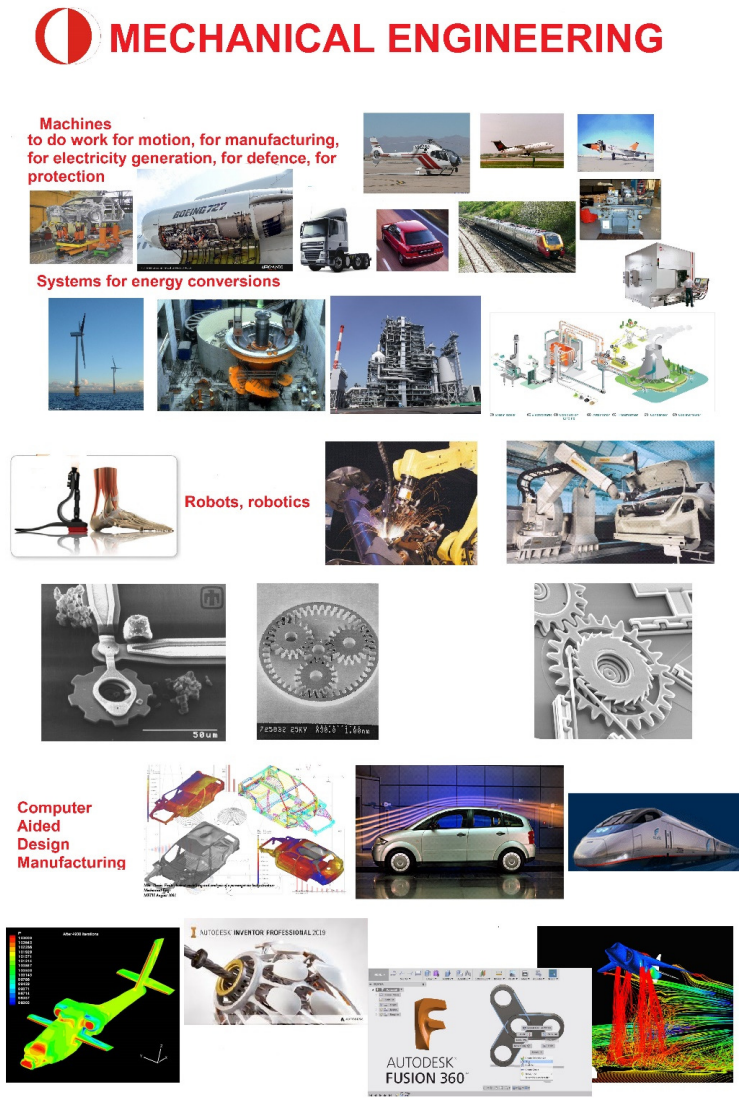


MECH 100

Introduction to Mechanical Engineering

WHAT IS ENGINEERING?

*The word ‘ Engineering’ derives from the Latin root *ingeniere* , meaning **to design** or to devise, Latin root “in generate” meaning “to create”

*“Mühendis” in Turkish derives from “hendese” which means “geometry” and thus mühendis is the one who makes calculations. “Hendesehane” means “School of Engineering”

*Engineers are individuals who *combine knowledge of science, mathematics and economics* to design an industrial product, to develop the technology for outputing a product, to solve technical problems for the benefit of people.

Engineers apply the theories and principles of science and mathematics to research and develop economical solutions to technical problems.

A profession

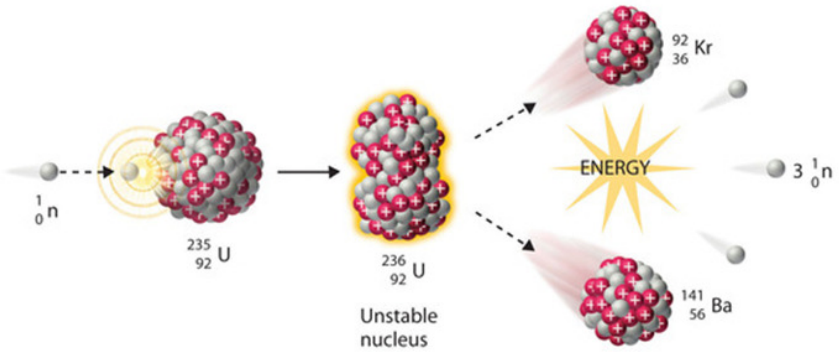
Science is the process of gaining knowledge and investigating by making observations, experiments

- Scientists are people who try to explain why and how things happen.

1. Formulate a hypothesis to explain a natural phenomenon
2. Conceive and execute experiments to test the hypothesis
3. Analyze test results and state conclusions
4. Generalize the hypothesis into the form of a law or theory if experimental results verify the hypothesis
5. Publish the new knowledge

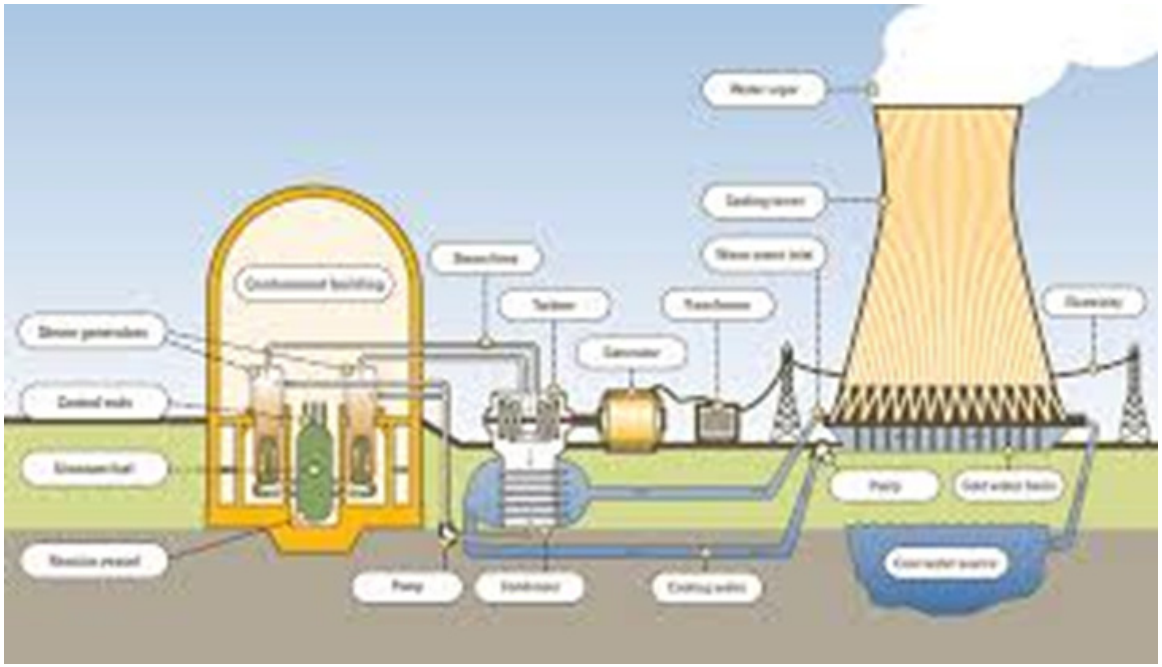
- A scientist tries to understand how our world, or other things, work.
- Some like to learn about living organisms. They are called biologists.
- Some like to study rocks. They are called geologists.

