

# INDUSTRIAL TRAINING IN ENGINEERING CURRICULUM

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## Abstract

*The new economic policy and WTO regime have facilitated the entry of multinationals and have resulted in a competitive environment in the country. Technical manpower can hardly survive or perform their professional duties efficiently without an industry interaction during their study at engineering college. The engineering curriculum and training in the institutions do not keep pace with the technological advancements in the related fields, as it is more theoretical. At present a widening gap exists between the theory taught in the institutions and the practice in industries. Introducing the industrial training in engineering curriculum can eliminate this widening gap. This paper proposes a scheme for industrial training to degree level engineering education. The availability of industries when compared to the strength of students are a very few and hence, the industrial training at the same time proves to be a difficult task. Training can also be imparted by making use of virtual training centres of virtual labs, which allow the students to understand how to handle the equipment, acquire knowledge and skills. The industrial training and exposure to industrial environment motivates them to be entrepreneurs.*

## 1.0 INTRODUCTION

It is envisaged that India is to become a developed country by 2020. The backbone of the development of a country is the availability of technical manpower. The technical education must thoroughly understand the rapid changes that face the industrial world and adapt their curricula to produce graduates who have the basic technical skills to succeed in a highly competitive environment. The globalisation of market place led to greater demand in technical education system to provide technical manpower, which is not only knowledgeable but also competent. The technical manpower should be updated through continual education programmes and specialise in the right way to become a major exporter of

technology, products and services. The technical institutions must carefully consider how to invest their limited resources to produce graduates through different channels, like University system/class room study, practical classes, industrial visits, seminars, industrial training in industry/R&D institutions for imparting the required skills into the students.

The students must be trained to equip themselves to update technology and practical skills, exposure to industrial problems, creative thinking ability, new technology and innovation, problems solving and communication skills, execution skills, effective career planning, interpersonal interactions, professionalism and ethics, entrepreneur ability, ability in technology assessment, self learning process other than

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the theoretical knowledge from the class room studies. Drastic re-orientation of technical education to produce international level manpower aimed at making Indian goods globally competitive is urgently needed. This can be achieved only by keeping engineering students in close contact with the industry, like the medical students who have close contact with the hospitals. So, effective decisions need to be taken by both the industries that give the training and the universities/academic institutions that receive the training.

### 1. 1 National Policy on Education

The national policy on education (1992) has recognised the need for re-organising the technical and management education in India' to meet the needs of

- Changes in Indian economic policies
- Global competition in products and services
- Achieving world class status in selected industrial and business sectors
- Coping with the exponential growth of technology and knowledge base

Apart from this, Tamilnadu government has announced a six months compulsory industrial training for all the engineering students who take admission in the coming years.

The industrial training programme in addition to engineering-curricula will build the necessary skills and right attitude in a student so that he/she can acquire the skills like, empathy, interpersonal skills, team spirit, presentation skill, leadership skill, team management skill, time management skill, negotiation skill, public relation skill, group thinking skill, analytical capability, selective judgement, etc.

### 1.1 Shortcomings in Current Curricula

At present nearly nine lakhs engineering graduates are produced in the entire world in a

year. Out of which India produces 33.33 % (3 lakhs) of engineers. In particular, Tamilnadu state contributes around 25 % (75,000) of Indian engineering graduates<sup>2</sup>. The following shortcomings have been identified for the progress of engineering education in Indian environment.

1. The curriculum and the training in the institutions do not keep pace with the technological advancements in the related field/discipline, as it is more theoretical.
2. The present curriculum pertaining to undergraduate courses is no longer adequate for the preparation majority of future professionals.
3. The behavioural patterns and personality characteristics required for practical professional work can only be developed by industrial practices which is not available in the current system (except in sandwich programmes offered by very few institutions).
4. Designing of the university curriculum is principally undertaken by university faculty; though the academic bodies contain members from industries they seldom commit time<sup>3</sup>.
5. Many engineering graduates are unemployed for extended period of time and many others are under - employed. Engineering graduates do not interestingly take self-employment and entrepreneurship due to lack of creativity, innovation and self-confidence.
6. Examination system puts more emphasis on reproduction of memorised facts rather than proper understanding of industrial problems and practical skills.
7. Industries often complain that technical institutions do not produce adequately trained professionals to meet the challenges posed. Industry normally

prefers students who have demonstrated their ability to take real world experience like industrial training, industrial projects and carry it to the completion.

