Engineering Council of India

4th National Convention

on

Seamless Engineering Education for the Better Employability of Engineers

July 20, 2009

Main Auditorium of T&DC Department
Main Administrative Building, Vizag Steel Plant
Visakhapatnam - 530031 (A.P.)

Proceedings

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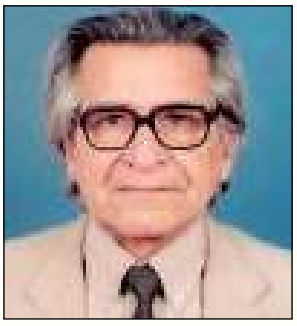

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VIZAG CHAPTER

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CONTENTS

Introduction

Towards Industry-Specific Engineering Education

The evolution of engineering over the years has been tremendous. Not only has engineering helped create structures that withstand the test of time, but by the sheer dent of efforts in R&D, it has also contributed in making the world a more eco-friendly place. The industrial revolution and developments in the field of inventions coupled with technical advancements necessitated the transition of engineering from a general phase to one of highly domain specific specializations. From the staid civil, mechanical and electrical, today engineering has advanced and branched into 18-25 specializations. In the present day world, technical breakthrough has revolutionised engineering activity. Integration of technologies and new materials are emerging at an accelerated pace. This has added new dimensions to engineering projects. Engineering profession now is a complex function of knowledge, skills and attitude. Globalization of engineering profession is unavoidable. In the WTO environment, an engineer is required to continually upgrade his/her skills to enhance his/her technical competency together with a commitment of providing an efficient ethics based service to the client customer / society. Today's engineer has to be of multi-skills and not of domain specific specialisation. More so, the paradigm shift in the way projects are implemented requires application of knowledge and skills other then staid engineering. A case in point being mega projects executed for the development of physical infrastructure in a nation. An integrated approach from project conception to completion is required to achieve the engineering marvels in the construction of hydro power plants, dams, roads, highways and air ports, townships, steel plants, oil refineries, petro and heavy chemical and fertilizer plants, aluminum, lead-zinc and copper refiners. Similarly, such an approach is also required in all the segments of information, space, nuclear industries, etc. Project planning, appraisal, implementation, monitoring and operation require integrated skills that may not be limited to a single discipline of engineering. The feasibility of projects is determined inter alia in the synergy between engineering and business management. Engineers also armed with a degree in business management can play a bigger role at all the stages of a project from concept to completion. It is, therefore, necessary that engineers of today are multi - skilled for taking up leadership role in the present complex world of competition. Engineers of today need to change their attitude and approach for embracing multi - disciplines including of engineering and business management sprinkled with essential components of the other professional disciplines such as law, economics, information technology, etc, apart from their own engineering disciplines which will make them project leaders in the present economic and business environment. It could more effectively be done through bringing in a major change in the very approach to the present practice of engineering education and training in the country. This is an issue which needs to be given a serious consideration.

In the Indian context, realization of the need for generalization in the engineering curricula at the degree level happened around 1960s with degrees such as Production Engineering, Industrial Engineering, Computer Engineering, etc, coming up as alternative degrees in the field of engineering. The change, however, has been very slow for the obvious reason that the Indian economy continued to

remain closed till very early 1990s. Trends across the world depict the rise in demand for seamless engineering education and training. India cannot remain isolated from this development now that the Indian economy has been opened up. We will have to respond to this change. ECI, therefore, felt that there is a need to start an in-depth discussion on the seamless engineering education and training for better employability of engineers in India for meeting the required synergic demands of the profession in the new WTO environment particularly for taking part in the global market of engineering services.

One of the objectives of Engineering Council of India (ECI), being the apex body of engineering associations in India, is to help promote the profession of engineering. This includes professional development of engineers for which the systems and procedures have been developed by the ECI, which are equivalent to that of the Engineers Mobility Forum (EMF) – a world grouping recognizing mutually professional engineering experience of engineers of its member countries. ECI felt that there is a need to start an in-depth discussion on the seamless engineering education in India for meeting the required synergic demands of the profession in the new WTO environment particularly for taking part in the global market of engineering services and making Indian engineers employable in the WTO economic environment. It is for this purpose that the council initiated the discussions on the subject by holding the 1st National Convention on the seamless engineering education for the better employability of engineers in August, 2006 at Kolkata, 2nd National Convention on the subject in May, 2007 at Baroda and the 3rd National Convention in February, 2008 at Baroda, 6th National Conference on Re-engineering Engineers in November, 2008 at New Delhi and the National Workshop on the subject in March, 2009 at Madurai, Tamil Nadu. These national conventions, 6th national conference and the national workshop were well attended by both the industry, the academia and engineering students. While there was a general consensus for a change, it was unanimously agreed that there was the need to make the engineering education seamless at the undergraduate level for making it more industry - specific. The subject would need to be further discussed as to how to go about it and what should be the subjects covered, duration of the course, should there be internship with industry in-between and what kind of specializations should be pursued and of what duration, etc, at the postgraduate level. It was also suggested that further in depth discussion on the subject should continue till the general consensus is reached for the change. The 4th National Convention on the subject is being held on July 20, 2009 at Visakhapatnam, Andhra Pradesh to discuss the subject further for evolving a consensous for the change.

Programme

0830 - 1000 Hrs	:	Registration
1000 - 1100 Hrs	:	OPENING SESSION
Programme Anchors	:	Shri M. B. V. Rao, AGM(R&D), RINL/ Shri G. Phanikumar, AGM(PPM), RINL, Visakhapatnam
Presenting Flower, Bouquets and Lighting the Lamp		
Welcome Address	:	Dr. Uddesh Kohli, Chairman, Engineering Council of India (ECI), Chairman Emeritus, Construction Industry Development Council (CIDC) & Chairman, Construction Industry Arbitration Council
Theme Address	:	Shri L. Pugazhenthy, President, Indian Institute of Metals & Executive Director, Indian Lead-Zinc Development Association, New Delhi
Address by the Chief Guest	:	Shri Y. Manohar, Director (Persoanl), RINL Ltd., Visakhapatnam
Vote of Thanks	:	Shri D. V. S. Murthy, Hony. Secretary, VMA & NC Member - ISTD
1100 - 1130 Hrs	:	Tea/Coffee
1130 - 1300 Hrs	:	TECHNICAL SESSION - I
Theme	:	*What Should be the Engineering Curricula and Duration of the Course- Views from the Industry and Academia*
Session Chairman	:	Dr. K. Srinivasa Rao, Head of the Department of Metallurgy, Andhra University.
Rapporteur	:	Shri G Ramesh Chander, AGM(BF), RINL, Visakhapatnam
Keynote Speaker	:	Shri P. N. Shali, Director, Engineering Council of India & Former Adviser and Consultant (State Plan -North East), Planning Commission, Government of India
Keynote Speaker	:	Shri M. Srinagesh, Chief Executive, Leowei Systems, Visakhapatnam
	:	Shri T Prabhakar Rao, Executive Director (Works), VSP, RINL, Visakhapatnam
Discussions		
1300 - 1400 Hrs	:	Lunch

1400 - 1530 Hrs	: TECHNICAL SESSION-II
Theme	: *What Should be the Engineering Curricula and Duration of the Course - Views from the Professional Engineering Associations*
Session Chairman	: Shri A. P. Chowdhry, Director (Projects) , RINL, Visakhapatnam
Reportear	: Shri G. Rajaraman, AGM (QA&TD), RINL, Visakhapatnam
Keynote Speaker	: Shri V.R. Singh, Chairman of IEEE-Delhi Section and a Distinguished Scientist at National Physical Laboratory, New Delhi.
	: Prof. Satyanarayana, Viswanadha Institute of Technology and Management (VITAM), Visakhapatnam
	: Prof. Swetha Chalapathi, Institute of Technology and Management (VITAM), Visakhapatnam
Discussions	
15.30-1600 Hrs	: Tea/Coffee
1600-1700 Hrs	: CONCLUDING SESSION & PANEL DISCUSSIONS
Theme	: *What Should be the Engineering Curricula and Duration of the Course- Views from the Professional Engineering Associations*
Session Chairman	: Shri Umesh Chandra, Director (Operations), RINL, Visakhapatnam & Chairman, IIM, Vizag Chapter
Reportear	: Shri S Mandal, DGM I/c QA & TD, RINL
	: Shri G Rajaraman, AGM, QA&TD, RINL, Visakhapatnam & Secretary, IIM, Vizag Chapter, Andhra Pradesh
Panelist	: Shri Ashok Sehgal, Institute of Marine Engineers & Member Board of Governors, ECI
	: Dr. S.R. Mallikarjuna Rao, General Manger (Trg. & HRD), RINL, Visakhapatnam
	: Dr. S.R. Gollapudi, Professor (IE, PE Training & Placement) GITAM University , Visakhapatnam
Discussions and Recommendations	
Programme Coordinator	: Shri Lalan Kumar Singh, AGM, RINL, Visakhapatnam, A.P. & Member National Council, the Indian Institute of Metals (IIM)

Recommendations

1. Presently, engineering profession in India is not regulated because there is no Statutory Council of Engineers in position; and as such it has no legal status because of there being no Engineers Act on our statute, unlike other professions such as Lawyers, Doctors, Architects, Dentists, Chartered Accountants, etc. The engineering profession also needs to be regulated and legally recognized. For this, Engineers Act should be brought on the statute and the Statutory Council of Engineers set up at the earliest.

2. Before sanctioning new engineering colleges, demand of engineers should be assessed. Then, before deciding about the curricula, the requirements of the industry should be assessed. These exercises should be a regular feature of the work of the regulatory body. This will check proliferation of engineering colleges of poor quality infrastructure and faculty in the country.

3. Reform of the engineering education should also include reform of the present CAT system and procedure for selecting students for engineering courses for ensuring the selection of only those candidates for engineering courses who have not only the knowledge of physics, chemistry, mathematics and general knowledge but also aptitude for engineering.

4. The current engineering curricula need to be reformed for producing multi-skilled engineers needed by the industry with a full consensus of academics, industry and practising engineers.

5. The practical case studies need to be included in the curricula and in the technical books and other reference materials meant for engineering students.

6. The industrial training during the course, which should be in the format of small projects on industrial problems assigned individually or collectively to a group of students, should be made mandatory. It should also be assessed and marks obtained thereof should be included in the marks obtained from the written examination.

7. After the theoretical course and during the course training is over, a paid internship of six months with an industrial unit should be made mandatory. It should also be assessed and marks obtained thereof should be added to the total score obtained by writing exams and in-plant training done during the course.

8. It should be made mandatory that the students will get engineering degree only after successfully completing the training done during the course and six months internship.

9. As a matter of policy, the industry should be compensated for the expenses that it may incur on the internship via the tax route.

10. The practice of delivery of engineering education should be reformed from its present form by placing more emphasis on self-learning and problem-solving.

11. There is a clear requirement for a regular training of the faculty so as to cope with the ever emerging challenges from the industry.

12. It is recognized that the fresh engineering graduates lack a strong ethical foundation. Introduction of ethics as a subject in engineering education in universities needs a serious consideration.

13. The continuing professional development (CPD) should form an important element of the regulatory mechanism of engineering education.

14. A working mechanism for facilitating the exchange of professionals for short periods between the academic institutions and the industry needs to be developed for providing an opportunity to them to have a hands-on experience of the "other side of the fence".

15. Industry - Academia partnership in technical education should be institutionalized.

16. It should be made mandatory to upgrade the engineering curricula once in every four years for keeping it in pace with the market trend. For this , the institutions delivering engineering education in the country should have the freedom for setting and revising the curricula keeping in view the changes in the perspective of industry, R&D, etc.