Nuclear Reaction



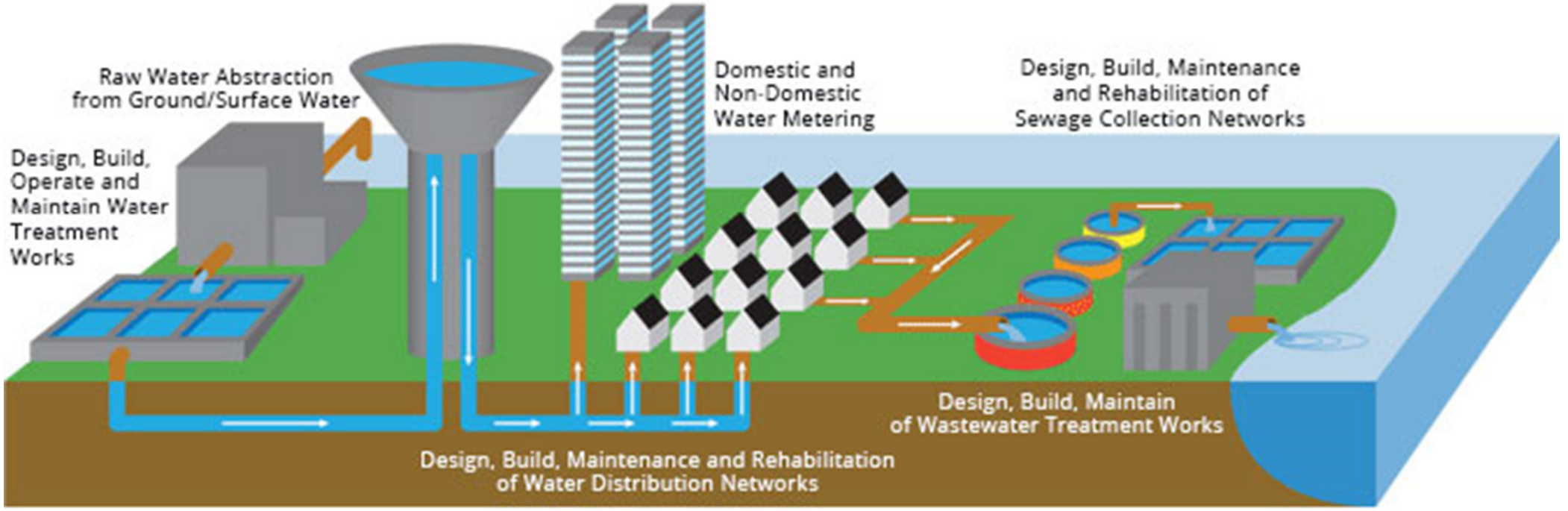
Science

Nuclear Power Plant



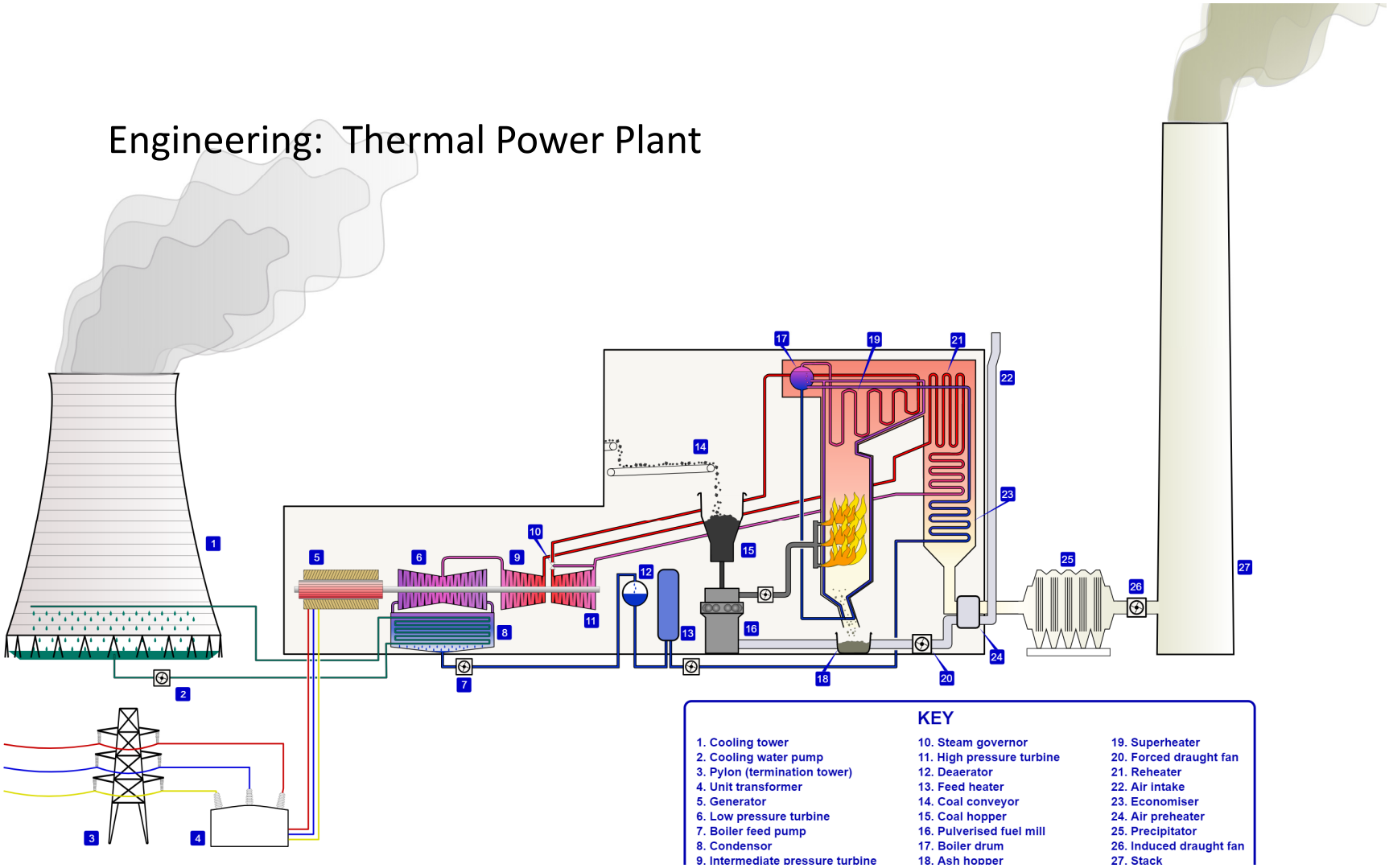
Engineering

Water Supply and Sewage Treatment



Science: Theory of combustion, $C + O_2 \rightarrow CO_2$

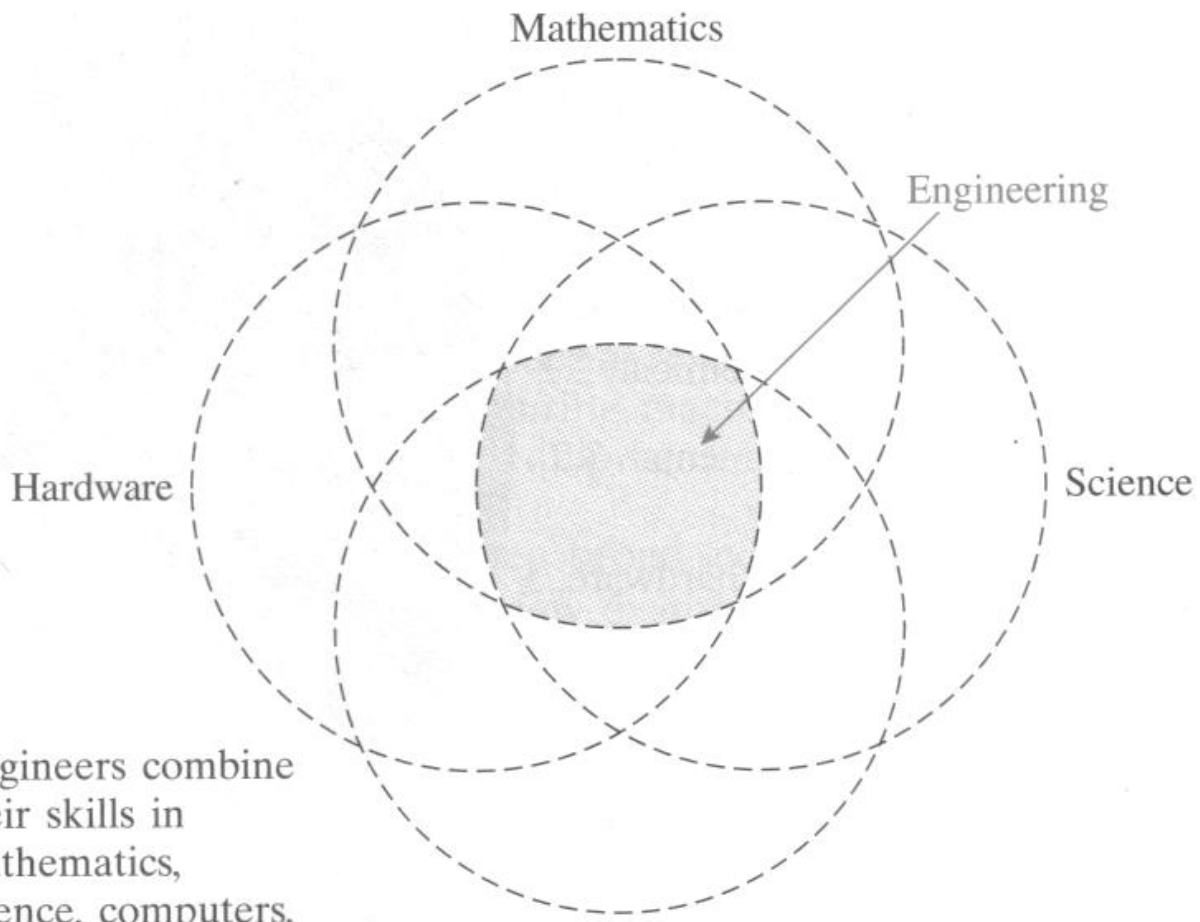
Engineering: Thermal Power Plant



WHAT IS ENGINEERING?

The word "engineering" derives from the Latin root *ingeniere*, meaning to design or to devise, which also forms the basis of the word "ingenious." Those meanings are quite appropriate summaries of the traits of a good engineer. At the most fundamental level, engineers apply their knowledge of mathematics, science, and materials—as well as their skills in communications and business—in order to develop new and better technologies. Rather than experiment solely through trial and error, engineers are educated to use mathematics, scientific principles, and computer simulations as tools to create faster, accurate, and economical designs.

In that sense, the work of an engineer differs from a scientist's, who would normally emphasize the discovery of physical laws rather than apply those phenomena to develop new products. Engineering is essentially a bridge between scientific discovery and product applications. Engineering does not exist for the sake of furthering or applying mathematics, science, or computation by themselves. Rather, engineering is a driver of social and economic growth and an integral part of the business cycle.



Engineers combine their skills in mathematics, science, computers, and hardware.

Engineers apply the theories and principles of science and mathematics to research and develop economical solutions to technical problems. Their work is the link between perceived social needs and commercial applications. Engineers design products, machinery to build those products, plants in which those products are made, and the systems that ensure the quality of the products and the efficiency of the workforce and manufacturing process. Engineers design, plan, and supervise the construction of buildings, highways, and transit systems. They develop and implement improved ways to extract, process, and use raw materials, such as petroleum and natural gas. They develop new materials that both improve the performance of products and take advantage of advances in technology.

What is Engineering ?

The Technological Team

The Technological Team

Engineers usually work in a team of;

- Scientists,
- Engineers,
- Technologists,
- Technicians,
- Craftsmans

which brings together complementary skills to solve a problem;

What is Engineering ?

Scientists

Scientists:

Search for new fundamental understanding of the world and develop existing knowledge

Applied Scientists:

Apply knowledge gained by theoretical advances to develop new products and devices

METU

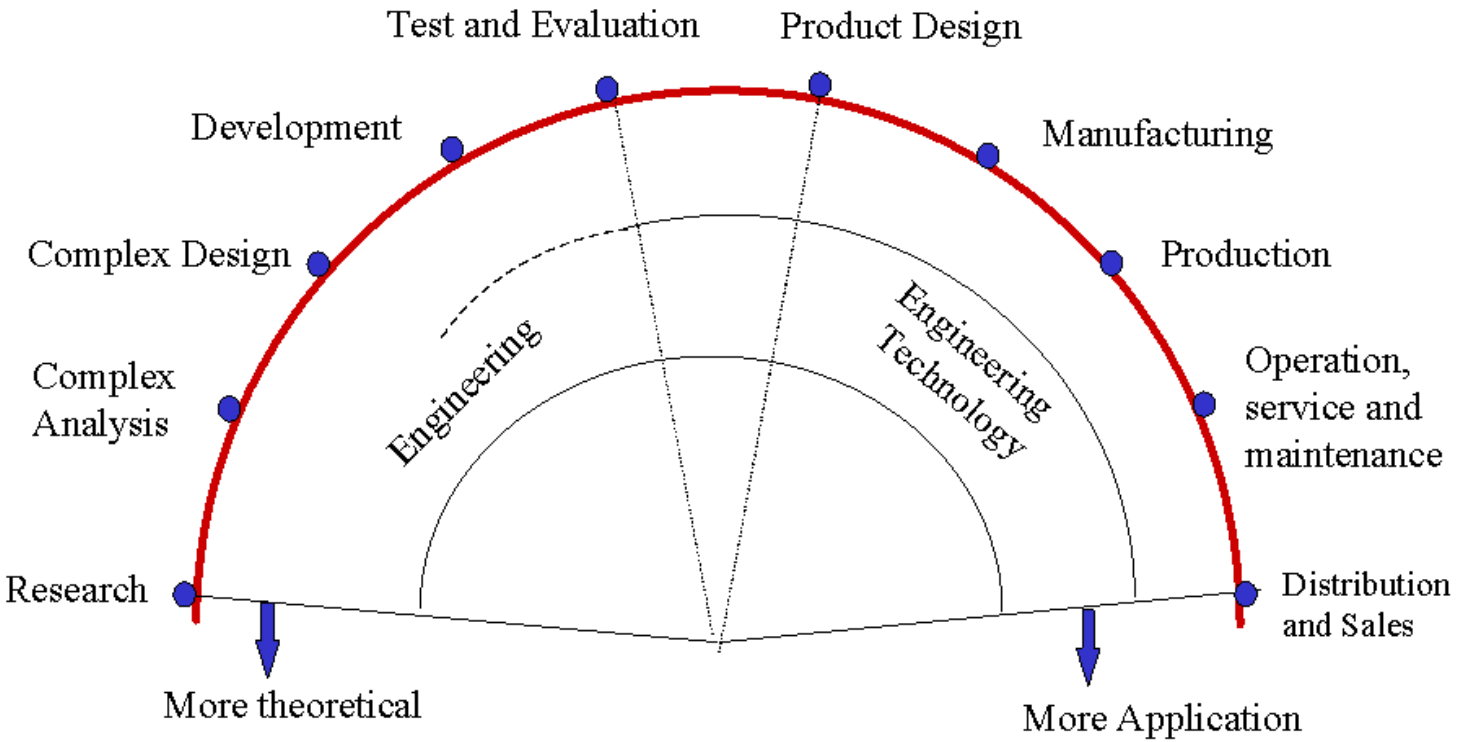
What is Engineering ?

Engineers

- Usually lead the team,
- Function: design of a new product, project or system

Engineering and Engineering Technology

Spectrum of Technical Job Functions



Technology refers to methods, systems, and devices which are the result of scientific knowledge being used for practical purposes.

A Technologist

- Has education with less mathematical requirement,
- Material is presented in less theoretical manner,
  - Often works with engineer and technicians,
  - Develops further changes on design,
- Initiative and abilities determine the assignments,
- Often the functions of the engineer and technologist overlap at the workplace

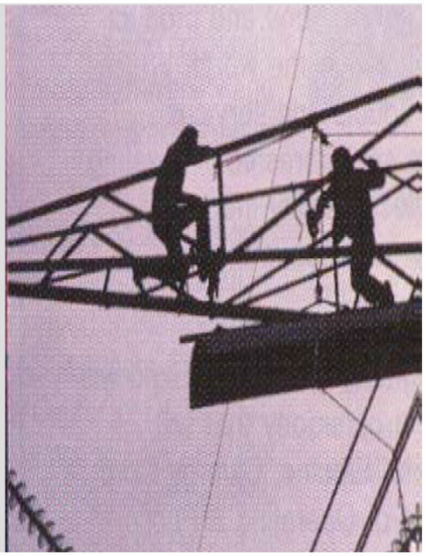
Technicians

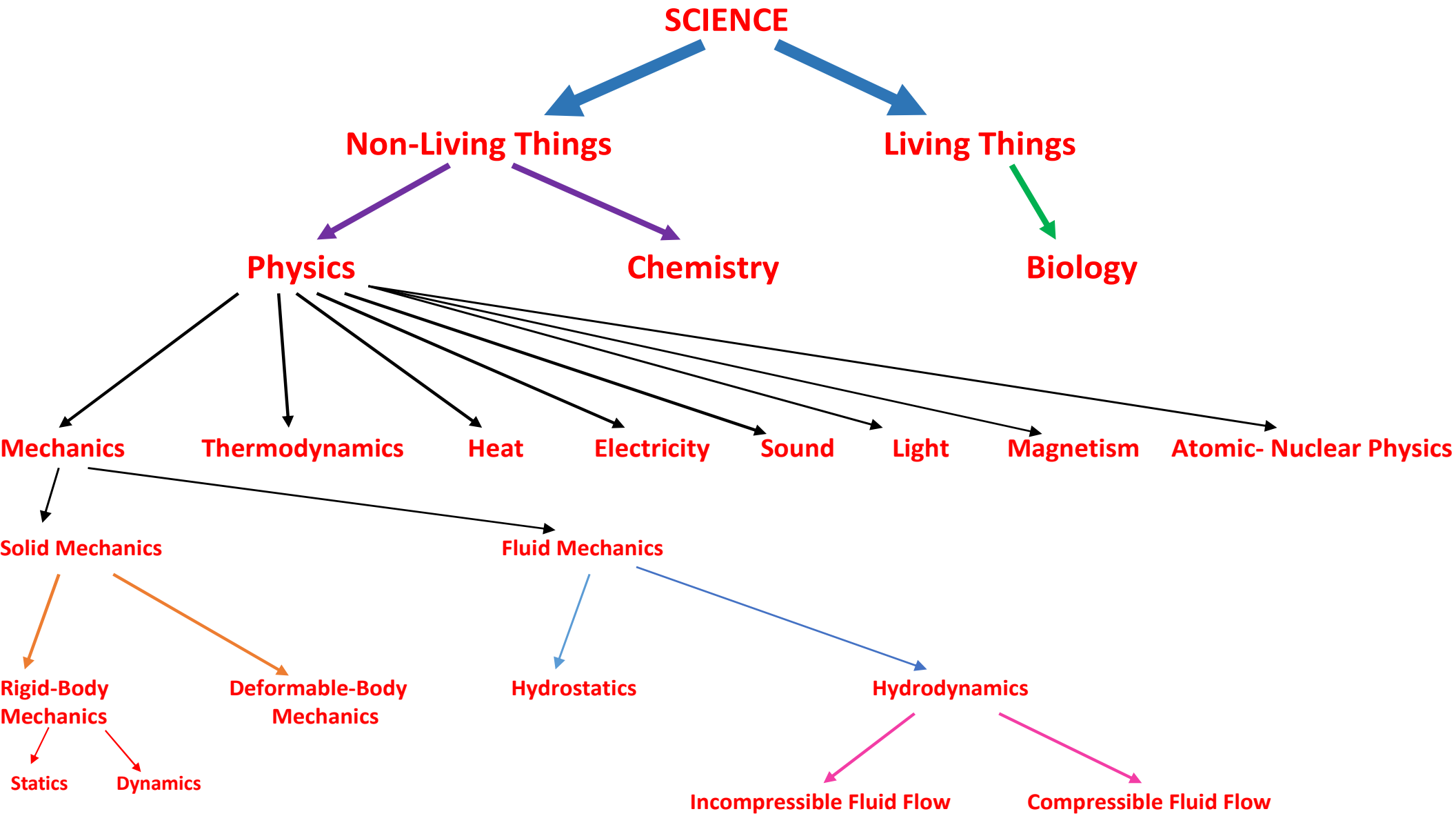
are hands on people;

