies increasing
Jobs in engineering design	Jobs in applied engineering and production



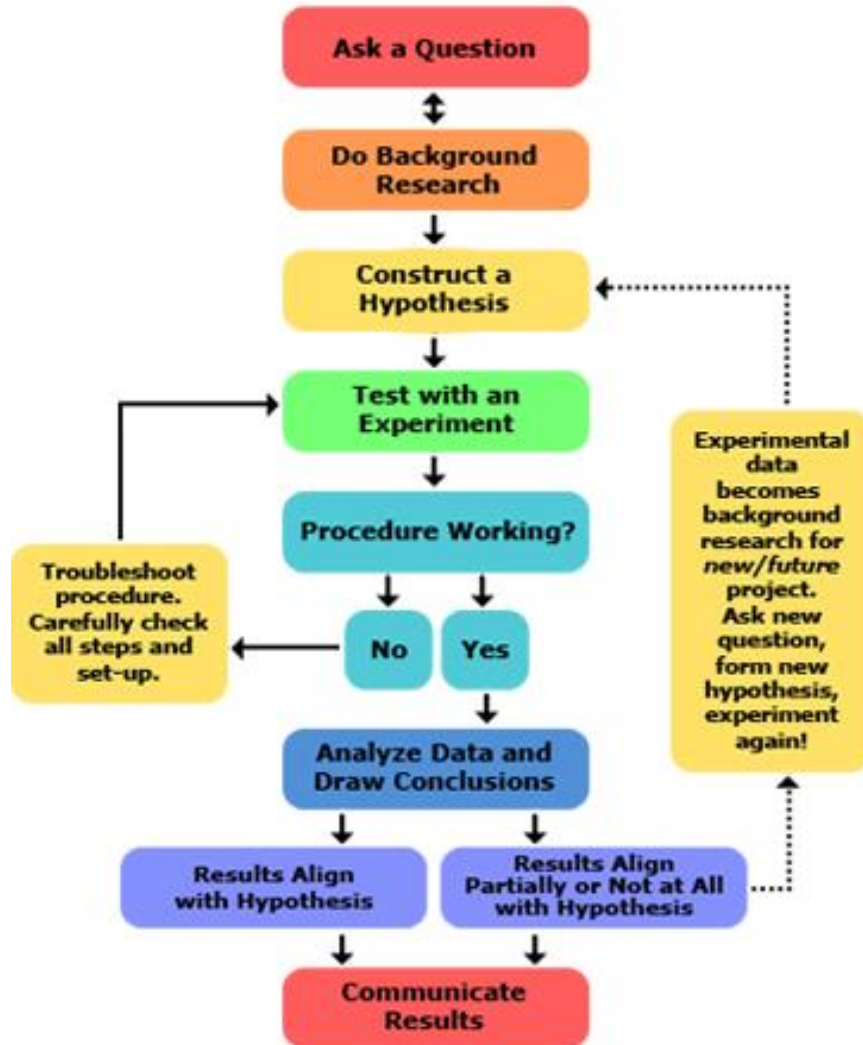
Sains dan Rekayasa

	Sains (science)	Rekayasa (engineering)
Tujuan	kebenaran (<i>truth</i>)	perbaikan (<i>improvement</i>)
Hasil	<u><i>knowing that</i></u>	<i>Know how</i>
Menurut Theodore von Karman	study the world as it is	create the world that has never been