17. Evaluation of the faculty by the students should be made mandatory for all the engineering colleges in the country as a matter of policy.

18. The curricula and training format of the Polytechnics and Industrial Training Institutes (ITIs) training diploma engineers and engineer technicians respectively need to be re-engineered for imparting required knowledge and skills to diploma engineers and engineer technicians. Their English language skills also need to be made better by including the language in their curricula.

Executive Summary

Presently, engineering profession in India is not regulated; and has no legal status as such because of there being no Engineers Act on our statute, unlike other professions such as Lawyers, Doctors, Architects, Dentists, Chartered Accountants, etc. The engineering profession also needs to be regulated and legally recognized like the above mentioned professions are. For this, Engineers Act should be brought on the statute and the Statutory Council of Engineers set up at the earliest. More so, the Engineers Act will also ensure that engineers practice their profession ethically. Further, engineers, by and large, are regulated abroad in all the developed countries and in some developing countries, particularly in the countries bordering India. We also need to regulate the practice of engineering in India because India is a signatory of the WTO, apart from its economy now stands opened up. Consequently, India is facing a severe competition from the foreign economies.

Further, we need internationally competitive and recognized professional engineers for taking part and competing in the international trade in engineering services, opening up of which is round the corner. This will imply that our engineers will get opportunities to work abroad and so will foreign engineers to work in India. It requires that our engineering degrees and professional experience will have to be recognized abroad and so should we do for engineers from out side India who will want to work in India. We have to take up steps which need to be taken for enabling this to happen. It is for this purpose also that we need to regulate engineering profession for which we need to bring on our statute the Engineers Act and create a Statutory Council of Engineers, take the Full membership of Washington Accord- a world grouping of countries which recognize mutually engineering degrees of its member countries and that of the EMF- a world grouping of countries which mutually recognize the professional experience of its member countries. Both these memberships would have to be with the respective statutory councils- AICTE and the Statutory Council of Engineers and not with any private institution. It is so, because one of the other important requirements of this whole process is signing up of bilateral and multilateral agreements between counties which can only be done by the statutory councils.

India produces around 8, 00,000 engineers annually. Do we need so many engineers? We do not have any idea about how many engineers India needs say for meeting the targets that have been set for the XIth Plan. Do we have any idea about what kind of engineers we need for this? There is no study done regularly for assessing the demand for engineers. As against this, if we look at the growth of engineering colleges in India during the period of last 10-15 years, we find the growth curve going up sharply. When our economy has been growing at 7 percent annually, our engineering colleges have been growing at a faster rate. When we look around Andhra Pradesh we find there are more than 500 engineering colleges and in Visakhapatnam alone about 75 % of these colleges are located. Most of these colleges do not have infrastructure and quality of the faculty of required standards. In most of these colleges the faculty is of engineering graduates. The same is the story, by and large, elsewhere in the country. The proliferation of engineering colleges, therefore, is an important issue that we need to consider. This is also the reason for the poor quality of engineering education in India, apart from the outdated curricula.

In short, we are producing more engineers than we need. It means that the competent authority in India has been sanctioning new engineering colleges without having done first any such a study. It has resulted in a sharp decline in the quality of engineering education in the country. Today, engineering graduate has the same value as that of a science graduate. Engineers accept jobs which can jolly well be handled by a science graduate. Then we notice engineers drifting to other professions such as software, civil services, management, finance, etc. Why is it happening? It is happening because our parents are not sure about what profession their children want to pursue. They are also not sure whether their children have the aptitude for engineering, which is also not assessed by the CAT. This will have to change. As a matter of fact, first we must look at it when we take up the issue of reform of engineering education in India. There is no proper appreciation of what the demand of engineers in numbers is and what the requiems in skills are of the industry. Before sanctioning new engineering colleges, demand of engineers should be assessed. Then, before deciding about the curricula, the requirements of the industry should be assessed. These exercises should be a regular feature of the work of the regulatory body.

The reform process should also include assessment of the infrastructure and quality of the faculty of engineering colleges, particularly set up in the private sector. After this is done, a concrete revamping action plan should be put in place where ever it is found that the infrastructure and the faculty are not of the desired standards. The plan should also have a provision of closer of the colleges who do not take action to bring up their infrastructure and the faculty of desired standards within the given time span as indicated in the concrete action plan after ensuring that the students enrolled in such colleges are provided alternate place to continue with their studies.

Today, most engineering projects are very complex with involving heavy investments, many inter-related inter-dependent activities, require high level of technology and need effective management of voluminous resources. They cross geographical boundaries, corporate channels, traditional systems and cultural diversities. Modern projects have inbuilt difficulties, uncertainties and risks. Today, engineers working on such projects require diverse technical and management skills for realizing the project objectives, within the specified time, budgeted cost and predefined quality specifications, by leading the project participants, efficiently, effectively and ethically.

Today, in the free market economy, engineers need not only require a sound knowledge and understanding of engineering branch in which they have specialized but also some basic knowledge and understanding of the other branches of engineering, knowledge of economics, statistics and management science and additional skills such as, project management, communication- both oral and written, presentation of technical reports, lateral thinking, group and team working, project appraisal and monitoring and so on. Today, the industry needs multi-skilled engineers or engineer-managers.

The current engineering education, which remains confined to its present so called branch - specific engineering specializations, does not produce multi-skilled engineers who only are suitable for undertaking several tasks as required by the industry. It is why the Indian industry finds branch-specific

engineers, who pass out every year unemployable. These engineers need further training before they can be employed which involves additional avoidable expenditure for the industry. The engineering education also lacks in practical aspects of industrial problems. The postgraduate engineering education is also confined to theoretical subjects with a little emphasis on industrial problems. Today, new paradigm of environmental sustainability and social concerns are emerging important issues. The current engineering education is not laying much emphasis on these subjects. This calls for re-engineering of the engineering education system including curricula for making it multi-disciplinary and multi-tasking. The engineering education in the country, therefore, needs to be revamped lock, stock and barrel with the objective of making it more need - based for both the manufacturing sector as well as for conducting innovative industrial R&D. The project in the final year should be based on some practical problem or related theoretical concept and should be done in a plant and not in the college, as is the case by and large now. Presently, ethics is not taught as a subject. It needs to be included in the curricula as a compulsory subject. We, therefore, need to reform the engineering curricula so that it meets the current and future needs of the economy.

The time relevancy of the engineering curriculum is not the point of emphasis with education planners. The curriculum is mostly theoretical and it does not cover real industrial problems and how to solve these. There is shortage of quality teachers. Though the practical training through industry tours is there as an important part of the curricula, it is not mandatory; it is not focused; and it is not assessed at the end of the training as such. Engineering research and development, as it is today, does not generally cover industrial problems and developing new technologies based on already established laboratory research, apart from there being no emphasis on the emerging futuristic technologies. The experimental activity is minimal (design on paper) and there is lack of identification - which in other words means that the curriculum does not reflect the national needs.

Stakeholders to engineering education are students, academia and the industry. All these stakeholders look at it from their own perceptions. The students look at it from the point of view of their employability; and employers- Industry- look at it from the point of view of generating profit by employing engineers; and academia from the point of view of training them which is confined to completing the curricula whether it is what industry needs or whether it is producing engineers who can take up jobs straight away or whether they are training engineers who get both theoretical and practical training of a balanced mix is not generally the main consideration with them. It is only when all these perceptions meet, we will get the kind of engineering education which will produce engineers who will be employable. The much needed reform of the engineering education will be possible only when these three different perceptions converge to a one single point. What we need to do, therefore, is to ensure that these different perceptions converge fully to one perception; and when it happens, it will give us the right way for reforming the present engineering education.

Our technical books are too theoretical and also continue to cover write-ups on technologies which are obsolete. It would be of great help if the theoretical concepts and hypothesis were explained using the case studies based on the practical problems of industry - which have been successfully solved. We

need to include such case studies in the technical books and the other course handouts or materials meant for engineers.

Reform of the engineering education should also include reform of the present CAT system and procedure for selecting students for engineering courses, apart from the curricula. It is very important to ensure CAT selects only those candidates for engineering courses who have not only the knowledge of physics, chemistry, mathematics and general knowledge but also aptitude for engineering.

We should also consider moving out of the present engineering discipline- specific education to sector-specific engineering education keeping in view the objective of producing sector-specific engineers. The sectors may include infrastructure, manufacturing oil exploration, production and refining, power generation and distribution, ports and harbours, roads and bridges, construction, etc. We should also produce engineers specifically for industry R&D. We can also consider having three-to-four schools-based pattern of engineering education; each school should be of a combination of engineering disciplines say mechanical, electrical, civil, metals and materials with additional courses included from management sciences, economics, IT and English language. Then there could be another school comprising, mechanical, electrical, chemical disciplines along with the courses from economics, management, IT and English language. We can have a school for designs which will produce design engineers for all technical sectors.

A modular approach for reforming the engineering curriculum design could also be an option worth considering. Some uniquely focused modules for meeting the unique needs of sectors such as civil aviation, ports and harbours, urban renewal, construction, manufacturing, logistics and transportation projects, telecom and power sector projects, oil and gas exploration projects and various other areas of infrastructure, wherever investments and execution of projects on a large scale is paramount, could be considered. To illustrate this approach, a construction engineer needs a familiarity with the world of business and commerce, dealing with people and resources, environmental, health and safety aspects, legal aspects, project engineering, logistics engineering, procurement engineering, application of IT and communication technology in construction, dealing with partnerships and joint ventures, learning the basics of contracts and claims, apart from the construction technology. Therefore, a construction engineer is far more multi - functional and better equipped to deal with complex issues of construction business than say, a pure civil engineer.

A construction engineer is, therefore, much more of an engineer - manager. Similar will be the case with the other modules. In the first place, as a matter of reform of engineering education, we may consider creating a focused module of construction engineering as a test model. While considering this approach for the engineering education, we may also look at the current curricula of industrial engineering and production engineering branches. It may be possible to create only one focused module of manufacturing engineering by amalgamating the curricula of these two branches into one with required additions from the other engineering disciplines and management, economics, etc. There could be another way out; this could be integrating branches such as of civil, mechanical and electrical engineering and including in it metallurgy and material engineering. In the curriculum delivery, a similar modular approach could be pursued.

A general engineering degree covering required courses of all the engineering disciplines plus subjects such as: management, statistics, public relations, law, communications, contract engineering, computer-related courses, human resource development, project formulation, evaluation and appraisal, etc, may also be an option worth considering. There could be other options like having a combined degree at the undergraduate level of management and engineering comprising of essential and relevant engineering sciences of all the branches and that of management. We may call it MBBE- Bachelor of Management and Bachelor of Engineering. The total course may be of 5 years including six months of mandatory paid internship with an industrial unit. The unit however would have to be compensated via the tax route.

Engineering courses earlier used to be of five years. We can consider this option as well. We can consider spreading these five years as follows: first two years of general courses of all the major engineering disciplines plus applied mathematics, applied physics and chemistry and some subjects from other than engineering disciplines say of management, economics, English language, etc. The third and fourth year can be of branch-specific courses. The fifth year can of two semesters. The first semester can have some advance courses from social sciences during the first three months and during the second three months the course project can be taken up which should be based on some practical problem or related theoretical concept and should be done in an industrial unit and not in the college, as is, by and large, presently the case. The last six month of the fifth year should be of mandatory paid internship with an industrial unit, which should be assesses and the marks or grade obtained should be added to the total score. The engineering degree should be awarded only after this assessment is done.