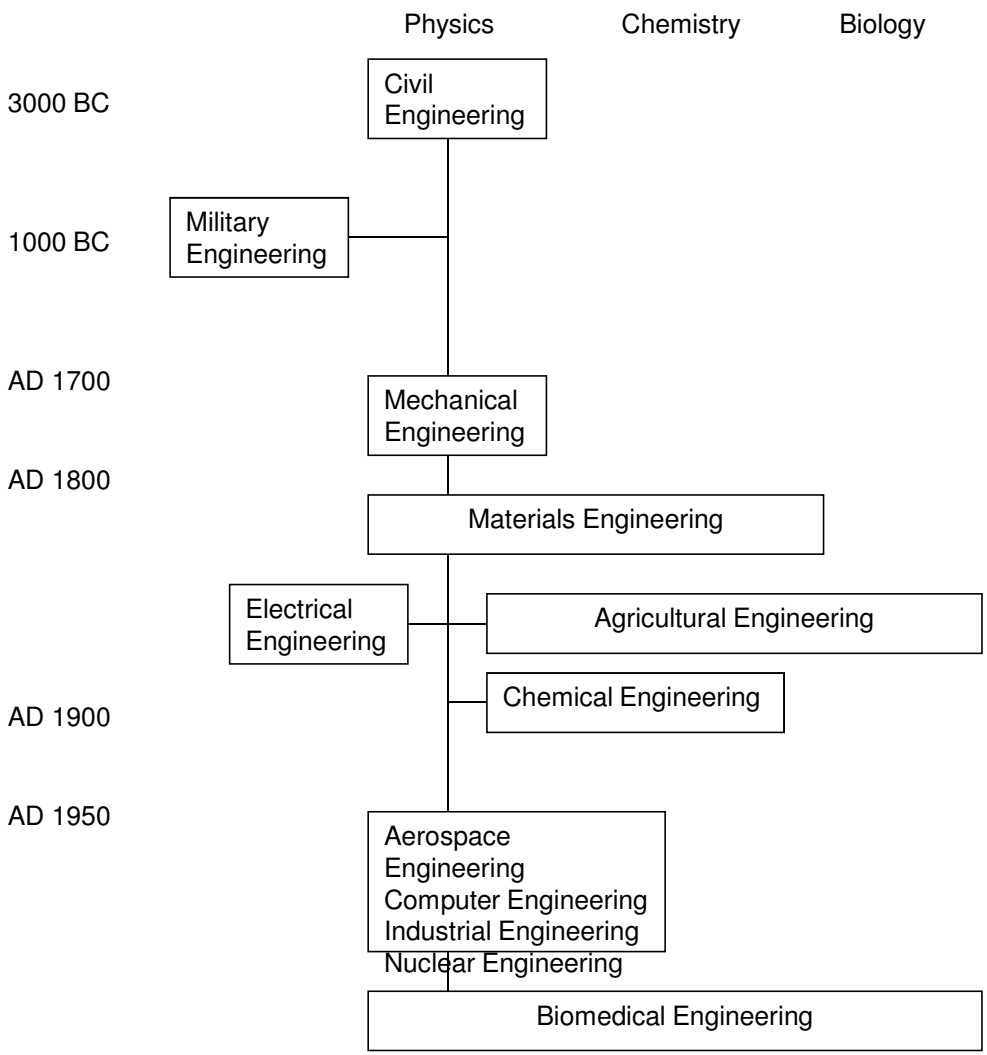
- Draftsman,
- Electric, Electronic Technician,
- Mechanic,
- etc

Craftsman

- are skilled workers,
- they have skills to build devices and systems




SCIENCE
Non-Living Things
Living Things
Physics
Chemistry
Biology
Mechanics
Thermodynamics
Heat
Electricity
Sound
Light
Magnetism
Atomic- Nuclear Physics
Solid Mechanics
Fluid Mechanics
Rigid-Body Mechanics
Deformable-Body Mechanics
Hydrostatics
Hydrodynamics
Statics
Dynamics
Incompressible Fluid Flow
Compressible Fluid Flow

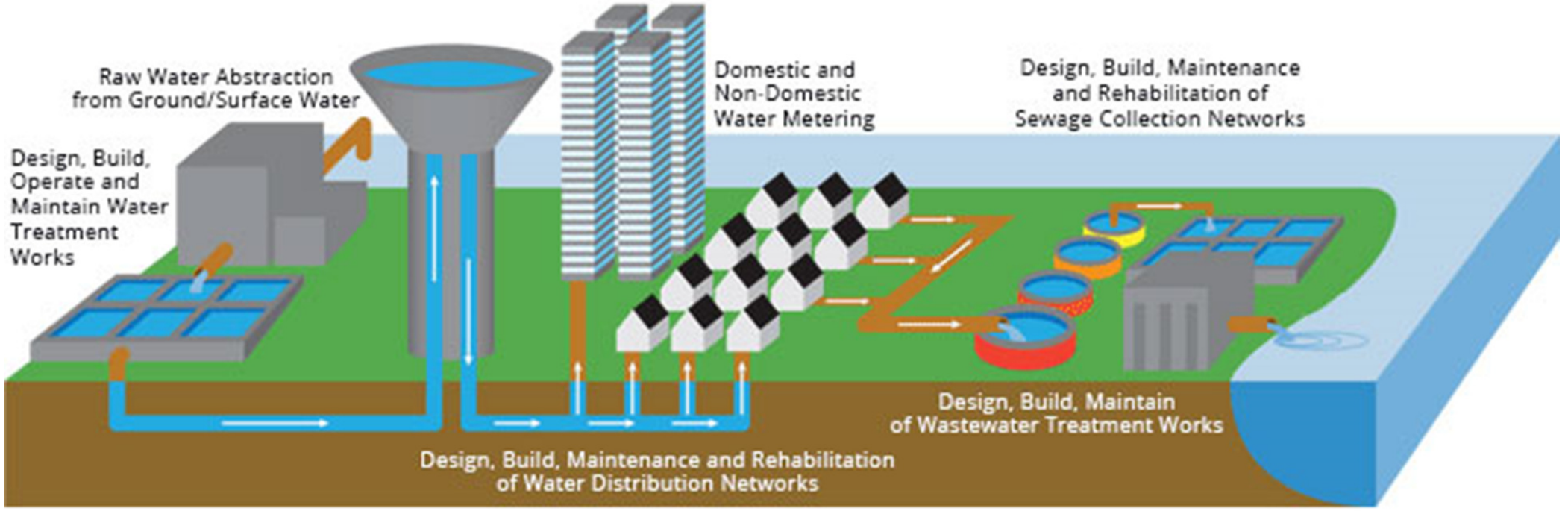


Birth of engineering disciplines

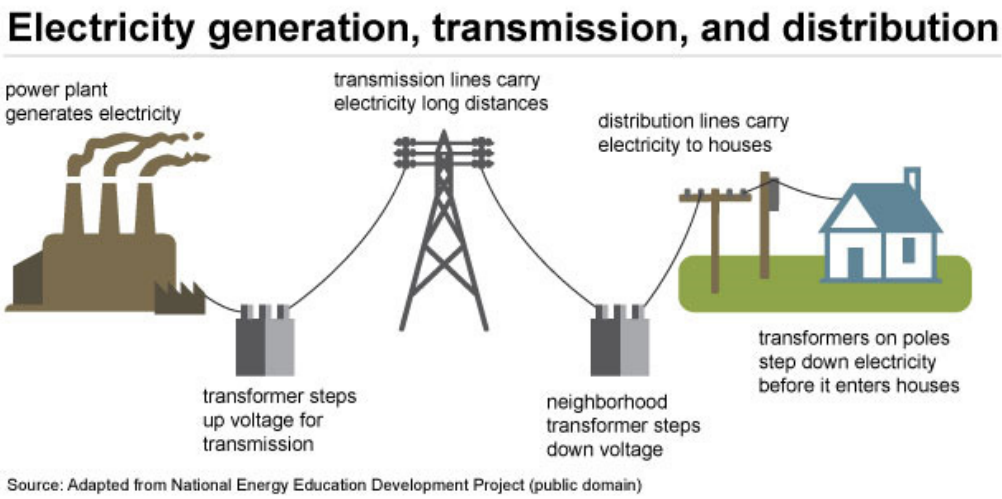
Civil Engineering: Civil engineering is generally considered the oldest engineering discipline-its works trace back to the Egyptian pyramids and before. Many of the skills possessed by civil engineers (e.g., building walls, bridges, roads) are extremely useful in warfare, so these engineers worked on both military and civilian projects.

Civil engineers are responsible for constructing large-scale projects such as roads, buildings, airports, dams, bridges, harbors, canals, water systems, and sewage systems.

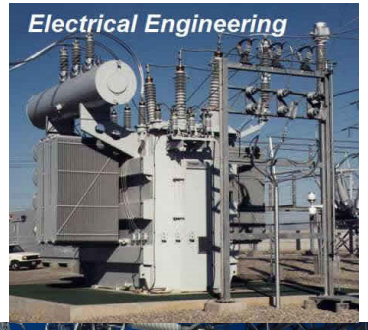
Water Supply and Sewage Treatment



Electrical Engineering: Soon after physicists began to understand electricity, the electrical engineering profession was born. Electricity has served two main functions in society: electricity generation, the transmission of power and of information. Those electrical engineers who specialize in power transmission design and build electric generators, transformers, electric motors, and other high-power equipment. Those who specialize in information transmission design and build radios, televisions, computers, antennae, instrumentation, controllers, and communications equipment.

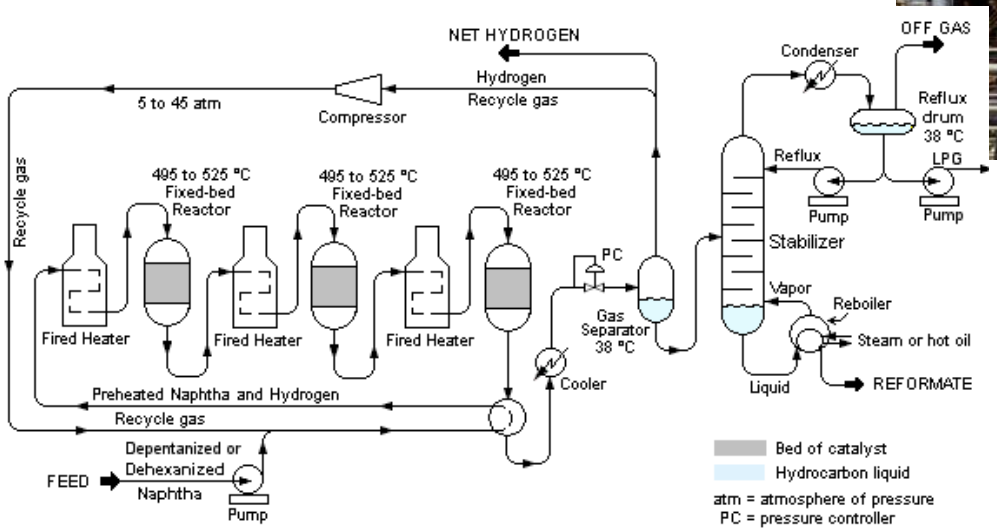


Modern life is largely characterized by electronic equipment. Daily, we rely on many electronic devices-televisions, telephones, computers, calculators, and so on.

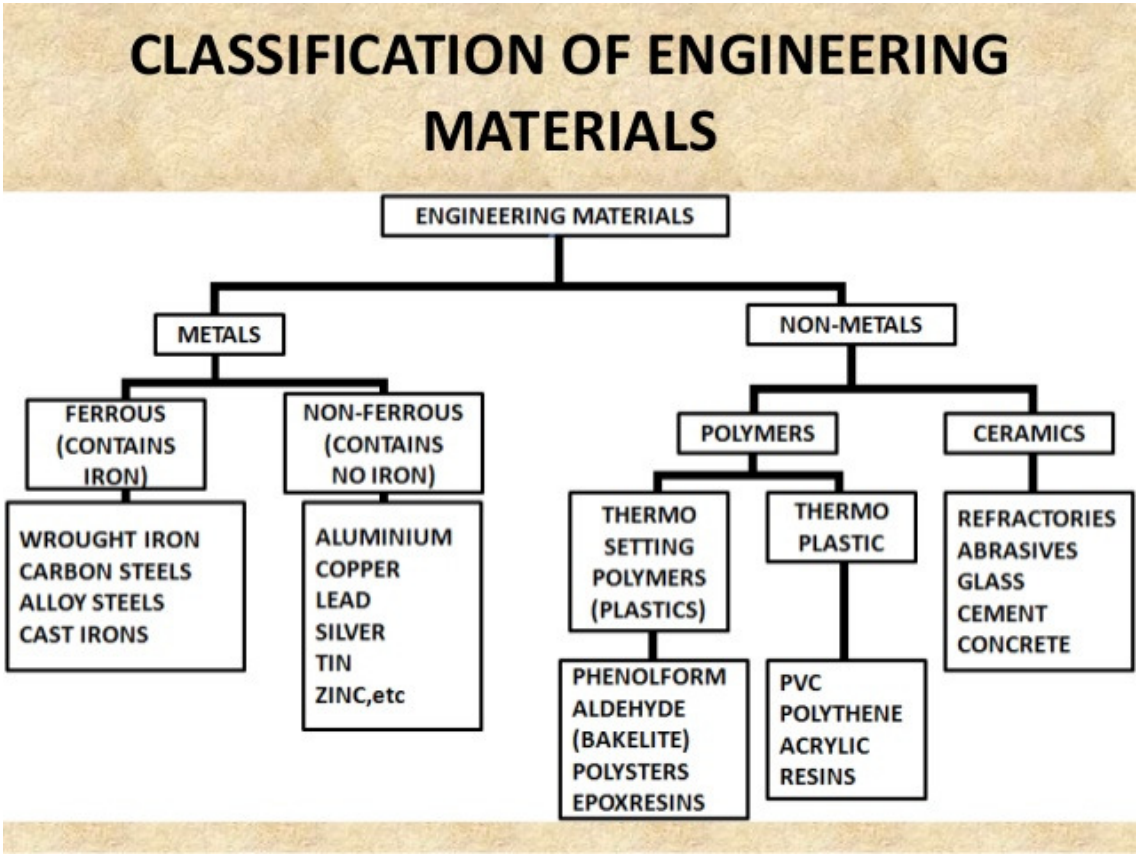


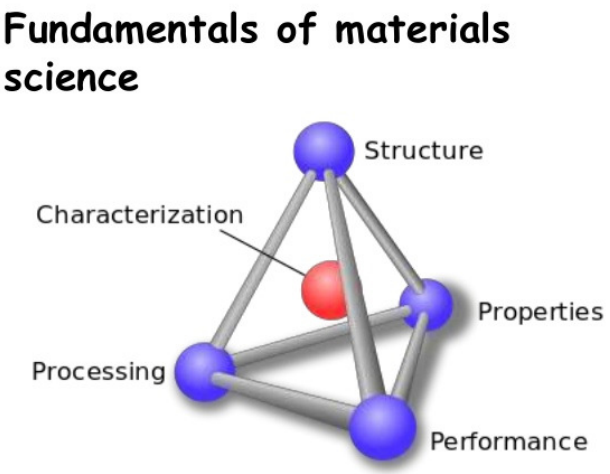
Chemical Engineering: Chemical engineering was born in 1880s as a combination of mechanical engineers and industrial chemists. **Chemical engineers are responsible for the industrial-scale production of chemicals and pharmaceuticals** and for managing the by-products of operations in petroleum, electronics, and biotechnology industries.

