THE ANNALS OF "DUNĂREA DE JOS" UNIVERSITY OF GALATI
FASCICLE III, 2014, VOL. 37, NO. 1, ISSN 2344-4738, ISSN-L 1221-454X
ELECTROTECHNICS, ELECTRONICS, AUTOMATIC CONTROL, INFORMATICS

ELECTRICAL ENGINEERING GUIDE

Marinescu Cristina-Mihaela

PhD student at UPB

Abstract: This paper describes the steps required to form a future electrical engineer. This guide informs what skills a future electrical engineer and what studies need to follow to meet the needs of an employer. This paper explains what educational programs must be completed in order to have a successful career in this field and a salary to match. Engineering is the art of applying scientific and mathematical principles ,experience, judgment, and common sense to make things that benefit people. An electrical engineer is responsible for designing, developing, testing, and supervising the production of electrical equipment and systems, in fields ranging from transportation to lighting and wiring systems to power generation and transmission.

Keywords: electrical engineering**,** degree, industries, system , solutions, schools.

1. INTRODUCTION

Like any other kind of scientist, electrical engineers must also know how to communicate their ideas to others in their field. A successful electrical engineer possesses not only an understanding of his area of concentration, but also a broad grasp of engineering.
This is why most electrical engineering degree programs begin with the fundamentals of engineering itself. Once the student has mastered these fundamentals, she can start to focus on a specialty. Electrical engineers aren't just "techies."
While engineers often work in the technology services arena, their tasks range from designing and building medical equipment to working for the military or Department of Defense.
Contrary to popular belief, electrical engineers don't just sit in their labs alone, tinkering with their latest invention. Electrical engineers often work in groups, so a great deal of teamwork is required from them.
Electrical engineering students learn through a combination of design and lab work.
This mix of theory and practical application allows students to think things through and then apply their ideas in a variety of real life situations.
Students also learn to diagnose problems and develop a variety of solutions.

2. ELECTRICAL ENGINEERING SCHOOL

Students may have an idea of what area of electrical engineering they want to go into.
However, you can expand your horizons when you enroll in an electrical engineering school.
There is a huge range of careers in the field so choosing to attend a specialist school is worth it.
Electrical engineering schools offer a range of degree programs. Admissions requirements vary depending on the nature of the program.
Bachelor degrees require a high school diploma or GED whereas a master's degree will require an undergraduate degree in a relevant field.
Each program prepares you to enter the workforce with the skills and training necessary to obtain employment. Bachelor of Electrical Engineering (B.S.): An entry-level undergraduate degree, the BS focuses on providing students with a comprehensive introduction into the field of electrical engineering.
Usually combined with computer science and other forms of engineering, students have the opportunity to gain a broad knowledge of the field.
This degree provides a strong foundation for more advanced study in the future or for entry-level employment in the field.
Master of Electrical Engineering (M.S.): A master's program is an advanced degree that promotes hands on and practical learning as well as theoretical education. Students can choose from a range of courses but are often provided with mentoring to enhance their employment prospects following graduation. What's unique about graduate-level programs is the ability to choose from a variety of specializations. Doctor of Electrical Engineering (Ph.D.): Finally, the Ph.D. in electrical engineering is designed to enhance research into the field and students are encouraged to formulate their own theories and innovations.

This paper was recommended for publication by Adrian Filipescu

There is a strong mentoring tradition with this degree so those wanting to take their education as far as possible gain significant benefits.

3. CAREERS FOR ELECTRICAL ENGINEERING GRADUATES

A degree in electrical engineering can qualify you to pursue a job in almost any industry you can think of. After all, nearly everyone uses electricity and electrical devices, so industries demand skilled professionals to build, repair, and improve these devices. Electrical engineering majors enjoy many options, more than enough for any student to find a job in a field he loves. The following job titles represent only a handful of the choices available:

a) Research engineers work in the lab, testing and inventing. This job requires a high level of creativity on the part of the engineer, as well as a great deal of patience. Whether inventing a new optoelectronic device or simply designing a better electric can opener, research engineers are responsible for the discovery-stage technology behind any new electronic product. Once a new technology is invented, it must be applied.

b) The design engineer uses computer simulations and models to turn innovations like wireless technology into the tiny parts that make up an actual cell phone.

Design engineers must visualize how the insides of a future product could look, while inventing several possible scenarios for the applications of new technologies.

Fig.1. The design engineer

c) The project engineer oversees many specialist engineers throughout the construction of a working prototype of a new product or technology.