The training by the engineering students in industry is now-a-days practically not given any significance. It has become a formality to be observed by the students; and the trainers in the industries also take it that way. This trend must be reversed. Industry training should be brought under assessment- awarding- credits mode for inclusion in the final grade of the examination. This should also include the mandatory six months of paid internship with an industrial unit. The degree should be awarded only after the students also clear these trainings.

Aptitude for engineering must be assessed before students are admitted to engineering courses. Aptitude also needs to be assessed for applied engineering research, development and designs before students are admitted to postgraduate courses in engineering. This can be better done by including appropriate questions in the common entrance test for admission to engineering colleges and for admission to postgraduate courses in engineering. This will have got to be on the similar lines as that of admission to management courses and that of the civil services.

Practising engineers should be involved in the education process. They should be invited to address the students through “Show and Tell” sessions which will complement faculty teaching, not substitute it. This should start right from the beginning of the first semester. Students should visit factories, design offices, sites, installations right from the first semester, guided by the same working engineers who have been speaking to them. Institutes should involve many and varied lot of practicing engineers into drafting and detailing of the curricula. Faculty should give up its arrogant know-all attitude about

engineering; and be consistently open and learn state-of-the-art developments from practicing engineers.

It is a well known phenomenon in the country that engineers are moving out to non-engineering areas like software industry, finance, marketing, human resource development and so on. Undoubtedly, there is a need to have competent professionals to work and cope up with ever rising demand in these areas. At the same time, it is not prudent to lose the bright engineering graduates to these areas. We need them for applying their knowledge and skills in the working of engineering designs, planning and implementation of engineering projects, in the manufacturing sector and so on. Obviously, employability and value of financial package attract bright engineers to work in areas away from the engineering profession. It is, therefore, necessary that the industry and employers must consider making the value of financial package for engineers in their own field more attractive and rewarding so that engineers are discouraged from moving out of engineering profession to these areas. This drift can also be checked by developing a certain sense of pride amongst engineers to remain working in the engineering profession for its growth, development and sustainability. Both, the industry and academia together can play a major role in this.

Though the faculty development programmes have been going on, whether the objectives set for these programmes were realized has not been evaluated. So, as a matter of reform of the engineering education, it should be made mandatory to evaluate the faculty development programmes.We will also have to evaluate technical education from the point of view of its infrastructure, faculty, academic research, laying more emphasis on industry sponsored research, industry – academia interface, faculty development, etc, and take remedial measures as required. We will have to attend to most neglected domains such as Ph.D research area concentrating more on applied research with the objective of developing technologies. Other areas in this category include the quality and regularity of using visiting faculty, sabbatical leave for going out for training in IITs, IISc, taking research in industrial establishments, post doctoral fellowships, faculty exchanges, etc.

We need to carefully evaluate the current status of our R&D organizations- looking beyond IITs from the point of view of institutional preparedness. It is well recognized now that we need to carry out research which is relevant to industry and society. We should take to more collaborative approach to research and development say with ISRO, DRDO and such other organizations. We should also look at multi-disciplinary approach to research such as environmental engineering, micro systems, etc. More so, we should go for research which will generate patents and hence IPR. We should encourage intellectual ventures. Rewards and recognitions will bring in best results in this area.

We should also develop, like engineering laboratories, personality development labs and practicals for developing listening skills, speaking, English language skills, behavioural sciences, communication-both oral and written, presentation of reports, team working skill, interpersonal skills, etc. One more foreign language from out of Russian, French, Spanish, Chinese, Japanese, German, etc, should also be taught.

We need degree engineers, diploma engineers and engineer technicians. This is what we call tier -1, tier -11 and tier -111 of engineering services. The ratio of these three tiers should normally be 1: 3: 9. When we look at the engineering education institutional structure, we find it is of reverse pyramid. It means flat top with a large no of engineering colleges followed by comparatively less no of polytechnics at the middle and the bottom is of a very small no of Industrial Training Institutes. This lopsided engineering education institutional pyramid needs to be reversed. We need at the top engineer-managers followed by engineering branch-specific diploma holders with additional skills that of English language, some basic managerial skills including of communication and other supervisory skills and at the bottom we need very sound engineering trade related skills and some additional skills that of English language and articulate personal behaviour, etc. This should also be included in the reform agenda of engineering education. More so, we need it for competing in trade of engineering services, opening up of which is round the corner. There is a very large market of the engineering services abroad for us to capture.

We need to create seamless interactive mechanism between the industry and academia so that the both can understand each other better, which will surely result in the kind of engineering education that we need today. We have to act now to set up this institutional mechanism. If we are able to create such a mechanism, it will inter alia lead to strengthening the current rather a very weak relationship with academic excellence in dealing with problems of industry and those arising from the statutory rules & regulations in force and as applicable to the industry through appropriate academic response. Even this mechanism could also be used in finding solution to financial problems that the academic institutions may be facing which affects their resolve to facilitate changes that may be required in their capacity building efforts. This will also help in providing appropriate inputs to the industry in furthering their business objectives.

A professional association of engineers can play an important role in the reform of engineering education for better employability of engineers because the membership of these associations is drawn from the industry, academia, administration and engineering students which provide the ideal forum for discussion of all issues involved. More so, the professional associations of engineers can act as a bridge between the industry and academia for ensuring need-based or industry-specific engineering curricula and training structure and system. Institute of Marine Engineers, India is contributing in a greater measure not only in the basic education but also in the continuing professional development (CPD) of Marine Engineers including in developing curricula which is a balanced mix of both the theory and practicals. The certificate issued by the institute is internationally recognized as it is accredited by the international accreditation authority of Marine Engineers. This degree represents a near model of seamless engineering or sector - specific engineering comprising of many basic engineering disciplines.

Opening Session

Welcome Address

Dr. Uddesh Kohli

First of all, I would like to thank the Chairman and Director (HR) of RINL for agreeing to sponsor the 4th National Convention and also to the IIM, particularly its Vizag Chapter for joining hands with the Engineering Council of India (ECI) in organizing the convention in this industrial city of Visakahpatnam. Some of you may know about the ECI but for others, I would like to give some background about the Council.

It was felt for a long time that while there were several professional institutions of engineers in India such as Institution of Engineers (I), the Indian Institute of Metals, Institution of Chemical engineers, IETE, etc., we did not have one body to represent the entire engineering profession. It was, therefore, suggested that we should have an apex body of engineering associations which can take up several tasks identified at that time, such as how to bring accountability in the engineering profession, how to make engineers responsible and how to make sure that the society does not suffer because of any engineering problem or mistake. A parallel was drawn from the other professions like Medical, Architecture, Dentistry, Chartered Accountancy, etc., which had statutory bodies to take care of such aspects. The second aspect, which is very relevant even today, is that there is no legal recognition to the engineering profession and statutory regulation of engineering practice in the country as such. Therefore, engineers from other countries are free to come here and practice but if Indian engineers want to go abroad and practice, they have to register there. So, it is a sort of disadvantage and it was observed that it may be necessary to join international agreements like the EMF for engineers' mobility. Accordingly, it was decided that an apex body at the national level needed to be set up which could help in developing such a mechanism in the country and could bring accountability in the engineering profession. The initiative for the setting of Engineering Council of India (ECI) was taken by Shri K. C. Pant in 2002, who is also an engineer and who was then the Deputy Chairman, Planning Commission. He took a meeting where the formation of ECI was discussed. Accordingly, 24 professional engineering associations, including the Institution of Engineers (I), came together and formed the Engineering Council of India (ECI) which was registered as a non-profit society in April, 2002.

For the past seven years, ECI has been working on many of it's the objectives mentioned earlier. For the legal recognition of the Indian engineers, we had intensive consultations and drafted the Engineers Bill which was submitted to the Ministry of HRD in September, 2004. The Ministry constituted a committee which went through the draft Bill and submitted a report to the Ministry. The Ministry later said that there must be wider consensus amongst the engineers on the subject. After a lot of consultations, another draft of the Engineers Bill was submitted to the Ministry in May 2007. This is still in the processing stage within the government, before it is introduced in the Parliament.

Dr. Uddesh Kohli is the Chairman, Engineering Council of India (ECI), Chairman Emeritus, Construction Industry Development Council (CIDC) & Chairman, Construction Industry Arbitration Council

The second objective of the Council is the promotion of quality in the engineering profession in the country. Today, most engineering projects are very complex with involving heavy investments, many inter-related inter-dependent activities, require high level of technology and need effective management of voluminous resources. They cross geographical boundaries, corporate channels, traditional systems and cultural diversities. Modern projects have inbuilt difficulties, uncertainties and risks. Today, engineers working on such projects require diverse technical and management skills for realizing the project objectives, within the specified time, budgeted cost and predefined quality specifications, by leading the project participants, efficiently, effectively and ethically. While our engineers possess required technical expertise, they often lack managerial, particularly project management skills and other skills such as of communication, presentation skills, etc. It is generally felt that instead of narrow specialization in specific areas of engineering, engineers should have multi-skills so that they can undertake several tasks as required by the industry. This calls for re-engineering of the engineering education system including curricula for making it multi-disciplinary and multi-tasking. Accordingly, ECI organized three National Conventions on the 'Seamless Engineering Education' for the better employability of engineers at Kolkata, Baroda and Hyderabad, a National Conference on Re-Engineering Education at New Delhi and a National Workshop on Engineering Education: What It Is and What It Should be for Better Employability of Engineers. Delegates from the industry and the academia took active part in these programmes very actively. A general consensus emerged at these programmes that the engineering education system including its curricula needed an urgent reform with a view to meeting the requirements of the industry and the society. It is in this context, that this 4th National Convention has been organized with focus on both the fresh as well as the working engineers. I am sure that the convention will further reinforce the consensus arrived at the previous programmes which will give us a way forward to move on for reforming the engineering education on desired lines.

I welcome Shri Y Manohar, Director (Personal), RINL Shri L.Pughazhenty, President, IIM, Shri A. P. Chowdhry, Director (Projects) , RINL, Shri Umesh Chandra, Director (Operations), RINL & Chairman, IIM, Vizag Chapter, Shri D. V. S. Murthy, Hony. Secretary, VMA & NC Member, ISTD and distinguished keynote speakers and panelists. I also welcome all participants to the convention and hope that the deliberations will lead to some concrete suggestions.

Theme Address

Shri L. Pugazhenthy

ECI, under the leadership of Dr, Uddesh Kohli, has been doing a commendable job by projecting a popular and positive image for the engineering profession, enabling networking, creating brotherhood among the fraternity and promoting the cause of engineering profession. While science always gets due recognition and appreciation, the engineering profession is always at the receiving end. While science is the foundation, engineering is the output. Engineers are the backbone of any country, more

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so for a fast growing economy like ours. With this background, it is all the more reason for us to discuss, deliberate and find out how we can improve the image as well as quality of engineers and also how to sustain this profession in its long term interest.

When man lands on the moon, it is heralded as a scientific achievement, but when such a mission fails it is attributed to a technical snag. When one sees the potholes in any city in India, you blame the engineers. On the other hand we have many examples before us displaying excellence in engineering such as the steam engine revolution brought about by James Watson in the second –half of the 19th century or in the great civil engineering marvels by the engineer that India produced the late Sir Visveraya. Today, the engineering profession in India has to pull up stocks to enhance its reputation - both in the quality of education as well as its practice. The most important reason for this is considered to be the quality of general education as well as the engineering education in India. Education in general means creating skill and values for the society. It also produces socially responsible citizens. It also sets up strong roots of democracy and leads to the social wellbeing. If education does not yield these, it is of no use. Similarly, if the engineering education system does not produce engineers required by the economy and they are not creating durable and long lasting assets, it needs to be given serious attention. Engineers also need to practice their profession ethically. Engineering profession is not legally recognized in India since there is no Engineers Act here. The Act, inter alia, would have ensured that engineers practice their profession ethically. So, we need to reform engineering education for making it more need based for both the manufacturing sector as well as for conducting innovative R&D.