Chemical engineering is characterized by a concept called *unit operations*. A unit operation is an individual piece of process equipment (chemical reactor, heat exchanger, pump, compressor, distillation column). Chemical engineers assemble chemical plants by combining unit operations together.



Materials Engineering: Materials engineers are concerned with obtaining the materials required by modern society. Materials engineers work to develop new compositions of matter. Metals and their alloys, plastics, ceramics, composites, rocks, concrete, and many others are commonly used engineering materials.





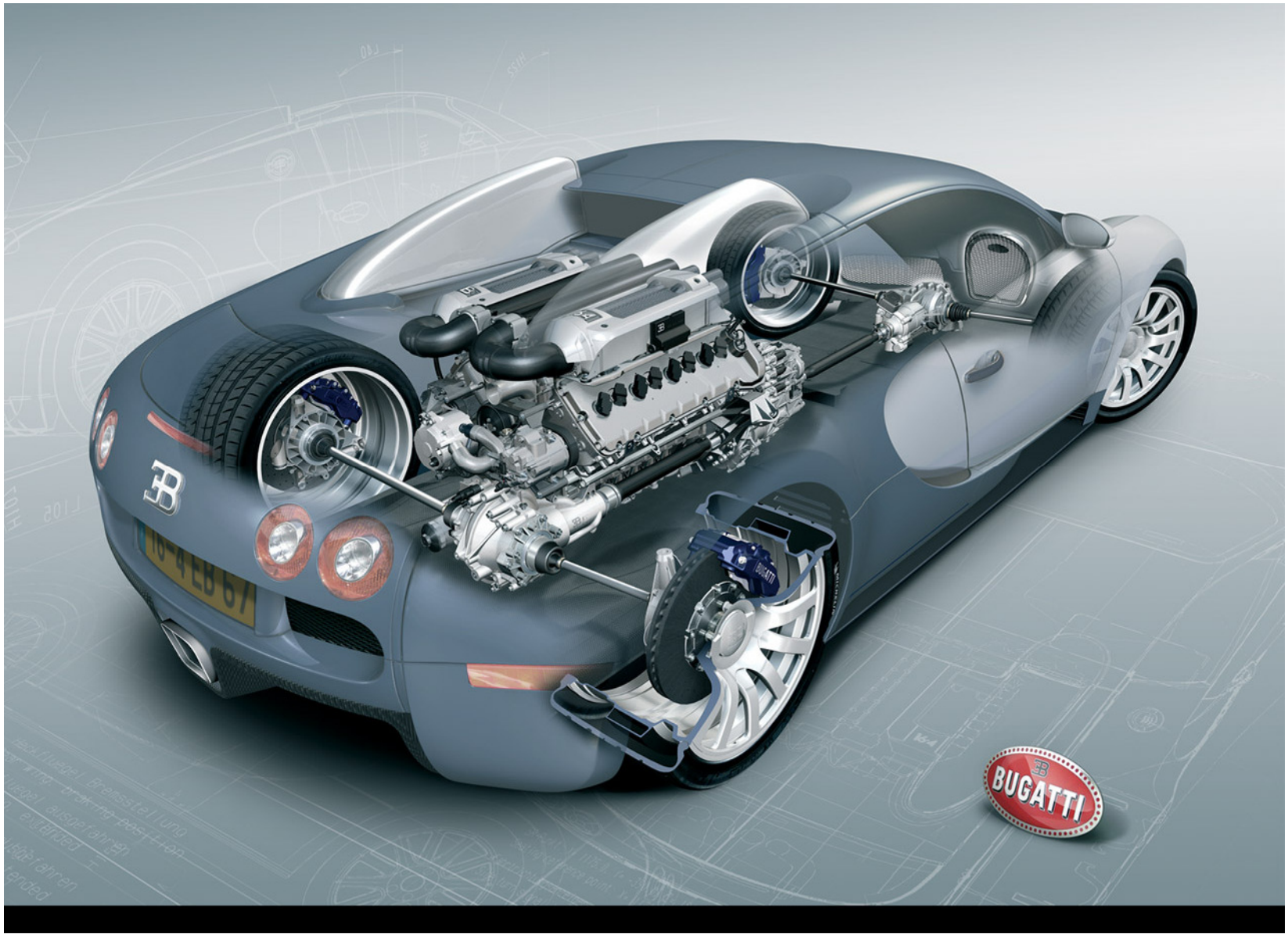
Mechanical Engineering: Mechanical engineering was practiced concurrently with civil engineering because many of the devices needed to construct great civil engineering projects were mechanical in nature. During Industrial Revolution (1750-1780), some machines were developed: steam engines, internal combustion engines, mechanical looms, sewing machines, and more. Thus, the birth of mechanical engineering took place as a discipline distinct from civil engineering.

Mechanical engineers research, develop, design, manufacture, test, maintain tools, machines, engines, vehicles (automobiles, trains, planes, ships), machine tools, heat exchangers, industrial process equipment, power plants, consumer items,.....), and systems for heating, refrigeration, air conditioning, and ventilation.

Mechanical engineers work on power-producing machines such as electricity-producing generators, internal combustion engines, steam and gas turbines, jet and rocket engines. They also develop power-using machines such as refrigeration and air-conditioning equipment, robots used in manufacturing, machine tools, material handling systems, and industrial production equipment.