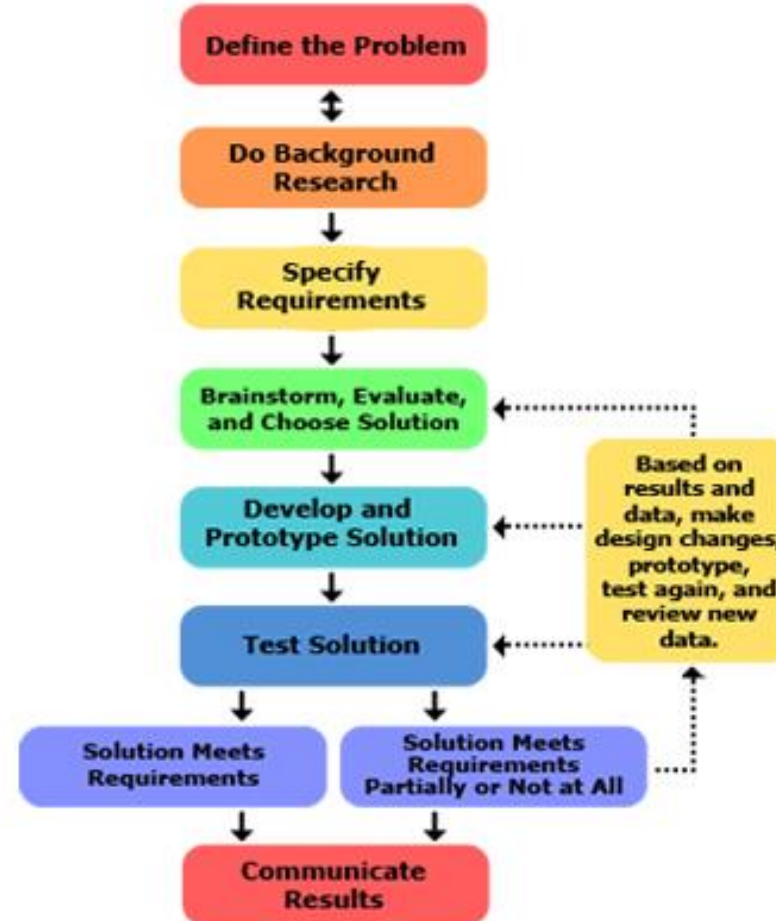


Sains dan Rekayasa

Scientific Method



Engineering Method



Rekayasawan

- National Council of Engineering Examiners:
 - “Engineer shall mean a person who, by reason of his special knowledge and use of mathematical, physical, and engineering sciences and the principles of engineering analysis and design, acquired by education and experience, is qualified to practice engineering”
- Kosky at all :
 - What is an engineer?
 - An engineer is a creative, ingenious person.
 - What does an engineer do?
 - Engineers create ingenious solutions to societal problems.



Profesi Rekayasawan

Area of Works	Functions
Research	explore, discover and apply new principles
Development	transform ideas or concepts into production processes
Design	link the generation of ideas and the production
Production & Testing	manufacture and assemble components or products
Sales	market engineering products
Operation	maintain equipment and facilities
Construction	prior to construction organizes bids, during construction supervises certain components of process
Management	optimize the use of resources (equipment, labor, finances)
Education	teach engineering principles in university and industrial settings
Consulting	provide specialized engineering services the clients. May work alone or in partnership other engineers