8. Due to the financial crunch and fast changing technology, the technical institutes are not able to keep pace with dynamic changes taking place in industries, so the students have to take training in industries in certain areas.

### **1.2 Need for Industrial Training**

Today's generation knows more about technology than do their teachers. They get bored, if they are doing only one function at a time. They need multiple stimuli. The institutions have to design and develop curricula, which develop technical manpower to perform more than one job, operate or manage with many skills and do many functions for the entire working career. So the present education system has to be supplemented or substituted with industrial training for the development of multi skills. The objectives of industrial training programme for the engineering students can be summarised as below:

1. Improve the capacity to apply fundamentals (basic sciences, mathematics and engineering fundamentals) to variety of industrial problems.
2. Knowledge and skill in the fundamental engineering practices.
3. Research based learning of engineering fundamentals.
4. More inter disciplinary elements and interfaces can be created in studies.
5. Provides an opportunity to understand the vast engineering operations.
6. Opportunity to work micro and macro level

problems and observe actions of real experts in technological fields.

7. A sense of social, ethical, political and human responsibility.
8. A creative and intellectual spirit, a capacity for critical judgement and enthusiasm for learning.
9. Learn the fundamentals of accounting, marketing and sales, as the industry needs practical visionaries.
10. Impart of management knowledge and business process skills.
11. Integration of more practice-oriented broader and deeper level of education in new areas.
12. The industrial training also stimulates the learning of students exposing them to personal and professional development.
13. As the student undergoes training he would develop many ideas and that may be in the frontline and priority areas of research and development.
14. The practical application skill in a student builds the entrepreneur abilities.

Several fundamental changes have taken place in the engineering education due to globalisation, the concept of sustainability, rapid advances in Science and Technology, especially in fields such as IT, biotechnology, material technology, etc. The new process of development utilisation and expansion of knowledge have raised questions of whether and to what extent the education and industrial training has to be adapted in order to meet these new challenges and requirements. The challenges for engineering education and engineering professions have also arisen from technological and organisational change and internationalisation of businesses.

## 2.0 GERMAN MODEL

Under the impact of ever changing and emerging technologies, the role of technical education assumes greater importance for a developing country like India as it has the responsibility of creating an adequate number of technical trained personnel skilled at different levels as needed by the industry. In Germany entrepreneurs, companies and economic associations are defending their extensive responsibility in vocational training and training requirements in higher (engineering) education.

**Technological park:** It is part of policy of technology and business establishment centres to offer young researchers and engineers, premises in the immediate vicinity of universities and colleges where for a limited time they can convert the results of technological research into marketable products in the frame work of new business.

**Vocational Training:** Vocational training (dual system) provides an opportunity of on-the-job training to the learner. The dual system includes, Practice semester (engineering education-degree level), diploma thesis, visiting faculty, faculty training and curriculum development. The federal government supervise the vocational training in companies.

**Practice Semester:** In many degree level programmes, a constituent part of study is made up of one or two practice semester spent in industry. With assistance of institutes own practical office, students try to find a company in their local region, in Germany or in aboard. In some cases the teaching continues at the institute for students taking their practical semester in order to compare knowledge gained in practical training.

**Faculty Training:** The faculty working in the degree institute has to undergo industrial training of one semester in every five years. This provides an opportunity for the faculty to expose themselves to the current technology trends in industry.