The Spectrum of Mechanical Engineering Functions

- 1. Research
- 2. Development
- 3. Design
- 4. Testing
- 5. Manufacturing
- 6. Operation and Maintenance
- 7. Marketing and Sales
- 8. Administration and Management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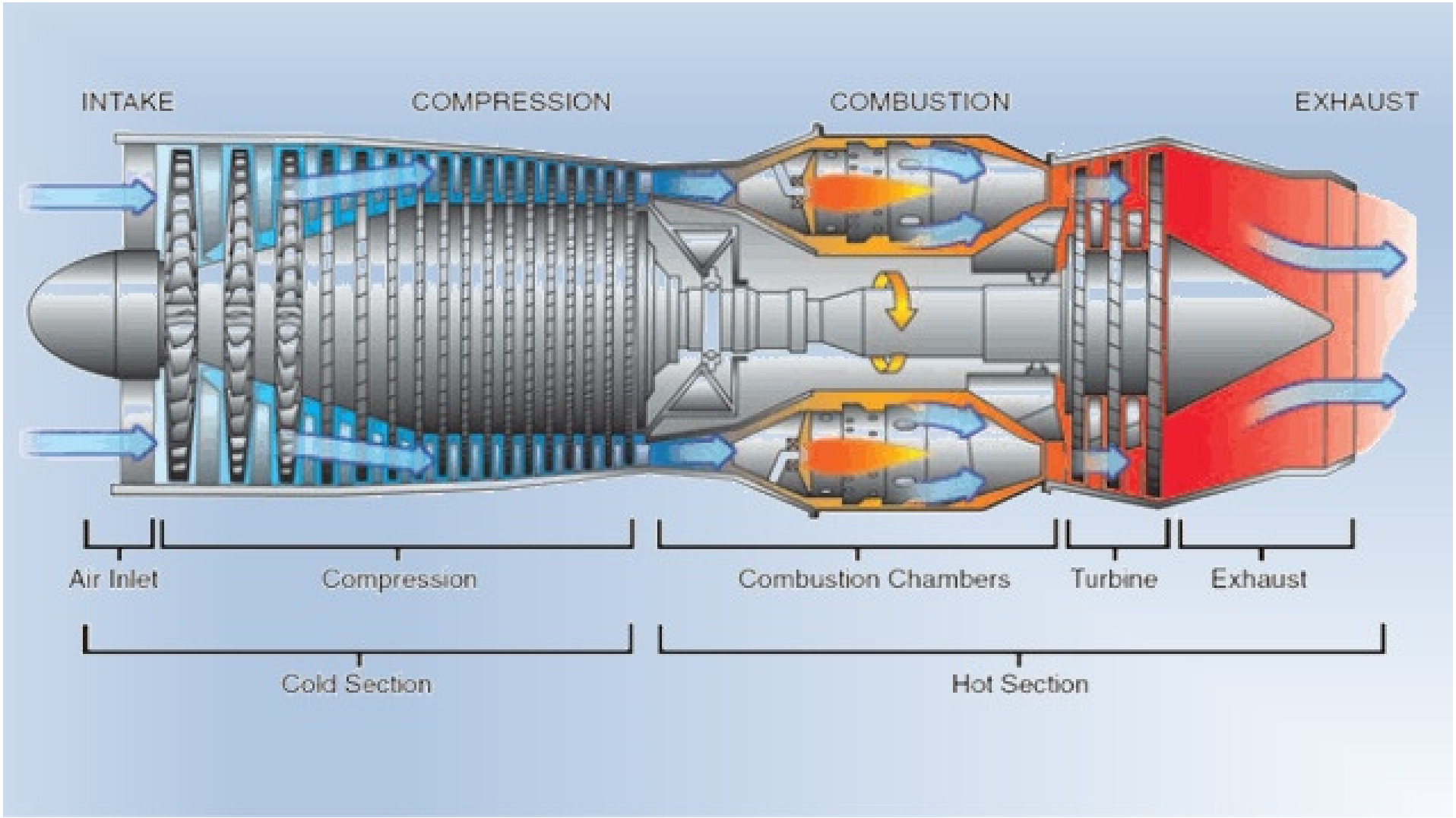
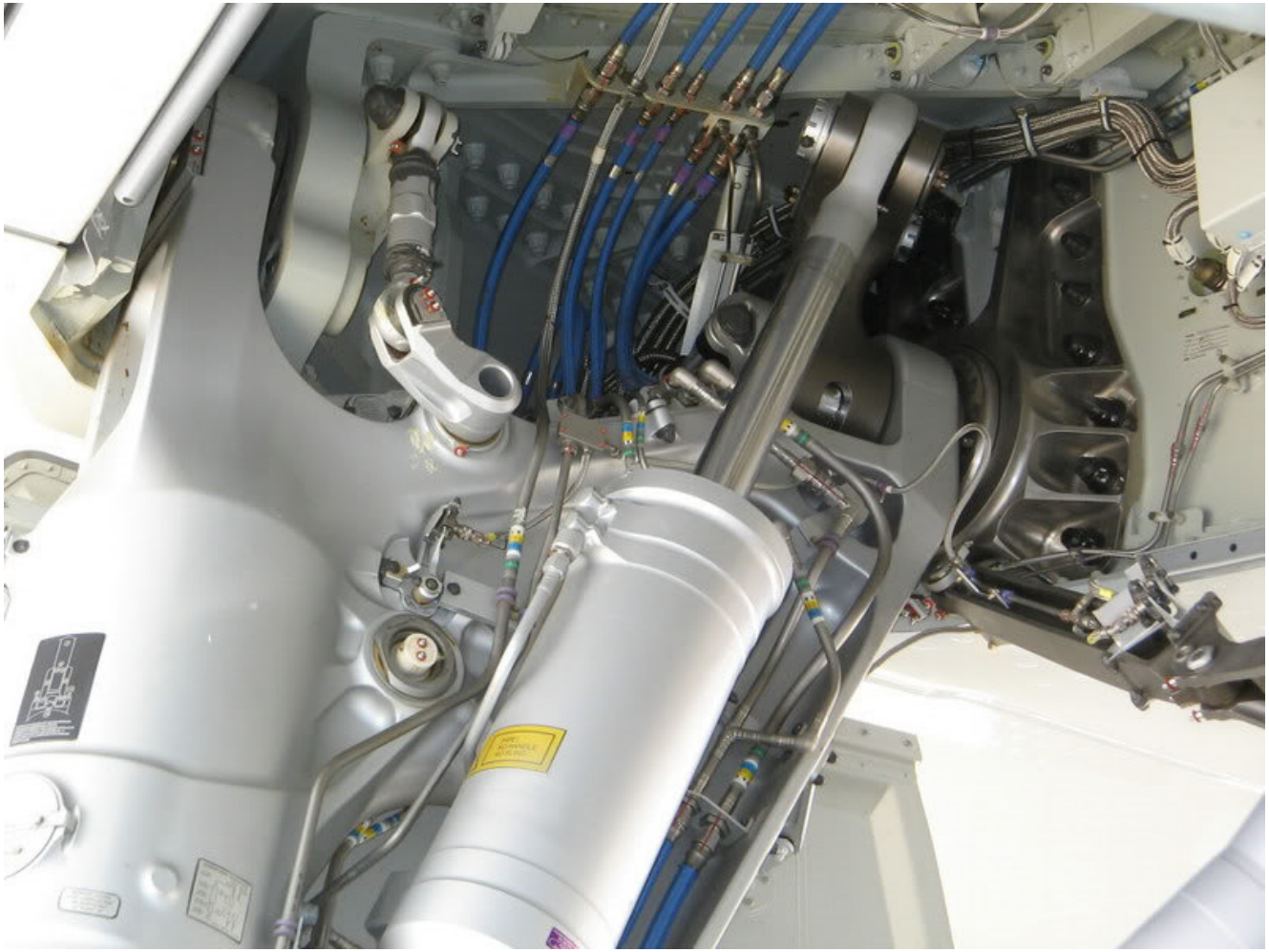
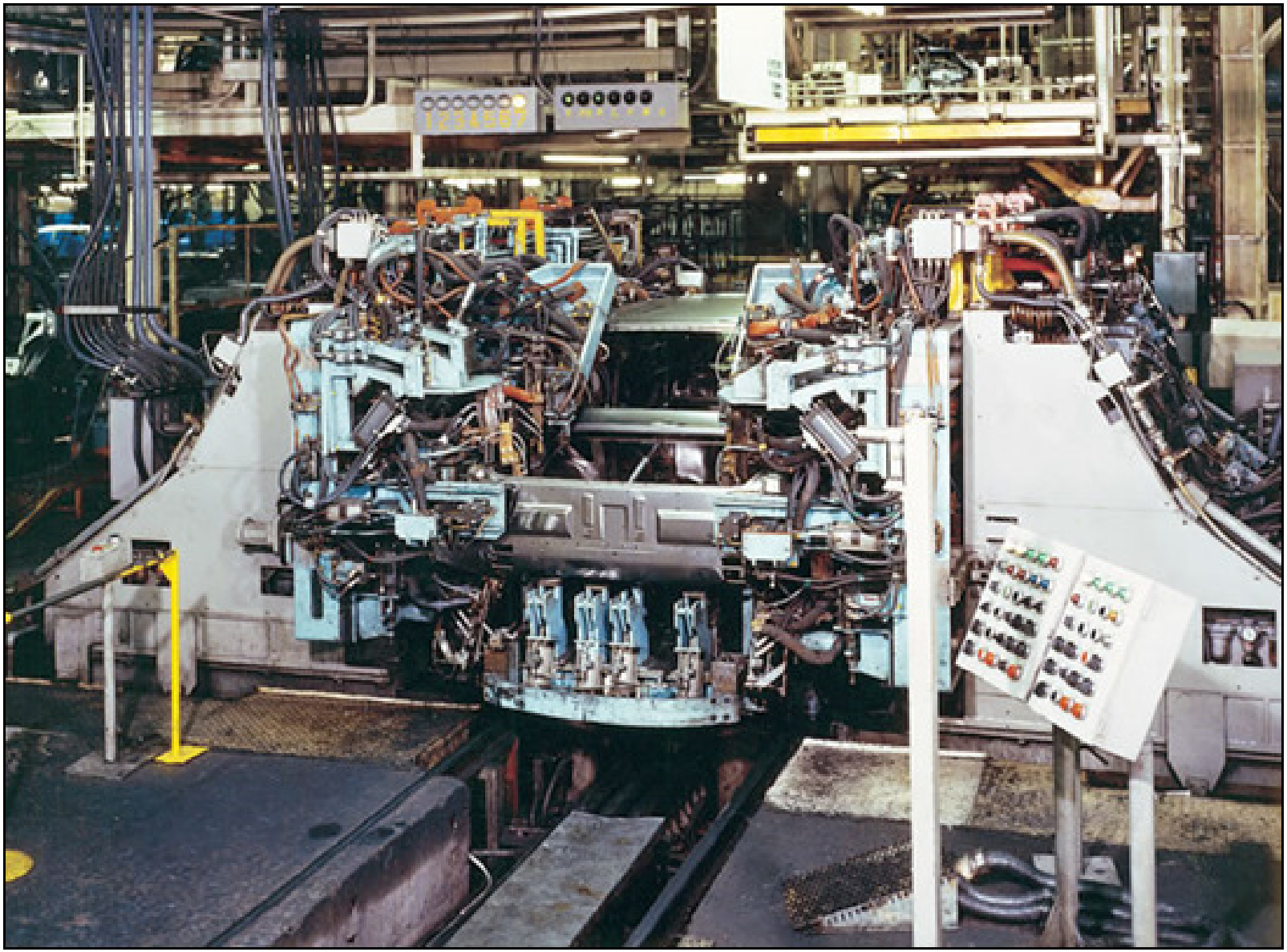
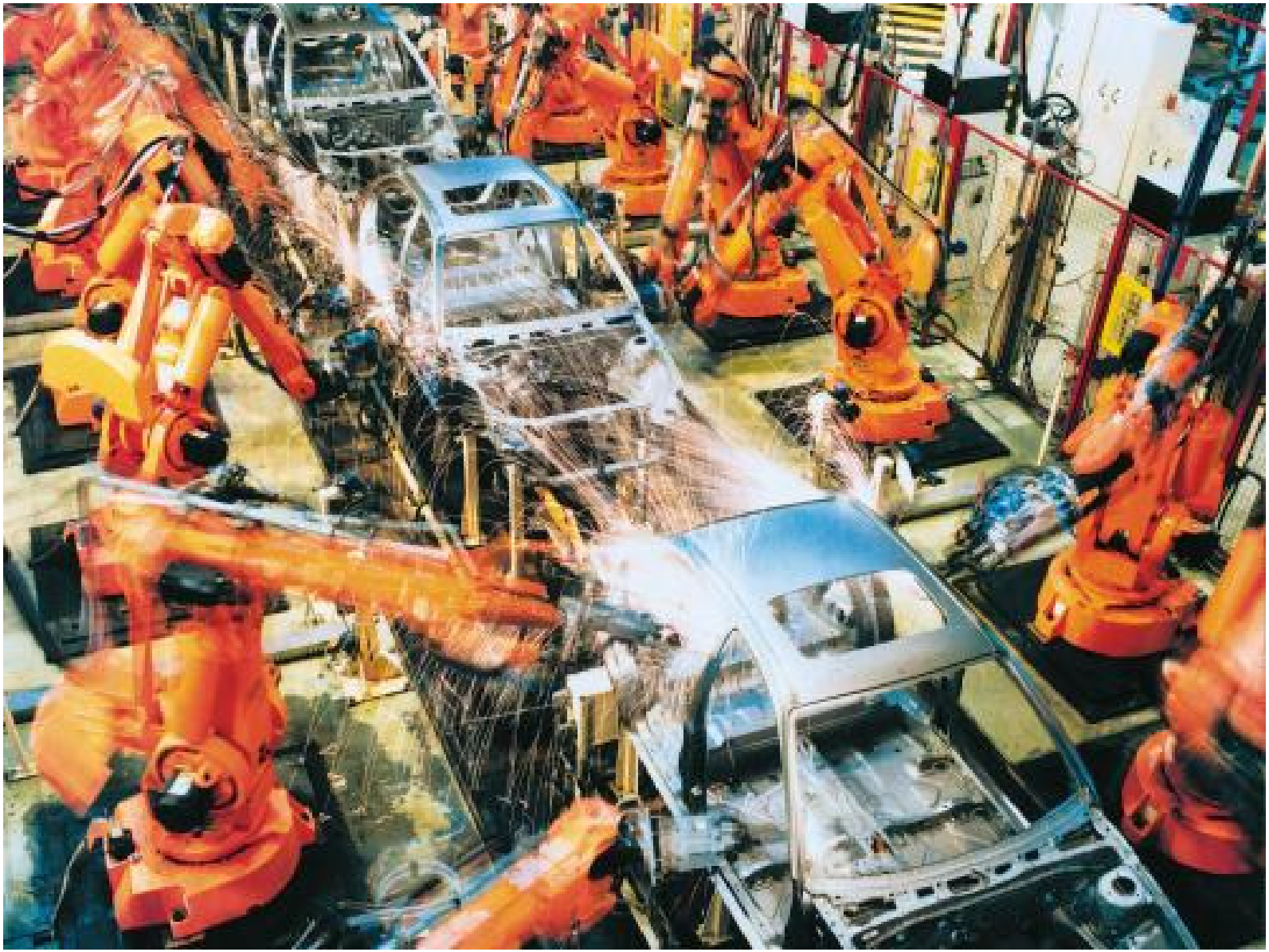
TURKISH
BOEING 737-800
BILECIK
GN
COPYRIGHT CO VAN DEN HEUVEL
AIRLINERS.NET


INTAKE
COMPRESSION
COMBUSTION
EXHAUST
Air Inlet
Compression
Combustion Chambers
Turbine
Exhaust
Cold Section
Hot Section