The project engineer must have natural leadership ability, as well as a high proficiency in a variety of electrical engineering disciplines.

d) Test engineers design programs to check the functions of electronic devices and to troubleshoot those devices when things go wrong. They keep technology working properly, and understand which elements to test and in what order. Successful test engineers remain sharp, even after long hours on the job.

e) Power grids, phone lines, and wireless networks all require the skills of a system engineer for proper installation and maintenance.

Keen attention to detail is important for graduates who enter this profession. Experienced system engineers rely on their ability to think holistically about the systems they create.

f) Application engineers work with whatever resources are available, adapting existing equipment and technologies to fulfill the needs of their employers. They need to be resourceful, while counting on their deep understanding of the capabilities and the potential modifications of existing equipment.

4. ELECTRICAL ENGINEERING ONLINE

Stony Brook University's Bachelor of Science in Electrical Engineering online (BSEEOL) degree program provides students with the flexibility and convenience needed to complete a Bachelor of Science degree in electrical engineering while working full-time. This program is ideal for professionals and qualified students who are seeking an excellent education in electrical engineering and commensurate opportunities for career advancement.

The BSEEOL program is administered by Stony Brook University and courses are taught online by faculty members at Stony Brook University, University at Buffalo and Binghamton University. This program offers upper-division undergraduate courses, typically offered during the third and fourth years of a four-year undergraduate program in Electrical Engineering. The program is taught completely online, asynchronously delivered for flexible scheduling, and provides all courses, materials, tests, labs, discussions, advising and contact with faculty completely online over the Internet. Note that, however, some prerequisite admission requirements may require students attend on-site courses. For example, a year of calculus-based Physics with laboratory is a required admission requirement for the program.

Some students satisfy this admission requirement by attending onsite courses in local universities / community colleges. Furthermore, students are required to go to proctoring centers or other approved venues to take exams in some courses.

A limited amount of synchronized sessions with instructors may also be required in some courses with hands-on component. BSEE Online is a NY state approved degree program in Electrical Engineering.

This program is supported by the College of Engineering and Applied Sciences at Stony Brook University.

5. OPPORTUNITIES

Electrical engineering is a very practical field.
You'll be able to use what you learn to create and fix things on your own time.
Additionally, as an engineer, you'll learn how to solve problems--the ultimate transferable skill.
Along with problem solving, you'll exercise your creativity and gain practical skills like writing and programming.
If you opt for a late life career change, a background as an engineer will prepare you well for a variety of fields. This field doesn't require you to have an advanced degree in order to find work.
With a bachelor's degree you will be able to enter the workforce and start earning money faster.
That means less student loan debt and more hands-on experience. Unlike becoming a doctor or professor, engineers are able to earn high salaries without putting in years of extra schooling.

6. TIPS FOR SUCCESS

1) Identify the people who inspire you, and find out what makes them tick. If you love Apple products, Steve Jobs may be your idol, or perhaps you love the Segway and its creator, Dean Kamen.
You can easily find out a lot of information about Jobs and Kamen or just about any other prominent person in technology so use it to look into what's helped these people and their companies become so successful. Then emulate their good traits in your personal, scholastic, and professional life.
2) Develop a portfolio of projects. Participate in every hands-on, experiential learning opportunity that a balanced schedule allows.
This way, you'll have something unique to show a prospective employer (or venture capitalist) when you graduate, while other students will only be able to list their courses. applying it and, in the process, boosting your communication and interpersonal skills.
3) Learn the value of networking. When it comes to being a leader, whom you know is almost as important as what you know. Attend lectures on your campus and introduce yourself to the speakers. Check with your school's alumni association to get a list of alumni from your program who want to connect with undergraduates.
4) Star Tip. In addition to E-mail, you can use LinkedIn or other social media tools to connect online. But remember: There's no substitute for a traditional, face-to-face meeting, so if you can find a way to meet in person, that's always the best.
5) Work in teams as much as you can.
Whether it's creating a solar-powered car, participating in a sport, or writing for the school paper, get involved with an organization that requires a team effort to produce great results.
Throughout your career, you can be sure you'll work in teams, and the skills you develop in school will help prepare you to lead teams when you graduate.
6) **S**eek informal leadership roles. You're always a leader, whether you're officially in charge of a team or not. Sounds counterintuitive, but you can lead from any position in an organization by influencing how people work together and how they make decisions. Usually people think that the leader is the president or the manager, but if you learn how to recognize and deal with various leadership styles from any position in a team, you'll be seen as a leader when you take on your first job or internship.
7) Find your flaws and fix them. As with any skill, leadership needs constant improvement.
When you are part of a team, try to create a way to get feedback from team members, group leaders, and professors. When you have concrete feedback on how people view you, you can work to improve your skills, including communication and leadership.
Plus, you'll learn how to accept and give constructive criticism. That's absolutely necessary for your future career.
8) Take a business class. As an engineer, it's not enough for you to be technically proficient; you need to have business savvy. If you're going to be a leader, you need to understand what a P&L is (also known as an income statement), read organization charts, know how to negotiate contracts, and be familiar with the myriad other functions that every top engineer needs to know. Otherwise, you won't understand what to do when an accountant, lawyer, or middle manager gets in the way.
A business course or two can take you a long way, and these classes are often easier to pass than your calculus course!
9) Take design and other humanities classes.
There's a wide world out there beyond problem sets, laboratories, and theory. Take a visual design course so you'll learn to represent ideas graphically.
Take a cognitive science course to learn how people interpret the world and understand it.
Take a literature course to develop your knowledge and appreciation of the classic books, which will help you write and communicate more effectively.
10) Make your summers productive. Employers place tremendous value on practical experience.
Seek out internship opportunities actively and early in your academic career. Try to demonstrate through your internships a series of evolving leadership experiences, and use the internships to build your portfolio of actual projects/products.
New graduates who can show a commitment to using their summer to continue to learn are always viewed more seriously by a prospective employer.
11) Recruit and develop your personal board of directors. As an undergraduate, you might feel alone when confronted with hard decisions about the courses to take, jobs to apply for, or even balancing school work and your personal life.