## 3.0 INDUSTRIAL TRAINING

During recruitment to industries, the employer finds there is a widening gap between what they want and what they get. This creates a disconnect, leading to many problems for both employers and recruiters such as, long training period, unable to get productive results during training period, unrealistic expectation leads to dissatisfaction and attrition. The industrial training is different from in plant training<sup>5</sup>. Industrial training is more serious, purposeful, and well organised. The industrial training enable the student to decide their carrier path based on their positive experiences and provides a wider perspective of company, its customer and operations. It can provide experience in almost all activities of the industry. A six-month training programme may be implemented in such a way that during each year the students have to undergo a six weeks (1.1/2 months) of industrial training. Table 1 provides the brake up schedule of the training programme.

Table 1. Schedule of 6 Months Training Programme. (Pl. see on Page No. 13)

### 3.1 Selection of Industry

The selection of industry for the training depends on the branch of study and syllabi of the course. It is not necessary that the industry must be closer to the university/institution. The students are allowed to choose any industry from the available list and allotment is done based on the preferences given. After selecting a particular industry for a student to undergo the training, the various training activities has to be finalised with the consultation of industry personal who offer the training. The table 2 indicates the type of training industries for the students to four major engineering branches.

Table 2 Training industries. (Pl. see on Page No. 13)

Each college should have a firm relationship with a set of companies in major disciplines-like civil, mechanical, electrical, computer

**Table 1.** Schedule of 6 Months Training Programme

Year	Term	Training period	Industry	Nature of Training
First Year	Odd semester	2 weeks	Small scale	Only observation of industrial activities
	Even semester	4 weeks	Small scale Industries	On-the-job training in industrial activities
Second Year	Odd semester	2 weeks	Medium scale Industries	Only observation in the various industrial activities in different departments
	Even Semester	4 weeks	Medium scale	On-the-job training in the various industrial activities in the different departments.
Third Year	Odd Semester	2 weeks	Large Scale Industrial/ service industries	On-the-job training in different industrial activities
	Even semester	4 weeks	Large Scale Industrial/ service industries	On-the-job training in different industrial activities working on macro problems of industries (mini project)
Fourth Year	Odd Semester	4 weeks	Large Scale Industrial/ service industries	On-the-job training/working on industrial projects/consultancy projects.
	Even semester	4 weeks	Large Scale service industries	If the students have not got Industrial/ placement then they have to take on-the-job training in other regions/other states.

**Table 2.** Training industries

S.No.	Group of Branch	Type of Industries	Remarks
1.	Civil Engineering	Construction companies, Highways, Town planning, PWD, Pollution control board, Irrigation department, R & D institutions, etc.	Accommodation and food can be offered at subsidised rates.  Stipend may be provide to students when they are working on real industry problems wherever possible
2.	Mechanical Engineering	Manufacturing industries, process industries, service and maintenance sectors, Transport organisations, Thermal power stations, R & D institutions, etc.	
3.	Electrical and	EB, Power stations, Instrumentation, Dept. of Tele-communications, networking, R & D institutions, etc.	
4.	IT related Engineering Branches	Computer software organisations, computer maintenance and service, Computer software and hardware training centres, Computer networking, Software development, etc.	

engineering, etc. One faculty for each discipline can be assigned to each company and one person from the company to be assigned as a coordinator. The company should train the students through real life jobs/projects based on students' ability and give necessary guidance and counselling for the successful completion of the training. They are evaluated based on reports/seminars presented after the training. The students should be awarded credits based on their performance. Arranging regular quizzes, discussions and sharing their experiences in industry can enhance their training.

In the training programme students are to be involved in selection of materials, productivity improvement, design analysis, new part development, quality control, process planning for components, cost control, marketing, inventory, software development, inspection procedures, job allocation/scheduling, personnel management maintenance of equipments, assembly and disassembly, safety measures, resource management, human relationship, etc.