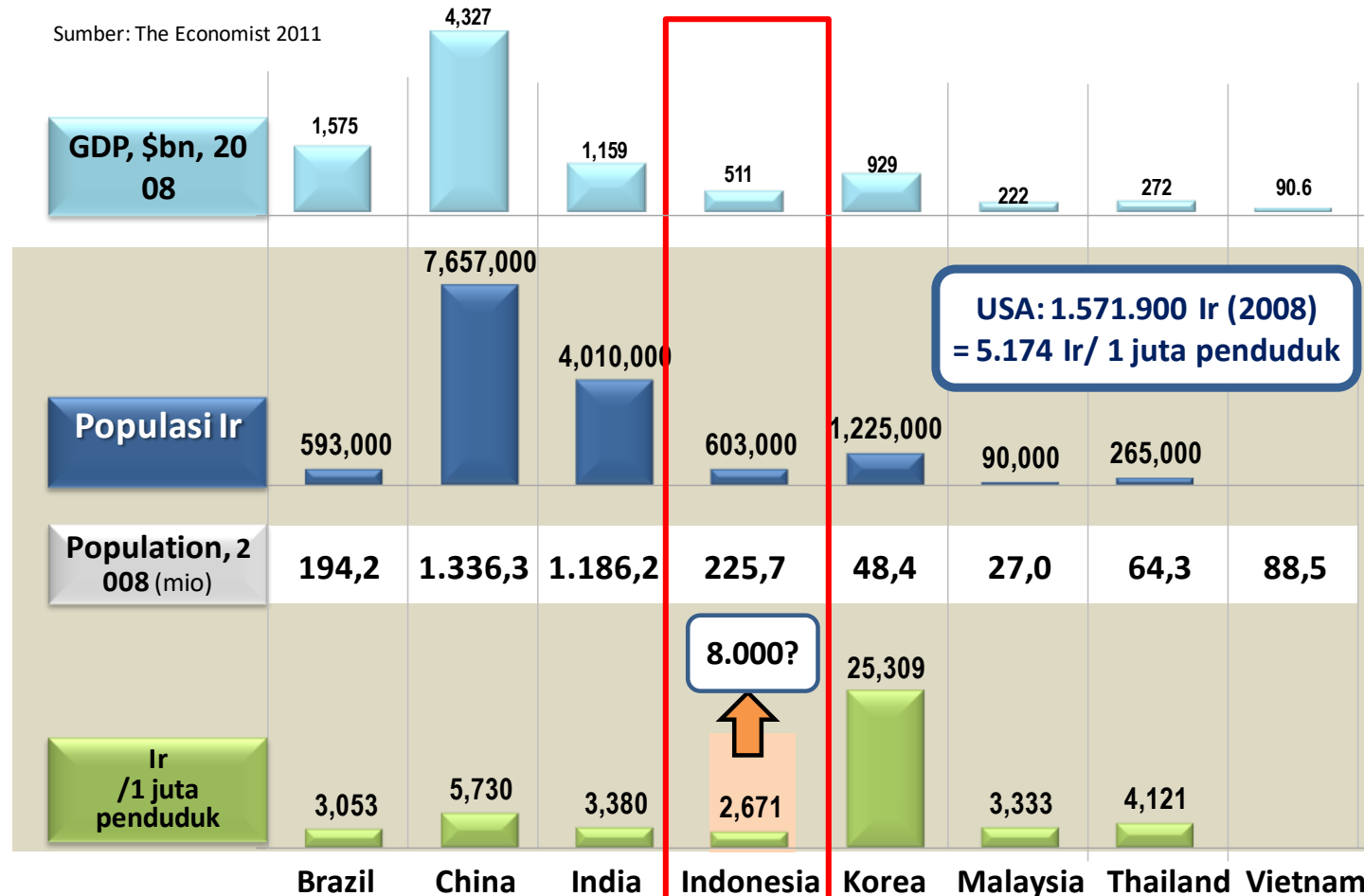


Pengaruh Populasi Insinyur pada PDB

Perbandingan

PDB terhadap Populasi Insinyur