You won't feel alone if you develop a personal board of directors just for you.

Just as a company has a board that guides the organization, you can stock your board with professionals from organizations and companies, as well as former teachers and knowledgeable family friends.

7. ENGINEERING FOR THE DEVELOPING WORLD

The world is becoming a place in which the human population (which now numbers more than six billion) is becoming more crowded, more consuming, more polluting, more connected, and in many ways less diverse than at any time in history.

There is a growing recognition that humans are altering the Earth's natural systems at all scales, from local to global, at an unprecedented rate, changes that can only be compared to events that marked the great transitions in the geobiological eras of Earth's history (Berry, 1988).

The question now arises whether it is possible to satisfy the needs of a population that is growing exponentially while preserving the carrying capacity of our ecosystems and biological and cultural diversity. A related question is what should be done now and in the near future to ensure that the basic needs for water, sanitation, nutrition, health, safety, and meaningful work are fulfilled for all humans.

These commitments were defined as the "Millennium Development Goals" by the United Nations General Assembly on September 18, 2000.

In the next two decades, almost two billion additional people are expected to populate the Earth, 95 percent of them in developing or underdeveloped countries (Bartlett, 1998). This growth will create unprecedented demands for energy, food, land, water, transportation, materials, waste disposal, earth moving, health care, environmental cleanup, telecommunication, and infrastructure.

The role of engineers will be critical in fulfilling those demands at various scales, ranging from remote small communities to large urban areas (megacities), mostly in the developing world (United Nations, 1998). If engineers are not ready to fulfill such demands, who will? As George Bugliarello (1999) has stated, the emergence of large urban areas is likely to affect the future prosperity and stability of the entire world. Today, it is estimated that between 835 million and 2 billion people live in some type of city slum and that the urban share of the world's extreme poverty is about 25 percent (United Nations, 2001). Considering the problems facing our planet today and the problems expected to arise in the first half of the twenty-first century, the engineering profession must revisit its mindset and adopt a new mission statement - to contribute to the building of a more sustainable, stable, and equitable world.

As Maurice Strong, Secretary General of the 1992 United Nations Conference on Environment and Development, said, "Sustainable development will be impossible without the full input by the engineering profession." For that to occur, engineers must adopt a completely different attitude toward natural and cultural systems and reconsider interactions between engineering disciplines and nontechnical fields.

For the past 150 years, engineering practice has been based on a paradigm of controlling nature rather than cooperating with nature.

In the control-of-nature paradigm, humans and the natural world are divided, and humans adopt an oppositional, manipulative stance toward nature.

Despite this reductionistic view of natural systems, this approach led to remarkable engineering achievements during the nineteenth and especially twentieth centuries.

For instance, civil and environmental engineers have played a critical role in improving the condition of humankind on Earth by improving sanitation, developing water resources, and developing transportation systems.

Ironically, these successes have unintentionally contributed to current problems by enabling population growth (Roberts, 1997).

Most engineering achievements of the past were developed without consideration for their social, economic, and environmental impacts on natural systems. Not much attention was paid to minimizing the risk and scale of unplanned or undesirable perturbations in natural systems associated with engineering systems.

As we enter the twenty-first century, we must embark on a worldwide transition to a more holistic approach to engineering.