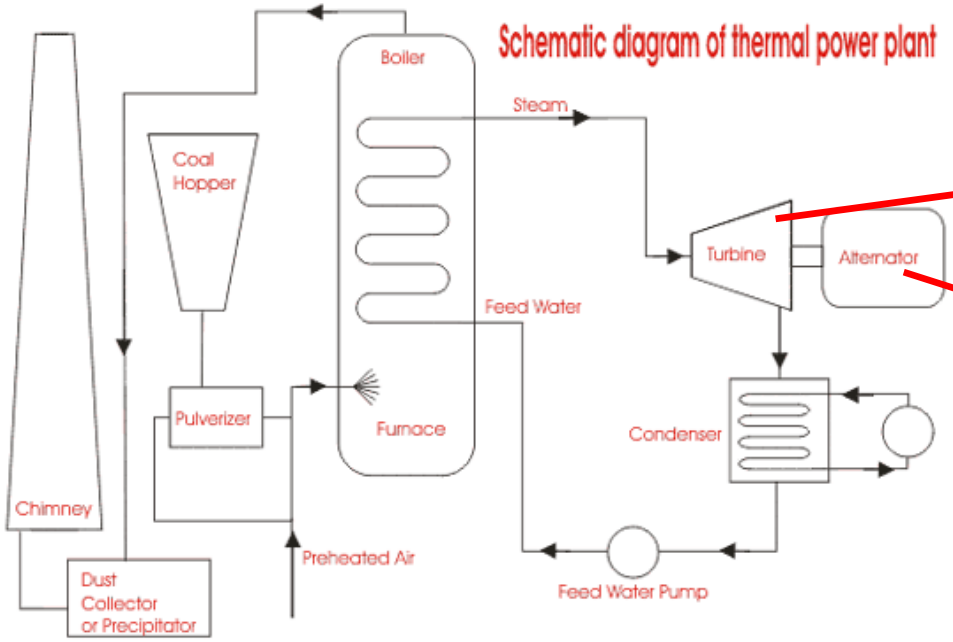


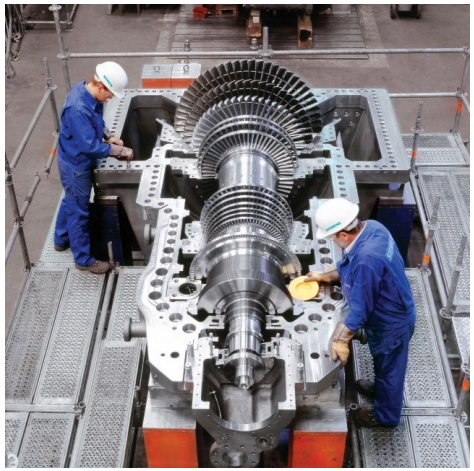


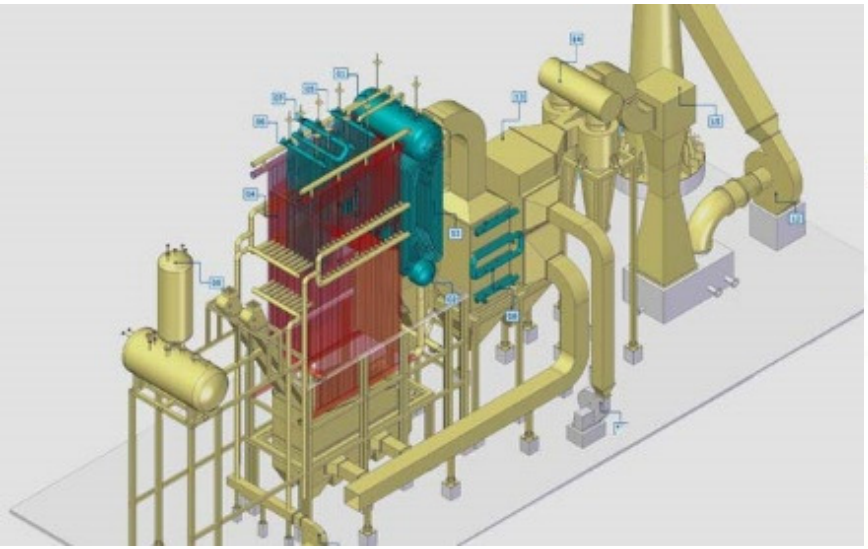


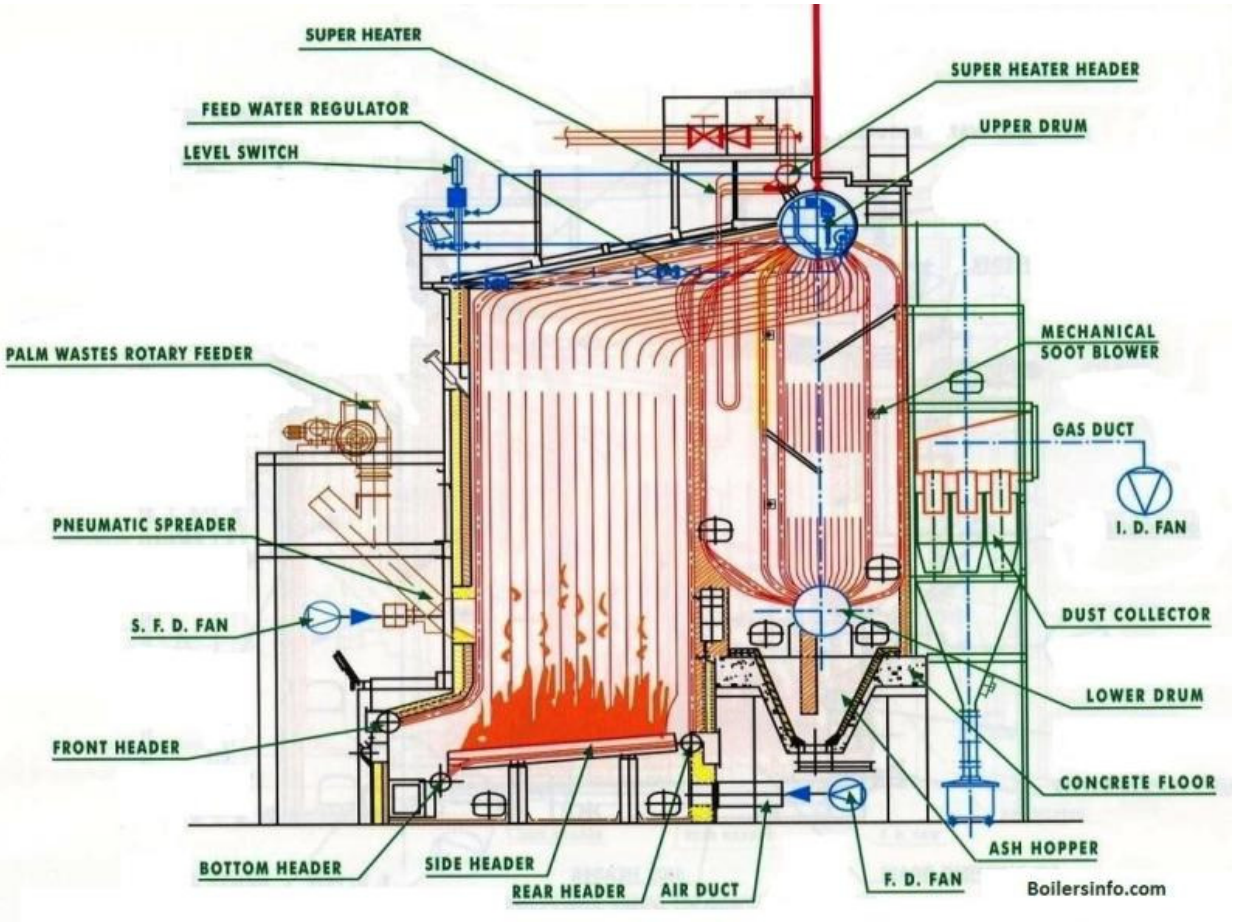

JCB


JUDY 30/3a

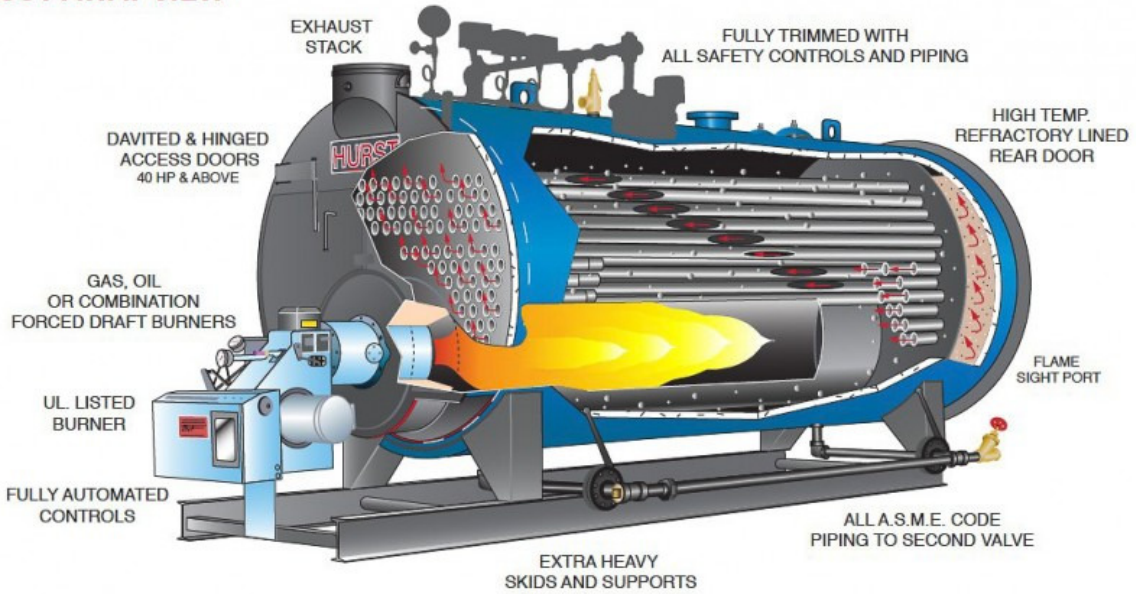

Schematic diagram of thermal power plant
Boiler
Steam
Coal
Hopper
Turbine
Alternator
Feed Water
Pulverizer
Furnace
Condenser
Chimney
Preheated Air
Dust
Collector
or Precipitator
Feed Water Pump

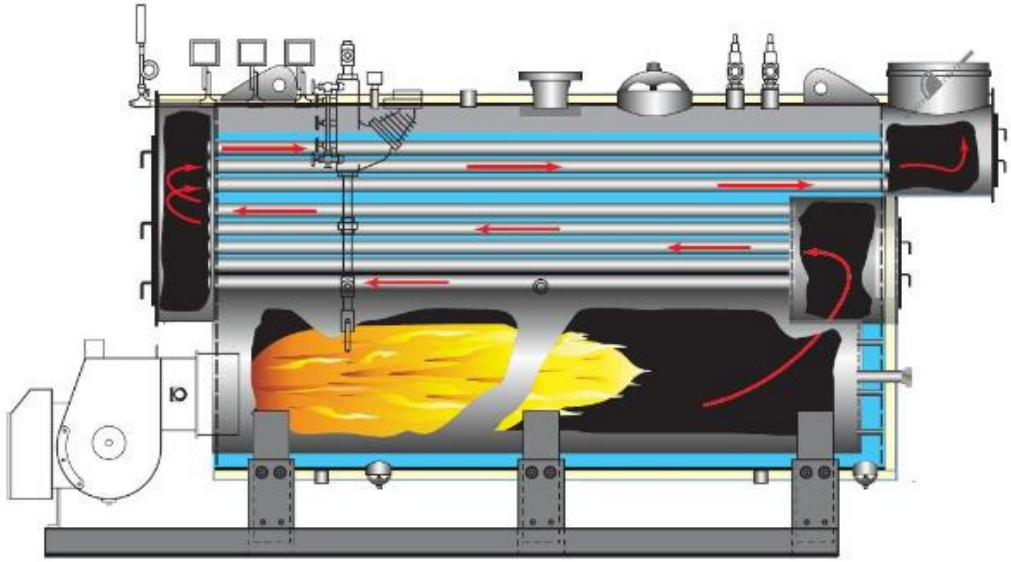





SUPER HEATER
SUPER HEATER HEADER
FEED WATER REGULATOR
UPPER DRUM
LEVEL SWITCH
MECHANICAL SOOT BLOWER
PALM WASTES ROTARY FEEDER
GAS DUCT
I. D. FAN
PNEUMATIC SPREADER
S. F. D. FAN
DUST COLLECTOR
LOWER DRUM
FRONT HEADER
CONCRETE FLOOR
ASH HOPPER
BOTTOM HEADER
SIDE HEADER
REAR HEADER
AIR DUCT
F. D. FAN
Boilersinfo.com

CUT AWAY VIEW






HERMLE


MAD


SMX 3500

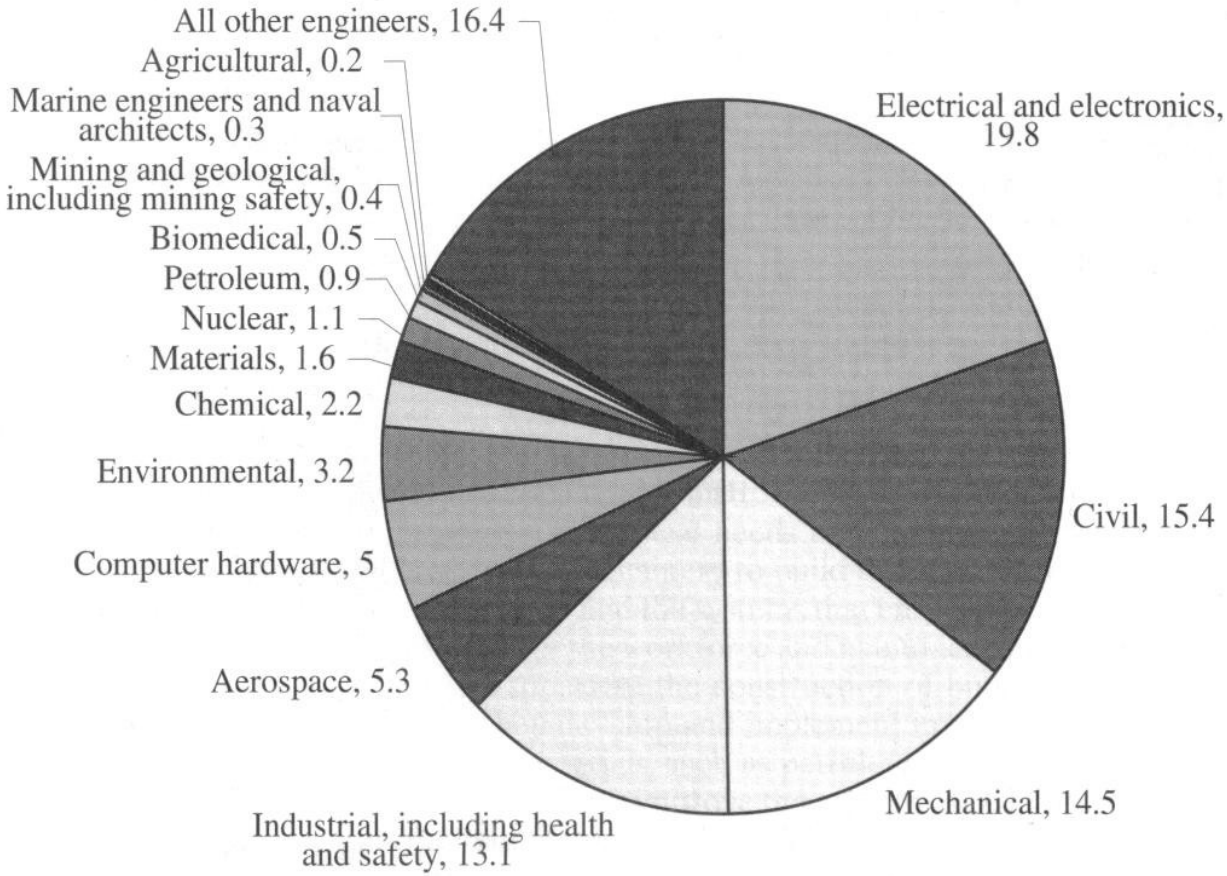
Engineering as a whole is generally broken down into five traditional fields: mechanical, electrical, materials, civil, and chemical engineering.

Electrical engineers work in such areas as the design and production of integrated circuits, wireless communication networks, aviation electronics, robot control systems, and the transmission and distribution of electrical power. Materials engineers work at the boundary of engineering and science in order to develop new compositions of matter that are used in applications encompassing semiconductors, lasers, advanced steel and aluminum alloys, and even the magnetic media used to store information in a computer's hard disk drive. Among their other activities, civil engineers design and construct roads, buildings, airports, tunnels, dams, bridges, and water-supply systems. Environmental concerns are often central to the work of a civil engineer and can encompass environmental biology to reduce the contamination of groundwater, soil, and the atmosphere. Chemical engineers are responsible for the industrial-scale production of chemicals and pharmaceuticals and for managing the by-products of operations in the petroleum, electronics, and biotechnology industries. Even within these disciplines, there are literally dozens of other specializations.

WHO ARE MECHANICAL ENGINEERS?

The field of mechanical engineering encompasses the properties of forces, materials, energy, fluids, and motion and the application of those elements to devise products that advance society and improve people's lives.

Mechanical engineers research, develop, design, manufacture and test tools, engines, machines, and other mechanical devices. They work on power-producing machines such as electricity-producing generators, internal combustion engines, steam and gas turbines, and jet and rocket engines. They also develop power-using machines such as refrigeration and air-conditioning equipment, robots used in manufacturing, machine tools, materials handling systems, and industrial production equipment.