I have been regularly attending the ECI programmes on the reform of engineering education in India; I think the initiative taken by the Engineering Council of India for reforming the engineering education in the country needs our whole hearted appreciation. Such programmes including the 4th Convention, which is underway here in this industrial city of Visakhapatnam, is a continuation of ECI's initiative. I have no doubt that the deliberations of the 4th Convention will further cement the consensus for a radical change in the engineering education system in the country which will help in improving quality and image of our engineering community.

Inaugural Address

Y. Manohar

"Every challenge can teach us something about our selves---to be open to this learning is the beginning of success"

The dream of a common man of India is to make his children either an engineer or a doctor. More and more engineering colleges are emerging out without proper infrastructure facilities. This results in lack of quality engineers produced which is an unhealthy situation for the industry to employ these engineers. To discuss and get prolific ideas from intellectual personalities, there could not have been a better platform than this at Visakhapatnam – an industrial city in Andhra Pradesh for organizing the 4th

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convention with the theme: Seamless Engineering for Better employability of Engineers. While we know what seamless means in metallurgy, what it is in engineering we do not know. In the Yash Pal committee report, the word seamless is defined. I think it means an engineering education which is not branch – specific, but, it is of all major engineering branches. Perhaps, ECI considers that it is so. I know that engineering in 1970s, when I passed out meant generally civil, mechanical and electrical. Some other branches like chemical, metallurgy, aeronautical etc., were also there. But, the former branches were the most sought after branches.

In the preset scenario, economy is growing at 7-8% annually, whereas the output from engineering colleges is growing at a much faster rate. At the same time, we are not in a position to create jobs for every engineer graduated from the college. Also as many new colleges are coming without proper facilities, it is our bounden duty to ensure that norms are followed for proper education in the engineering colleges. Proliferation of engineering colleges is the issue that we need to consider.

We need engineers, we need diploma holders and we need technicians. This is what we call tier-I, tier-II and tier-III engineering services. When we look at the engineering education Institutional structure, we find it is like a reverse pyramid. It means flat top with a large no of engineering colleges followed by comparatively less number of polytechniques at the middle and the bottom is of a very small number of industrial training institutes. This lopsided engineering educational institutional pyramid needs to be corrected. We need at the top engineer-managers followed by engineering branch - specific diploma holders with additional skills that of English language, some basic managerial skills including of communication and other supervisory skills and at the bottom we need a very sound engineering trade related skills and some additional skills that of English language and articulate personal behaviour.

There is a dichotomy between management and engineering. There is a general feeling that with branch-specific engineering education we are not producing engineers from any of our large population of engineering colleges in the country who can be employed straightaway by the industry. These engineers need further training before they can be employed. It is also true that the industry today is of complex integrated technologies controlled by micro processors. In the free market economy additional skills expected of engineers apart from a sound knowledge and understanding of engineering branch in which he/she is specializing include some basic knowledge and understanding of other branches of engineering, project management, communication, presentation, lateral thinking, team working, project appraisal and monitoring and so on. What we need today is, therefore, engineer-managers coming out of the engineering institutions. I fully agree that the technical education in the country should be revamped suitably.

We need to include more practical content in the engineering education. It is only then that the industry will find engineers employable straightaway. This is what I think is the meaning of the word seamless engineering. If it is so, I think engineering education, as it is today, needs an urgent reform. As such, therefore, the 4th convention, underway now is apt and timely. We also need to create seamless interactive mechanism between the industry and academia so that the both can understand each better, which will surely result in the kind of engineering education that we need today. This is well recognized need. We have to act now to set up this institutional mechanism.

When we look at the current engineering curricula, we find it out-dated. I think this is the general view of both the industry and academia. Understandably, this view has also surfaced as a consensus recommendation of the conventions, workshop and the national conference that the ECI has organized previous to this 4th National convention with the theme of reform of engineering education for better employability of engineers.

We need to reform the engineering curricula, therefore, so that it meets the current and future needs. Second, our technical books are too theoretical and continue to cover write-ups on technologies which are obsolete. It would be of help if the theoretical concepts and hypothesis were explained in the back ground of these solved practical problems from the Industry. We need to include the case studies based on the practical problems of industry - which have been successfully solved - in the technical books and the other course handouts or materials. We need to make curricula such as it would produce multi- skilled engineers. The project in the final year should be based on some practical problem or related theoretical concept and should be done in a plant and not in the college, as is the case, by and large, now. Ethics is another important point that I would like emphasize. Currently, in all the engineering colleges' ethics is not taught. It needs to be included in the curricula as a compulsory subject.

Thus, in my view the following priorities should be addressed with concern and commitment from all players : infrastructural facilities at the engineering colleges, regular reviewing of the quality and content of curriculum, organizing networking programs like seminars, conferences, workshops, etc, for interaction among different colleges, close interaction with the industry and academics, energetic participation of faculty in understanding industry's requirements, improving the quality of engineering faculty, community and society orientation , legal frame work,etc,.

I agree fully with the view expressed by Dr Uddesh Kohli and support his contention that the Indian engineering profession needs to be regulated and legally recognized like the other professions such as Doctors, Architects, etc, are legally recognized. For this, Engineers Act should be brought as the statute and the statutory council of engineers set up at the earliest convenient. I take great pleasure in declaring the convention open and wish the proceedings would be of immense help to the entire engineering community.

Vote of Thanks

D. V. S. Murthy

I fully support the view that we need a through reform of the engineering education and training for making it suitable to the needs of our industry and R&D and hence engineers employable. I am sure the 4th convention which is being organized today will further reinforce consensus for the reform of engineering education. In a way, Indian Society of Training and Development, to which I belong, has been engaged since its inception in the training and development efforts, particularly of our technical workforce. Dr Udesh Kohli has contributed significantly in this endeavour of the Society.

Shri D. V. S. Murthy is the Hony. Secretary, VMA & NC Member – Indian Society of Training & Development (ISTD).

Technical Session - I

Keynote Presentations

P.N. Shali

It is now a well recognised fact that a large number of engineers who pass out every year remain unemployed because of a critical shortage of skills that the Indian industry needs in engineers. According to McKinsey Global Institute, multinationals find only 25% of Indian engineers employable. Reportedly, Knowledge Commission is of the view that most graduates (engineers in particular) do not possess the skills needed to compete in the economy, and the industry has been facing a consistent skills deficit. Engineers who come out of engineering colleges are discipline-specific engineers. They do not have sufficient knowledge to start working straight away on their jobs in an industrial unit. We have working engineers who often get stuck in the domain-specific jobs. They do not move out to acquire multi-skills required today for meeting the changing needs of the engineering profession. Primarily, we have landed in this situation because of the fact that the engineering education has come to stay in highly domain - specific specializations; while as a sea change has taken place in the domain of technologies , in the size and forms of engineering projects, in engineering designs, in the science of management and in the economic development paradigm. India has also moved out from its inward looking policy of development to outward looking policy paradigm. Integration of technologies, advent of computer and microprocessors as important integrated components of advance technologies, institutionalisation of technical and managerial services has made the life difficult; engineers are no exception to this phenomenon. As against these developments, the engineering education is still very much grounded in the old functional paradigms. Paradigm - shift in the way projects are implemented is necessitating application of knowledge and skills other than staid engineering. While too much theory is taught, too little emphasis is given on experiments and on- the - job training. There is, therefore, no correlation in the present engineering education system between theory and practice. Today, the competence and multi-skills for managing multi – tasks, therefore, are required in engineers. The rate, at which new technologies, new products and new processes are coming up, is extremely rapid. A single engineering branch-specific subject can make you understand technology in its entirety; it needs interdisciplinary skills and knowledge to understand, comprehend and manage technologies and mega engineering projects today.

The basic challenge to the engineering education is the ever-changing definition of engineering itself which demands a new way to educate future engineers. We need today interdisciplinary and multi-skilled engineers. In other words it means, we need seamless engineers today. Mere specialization in one branch of engineering, as is the practice now, does not produce such engineers. More so, engineering education system - as it is today - does not prepare engineers for the role of project engineers and managers. Though a definite trend in the world of knowledge creation and its

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dissemination can be seen quite clearly today which is essentially a trend towards convergence and indivisibility, it is not so in the case of engineering education. We must change this. We need engineers today who have skills to deal with matters such as: business and commerce, people and resources, environment, health and safety, legal aspects, project, logistics and procurement engineering, application of IT and communication technology, the finer elements of contracts and claims, apart from the changing world of technology itself, Besides, all engineering activities have economic implications. Engineers need to be able to analyze the economic aspects of engineering applications. This empowers engineers to make well-reasoned decisions-in analyzing personal decisions as well as business, technology and informed conclusions about public policy based on a comprehensive analysis of costs and benefits of alternatives.

Specifically speaking from the point of view of industry perspective, engineers today should have a sound basic technical knowledge of selected branch of engineering complemented by the knowledge from neighbouring technical and social disciplines, social and ecological implications of technology, inter-cultural understanding and cultural empathy and skills such as system-building and problem-solving, effective communication both verbal and written, presentation, interpersonal, team working, business process, financial know-how, decision-making, project management, marketing, leadership and English language skill, apart from a sound understanding of the entire value-chain management. Some other foreign language proficiency skills such as Chinese, South East Asian languages, Spanish, etc, will also be very useful.

When we look at the curricula, we find the concepts that are being taught, topics and subjects that are in the curricula are quite outdated. . There is a need, therefore, to put in place a dynamic mechanism for synchronizing what we need to teach students so that they can meet the needs of the current and the future industry. It is only then that it would be possible for the stakeholders to come to common understanding as what engineering curriculum needs to be taught. Any change that we may want in the conventional practices cannot be done through legislation. It can be better and quicker done through credible consensus building process.

An institutionalized dynamic and working Industry-academia interactive mechanism is what will ensure what the industry needs in engineers and academia will provide that. This mechanism should be created as a matter of policy. It is well established abroad to the extent that professors become with their position in the academy automatically the top most industrial consultants.

Coming to the sector-specific requirement of engineers as an illustration, let us have a look at what we need in a construction engineer. Presently, only civil engineers are, by and large, in demand for the construction sector. Is a civil engineer a construction engineer by virtue of his education? I think., no, A pure civil engineer is not so equipped by virtue of education. A construction engineer needs a familiarity with the world of business and commerce Dealing with people and resources, environmental, health and safety aspects, legal aspects, project engineering, logistics engineering, procurement engineering, application of IT and communication technology in construction, dealing with partnerships and joint ventures, learning the nitti gritties of contracts and claims, apart from the

changing world of technology itself, apart from basic engineering knowledge of civil, mechanical, electrical and material engineering, electronics and computer engineering, etc. A construction engineer should be far more multi - functional and better equipped to deal with complex issues of construction business. Construction engineer is much more of an engineer – manager. The suitability and hence the employability of graduate engineers can be enhanced , therefore, with the creation of some such uniquely focused sector-specific modules for meeting the unique needs of civil aviation, ports and harbours, urban renewal, manufacturing, logistics and transportation projects, telecom and power sector projects, oil and gas exploration projects.

