ENGINEERING – THE WAY AHEAD*

By

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Abstract:

Engineering / Medical education is the most sought after degree in India in
Higher Education sector. India has close to 800 universities offering engineering degree
programmes and close to 4000 engineering colleges across the country. These
institutions market their programmes (disciplines) in terms of course content, best
practices followed in their institutions etc for admissions. But, unfortunately, students
are less informed about career prospectus in the programmes of study. In this paper an
attempt has been made to highlight about career prospectus in various engineering
programmes.

Introduction

Education has been considered as one of the very important domains in our country.
India’s higher education system is the third largest in the world after China and the
United States.

Engineering education in India was started in 1840’s to generate professionals
for catering to the needs of surveying, irrigation, civil construction and maintenance. The
classes started in Bombay and Madras. But, it did not have good response and both
the schools were short lived.

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The first Technical Institute was established in Roorkee in the year 1847, with civil engineering in focus. This was known as Thomason College of Engineering.

In 1857, three Universities were set up in Calcutta, Bombay and Madras.

Towards the end of the 19th century, there were 4 engineering colleges, 20 survey schools and technical institutes and 50 industrial schools in India.

India launched a massive program for planned development soon after becoming independent. In the early years of independence, apart from shortage of material resources, the country faced acute shortage of technicians and graduate engineers. An ambitious program of expansion of technical education was undertaken to overcome this problem.

After the Second World War and with enhanced activity of Indian Independence movement, getting experts and Professors from Britain or elsewhere became more and more difficult. To overcome this crisis, Sarkar committee was constituted in 1945 for addressing the necessary measures for expansion of technical education in the country and also to improve the manpower. By 1946, there were 46 engineering degree colleges with a total intake capacity of 2500 students. There was no scope for post-graduate education and one had to go abroad. Most of these institutions were managed by Britshers.

In earlier days, we had only Electrical, Mechanical and Civil Engineering and no other disciplines. With the advancement of technology other disciplines were added later.

From 1990 onwards liberalization has taken place with huge private participation. This was initiated to meet the increasing demand for persons with competence in science, engineering, technology, management, computers, medical and agricultural sciences. This increasing demand for professionals in these fields has necessitated rapid growth particularly in professional courses. National Knowledge Commission in its
report recommended setting up of at least 1500 Deemed to be universities by 2015 and has recommended starting of at least 50 more National Universities. It has also recommended that Deemed to be universities be formed through Independent Regulatory Authority for Higher Education (IRAHE). It is obvious that in the years to come India will have more and more universities

**Programme wise Discussions**

Let me mention to you about job opportunities in various programmes.

**Computer Science**

It is difficult to imagine a world without computers now-a-days. Owning a computer was a luxury just two decades back and has become a necessity now. Now, there is no area left in engineering or our real life which do not use computers. Call it finance, health care, transport, agriculture computers find wide applications. Computers have become an indispensable part of human civilization.

Computers find applications in all disciplines of engineering. For example, if I take mechanical engineering, today almost all companies are moving towards automation. Conventional machines used earlier are getting replaced by computer controlled machines. In advanced countries, humans are being replaced by robots. Different activities of manufacturing such as design (Computer Aided Design-CAD), drawing (Computer Aided Design and Drawing-CADD), planning (Computer Aided Process Planning- CAPP) etc. are being done with the help of computers. Even activities such as material planning, inventory control, finance estimates are all done with the help of computers. Same is the position in other programmes of engineering. Why only engineering programmes, computers find applications in medical applications, agricultural applications etc. This widened application of computers has increased job opportunities not only for computer science engineers, but also for other programmes of engineering. Also, the applications of computers in all fields will continue and we need more computer engineers in the years to come.
But I suspect Computer Science may not remain as computer science any more in the years to come. It may take several spin-offs. For example already we have Information Technology (IT) which is a spin-off from computer science. Other spin-offs could be computer graphics, computer game design are likely in the days to come.

Computers have become so insidious that in the days to come, the study of computing may soon be subsumed by other academic subjects.

The IT revolution has probably reached a billion people of the world so far. In the next 5 years, it is expected that it will reach the next billion. This is likely to create more job opportunity for computer and IT engineers.

Keep in mind, today more and more people are going computer savvy and computer science / IT find more applications in every aspect of the real life.