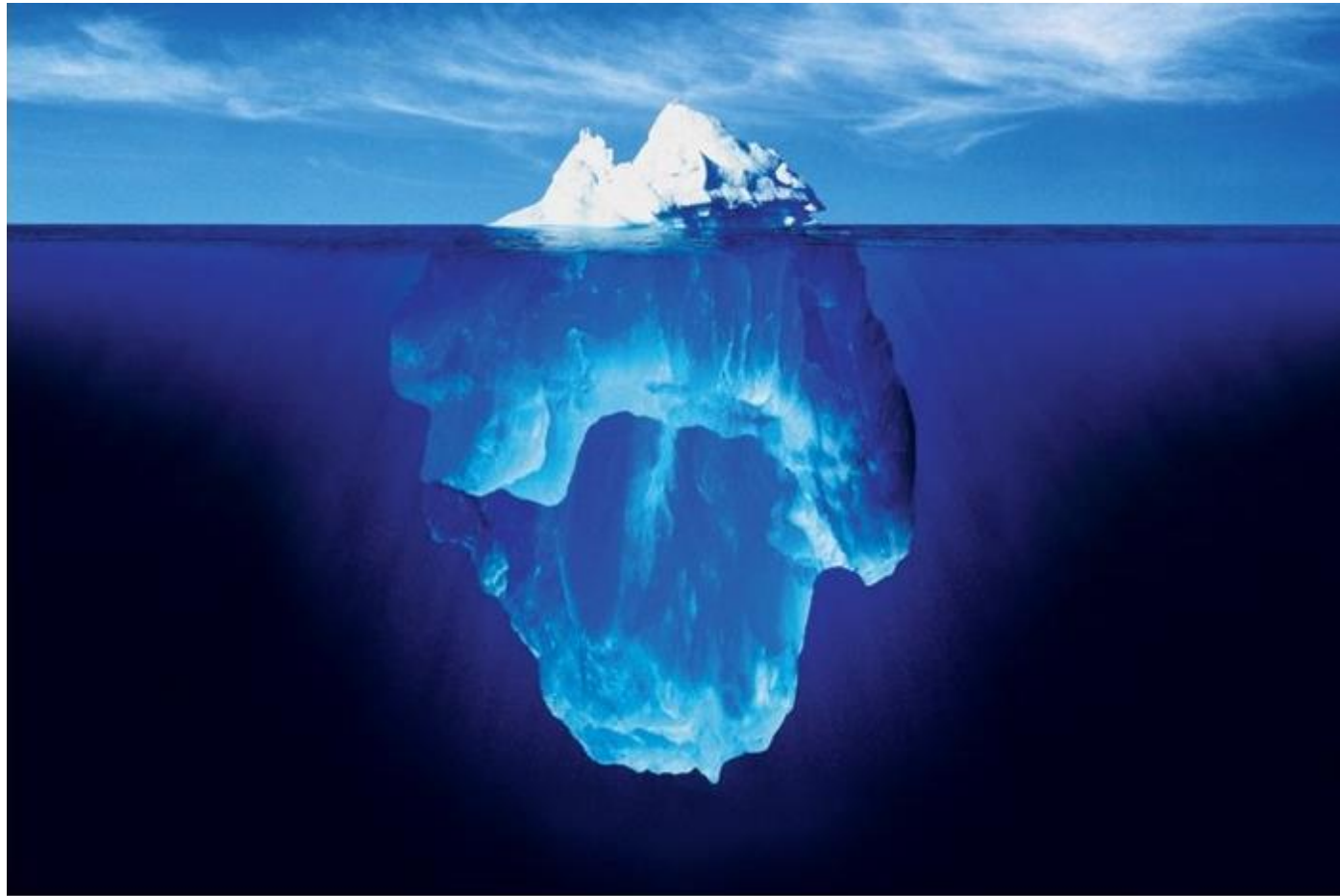
Sumber: The Economist 2011



Dari berbagai sumber, dari tahun 2004 2007