The industrial training can also be imparted by making use of virtual training centres of virtual labs, which allow the students to understand how to handle the equipments, acquire knowledge and skills (chemical industries, ship building companies, automobile manufacturing industries, power generation and distribution, etc.). Virtual reality can be used for training anything that needs physical models and components to demonstrate its operation, which enhances the creative abilities, explores the critical thinking etc. Virtual reality becomes more advantages in the areas where the equipment are expensive and dangerous to handle directly.

### **3.2 Monitoring the Training Programme**

A training management team consists of professors in academic institutions and executives from industries must be set for

executing the training programme for each main engineering branch of study. A questionnaire may be used to collect feedback from students before imparting industrial training and one more after finishing the training programme. The questionnaire should have the features, which provide concise consolidation, rational review and effective validation. Thus the training programme can be organised in a well-planned manner involving both the faculty of institution and industry. The upgrading of industrial training programme for engineering students must be continuous and regular affair due to fast obsolescence of subjects and changing needs of industries globally.

There is a need for establishing training monitoring groups under the technical education system at university level, drawing experts from different technology/management areas representing academia and industries to suggest shelf-life of curriculum and what type of changes in training that has to be brought in periodically. Conducting technological discussions, panel seminars and conferences to develop innovative ideas to implement the industrial training in engineering curriculum. The industrial associations and professional societies like, Confederation of Indian Industries (CII), Institution of Engineers, All India Council for Technical Education (AICTE), Indian Society of Technical Education, etc. may be involved in this process.

The industry can play an active role by giving practical training to the students in an industrial environment, and permitting industrial visits to students. This indirectly helps the industries to select best students for their requirement, because this gives an opportunity to identify the good students as their future employee. The industry may utilise the expertise and facilities available in the institute to train their people. This way the industry also feels committed to give the practical training to the students. This makes a mutual benefit to both the industry and the institute because Industry-Institute Interaction (III) is the order of the day due to

liberalisation and globalisation and keeping the standards of education high.

### 3.3 Inter-institute linkages

In a region it is natural that different institutions of varying standard and inputs (faculty expertise, laboratories, library and computer facility) co-exist and it is desirable to use the resources optimally. Reputed institutions like IITs should take lead in helping less endowed institutions in the neighbourhood in the planning of industrial training and general guidance to teachers/students etc. AICTE may evolve suitable schemes to effect such interaction with appropriate funding schemes.

### 4.0 BOTTLENECKS

The vast strength of students compared to available industries for industrial training at the same time is somewhat difficult task. Here some type of strategy has to be evolved to give at least 5-6 months industrial training during their four-year study period.

The gap existing between the theories taught in institutions and the practice in industries can be bridged for effective training by performing a detailed SWOT (Strengths, Weaknesses, Opportunities and Threats) analysis<sup>6</sup>.

A training centre can be established as joint venture, at industries to give training to the students and to employees (either training in new technology area or refresher courses). The joint venture may be involving a group of industries, institutes, Govt. agencies and R & D institutes.

Inadequate rapport between academic institution and industry may lead to improper or inadequate industrial training. Alumni can be utilised for creating rapport and giving training to students in their workplaces. Collaboration between industry associations such as Federation of Indian Chambers of Commerce and Industry (FICCI), CII, etc, and professional societies and academic institutions will lead to

more industry-institute interaction. There may be a regional imbalance between the technical institutes' available and different industrial functioning units. In this situation the students can be permitted to go to other regions and even to other states.

### 5.0 CONCLUSION

To survive and grow in a competitive industrial environment the Indian technical manpower has to assimilate the latest advances in engineering and technology and training. Industrial training for students should be made compulsory for about 1.5 months in a year as part of curriculum. Credit based industrial training has to be formulated for evaluation. The rules for supervising the training programme should be created and the government should support the training programme, The students can be made more dynamic by exposing them to industrial practices, so that they will be able to transform natural and human resources efficiently into final products and services. They should be empowered to make the right choice of specialisation, career orientation and self-employment for a better future.

### 6.0 REFERENCES

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