This will require: (1) a major paradigm shift from control of nature to participation with nature; (2) an awareness of ecosystems, ecosystems services, and the preservation and restoration of natural capital; and (3) a new mindset of the mutual enhancement of nature and humans that embraces the principles of sustainable development, renewable resources management, appropriate technology, natural capitalism (Hawken et al., 1999), biomimicry (Benyus, 1997), biosoma (Bugliarello, 2000), and systems thinking (Meadows, 1997).

In addition, engineering educators must take a closer look at how engineering students are being prepared to enter the "real world."

Current graduates will be called upon to make decisions in a socio-geo-political environment quite different from that of today.

In their lifetimes, engineering students now attending college can expect to see an increase in world population from 6 to 9 or 10 billion people, major global warming phenomena, and major losses in biological and cultural .diversity on Earth.

Whether colleges and universities are doing enough proactively to teach students what they need to know

to operate in a future environment is an open question (Orr, 1998). Clearly, engineers must complement their technical and analytical capabilities with a broad understanding of so-called "soft" issues that are nontechnical. Experience has shown that social, environmental, economic, cultural, and ethical aspects of a project are often more important than the technical aspects.

An issue of equal importance is the education of engineers interested in addressing problems specific to developing communities.

These include water provisioning and purification, sanitation, power production, shelter, site planning, infrastructure, food production and distribution, and communication, among many others.

Such problems are not usually addressed in engineering curricula in the United States, however. Thus, our engineers are not educated to address the needs of the most destitute people on our planet, many of them living in industrialized countries.

This is unfortunate, because an estimated 20 percent of the world's population lacks clean water, 40 percent lacks adequate sanitation, and 20 percent lacks adequate housing.

Furthermore, engineers will be critical to addressing the complex problems associated with refugees, displaced populations, and the large-scale movement of populations worldwide resulting from political conflicts, famine, shortages of land, and natural hazards. Some of these problems have been brought back to our awareness since the tragedy of September 11, 2001. The engineers role is critical to the relief work provided by host governments and humanitarian organizations.

According to the World Health Organization (WHO), 1.8 billion people (30 percent of the world's population) currently live in conflict zones, in transition, or in situations of permanent instability.

It is clear that engineering education needs to be changed (or even reinvented) to address the challenges associated with these global problems.

There is still a large disconnect between what is expected of young engineers in engineering firms, the magnitude of the problems in our global economy, ABET 2000 engineering criteria (Criteria3 and 4 for instance), and the limited skills and tools traditionally taught in engineering programs in U.S. universities. Engineers of the future must be trained to make intelligent decisions that protect and enhance the quality of life on Earth rather than endangering it.

They must also make decisions in a professional environment in which they will have to interact with people from both technical and nontechnical disciplines. Preparing engineers to become facilitators of sustainable development, appropriate technology, and social and economic changes is one of the greatest challenges faced by the engineering profession today. Meeting that challenge may provide a unique opportunity for renewing leadership of the U.S. engineering profession as we enter the twenty-first century.

8. CONCLUSION

Creating a sustainable world that provides a safe, secure, healthy, productive, and sustainable life for all peoples should be a priority for the engineering profession. Engineers have an obligation to meet the basic needs of all humans for water, sanitation, food, health, and energy, as well as to protect cultural and natural diversity. Improving the lives of the five billion people whose main concern is staying alive each day is no longer an option; it is an obligation.

Educating engineers to become facilitators of sustainable development, appropriate technology, and social and economic changes represents one of the greatest challenges faced by the engineering profession today. You might be in full-time employment for the next 40 or 50 years so it is important that you choose a career that gives you plenty of enjoyment and satisfaction.

If you need futher convincing that a career in engineering is right for you, then read on!

a) Never a dull moment
b) Benefit Society
c) Explore the world
d) Professional Environment
e) Challenging Work
f) Prestige
g) Technological and Scientific Discovery
h) Financial Security
i) Variety of Career Opportunities
j) Greater understanding of how things work

9. REFERENCES

Garrison, R. D., & Kanuka, H. (2004). *Uncovering its transformative potential in higher education. The Internet and Higher Education*, 7, 95-105.

http://www.jobguide.thegoodguides.com.au/occupation/Electrical-Engineer

Pivic, M. (2007). *Play and learn: Potentials of game-based learning. British Journal of Educational Technology*, *38*(3), 387–393.

Allenby, B. (1998). *Earth systems engineering: the role of industrial ecology in an engineered world. Journal of Industrial Ecology ,2*: 73- 93.

Berry, T. (1988). *The Dream of the Earth. San Francisco: Sierra Club Books.*

Bugliarello, G. (1999). *Megacities and the developing world.* The Bridge 29(4): 19-26.