To conclude: Seamless transition in the engineering education has become important as is the general consensus that emerged at the previous three national conventions held at Kolkata in August, 2006, Baroda in May 2007 and Hyderabad in February, 2008 and the national conference held at New Delhi in November, 2008 and the national workshop held in March, 2009 at Madurai, TN.

M. Srinagesh

We know that Indian has got more engineers than the US. Our engineering colleges are producing around 8, 00,000 engineers every year. Employability of engineers coming out of IITs is better when compared with engineers coming out of the other colleges. If 100 engineers are employed, 65 % of these are from the IITs and the rest 35 % are from the other colleges- mostly, from the NITs. In absolute terms, the number is rather very small given the fact that the population of engineers produced by other than IITs and NITs is very large, who do not find employment easily. It is why, reportedly, MNCs find only 25 % engineers employable. This is the ground reality in India. Around 75% of vizag-based engineering colleges are having inferior infrastructure and fresh engineering graduates as the teaching faculty. Some thing similar is, by and large, the position in engineering colleges in the other states of the country. As against this, IITs and NITs are having better infrastructure facilities and faculty when compared to other state and central universities in our country. Why it is so? In my opinion the problem with our present engineering education system is that these colleges are not producing quality engineers, IITs and some of the NITs are the only exceptions. This is why our industry does not find a large number of engineers employable. We have landed in this situation primarily, I think, because of the privatization of engineering education which has lead to a sharp growth of engineering colleges with inferior infrastructure and poor quality faculty. It becomes very clear when we look at the growth of engineering colleges in India- mostly in the private sector- during the period of say last 20 years or so, we find the growth curve sharply moving upwards. In AP alone, we have more than 500 engineering colleges; and out of these, about 75 % colleges are located in Visakhapatnam alone.

The current engineering branch - specific engineering education is not producing employable engineers, primarily because it is not producing multi-skilled engineers which the industry requires. The current open economy needs such type of engineers. One of the other major draw backs of the current engineering education is that the students, who pass out, have a very poor communication and

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English language skills. There is no mechanism in position to assess the competency of the engineering faculty. This issue relates to the regulation of engineering education in India. We need seamless engineering education covering the basic subjects of the major disciplines of engineering sciences, management and social sciences like economics, statistics, information technology including computers and microprocessors, CAD, English language skills, etc, which will impart required multi-skills in engineers. It is, therefore, necessary that the current engineering system is restructured and reformed so that it delivers engineers required by the industry for meeting the challenges and seizing opportunities which are coming up at a fast pace in the current liberalized economy

Now is the question of reforming engineering education for making engineers employable. How to go about it? There may be some options before us. We need to examine these options. But, first we need to look at what we need to do. The reform may include, first the curricula, the second engineering educational infrastructure, third the faculty and the fourth the system as a whole. Let us consider first the curricula. It is well recognized fact that today we need wholesome engineers which the current branch - specific engineering education is not producing. As stated above we need to include subjects covered above in the curricula.

While considering reforming of our engineering curricula, we may also look at the other options like producing sector-specific engineers and not the branch - specific engineers as at present. In other words it means producing engineers for infrastructure sector, for the construction sector, for ports and harbours and so on. We should also produce engineers to meet the requirement of Industry-research and development. We can also consider producing seamless engineer- managers by combining management and engineering degrees in a five year continuous programme.

We can also consider having three-to-four schools-based pattern of engineering education; each school should be of a combination of engineering disciplines say mechanical, electrical, civil, metals and materials with additional courses included from management sciences, economics, IT and English language. Then there could be another school comprising, mechanical, electrical, chemical disciplines along with the courses from economics, management, IT and English language. In other words, these schools would produce engineers for construction of mega projects, for manufacturing, etc. We can have a school for designs which will produce design engineers for all projects. Similarly, we should reform the post graduate engineering education.

Presently, the duration of engineering course is of four years with common subjects during the first year and branch-specific engineering courses thereafter. Earlier it used to be of fiur years with common subjects during the first two years of the course and branch- specific during the remaining two years. I think that the undergraduate engineering education should be of five years with mandatory six months of paid internship with an industrial unit which should also be assessed and the marks or grade obtained thereof added to the total score. After this assessment is completed, the engineering degree should be awarded. The first year can include the basic engineering sciences covering all the major branches of engineering. Like engineering laboratories, we should also have personality development labs and practicals for developing listening skills, speaking, English language skills, behavioural

sciences, communication- both oral and written, presentation of reports, team working skill, interpersonal skills, etc. One more foreign language from out of Russian, French, Spanish, Chinese, Japanese, German, etc, should be taught.

We need to assess fully the current infrastructure that is there with the engineering colleges in the private sector and identify colleges which need to upgrade their infrastructure. As a matter of policy , these colleges should be give a definite time frame for improving their infrastructure and if they do not do it within that time frame, they should be asked to close down , but before that their students should be accommodated in the NITs and the other government engineering colleges.

We should also assess quality of the faculty that the private engineering colleges have. If we find from this assessment that quality of the faculty is not as per the standards that have been set by the regulatory bodies, engineering colleges thus identified should be put on a similar notice as that for the infrastructure. Even some of the IITs and NITs may also require some revamping in this regard. It is thus that we will ensure that the engineering education does not remain confined to IITs and NITS only; it is also delivered by the large body of private sector engineering colleges. While doing all that has been said above, we should also ensure that the standard of our engineering education matches with that of what it is in the developed countries.

We may also have to consider the present system, procedure and mechanism of selecting students for engineering course. We must not thrust engineering on our children; we must allow them to have their way in deciding what they want to do. We should also assess aptitude for engineering at the time of the common admission test (CAT).

For enabling our engineering degrees to be recognized by the developed countries, India should become the Full member of Washington Accord - a world grouping of countries mutually recognizing engineering degrees of its members-without further delay. AICTE should take action accordingly for this. This will enable our engineers to practice abroad. Similarly, for the recognition of professional experience of the Indian engineers, the Full membership of the EMF should be with the statutory body of engineers that will be created by an act of Parliament in due course.

Lastly, it is need of the hour that the professional bodies of engineers also take initiative for much needed reform of the engineering education by bringing government bodies, engineering institutions and the industry together at one platform to discus the matter thread bear and bring up some concrete time-bound action plan for this purpose.

T Prabhakar Rao

Earlier engineering course was of five years. Now, it has been reduced to four years. It is better to have five-year course, which need not be entirely in the college itself. There can be an internship of six-one year in the industry. It will provide practical exposure to the students. In this context, I may inform that the RINL is allowing hands-on experience to its engineers. Coming to the curricula, there is a need for

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its reform. Even today, some very old concepts are still taught which are no longer relevant. Emphasis in the curriculum has to be on the latest developments and future forecasts in technologies, apart from imparting multi-skills in engineers as required today by the industry. This can be done by including subjects in the curricula from other than engineering disciplines. This is also a well recognized need.

Coming to the population of the engineering colleges, we notice a very fast rate of growth of this population since 1970s. While there is nothing wrong with this growth, the problem is that this growth in most of the cases has been of engineering colleges with substandard infrastructure both physical and faculty. This fact is also well recognised.It needs to be dealt with as required. I think the competent authority has the full information about the engineering colleges which do not have infrastructure of required standards and these colleges can be asked to take action for upgrading their infrastructure to the required standards within a specific time frame and if they do not do it, these colleges should be asked to close down after taking appropriate measures for protecting the interest of the students of these colleges. This issue should be tackled before the competent authority sanctions new engineering colleges.

Coming to the skills that the engineers should have today, apart from a sound knowledge of the engineering discipline in which they have specialized. I think, engineers today should also have additional skills such as communication, interpersonal, lateral thinking, team working, creativity, objective reasoning, project management, understanding different facets of work, team working, presentation, etc. These can be imparted through including in the curricula subjects from the other disciplines such as management science, economics, industrial law, statistics, etc. While it may not be feasible to add more subjects to the curricula, abridged courses covering subjects such as project formulation, appraisal, monitoring of implementation, modes of financing projects, drafting of contacts, resolving disputes, etc, can also be run as a matter of continuing professional development by the professional bodies for their members as well as by the industry for their employed engineers. Today engineers should have these additional skills. From this view point, having a five years engineering course is also justified.

It is opined that we can also think of an engineering degree of all relevant basic courses of all the major engineering disciplines with required courses added from the other disciplines such as, economics, statistics, management science including finance management, managerial economics, future forecasts and contract management, dispute resolution, labour law, etc. There should be a mandatory paid internship of six months in an industrial unit which should be duly assessed and credits included in the overall score. The engineering degree should be awarded only after this is done. The concerned industrial unit should be compensated through tax incentive as a matter of policy so that the parents are not further burdened with the cost. During the course, responsibility, accountability and integrity should also be infused in the students through appropriate measures. We can also consider the other alternative; and this can be linking engineering education directly with the industry. For example, steel producing units setting up an engineering college having multidisciplinary curricula which will meet the needs of that industry and also of the other manufacturing units including those units which are

using technology based on chemical processing. We can also think of engineering education based on sectors such as infrastructure, manufacturing, ports and harbours, etc. All these specialized branches can be of multi disciplines.

Session Chairman's Remarks

Dr. K. Srinivasa Rao

Engineers, after passing out, imagine that they can now work in the industry. But when they join the industry they find that they cannot do what they had imagined. They need retraining for coping up with the industrial operations. The industry also finds them not employable as such. The industry realizes that they have to retrain these raw engineers for enabling them to work there, which involves additional expenditure for the industry. Many units, particularly of the small and medium sectors prefer recruiting engineers with some experience. The problem is that whatever is taught to the students in engineering colleges is not what the industry needs in engineers. There is a net skill deficit in this process which the industry tries to fill up with the additional training at a cost. This is the dilemma of the current engineering education. We have to consider what methodology and modalities we should adopt for engineering education so that the product that the engineering colleges produce and the industry further improves it by retraining at an expenditure which it has to recover somehow should reach the society at a least cost option and the society gets the benefit that it wants from this product (engineers).The pertinent questions that need to be considered today in this 4th national convention, which is on now, in this regard are: how to recognize the curriculum, how to frame the curriculum, what are the various curricula under practice and what curricula and methodology that can be suggested for the refinement of the existing process of producing engineers. There should be no subjectivities in the present assessment process, it should be more objective.

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Technical Session - II

Keynote Presentations

Dr. V.R. Singh

I am of the view that we should have an engineering education which will deliver multiskilled engineers, which are in demand from the Industry today. But we may continue with the four year course say of civil engineering in which in-depth study, as it is today, should continue in this branch and we should also include courses relevant to engineering from the other subjects such as of management science, economics, law, statistics, communication, etc. Earlier, we used to teach common subjects in the first two years of the course and branch-specific subjects were covered in the remaining two years of the course. This way we used to impart reasonably fair amount of knowledge to the students from the other engineering disciplines, applied science and mathematics. This practice was changed to first year of common courses and the remaining three years of branch - specific courses. Well, this change has proved to be counter productive.

We have a well recognized problem today of not having in most of the engineering institutions the faculty of a desired quality. Not much interest is shown by engineers to go for teaching. Perhaps, it is due to the fact that teaching is no longer a preferred area of work with engineers. Reason for this is well known and, therefore, needs no elaboration here. We must tackle this issue with the speed that it demands. We should make teaching in general and technical in particular pay-wise quite attractive as a matter of policy for motivating the right people to the teaching profession.