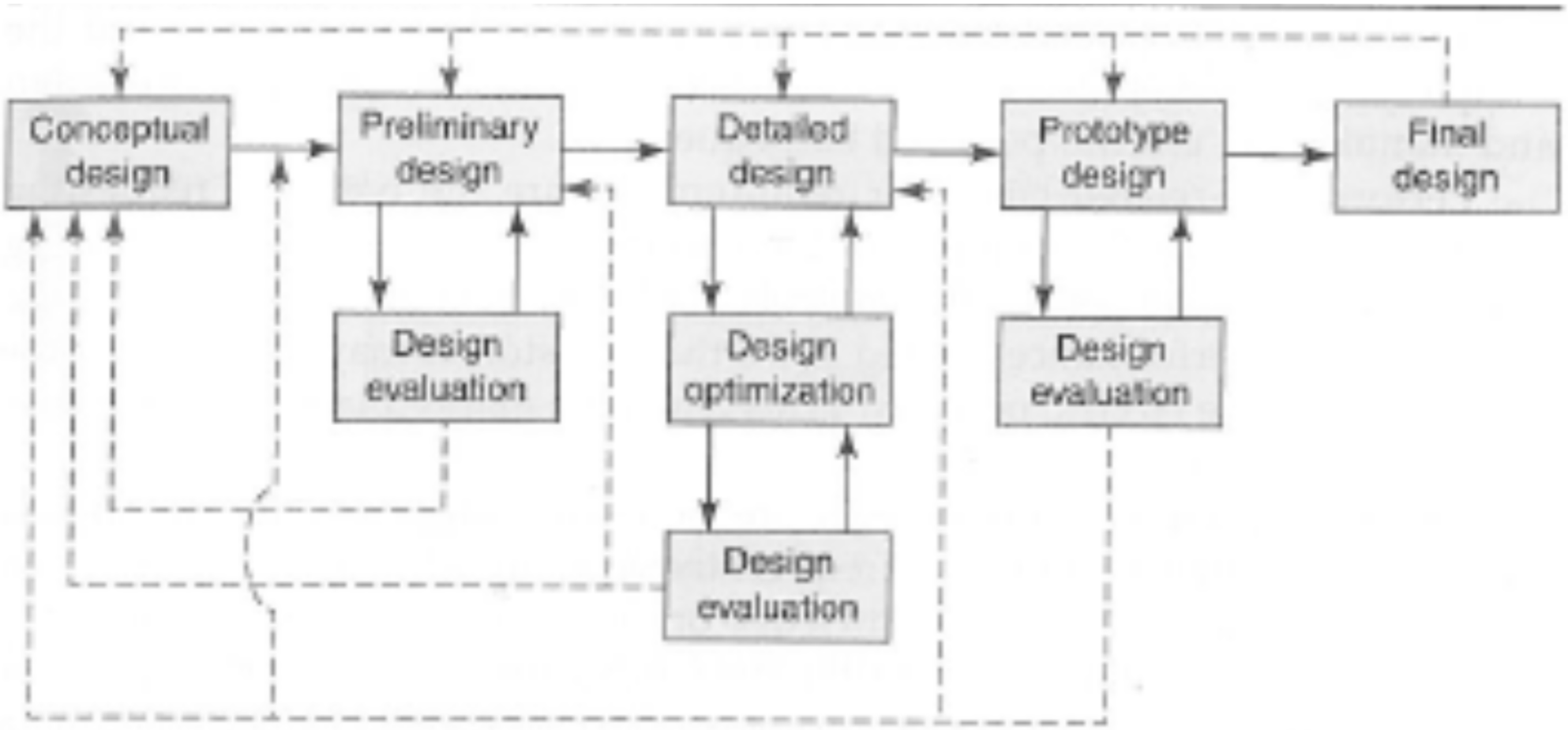
Percentages of engineers working in the traditional engineering fields and their specializations.

Compiled by United States Department of Labor.

. ENGINEERING FUNCTIONS

Regardless of their disciplines, engineers can be classified by the function they perform:

- *Research engineers* search for new knowledge to solve difficult problems that do not have readily apparent solutions. They require the greatest training, generally an MS or PhD degree.
- *Development engineers* apply existing and new knowledge to develop prototype of new devices, structures, and processes.
- *Design engineers* apply the results of research and development engineers to produce detailed designs of devices, structures, and process that will be used by the public.
- *Production (construction) engineers* are concerned with specifying production schedules, determining raw materials availability, and optimizing assembly lines to mass produce the devices conceived by design engineers.
- *Testing engineers* perform tests on engineered products to determine their reliability and suitability by design engineers.
- *Operations engineers* run and maintain production facilities such as factories and chemical plants.
- *Sales engineers* have the technical background required to sell technical products.
- *Managing engineers* are needed in industry to coordinate the activities of the technology team.
- *Consulting engineers* are specialists who are called upon by companies to supplement their in-house engineering talent.



A flow diagram for the categories of engineering design.

Salary Information for Drafters, Architects, and Engineers

Earnings for drafters vary depending on the specialty

civil drafters were $44,490

architects were $70,325

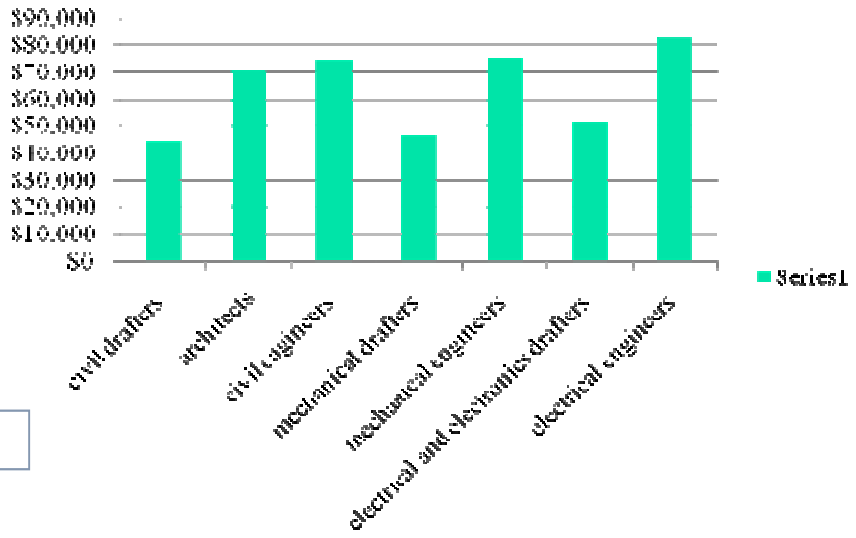
civil engineers were $74,610

mechanical drafters were $46,640

mechanical engineers were $74,922.

electrical and electronics drafters were $51,320

electrical engineers were $82,160



According to the U.S. Department of Labor, approximately 251,900 people were employed as drafters nationwide in 2008. Overall employment for drafters is expected to grow by 4% - 9% between 2008 and 2018.

Acreditation Board for Engineering and Technology- ABET

An organization formed by over two dozen technical and professional societies, including ASME.

ABET is responsible for accrediting the educational programs that grant engineering degrees in the USA, the board has identified a set of skills that new engineering graduates are expected to have

a nonprofit, non-governmental agency that accredits programs in applied and natural science, computing, engineering and engineering technology.

ABET accreditation provides assurance that a college or university program meets the quality standards of the profession for which that program prepares graduates.

ABET accreditation is voluntary, and to date, 4,005 programs at 793 colleges and universities in 32 countries have received ABET accreditation. Over 100,000 students graduate from ABET-accredited programs each year, and millions of graduates have received degrees from ABET-accredited programs since 1932.

Engineering Accreditation Commission (EAC)
Programs:
Engineering
Levels:
Bachelor, Master

Engineering Technology Accreditation Commission (ETAC)
Programs:
Engineering Technology
Levels:
Associate, Bachelor

responsible for setting standards within the independent further and higher education sector. BAC accreditation is held by hundreds of colleges and training providers in the UK and overseas.

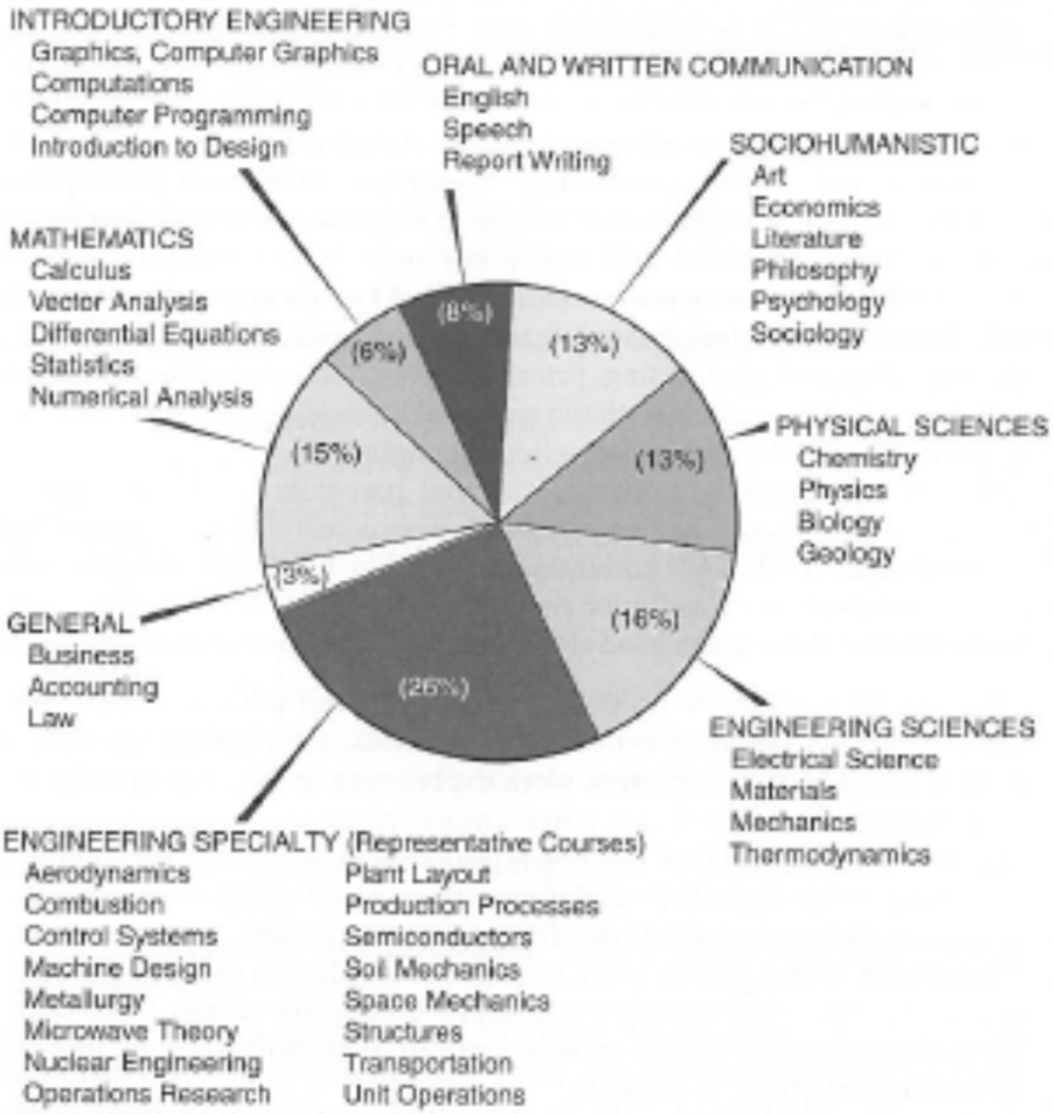
MÜDEK Association for Evaluation and Accreditation of Engineering Programs

Association for Evaluation and Accreditation of Engineering Programs (MÜDEK), is a non-governmental organization operating for the purpose of contributing to the enhancement of quality of engineering education by means of the accreditation and evaluation of and providing information services for engineering education programs in various disciplines.

MÜDEK was initially established with a name Engineering Evaluation Board as an independent, non-governmental platform in 2002 by the Engineering Deans Council (MDK), which is formed by the deans of faculties administering engineering education programs in Turkey and TRNC, in order to prepare and conduct a comprehensive program for the evaluation of engineering undergraduate programs run by these faculties and started the evaluation of engineering programs in 2003. MÜDEK became an association in 2007.

- According to ABET (Accreditation Board for Engineering and Technology, USA) engineering programs must demostrate that their students attain the following outcomes:

a. an ability to apply knowledge of mathematics, science and engineering
b. An ability to design and conduct experiments, as well as to analyze and interpret data
c. An ability to design mechanical and thermal systems, components, or processes to meet the desired needs within realistic constraints
d. An ability to function on multidisciplinary teams
e. An ability to identify, formulate and solve engineering problems
f. An understanding of professional and ethical responsibility
g. An ability to communicate effectively
h. The broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and social context.
i. A recognition of the need for, and an ability to engage in life-long learning
j. A knowledge of contemporary issues
k. An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice



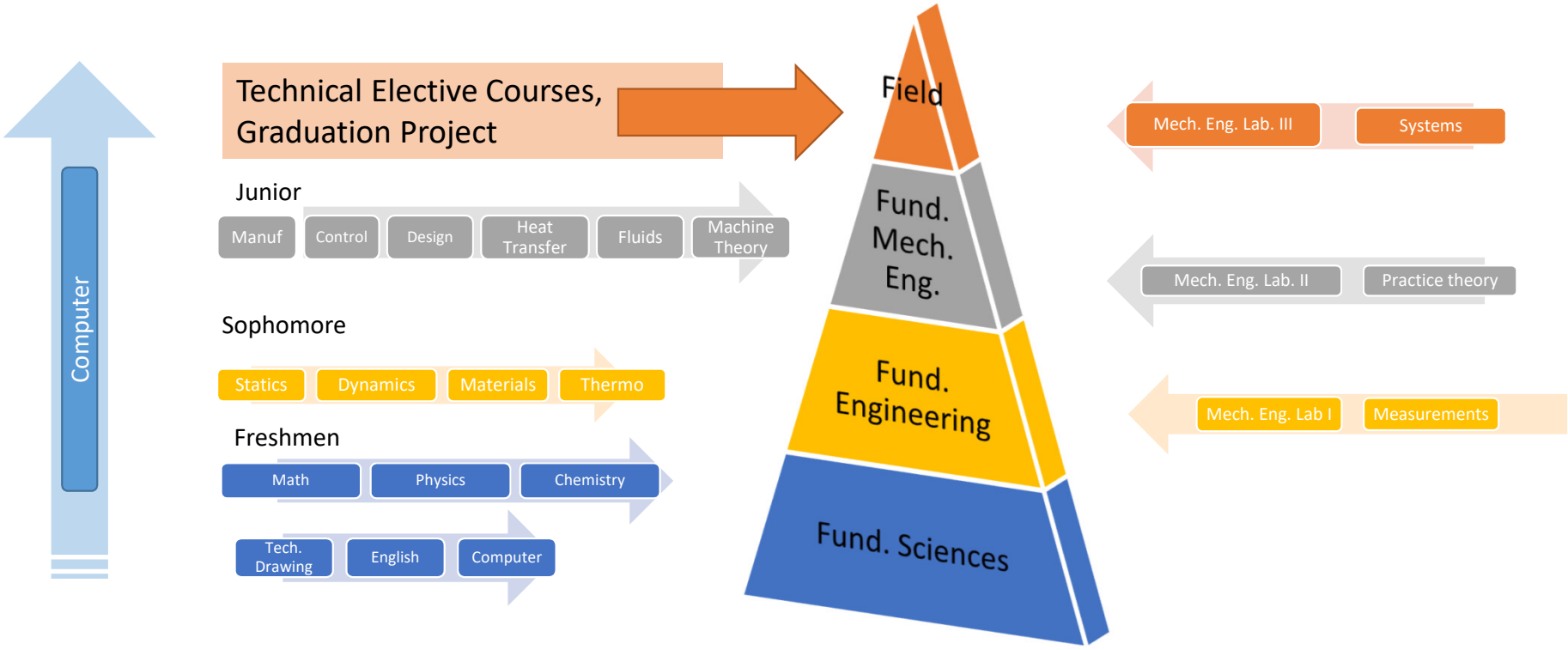
Elements of engineering curricula.