In a survey conducted by U.S. Department of Labor predicts that computing-based jobs will be among the fastest-growing and highest-paying over the next decade. It is predicted that by the year 2018, there shall be a requirement for 1.4 million computer specialist jobs. But, unfortunately so many graduates are not available in the market to cater to the requirement.

In last 3 to 4 years, software field and IT sectors were highly demanded by the private companies and most of the engineering graduates are getting jobs in the computer area irrespective of the discipline they study.

Before 1990 there were only 13,500 seats in CSE / IT in India. In the year 2007 there were 193,000 seats of computer science / IT in engineering colleges in India whereas around 22,700 seats of civil engineering in India. This statistics shows the exponential growth in the area of computer science engineering.
Today computer science and related fields are among the highest job paid. Irony is for computer science / IT professionals salary is either on the top during software boom or at rock bottom during recession.

As a computer engineer you have a wide range of options like:

Software Engineer / Programmer, Developer (.NET / JAVA / C++ etc...),
Network Administrator, Database Administrator, Network Programmer, Tester
System Analyst, Business Analyst, System Engineer, Hardware Engineer and Support Specialist

Civil Engineering

Amongst all branches of engineering, the range and application of civil engineering is the broadest and the most evident.

According to the recent report of Royal institute of chartered surveyors, by 2020 there will be need of 400,000 civil engineers are required but today there are only 65,000 professionals available.

According to the latest report by NassComm, in future civil engineers are going to have good demands.

Indian government need civil engineers in large numbers but due to lack of civil engineering professionals’ governments are delaying their works.

Between 2000 to 2014, the Indian government has invested a lot of money in the construction sector. The money is around Rs.13,000 Crore. In whole country around 100 smart cities are going to build and by 2020 bullet trains are going to start in our country. This is expected to invite huge investment from government and private sectors creating more jobs for civil engineering and also for other programmes of engineering.
It is expected that projected urban population by 2020 will increase by 40%. This increase in urban population, creates necessity for more civil engineers for design and construction of transportation, water supply, pollution control systems, buildings etc.

Transforming India creates more job opportunities in civil engineering field. May it be transport, architecture, drinking water facilities, building concepts, railway concepts.

Civil engineers are also needed to repair or replace existing roads, bridges, and other public structures. Construction industries, architectural, engineering and related services employ many civil engineers employment opportunities will be bright for civil engineers.

As a Civil Engineer you can work in the areas of structural; environmental; geotechnical; water resources; transportation; construction; urban planning etc.

Jobs directly related to civil engineering degree include:
Building control surveyor, Consulting civil engineer, Contracting civil engineer, Nuclear engineer, Site engineer, Structural engineer, Water engineer, Building services engineer, Engineering geologist, Environmental consultant, Patent attorney Quantity surveyor etc.

**Electrical, Electronics and Communication Engineering**

Future for electrical, electronics and communication engineers in India and globally is encouraging.

The electronics market in India is one of the largest in the world and is anticipated to reach US$ 400 billion in 2022 from US$ 69.6 billion in 2012. The market is projected to grow at a compound annual growth rate (CAGR) of 24.4 per cent during 2012-2020.
Government of India also supports entrepreneurs working in the areas of electrical, electronics, telecommunication & communication is several ways. For example to boost manufacturing of electronics goods, GoI provide a capital subsidy of up to 25% for 10 years. The Indian government has further announced several initiatives to stem the growth in “Electronics System Design and Manufacturing (ESDM)” sector. All this will likely to contribute for the growth of electronics and communication industry which in turn will create job opportunities.

Another dream project of our Prime Minister Mr. Narendra Modi *Digital India Plan* is likely to enhance job opportunities. Digital India plan aims at providing (by 2019) broadband in 2.5 lakh villages, universal phone connectivity, 4 lakh public internet assess points, wifi in 2.5 lakh schools and in all universities, public wi-fi hotspots for citizens, e-Governance and e-services across the Government. With digital India plan, it is expected that India will be leader in IT in services like health, education and banking.

This *Digital India plan* is likely to open up job opportunities in all programmes of engineering either directly or indirectly.

Market for electrical and allied fields is not only bright in India, but also abroad. For example, according to the U.S. Bureau of Labor Statistics, electrical and electronics engineers hold about 19.4% of the 1.5 million jobs held by engineers in U.S.A. It is also projected that the demand for electrical devices such as electric power generators, wireless phone transmitters, high-density batteries, and navigation systems will increase across the globe resulting in more job growth in electrical and allied fields.