The current engineering education, curricula-wise, is too theoretical. We will have to include in the curricula a fair amount of practical component which should be of the case studies based on industry problems tackled successfully. The theoretical aspects of the curricula should be woven with these case studies in such a manner as would explain the theoretical concepts involved very clearly. We need to have technical books which, apart from covering the theoretical aspects, also include back-up case studies of the industry problems tackled successfully. By this way of engineering education, it will become easy for the students to under stand the concepts better which will have a retention potential for a quite long time. We should also include mandatory industry training in the curricula which should be assessed and credits obtained thereon included in the total credits obtained by a student at the end of the course. We should also have a mandatory six months of industrial internship after the course is completed in continuity and this internship should also be assessed and credits obtained thereon should be added to the total score. The degree should be awarded only after the successful completion of the paid internship. The industry should be compensated for the expenditure that it may incur thereon via the tax route.

The shortage of the quality engineering faculty can be met to some desirable extent by enabling practicing engineers and engineer consultants, who have demonstrated their engineering skills by way

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of their positions held in the industry and by way of having provided engineering consultancy to large projects and consequently have well established themselves nationally and internationally as practicing engineers and engineer consultants, to teach as a matter of policy.

We also need to keep engineering curricula dynamic in the sense that it is in step with the emerging new technologies, process innovations and construction methodologies and the like. In other words that the curricula should be such as would produce engineers who are able to meet the technological, managerial and the other business challenges prevailing at any point in time. More so, the engineering curricula should also enable meeting the specific industry needs at any point in time, for which it also needs to be a dynamic curricula. This calls for having an effective and efficient institutional industry-academia interface mechanism. This mechanism should be set up as a matter of policy.

The professional engineering associations like the IEEE should also endeavour to develop multi-skills in its members by taking up at regular intervals such continuing professional development including career enhancement programmes as would impart desired multi-skills in them, apart from sharpening their technical skills. The CPD should also include computer related programmes such as computer aided designs, computer aided manufacturing, etc.

Coming to electronics engineers, who are interested in developing medical equipment and accessories, which is a fast growing sector, will have to be multi-skilled seamless engineers having knowledge and skills of electrical, metallurgical and material, mechanical, electronics engineering and managerial skills, communication skills, marketing skills, presentation skills, public relation skills and the understanding of economics and statistics all rolled in an optimum mix in the curricula. They need to have a seamless engineering degree and industrial training. Similarly we have aeronautical engineering, industrial engineering, production engineering which are in a way seamless engineering and much in demand. We have now what we call nano technology which is also a fast growing sector both in science & engineering and in commerce. It is again seamless engineering. The conventions organized by the ECI including this 4th convention, therefore, are apt and timely steps taken by the Council for reforming the engineering education in the country for making it suitable to the current and future needs of the Industry.

I. Satyanarayana

Today, the number of technical people going abroad has come down to just 10 percent. The demand for civil, mechanical, and electrical engineering courses is increasing due to a high growth of our economy. These are very welcome signs for our engineers. The problem is that we have a student: teacher ratio very adverse. We have more students and fewer teachers to teach them when we compare it with the standard bench mark. This is one of the important reasons for our poor quality of engineering education. We need to tackle this problem. The other problem that we face today in engineering education is that we have a very rigid regulatory regime for deciding about the curricula. There is no freedom available to the institutions to decide about the curricula. Perhaps, the only exception is that

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of the IITs. This being so because the technical education is regulated by the AICTE. The institutions delivering engineering education in the country should have the freedom of setting the curricula and revise it from time-to-time depending on the changed perspective of the industry, R&D, etc.

We have a large no of colleges in India who do not have the infrastructure which is matching with that of the similar colleges in the developed world. I think we cannot afford to compromise or cut corners in the case of infrastructure as well as the faculty since we have to compete now with that of the world industry and R&D. The course delivery continues to be rudimentary in methodology and technology. The industry training during the tenancy of the course is not effective, as should have been; it is not assessed also; therefore, it is not taken that seriously both by the students and the faculty. The training with the industry should be a regular feature of the curricula; it should be assessed and the credits thus obtained by the students should be added to the total score at the end of the course. Additionally, there should be a mandatory paid internship of six months with an industrial unit, which should also be assessed and credits thus obtained by the students should be added to the total credit; and there should be a provision of repeating the training if a student has failed earlier to get at least the minimum credits that have been laid down for the training or for improving the overall grade of the course. The industry should be compensated for the paid internship via the tax route. With this reform, it will be possible for the industry to employ engineers straightaway on the jobs after a brief orientation of the work that the employing industrial init is doing and the technology (ies) that it is using for that work, etc. Presently, the industry finds engineers who come out of the colleges every year not employable straightaway on their jobs which involve realizing targets without further training which involves expenditure to the employing industry. The industry finds it expensive and, therefore, they prefer engineers with some experience. In the process, some body has to incur this expenditure in the first place and, therefore, industry is reluctant to pick up this expenditure. We will have to remove this position with the introduction of proper in-study training and the post study internship with the industry.

Swetha Chalapathi

During the course of my experience, I have observed many engineering students, though having obtained excellent credits in their engineering studies, not having clear concepts including of fundamentals of the branch of engineering discipline that they had studied. They had virtually nil practical knowledge of what they had studied. I am sure that there will be many people of a similar experience. The reason being that it is not the syllabus per se, it is because of the way the syllabus is taught that we produce such type of engineers. It is the quality of teaching. ; in turn it is due to quality of the engineering faculty that we have in a large number of engineering colleges in the country.

I would like to suggest that before introducing a syllabus, let us first look in depth at its practical aspects and satisfy ourselves that it will produce engineers that the industry needs today. It is well recognized fact now that the industry today needs multi-skilled engineers who cannot be produced merely by

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confining them to the domain-specific engineering education, but adding to the engineering syllabus subjects from the relevant social sciences such as management, economics, statistics, etc, apart from the relevant subjects from the other than a particular engineering domain in which a student has taken the admission.

I have also observed that the students are heavily loaded with the curricula and the dead lines to complete it. Where is the time and space for introducing more subjects in the course for making engineers multi- skilled as has been suggested by earlier speakers? We need to review across the board the current engineering curricula for its relevance to the current industry and the future industry. Perhaps, we will find that many of the subjects in the current curricula have become obsolete. We should delete these subjects and thus create space for the new subjects both of the engineering side and also from the social sciences sector.

Presently, the emphasis is for the curricula and not on whether it is objectively covered, is it giving the desired effect on the students? Are they acquiring a clear conceptual knowledge and practical applicability of the curricula that they are studying? This must change. The curricula should be more objective and focused.

We should revert back to the earlier practice of having a common curriculum for the first two years of the course out of the engineering disciplines other than the one to which a student has been admitted. The engineering domain-specific courses for which a student has been admitted can be there during the third & fourth year of the course. After weeding out the obsolete part of the curricula both in the general steam and the engineering domain-specific specialized stream of the course, we should add some general courses in the first two years of the course from the social sciences and management and also some in the final year of the course. We can as well consider increasing the duration of the course to five years, as it was also the practice in the past. We can, however, think of keeping the six months of the last year for the mandatory paid internship with an industrial unit. The industry should be compensated via the tax route as a matter of policy.

The present predicament in which we find ourselves with the engineering education is also substantially due to the very regulatory mechanism represented by the UGC/AICTE. If AICTE had done its job as per its set objective, perhaps we would not have been in this position in which we are, as is now well recognized. We must reform this regulatory mechanism so that it delivers the world-class engineering education in India.

We can get excellent professionals only if one takes the profession based on his / her aptitude and liking for it. The aptitude for engineering is not assessed as the current CAT format does not do it. We need to incorporate this feature in the CAT format.

We should also pay attention to improving the quality of our engineering faculty and direct the engineering colleges not having adequate and required infrastructure to upgrade their infrastructure and faculty with in a certain time frame. In case they fail to do so, they should be directed to wind up their business, but this should only be done after the students have been placed at alternate places so

that they do not suffer the consequences of such closures. The new engineering colleges should be approved only after they have included standard infrastructure and faculty in their proposals. This should be further checked up before these colleges start admitting students.

From the Floor

Dr. P. Puthiyavenayagam

The aim of Engineering Council of India (ECI) of imparting practical skills in the engineering curriculum itself is welcome and is much needed today. But any discipline say civil, mechanical, electrical or the like has many streams and the students may go to any stream. In that case, imparting skills in all possible streams might be difficult in the curricula itself purely from the point of time needed. Hence, I suggest that professional bodies of engineers may float certificate courses to start with relevant to their specialization which could be upgraded to diploma level course gradually duly accredited by relevant agencies. Further, the industry could be encouraged to start such courses as would lead to a "win - win" situation for both the industry and engineering students.

The duration of the engineering course should be made five years from its present duration of four years. Out of this, one year should focus on additional skill building courses and six (6) months paid internship with an industrial unit. The industrial unit should be compensated for the expenditure that it will incur via the tax route.

ECI should press for a membership of bodies which are concerned with the engineering education including its accreditation so that the ECI's views are known to the policy players. It will also help in checking the growth of the ill-equipped engineering colleges in the country.

Evaluation of the faculty by the students should be made mandatory for all the engineering colleges in the country as a matter of policy. The bench mark should be at least 85 % for them to continue to run the college. This will help in a great measure to maintain the quality of engineering education.

It should be made mandatory to upgrade the engineering curricula once in every four years in which ECI should have a say. This will help in keeping the curricula in pace with the market trend.

During the last five- ten years period more than 500 Engineering colleges have come up in this part of the country (South India); and most of these colleges came up in and around Visakhapatnam. Why has this happened? Why it was not done in a planned way? Why there is no Government college among these colleges? When we studied, there were only government colleges. It is well accepted that these colleges delivered quality engineering education. Is this mushrooming of engineering colleges in the private sector not one of the reasons for deterioration of the engineering education in the country? I think it is.

While the AICTE was supposed to regulate the engineering education, it appears, therefore, that it did not do its job quite objectively. Otherwise, this mushrooming of engineering colleges without required infrastructure and quality faculty would not have happened. This should be looked into. Though, some

body may be getting more money at other places, still if he / she is interested to join the faculty, he / she will do it. The position today is not like this. It is better remuneration at other places which takes away engineers from the teaching positions even though they may be interested and may be having the aptitude for teaching. It is primarily because of this he / she does not join the fcaulty.Earlier this was not the case. We used to get a very good faculty. This is another important point that we must also look into.

P.S. Murthy

A suggestion was made that the duration of the engineering course should be increased from the present four years to five years. I think that we should consider the financial burden that it will put on the parents. We can produce multi-skilled and quality engineers even in four years. We need to develop proper curricula and find quality faculty. The marine engineers are trained in four years. During the first three years of the course in the total working day of 10 hours, workshop practice is compulsory for 6 hours a day apart from 4 hours of classroom study. During the fourth year the whole day's work is related to theory. Thus, during the first three years of the course, a student studying marine engineering gets enough workshop practice. It is because of this appropriate mix of practicals and theory marine engineering students, when they pass out, are received with open arms by the industry. Can a similar practice be though of for the other engineering branches?