Fenomena Gunung Es



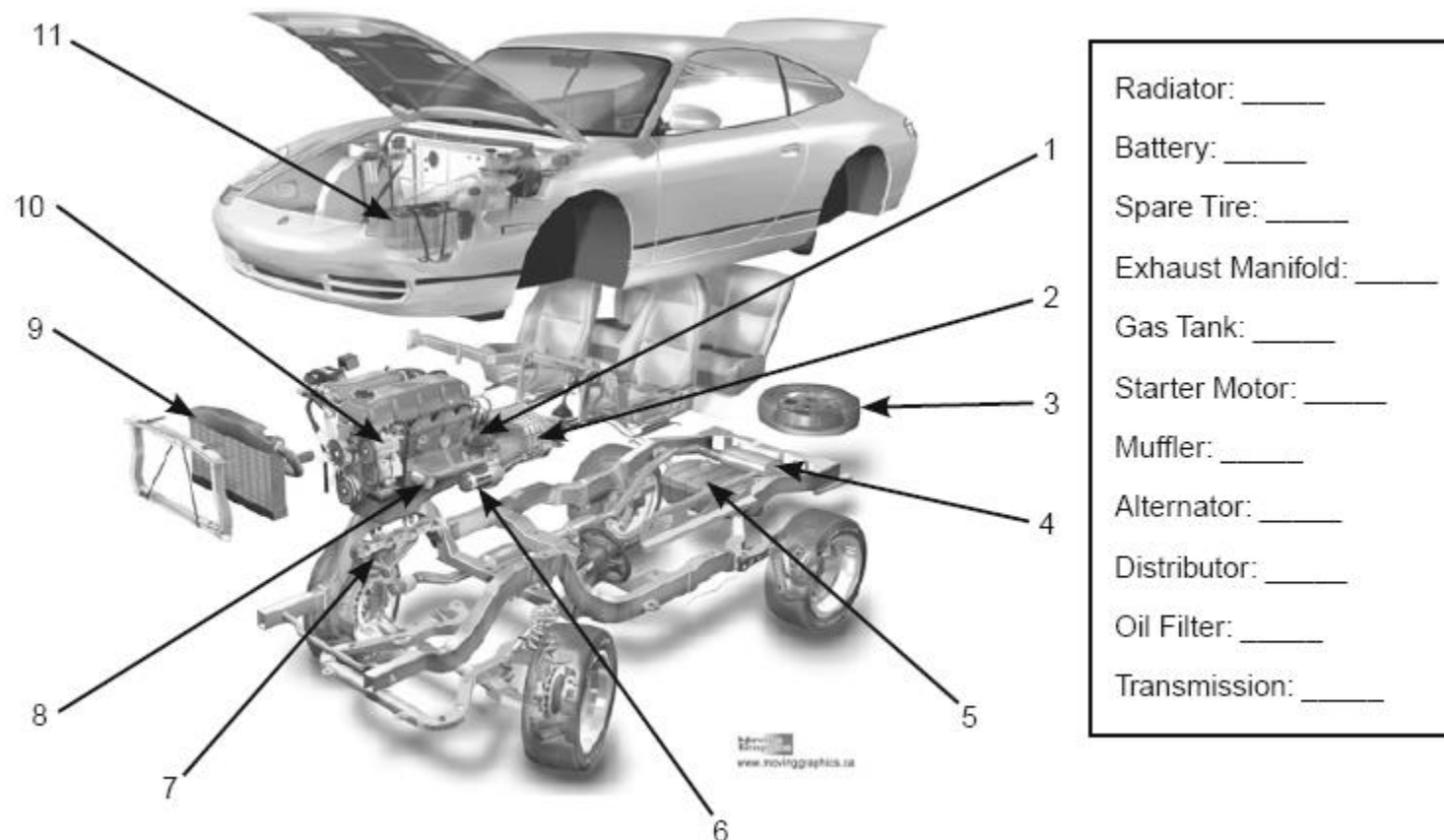
Bidang Rekayasa : Multi Aspek, Multi Disiplin