- The Mechanical Engineering program at METU NCC aims at graduating students who:

1. have mastered the fundamental notions of engineering and principles of mechanical engineering discipline.
2. are able to independently learn various applications, think critically, evaluate and find solutions and improve their knowledge and skills.
3. are open to team work, inquisitive, innovative and take initiatives.
4. communicate effectively through oral, written and graphical means, are sociable, well rounded culturally in a diverse and multilingual environment and have broad interests.
5. are aware of their professional and ethical responsibilities.

4 years
(8 semesters)

44 credit courses
(=143 credits)
9 non-credit



METU NCC
Mechanical Engineering
Curriculum

FIRST YEAR		
First Semester		
MAT 119 (a)	Calculus with Analytic Geometry	(4-2) 5
PHY 105	General Physics I	(3-2) 4
CNG 230	Introduction to C Programming	(2-2) 3
MECH 113	Computer Aided Engineering Drawing – I	(2-2) 3
ENGL 101	Development of Reading and Writing Skills I	(4-0) 4
GPC 100	First Year on Campus Seminar	(0-2) 1
CNG 100	Introduction to Information Technologies and Applications	(2-0) NC
Second Semester		
MAT 120	Calculus for Functions of Several Variables	(4-2) 5
PHY 106	General Physics II	(3-2) 4
CHM 107	General Chemistry	(3-2) 4
MECH 114	Computer Aided Engineering Drawing – II	(2-2) 3
ENGL 102	Development of Reading and Writing Skills II	(4-0) 4
MECH 100	Introduction to Mechanical Engineering	(1-1) NC
OCHS 101	Occupational Health and Safety-I	(0-0) NC

SECOND YEAR		
Third Semester		
MAT 219	Differential Equations	(4-0) 4
MECH 202	Manufacturing Technologies	(3-2) 4
MECH 203	Thermodynamics	(4-0) 4
MECH 205	Statics	(3-0) 3
MECH 227	Engineering Materials	(3-0) 3
TUR 101 (b)	Turkish I	(2-0) NC
Fourth Semester		
MAT 210	Applied Mathematics For Engineers	(4-0) 4
MECH 206	Strength of Materials	(3-0) 3
MECH 208	Dynamics	(3-0) 3
MECH 220	Mechanical Engineering Laboratory – I	(2-2) 3
EEE 209	Fund. of Electrical and Electron. Engr.	(3-0) 3
ENGL 211	Academic Oral Presentation Skills	(3-0) 3
TUR 102 (b)	Turkish II	(2-0) NC

THIRD YEAR		
Fifth Semester		
MECH 301	Theory of Machines	(4-0) 4
MECH 305	Fluid Mechanics	(4-0) 4
MECH 307	Mechanical Engineering Design	(3-0) 3
MECH 310	Numerical Methods	(3-0) 3
ECO 280	Engineering Economy	(3-0) 3
HST 201 (c)	Principles of Kemal Atatürk I	(2-0) NC
MECH 300 (d)	Summer Practice – I	NC
Sixth Semester		
MECH 303	Manufacturing Engineering	(3-0) 3
MECH 304	Control Systems	(3-0) 3
MECH 308	Design of Machine Elements	(3-0) 3
MECH 311	Heat Transfer	(4-0) 4
MECH 320	Mechanical Engineering Laboratory – II	(0-2) 1
	Non-Technical Elective	(3-0) 3
HST 202 (c)	Principles of Kemal Atatürk II	(2-0) NC

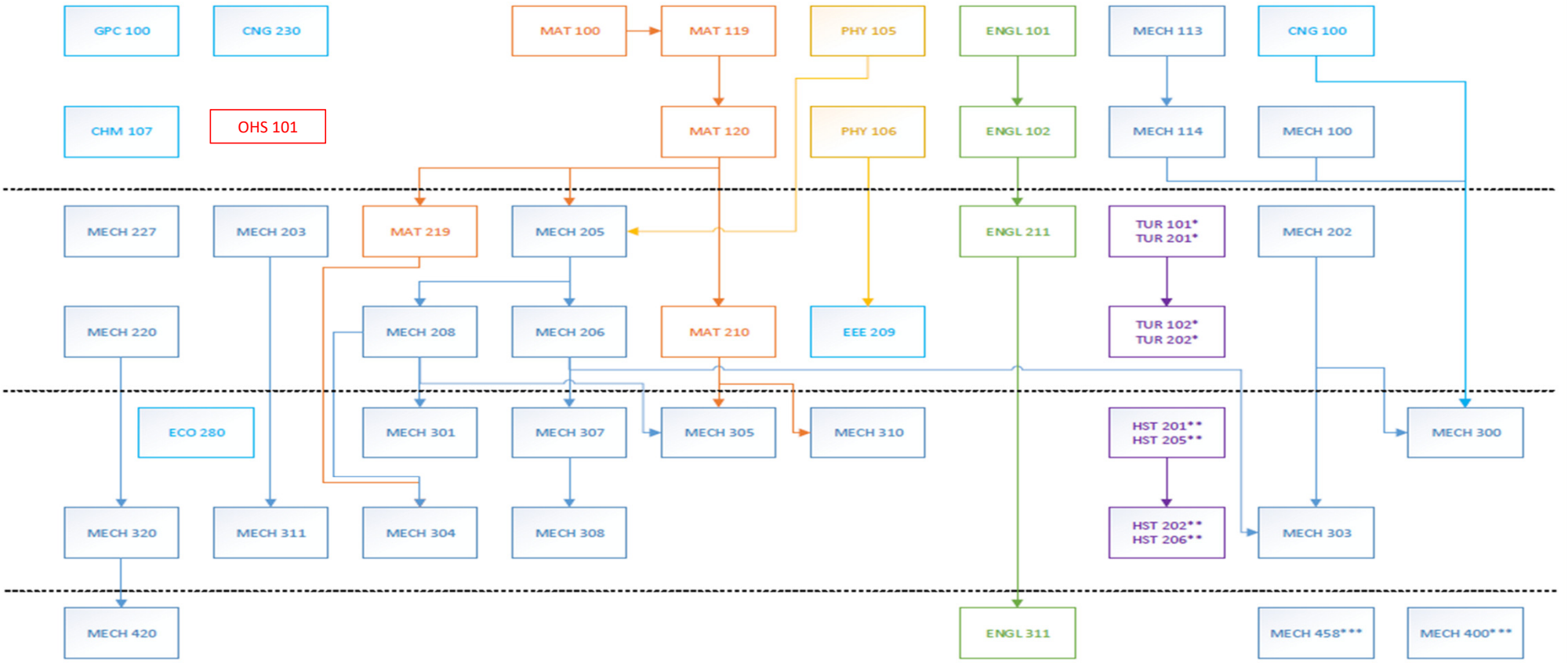
FOURTH YEAR		
Seventh Semester		
MECH 4xx	Technical Elective	(3-0) 3
MECH 4xx	Technical Elective	(3-0) 3
MECH 4xx	Technical Elective	(3-0) 3
	Non-Technical Elective	(3-0) 3
ENGL 311	Advanced Communication Skills	(3-0) 3
MECH 400 (d)	Summer Practice II	NC
Eighth Semester		
MECH 420	Mechanical Engineering Laboratory – III	(0-4) 2
MECH 458	Graduation Design Project	(0-6) 3
MECH 4xx	Technical Elective	(3-0) 3
MECH 4xx	Technical Elective	(3-0) 3
MECH 4xx	Technical Elective	(3-0) 3
	Free Elective	(3-0) 3

Notes:

(a) Students who successfully completed "MAT 100 Precalculus (1-2)2″ course or passed "Mathematics Proficiency Examination" can take MAT 119 course.
(b) International students are required to take TUR 201 and TUR 202 instead of TUR 101 and TUR 102.
(c) International students are required to take HST 205 and HST 206 instead of HST 201 and HST 202.
(d) Students are expected to complete their summer training prior to registering MECH 300 and MECH 400.

METU
NORTHERN CYPRUS CAMPUS

Mechanical Engineering Program
Prerequisites Flowchart



* International students are required to take TUR 201 and TUR 202 instead of TUR 101 and TUR 102.
** International students are required to take HST 205 and HST 206 instead of HST 201 and HST 202.
*** Consent of the program is required for MECH 400 Summer Practice II and MECH 458 Graduation Design Project.

ver. June 2016

	a	b	c	d	e	f	g	h	i	j	k
MECH 100						x		x	x		
MECH 113							x				x
MECH 114							x				x
MECH 202			x	x							
MECH 203	x				x		x				
MECH 205	x				x		x				
MECH 206	x		x		x		x				
MECH 208	x				x		x				
MECH 220		x		x		x	x		x		x
MECH 227	x	x	x		x						
MECH 300			x	x		x	x				x
MECH 301	x		x		x						
MECH 303	x		x		x						
MECH 304	x		x		x		x				
MECH 305	x				x		x				
MECH 307			x		x		x				
MECH 308			x		x		x				
MECH 310	x				x						x
MECH 311	x		x		x						
MECH 320		x		x		x	x				x
MECH 400							x			x	x
MECH 420		x		x			x				x
MECH 458			x	x		x		x	x	x	x
MECH 401	x				x						
MECH 402	x		x		x						
MECH 403	x		x		x						
MECH 405	x		x		x						
MECH 408	x		x		x		x	x	x		x
MECH 413	x				x		x				x
MECH 421	x		x		x		x				x
MECH 429	x		x		x						x
MECH451											
MECH453	x		x		x		x		x		x
MECH461		x	x		x		x		x		x
MECH465											
MECH466	x				x		x		x		x
MECH468											
MECH471	x		x		x		x	x	x		x
MECH478	x		x		x						x
MECH 485	x				x		x		x		x
MECH495	x		x		x		x		x		x

Engineer

Senior engineer

Technology development

Business development

Advanced engineering degrees

Staff engineer

Principal engineer

Fellow

Technical path

Project engineer

Engineering manager

Technical director

Management path

Advanced business degrees

Potential engineering careers encompassing technical and management responsibilities.

Managers

- more than 75% of engineers become managers,
- It is not always necessary to develop technologies,
- Using available technologies in industrial area is more important,

Technical Managers

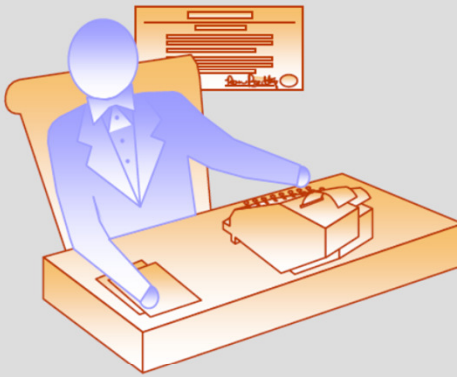
- comprehend new technologies and have an intuitive,
- understanding of which opinion to accept

Managers

Engineers because of their education and training develop an intuition & can quickly learn management skills to run technical industries

Managers

- manage resources, people, money & materials,
  - interpersonal skills are necessary,
- Attend meetings,
- Read reports etc,
- Organize, direct & control several tasks and activities simultaneously



- Most management situations involve problem solving,
- Managerial difficulties also involve solving people's problems,
  - a skill that can be learned &
  - an art that can be refined

Main Duties of Engineering Societies

- Enhance the standing of engineers,
- Maintain and improve standards of engineering education,
- To bring engineers together for exchange of information and ideas,
- To give attention to the professional and economic aspects of the practice of engineering
- Provide reports and opinions on technical issues to local and/or state administrations

THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS ASME

ASME is a not-for-profit membership organization that enables collaboration, knowledge sharing, career enrichment, and skills development across all engineering disciplines

The American Society of Mechanical Engineers

https://www.asme.org/

TMMOB MAKİNA MÜHENDİSLERİ ODASI 1954

Chamber of Mechanical Engineers is a professional association as a public institution which was established in the context of the constitution of Republic of Turkey in 1954. Chamber of Mechanical Engineers is one of the 24 constituent chambers of engineering of the Union of Chambers of Turkish Engineers and Architects.

https://www.mmo.org.tr/