Session Chairman's concluding Remarks

A.P. Chowdhry

When engineers join the industry, they find themselves lost. Why? This being so because they are not able to comprehend what they have to do there. This has not been taught to them during their course. It is true for all engineers who come out from engineering colleges and join the industry. It was true for my self also. Perhaps, you may have had a similar experience. Let us take an example. When engineers with a degree in metallurgy enter steel plant, they find there large black furnaces , pipes doting the roof, big rolling mills, heat and dust, etc, and they realize that it is a different world for them. Then they find that they have to do some other things in the steel plant which they have not been taught during their course in the engineering college. So, they are to be trained for what they have to do in the steel plant. This training has to be given to them by the employing steel plants, which these plants do; and it is done by incurring some expenditure, which they do not like to incur, but, given the engineering education as it is, they have no choice. The story is the same for engineers of the other branches when they enter the industry. So, the pertinent question here is: can we do away with it? Yes, it should not be difficult question to tackle. It needs a reform of our engineering education. Learned key note speakers in this session have spoken like-wise and also given their views as to how to go about doing this.

The pertinent question now would be: can we think of engineering branches which are not branch-specific as at present? Instead, can we have sector- specific engineering branches? Say for example,

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steel technology & Commerce, industrial production or manufacturing, roads & buildings, infrastructure, electro-chemical processes oil exploration and refining, automobile, construction, power generation and transmission and so on. Can we think of having a combined degree of management & engineering? Such a degree will enable its holder to walk across the whole spectrum of industry that we have and , therefore, it is likely to be in much demand given its rather a large scope for moving up in the career. I am told that a similar kind of view has also emerged at the past three national conventions, national workshop and at the 7 national conferences that the Engineering Council of India have organized on the reform of engineering education.

We have already in position some general industry-specific degrees in engineering such as industrial engineering and production engineering. These two separate degrees can be easily merged into one engineering degree with the title of manufacturing. Similarly, we have in position an engineering degree called petroleum refining. We can add required courses from oil geology and oil exploration along with some courses from economics, statistics and management to it for making it a degree in oil exploration and refining. Engineers with this kind of degree can also work in many other sectors at the higher management level. If you consider all these sectors, you will find that the curricula for these sector-specific engineering branches will have to have subjects from the current mechanical engineering, electrical engineering, chemical engineering, metals, metallurgy and material engineering, etc. Second important point here will be that these sector-specific engineering branches can be a part of the industrial sector and taken up by the industry itself. By this way, we will be able to merge industry and academics into a one whole as like that of the medical education. We can also think of other industry-specific engineering branches.

There will be many common subjects in all these sector- specific engineering branches. These will be commercial aspects of the sector, project management, economics, statistics, applied physics, applied mathematics, applied chemistry, relevant subjects from management science, etc., apart from dealing with labour, regulatory bodies, report writing and presentation and English language. All these subjects and sector-specific engineering subjects can be included in a syllabus of four-year course. In between during the course, mandatory industry training can also be included in the programme, which is assessed and credits thus obtained are added to the overall credits. Additionally, there should be at least six months mandatory internship with an industrial unit or an organization pertaining to that particular sector. This internship should also be assessed and credits thus obtained added to the over all credit; and the degree should be awarded only after these credits are included in the total credits- from examinations and from the in- course industrial training and internship training with an industrial unit or sector-specific organization. As a matter of policy, the industrial unit or an organization- where the student takes the internship -should be compensated by the government via the tax route for the expenditure that they will incur on the training .

It is a fact that our engineering faculty is also not, by and large, of that quality which we need today. This is also a very important reason for our low quality of engineering education. The practicing engineers and engineer consultants are not there on the faculty. Taking the example of a degree in steel

technology & commerce, if we have such an engineering degree as a matter of policy, the practicing engineers, who have worked in large steel plants, set up steel mills or have provided independent consultancy in setting up steel plants will be the better persons to teach all about steel industry. Further, training during the course in the running steel plants would provide an excellent means of clearing the concepts learned during the course. If such training is made compulsory as a matter of policy and is also assessed at the end of the course and credits thus obtained by the students are added to their overall credits, it will make the students as well as training providers serious about their task. Second, I agree with the suggestion made by some learned keynote speakers that six months paid internship should also be made mandatory as a matter of policy and the industry should be compensated for this via the tax route. We need to address these points for arriving at the right course of action for reforming the engineering education.

Coming to R&D, I think that we need to produce R&D engineers who have aptitude for it. Run of the mill students going for R&D with the objective to get some monthly payments till a job is found. This is the position today. It is not desirable. We have got to change it. This can better be done via the entry selection process to such courses by assessing aptitude for R&D. We must admit only those students to postgraduate courses that have aptitude for the R&D. As a matter of policy, we need to make the industrial R&D jobs financially attractive.

Panel Discussion

Panel Presentations

A.K. Sehgal

Increasing the duration of engineering course to five years, in my opinion, is not desirable as it will impose additional financial burden on the parents as has been pointed out by some of the speakers. Some speakers have suggested that the duration of the engineering course can be of four-and-a- half years instead of present four years. In my opinion this proposal is not practical as the commencement of the course will not be at the same time of the year every year. However, introducing compulsory internship of six months with the relevant industry may be considered before being eligible to employment /practice, as in case of the medical profession. Since our engineers have proved their capabilities world-over as well as in the country, I think there is nothing fundamentally wrong with the curricula of engineering education as such. However, periodic review /revision is desirable and necessary .I feel that the review / revision of the syllabi / curricula should be based on the interaction between the industry and academia. In my opinion, if these measures are considered, it will help the engineers who pass out to work in the industry straightaway without much of retraining to the expectations of their employers.

The applicability of the idea of seamless engineering as mooted by the engineering Council of India and deliberated at the previous three national conventions, national workshop held at Madurai and at the 6th national conference held at New Delhi needs to be looked into in depth. In my opinion, in my field i.e., marine engineering, the training that is imparted is, in a way, seamless. It also has the approval of the international body – International Maritime Organization. It has got an inbuilt system of continuous professional development. The qualification / certification at all stages are recognized internationally. To be eligible for almost every promotion on the ship, a marine engineer has to suitably upgrade his knowledge and skills and pass the examination of the appropriate level, the examinations are conducted by the Indian Maritime Administration. The government of India has also set up Indian Maritime University. As Shri P.S.Murthy has said a short while ago, the marine engineering curriculum is an optimum mix of practicals and theory.

In my opinion, the viewpoint of seamless-engineering can also be conceived by grouping together industries for meeting the requirements of a particular sector say infrastructure, construction sector, power sector, steel technology and commerce and so on. Accordingly seamless curricula can be developed for each sector. With this method, we may end up having fewer seamless engineering branches as against the current engineering discipline-wise degrees. One of the important considerations in the reformation of the curricula should obviously be an optimum combination of the practical and theoretical aspects of the course, keeping in view the requirements of the industry.

Shri Ashok Sehgal is from the Institute of Marine Engineers & Member Board of Governors, ECI.

Dr S.R.M.Rao

In my opinion employability of engineers should be the responsibility of the institutions that teach engineering and thus produce engineers. In other words, these institutions should take responsibility to produce engineers who are employable. Accordingly, in turn, it should be the responsibility of the faculty of these institutions. The total training structure including the quality of curricula and the quality of faculty should be such as would produce employable engineers. The engineering teaching institutions should also be ranked as per their performance. It should be a kind of index which is based on the employability criteria of engineers that these institutions produce.

I am of the opinion that the present duration of four years of the engineering course should stay as it is. Reform of the curricula can be considered for making it such as would meet the current and future needs of the industry and R&D.We may also consider including in the curricula project-oriented practical training. This training may be of two components- one in the college itself and the second in an industrial unit. The course project may also be on some industrial problem. The postgraduate course should be of subject-specific specialisations, where the depth of knowledge of the subject of specialisation is the main consideration. .

Dr. S.R. Gollapudi

I am a retired General Manager of Visakhapatnam Steel Plant with 35 years of Industrial Experience and right now Professor (IE, PE Training & Placement) at GITAM University, Visakhapatnam . I consider the theme of the 4th convention apt and timely. My job during the last ten years has been of teacher of engineering. I agree with what Dr Rao has said a short while ago that it is the responsibility of engineering institutions to train the students in such a manner as it would make them readily employable. The training structure, mechanism and delivery should enable it. The faculty has a big role to play in enabling it provided of course, it is of the desired quality. If the faculty is not of the desired quality, it will not happen. This must be clear. It is a well recognized fact that today in most of the engineering institutions we do not find the faculty of desired quality. The curriculum is also not generally of an optimum mix of both the theory and practicals. In this regard, we may take note of what Shri Sehgal of the Indian Marine Engineers has stated a short while ago in his panel presentation.

The curricula should also include practical training during the course and also project-oriented industry training in an industrial unit as has been suggested by DR Rao in his panel presentation. I will add that this training should also be assessed and marks assigned to it which should be added to the total score. The degree should be awarded only after this is done and not on the basis of only written examination. The curricula should also ensure that the students acquire required multi-skills apart from a sound theoretical and practical knowledge of the engineering subjects of that branch for which they have been selected. Many subjects have become obsolete. These subjects should be deleted from the curricula and new subjects included in their place. Secondly while doing this exercise, we may also try

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to accommodate subjects from the other relevant social and management sciences in such a manner that the curricula becomes wholesome and gives the desired result.

We will have to give full freedom to the institutions to set their curricula that they need to teach in order to reach to the 100% employability target as their output. This freedom is not there presently as it is regulated. In the institution in which I teach, our objective of the training is the employability of engineers that we produce. Though, we have succeeded, after we have become Autonomous and Deemed University, but, it is only to some extent and not to the full extent. It is primarily because of the regulation that is in force. The general experience with the present regulation is that it has become counterproductive and hence needs an urgent reform.

Session Chairman's Concluding Remarks

Umesh Chandra

In my opinion reform of the engineering education is called for. I agree with the views expressed by the distinguished panelists of this session. I am also satisfied with the discussions that have taken place which, by and large, reflected the consensus not only on the urgency for reform of the engineering education, but also the lines on which it should be done. Most importantly, the important recommendation, which has been made unanimously in this convention, is for a mandatory paid internship of at least six months with an industrial unit which should be assessed and credits thus obtained by the student should be added to his / her total score and the engineering degree should be awarded only after that. The industry may be compensated by the government via the tax route.

The second important recommendation that emerged is regarding reforming the current regulatory mechanism itself for giving much needed flexibility to the engineering educational institutions to revise their curricula for making it meet the needs of the industry and & R&D from time-to-time. The third recommendation that was made pertained to making the work of faculty financially attractive for attracting to the best talent. This needs an urgent consideration of the competent authority.

I am also pleased to note that the unanimity was there for including in the engineering curricula a mandatory industrial training during the course with a proviso that it should be assessed and credits that the students get should be added to the total score of the course.

I would add that we also need to reform our course books of engineering by adding practical component to these books which may be of the important case studies of successful projects implemented or an important industry problem successfully tackled. These case studies can be appropriately linked to the theoretical course which will make it easy for the students to understand the concept clearly that is being taught in the form of theory.