> 1 juta unit terjual



Complex System in Details

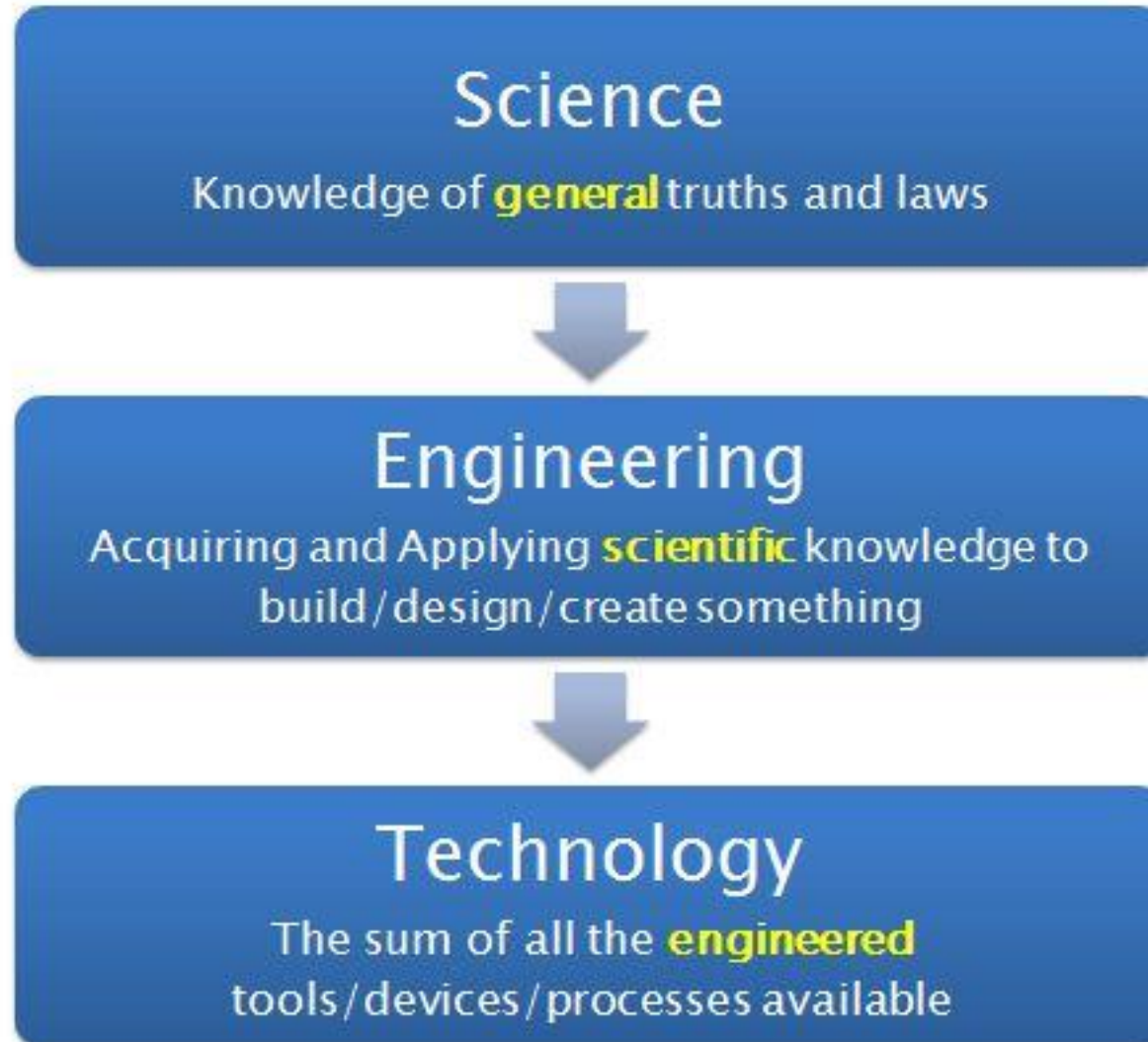


Profil Rekayasawan

- THINK GLOBALLY (hollistic, multi aspect, multi discipline) ACT LOCALLY (detail, precise, codes, ..)
- Communication skills (team work, oral, written)
- Creative
- Problem solver

(disarikan dari Top 10 Qualities of an Engineer : engineeringschool.com)

Wrap Up



Personal and Professional Ethics

What are personal ethics ... and what do they have to do with engineering?

What are professional ethics?

Personal Ethics

- **Standards of human behavior**
- Individuals of different cultures have constructed to make moral judgement about personal or group situations
- They vary over time and from culture to culture, resulting in conflict when what is acceptable in one culture is not in another
 - Example: privacy in US culture is very strong, whereas in Japan is open. In US, a desk is considered an extension of that privacy, whereas in Japan a desk would be considered public domain

The Five Cornerstones of Ethical Behavior

Examples of codes of personal ethics

- **Do** what you say **you will do**
- **Never divulge information** given to you in confidence
- Accept **responsibility** for your **mistakes**
- **Never** become involved in a **lie**
- **Never accept gifts** that compromise your ability to perform in the best interests of your organization

Ethical Situation Example

- You and your roommate are both enrolled in the same engineering class. You did the homework, but your roommate did not do the homework and ask you to see it. You are afraid he/she will just copy it in as his/her own work. What are you ethically obligated to do? What are your ethical responsibilities?
- a. Show your roommate the homework
- b. Show the homework but ask your roommate not to copy it
- c. Show the homework and tell him/her that if it copied, you will tell the professor
- d. Refuse to show the homework
- e. Refuse to show the homework but offer to spend time tutoring the roommate