There are several subfields involving all the three constituents of electrical engineering including: power engineering, control engineering, signal processing, solid-state physics, radio engineering, telecommunications, control systems, instrumentation engineering, microelectronics, mechatronics, telecommunications, telegraph and telephone, radio and television, satellite and space technology, optical fiber and many others. You have job prospectus in all these fields.
**Mechanical Engineering**

Mechanical Engineers design and manufacture the products used by you. Mechanical engineering will always be there until there is a motion.

With growing demand for automobiles, power sectors and more number of manufacturing companies coming up, demand for mechanical engineers is likely to increase in the years to come.

As you are aware India is one of the leading exporters of small cars in the world. Every automobile major is either planning to enter Indian market or expand its current position. This is expected to create more job opportunities for mechanical engineers.

You are very much aware, India is a power deficient country and the its need for power is growing exponentially. There is a huge gap between power generated and power required. To bridge this gap several power plants are being planned based on coal, gas, hydro and nuclear. Government agencies are not able to fulfill the current demand and hence many private players are also active. It is expected that many multi-nationals will be entering the market and jobs for mechanical engineers is likely to expand in power sector.

Our Prime Minister Mr. Narendra Modi’s dream project “Make in India” is likely to give start to many start-up companies in design and manufacturing sector.

I have only listed a few sectors here but there are numerous others sectors which would continue to boost job prospects for mechanical engineers at least for a few generations. This is just tip of an iceberg. Companies require mechanical engineers not only for production but also for R&D, maintenance, technical sales etc.

With degree in mechanical engineering, you can become manufacturing / production engineer, design engineer, maintenance engineer, quality control engineer etc.
It is myth that the salaries are low in these sectors. Though fresher’s get less
compared to computer science /IT graduates but with time they get at par and even
ahead of these computer engineers.

**Petroleum Engineering**

The study of petroleum engineering can be broadly divided into two sectors:
1. *Upstream Sector*, deals with the exploration, drilling, production and exploitation of
   hydrocarbons (Petroleum and Natural gas).
2. *Downstream Sector*, deals with refining, marketing distribution.

Most of the institutes in India offer petroleum engineering courses which cover
the study of the upstream sector, whereas the downstream sector companies recruit
chemical engineers.

As you are aware, more than 50% of energy consumption in the world is through
oil and natural gas. That is, there is more dependency on Petroleum and Natural gas
for the major portion of energy requirement, and renewable sources account only for
small portion (nearly 1.6%) of the total energy needs.

It is clear that our energy demands are increasing at an exorbitant rate and the
current technology won't be able to enable us to shift away from fossil fuels anytime in
the near future.

Also it is expected that India will overtake Japan to become the world's third
largest oil consumer behind the US and China by 2025. To furnish the domestic oil &
gas sector in India there shall be a growing demand for petroleum engineers who can
contribute to growth of petroleum industry and as well for research, development
activities in these areas.
The American Petroleum Institute said in a report that oil, gas, and petrochemical companies has a demand for nearly 30,000 employees for next 20 years.

As a petroleum engineer you can take the roles of petroleum geologist, reservoir engineer, production engineer, drilling engineer etc.

The future:

A survey conducted by American Society of Mechanical Engineers (ASME) to know which areas of engineering are fading (days are numbered), enduring (has been and will continue to be around for a long time), or emerging (will be seeing more of this in the future). You have good news here. None of the fields of engineering have fading scores. In fact, all of the fields had at least some responses in the “emerging” category. Topping the list of fields that respondents thought would enjoy the greatest attention in the future were nano medicine and nanotechnology.

Conclusions

This paper has highlighted career opportunities in different programmes of engineering. Students should notice that there is no programme which guarantees you job after graduation. Of course, there is job for all deserving candidates. Just because you have a piece of paper called engineering degree you will not get a job. Your employability skills are as important as your technical competence.

To increase your employability opportunities, you need to:

- Focus more on interdisciplinary knowledge just not your core course.
- You need to be more skillful in soft skills especially communication
- Should have flexibility to relocate for career opportunities
- Integrate knowledge of engineering with knowledge of science.
- Should be aware of business world, economics, societal development of the country and globe,