Shri Umesh Chandra is the Director (Operations), RINL & Chairman, IIM, Vizag Chapter

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59. K.V.E. Shekar
RINL/ AGM ERP

60. Dr. Kanika Singh
IEEE

61. Kuldeep Kapoor
CE, Military Engineering Services
Visakhapatnam

62. Lalan Kumar
VSP

63. L Pugazhenthy
President, IIM & ED, ILZDA
New Delhi

64. M. B. Srinivas
Professor and Group Leader Electronics and Communication Engineering BITS-Pilani, Hyderabad Campus, Hyderabad - 500 078

65. M. Srinagesh
Visakhapatnam

66. M.B.V. Rao
R&D, VSP

67. M.C. Mane
VSP, ERS

68. M. Madhusudhana Rao
T&DC, VSP

69. N. Gouri Shankar Rao
AGM,ERP, VSP

70. N. R. P. Rao

71. O P S Rana
ACE (Reserve)
Military Engineering Services
Visakhapatnam

72. O.R.M. Rao
T&DC, VSP

73. P . Vidhya Sawan
ESUF, VSP

74. P K Mitra
Vizag

75. P M Rao
GC Member,
Visakhapatnam

76. Dr. P M Rao
Visakhapatnam
Andhra Pradesh

77. P. M. Rao
Vishakhapatnam

78. P. Puthiya Venayagam
IGIAR Kalpakkam

79. P. S. Murthy
Past President, IMEI, Vizag

80. P. Sri Hari Balu
VSP, Blast Furnes Dept.

81. P. Verraju
VSP

82. P.C Nayak
T&DC, VSP

83. P.N. Shali
Director, ECI

84. P.V.C. Rao
AU

85. P.V. Ravi Kumar

86. R.V. Satyanarayana
VSP, T&DC

87. R.S. Prasad
Addl.Director General
CPWD, New Delhi

88. R.W. Achanya
BF, VSP

89. Ramana Murthy
Sr. Manager
Mktg., IOCL

90. Ruchira Gupta
QA&TD, VSP

91. S K Pandey
AGM,VSP

92. S R Gollapudi
GITAM University Rushikonda,
Visakhapatnam

93. S. Chandra Sekhar
Govt. PSU Tech.

94. S. K Jha
LMMM, VSP

95. S. K. Jayaswal
QA&TD, VSP

96. S. Mandal
DGM(QA&TD)I/c, VSP

97. S. Swetha Chalapathi
Professor, VITAM

98. Satyanarayana ,
Professor, VITAM

99. Surendra Babu
AP Transmission

100. T. Goutham
QA&TD, VSP

101. T. S. Reddy
SE (Reserve), Military Engineering Services
HQ CE (Navy), Visakhapatnam

102. T.V. Ramana Rao
T&DC, VSP

103. U. N. Behra
QA&TD, VSP

104. Dr. Uddesh Kohli
Chairman, ECI

105. V S R K Prasad
Principal, Anil Neerukonda Institute of Engineering & Technology Visakhapatnam, Andhra Pradesh

106. V. Devi Prasad
Chartered Engineer & Secy., IOV

107. V. L. A. J.A Sekhar
VSP, BF

108. V. R. Singh
IEEE

109. V. Aruna
T&DC, VSP

110. V.H.V.K. Narasimha Rao

111. Vayyasi Suresh
Associate Professor
Computer Science and Engg. Deptt.,
Pydah College of Engineering and Technology
Visakhapatnam, A.P.

112. A. P. Chawdhry
Director(Proj.), RINL
Visakhapatanam

113. G. Rajaramn
AGM(QA&TD), RINL
Visakhapatanam

114. Umesh Chandra
Director(Operations), RINL,
Visakhapatanam

Engineering Council of India (ECI)

Objectives

The main objectives of ECI are to work for the advancement of engineering profession in various disciplines and for enhancing the image of engineers in society. To this end, ECI will be focusing on quality and accountability of engineers.

In the emerging WTO/GATS environment, mobility is becoming an important issue. Mobility of Indian engineers for delivering engineering services in other countries will be hindered unless expertise of Indian engineers is recognized and accepted at the international level. Conforming to internationally laid down norms is essential also for protecting employment of engineers in internationally funded projects, multinational corporations and large companies in India.

According to its Memorandum of Association, the objectives of ECI are as follows :

1. To promote the science and practice of engineering for national development, collectively along with constituent members.
2. To encourage engineers to serve the needs of the society.
3. To promote advancement of education of engineering in the country.
4. To promote the practice of continuing education and training to upgrade the quality of engineering professionals.
5. To identify and undertake activities of common interest to the engineering profession.
6. To encourage inventions, investigations and research; and promote their applications for development of the national economy.
7. To identify and undertake activities directed to enhance prestige of engineers in the country, and to secure their rightful place at various levels of planning, administration etc.
8. To promote steps to attract bright persons of the younger generation to the engineering profession.
9. To assist Associations/Professional Societies in normalizing criteria for membership so as to make these nationally equitable and internationally acceptable.
10. To establish a common "Code of Ethics" for professional and consulting engineers adoption by Association/Professional Societies and to evolve the strategy for its enforcement.
11. To interact with the government at State and Central levels and help adoption of policies for betterment of the engineering profession.
12. To represent engineers and engineering professionals of all disciplines, at National and International levels.

13. To maintain a Natioanl Register of "Professional Engineers" and a National Register of "Consulting Engineers" who are engineering organisations employing professional engineers where principal occupation is the independent practice of engineering.
14. To acts as a Nodal Body, representing India, for bilateral/Multi-lateral recognition of "Professional Engineers" and "Consulting Engineers" on mutual and reciprocal basis.
15. To identify and encourage the implementation of best practices for the development and assessment of engineers intending to practices for the development and assessment of engineers intending to practice as professionals in domestic as well as foreign markets.
16. To standardize criteria to be adopted for according status of "Professional Engineer" and "Consulting Engineer" and to accord licence/accreditation to practice engineering in India.
17. To identify major engineering disciplines in which substantial cross-border mobility is expected and to cater to those disciplines in which substantial cross-border mobility is expected and to cater to those disciplines in ECI's policies, practices and their registers/sub-registers.
18. To identify barriers to professional engineers' mobility and to develop and promote strategies, to advice and, if required, assist Central and State Government Departments, in managing those barriers in an effective and non-discriminatory manner.
19. To develop mutually acceptable standards and criteria for facilitating cross-border mobility of experienced Professional Engineers and Consulting Engineers among WTO signatories.
20. To establish such committees, as may be necessary, for reciprocal joint activities with similar professional bodies in other countries who are signatories of WTO and other related agreements.
21. To network and cooperate with other such international bodies who are engaged in similar activities.
22. To perform any or all other acts, deeds and things, which may become necessary to be performed at any stage to achieve the main objectives of improving the image of the engineering profession and of the professional engineer and to serve the needs of the society.

Tasks

In order to meet its objectives, ECI task include the following :

- Certify the competence of engineers for undertaking professional activities.
- Certify the competence of organisation offering engineering consultancy services.
- Integrate continuous development programme with the certification process to upgrade expertise continuously.
- Lay down norms of professional conduct and take appropriate action promoting and ensuring compliance.

- Join international networks such as Engineers Mobility Forum for protecting the interests of Indian engineers in the emerging international scenario.

Engineer's Bill

ECI has prepared a draft Engineer's Bill for the consideration of the Government of India, which lays down the criteria for the process of registration of Professional Engineers and Consulting Engineering organisations and provide necessary statutory framework for the same. The draft is being processed by the Ministry of Human Resource Development.

Membership

Membership of the ECI is open to societies/organisations of engineers who meet the following requirements :

- having been established statutorily or registered in accordance with law.
- having atleast 100 corporate members.
- having existed for atleast four years.
- the accounts being audited annually.

Board of Governors

Chairman

Dr. Uddesh Kohli	Chairman Emeritus Construction Industry Development Council (CIDC)

Vice -Chairman

Mahendra Raj	President Indian Association of Structural Engineers

Treasurer

Chander Verma	President International Council of Consultants

Members

S. Ratnavel	Member Association of Consulting Civil Engineers (India)
P. S. Sundaram	President Broadcast Engineering Society (India)
Dr. Naresh Kumar	Advisor, Head - RDPD Council of Scientific and Industrial Research
P. R. Swarup	Director General Construction Industry Development Council
K. K. Kapila	President Consulting Engineers Association of India
Rajeev Kher	Joint Secretary Dept. of Commerce, Ministry of Commerce and Industry
Prof. C. V. Ramakrishnan	Member Indian National Academy of Engineers
S.K. Vij	President Indian Buildings Congress
D. P. Misra	Past President Indian Institute of Chemical Engineers

Lt. Gen. (Retd.) A. K. Puri *PVSM, AVSM*	Chairman Indian Institution of Bridge Engineers (DSC)
Dr. K.K. Padnabhan	Chairman Indian Institution of Industrial Engineering
J. S. Saluja	Member Indian Institution of Plant Engineers
Dilip Takbhate	President Indian Society for Non Destructive Testing
Niranjan Swarup	Executive Director Indian Society for Trenchless Technology
B. N. Puri	Principal Advisor (Transport) Planning Commission
R.S. Prasad	ADG (Trg) CPWD, Ministry of Urban Development & Poverty Alleviation
Gp. Capt. (Retd.) H.C. Bhatia	Secretary (Admin) The Aeronautical Society of India
Dr. Baldev Raj	Past President The Indian Institute of Metals
Prof. K Rajgopal	Chairman The Institute of Electrical and Electronics Engineers Inc.
Lt. Gen. (Retd.) Ashok Agarwal *PVSM*	President The Institution of Electronics and Telecommunication Engineers
Ashok K. Sehgal	Member The Institute of Marine Engineers (India)

Executive Committee

Dr. Uddesh Kohli *Chairman, ECI*	Chairman Emeritus Construction Industry Development Council
Mr. Mahendra Raj *Vice Chairman, ECI*	President Indian Association of Structural Engineers
Mr. Chander Verma *Treasurer, ECI*	President International Council of Consultants
	Chairman Construction Industry Development Council
	Chairman Indian Society for Trenchless Technology

Members

Mr. K. K. Kapila	President Consulting Engineers Association of India & Indian Buildings Congress
Mr. P. R. Swarup	Director General Construction Industry Development Council
Lt. Gen. (Retd.) A.K. Puri, PVSM, AVSM	Chairman Indian Institution of Bridge Engineers (DSC)

Invitee

Lt. Gen. (Retd.) Ashok Agarwal, PVSM	President The Institution of Electronics and Telecommunication Engineers
Mr. P. N. Shali	Director Engineering Council of India

Engineering Council of India

ECI has been formed by coming together of a large number of professional associations / institutes of engineers. The present members are :

1. Association of Consulting Civil Engineers (India)
2. Broadcast Engineering Society (India)
3. Computer Society of India
4. Consultancy Development Centre
5. Construction Industry Development Council
6. Consulting Engineers Association of India
7. Indian Association of Structural Engineers
8. Indian Buildings Congress
9. Indian Concrete Institute
10. Indian Geotechnical Society
11. Indian Institute of Chemical Engineers
12. Indian Institution of Bridge Engineers
13. Indian Institution of Industrial Engineering
14. Indian Institution of Plant Engineers
15. Indian National Group of The IABSE
16. Indian Society for Non Destructive Testing
17. Indian Society for Trenchless Technology
18. Institute of Urban Transport (India)
19. International Council of Consultants
20. Institution of Mechanical Engineers (India)
21. The Aeronautical Society of India
22. The Indian Institute of Metals
23. The Institute of Electrical and Electronics Engineers. Inc.
24. The Institute of Marine Engineers (India)
25. The Institution of Civil Engineers (India)
26. The Institution of Electronics and Telecommunication Engineers
27. The Institution of Surveyors

4th National Convention on Seamless Engineering Education for Better Employability of Engineers

July 20, 2009, Visakhapatnam

From left, Shri D. V. S. Murthy, Dr. Uddesh Kohli, Shri Y. Manohar & Shri L. Pugazhenthy on the dias in the opening ssession

Shri Y. Manohar, Director, RINL & the Chief Guest lighting the lamp

Dr. Uddesh Kohli presenting his Welcome Address

Shri P.N. Shali presenting his Keynote Address

Shri L. Pugazhenthy, President IIM presenting Theme Address

Shri Y. Manohar, Presenting inaugural address

A view of the Audience