Ethical Situation Example

Solution

- Answer to an ethics question by applying a code of ethics
 - The Five Cornerstones of Ethical Behavior will be used
1. Do what you say you will do
 2. Never divulge information given to you in confidence
 3. Accept responsibility for your mistakes
 4. Never become involved in a lie
 5. Never accept gifts that compromise your ability to perform in the best interests of your organization



Top Ten Question on Ethical Decision

Top ten questions you should ask yourself when making an ethical decision:

1. Could the decision become habit forming? If so, don't do it
2. Is it legal? If it isn't, don't do it
3. Is it safe? If it isn't, don't do it
4. Is it the right thing to do? If it isn't, don't do it
5. Will this stand the test of public scrutiny?
6. If something terrible happened, could I defend my actions? If you can't, don't do it
7. Is it just, balanced, and fair? If it isn't, don't do it
8. How will it make me feel about myself? If it's lousy, don't do it
9. Does this choice lead to the greatest good for the greatest number? If it doesn't, don't do it

And the #1 question you should ask yourself when making an ethical decision:

10. Would I do this in front of my mother? If you wouldn't, don't do it

Professional Ethics

- Personal and Professional Ethics
 - Personal Ethics (vary over time and from culture to culture)
 - Personal ethics are the standards of human behavior that individuals of different cultures have constructed to make moral judgments about personal or group situations.
 - Professional Ethics (honesty and integrity)
 - Having a code of ethics enables an engineer to resist the pressure
 - to produce substandard work
 - to allow concerns such as personal desires, greed, ideology, religion, or politics to override professional ethics.

National Society of Professional Engineers Code of Ethics

Fundamental canons

- Engineers, in the fulfillment of their professional duties, shall
 1. Hold paramount the safety, health, and welfare of the public.
 2. Perform services only in areas of their competence.
 3. Issue public statements only in an objective and truthful manner.
 4. Act for each employer or client as faithful agents or trustees.
 5. Avoid deceptive acts.
 6. Conduct themselves honorably, responsibly, ethically, and lawfully so as to enhance the honor, reputation, and usefulness of the profession.



Engineering Ethics Decision Matrix

Options → NSPE Canons ↓	Go along with the decision	Appeal to higher management	Quit your job	Write your state representative	Call a newspaper reporter
Hold paramount the safety, health and welfare of the public					
Perform services only in the area of your competence					
Issue public statements only in an objective and truthful manner					
Act for each employer or client as faithful agents or trustees					
Avoid deceptive acts					
Conduct themselves honorably					



KODE ETIK INSINYUR INDONESIA

www.pii.or.id

- **CATUR KARSA, PRINSIP-PRINSIP DASAR :**

- Mengutamakan keluhuran budi.
- Menggunakan pengetahuan dan kemampuannya untuk kepentingan kesejahteraan umat manusia.
- Bekerja secara sungguh-sungguh untuk kepentingan masyarakat, sesuai dengan tugas dan tanggung jawabnya.
- Meningkatkan kompetensi dan martabat berdasarkan keahlian profesional keinsinyuran.

- **SAPTA DHARMA, TUJUH TUNTUNAN SIKAP :**

- Insinyur Indonesia senantiasa mengutamakan keselamatan, kesehatan dan kesejahteraan Masyarakat.
- Insinyur Indonesia senantiasa bekerja sesuai dengan kompetensinya.
- Insinyur Indonesia hanya menyatakan pendapat yang dapat dipertanggung jawabkan.
- Insinyur Indonesia senantiasa menghindari terjadinya pertentangan kepentingan dalam tanggung jawab tugasnya.
- Insinyur Indonesia senantiasa membangun reputasi profesi berdasarkan kemampuan masing-masing.
- Insinyur Indonesia senantiasa memegang teguh kehormatan, integritas dan martabat profesi.
- Insinyur Indonesia senantiasa mengembangkan kemampuan profesionalnya.



Engineering Disaster

- Januari 1986,
Cape Kennedy, “Challenger disaster”
- Februari 2003,
Texas “Columbia disaster”
- Nopember 2011,
Jembatan “Kukar” ambruk
Kalimantan Timur
- Desember 2014,
Air Asia Flight 8501 Crash

