

## CHALLENGES IN ENGINEERING EDUCATION IN INDIA



**Rakesh Mehrotra**  
*Former Associate Professor*



**S. K. Mazumder**  
*Former AICTE Emeritus Fellow  
and Professor*

*Department of Civil Engineering,  
Delhi College of Engineering (DCE/ DTU)*

### INTRODUCTION

India has been evolving the educational system for over the past seven decades taking into consideration its priorities and global trends. The major issues to be addressed in the Indian Education System are quality and scale. Post Independence, India started off with quality as the primary factor in establishing the Indian Institutes of Technologies (IITs) and the National Institutes of Technologies (NITs). That was followed by a phase with focus on large scale increase in educational institutions. India has been trying to expand higher education from its present enrolment of 25.8% to target the World average Enrolment ratio of 33%. As per the All India Council of Technical Education's (AICTE's) latest notification ([m.hindustantimes.com](http://m.hindustantimes.com), dated 18 May 2019) there were 3,241 institutes offering Undergraduate (UG) and Post Graduate (PG) courses in Engineering disciplines with an intake of 15,87,097 seats in 2018-19. The expansion sans job opportunities saw seat vacancy in 2018-19 at 49.3%. It has also resulted in a recommendation not to allow any new Institute in the next two years.

Before 1990, technical education was largely Government funded however over a period of time the Government was unable to find resources for meeting the growing demand. The private sector saw it as a lucrative opportunity when the Government policy allowed setting up of self financing Technical institutions. That resulted in more than 10 times increase in number of UG/ PG Engineering education Institutes and available seats. In the current situation a large number of the self financing Institutions may close down in future due to lack of demand and consequent financial viability.

The single minded pursuit for inclusion and growth in enrolment took quality aspects to the back seat and led to a situation where higher financial outlays are resulting in negative outcomes in terms of quality deficits and inappropriate human resource development. The repeated statements by industry captains that only 10-25% of the engineering graduates have chances of getting employed needs to be heeded by the higher education regulators, policy makers and the administrators of the Technical Education Institutes. There is much to be modified in the system to improve the Technical education in the country.

### PREVAILING EDUCATION SYSTEM

The present system is focused on encouraging rote learning, and preparation with no value for nurturing creativity. The students and the school administration measure success of an individual or the school in terms of their students getting high marks in Board exams and cracking competitive exams that are largely designed to test rote learning and have little to do with creative thinking and application of knowledge. These patterns continue in higher education

institutions including engineering colleges as well. There is excessive importance on marks for seeking admissions to higher classes and for jobs. Due to huge variability of standards and decreasing reliability in public examinations, admission tests and competitive exams for jobs have become a normal practice. All the above have resulted in exam focused study instead of knowledge and learning orientation not only at secondary education stage but even at UG/ PG level and beyond. Coaching centers have mushroomed for cracking such tests. Therefore the whole educational ecosystem has become exam centric particularly where paper setting and question paper evaluation is not done in-house/ internally.

## OBJECTIVE OF HIGHER EDUCATION

There is a big difference between perceived objectives of higher education and ground realities in India. Today, it is common to acquire an academic degree to qualify for a job or to fulfill a prerequisite for a higher degree. For many it may just be for time pass. Lofty objectives like intellectual growth, developing knowledge, competency in certain subjects and quest of knowledge touch very few among those pursuing higher education degrees. It must also be understood that the purpose of higher education and the training requirements vary widely depending upon the programme being pursued such as Academic- BSc, MSc, BA, MA in pure Sciences or Humanities; Vocational/ Skill or Professional- B Tech, M Tech in Engineering and Technology.

- The Professional degree programmes require all the theoretical concepts and knowledge of standard imparted in BSc/ MSc along with experiential learning, industry relevant practices and skills and practical application of knowledge. For Engineering degree holders, there is a possibility of a predetermined future. Therefore appropriate exposure, proficiency and adaptability can improve suitability for the job.
- The Academic degree programmes do not have any task other than academic coursework. Unlike professional courses/ job oriented courses there is hardly need for anything except academic rigour.
- In Vocational degree programmes there is very little theory and large part is related to practical training.

## POLICY AND ADMINISTRATIVE DEFICIENCIES

Forces of globalization and liberalization have cast their influence on the higher education system in India. While joining the rat race for QS or Times, World University ranking the focus is on parameters and weightages used in getting scores. In view of the above, lopsided importance is being given to PhD, research papers, attending courses, etc. for faculty recruitment, appraisal and promotions.

- The Indian higher education system has been operating on assumptions that academicians are honest, hardworking, dedicated, not prone to monetary inducements, etc. This may have been true 40 yrs back but today most people are compelled to deriving benefits by gaming the system. Various criteria as given below have been evolved over the years: A higher education desk in Delhi thought that PhDs would increase the quality of Indian higher education system and it became an essential qualification. Consequently, all and sundry started doing PhDs and M.Phils.
- When number of seminars and conferences became a criteria for fetching marks during assessment, all colleges started conducting national and international seminars.
- When ‘articles published’ became one of the norms, a number of article publishing industries sprang up serving the poor and needy teachers who otherwise can’t write and publish.
- When publishing an article in a UGC approved journal became the norm, almost all the journals managed to get the stamp of approval from UGC and the publishing industry thrived.

- When honours and awards became the norm and began to be recognised, people in Higher Education Industry made it so simple that one can get a D.Lit. degree for a paltry sum.
- When Higher Education in India started recognizing ‘member of editorial boards’ or Editors, many serving and retired Professors either started their own journals, especially online journals with a prefix of ‘international’ or became members of editorial board on quid pro quo basis.
- Likewise, being a member of BOS (Board of Studies) is an honour for a professor which can be tacitly got by ‘understanding’ and ‘influence’.
- When ‘books published’ started getting marks during selection process of Assistant Professors, many aspiring teachers became authors, overnight.
- When minor and major research projects became to be recognized as merit, clamour started building around them, and people started getting them.
- 25 yrs back, low pass percentage meant higher quality. Sometimes, in a class, only a few used to secure the passing minimum. Marks scored by students truly reflected their quality and erudition in the subject. Students got the Marks that they really deserved. However, after the advent of National Assessment and Accreditation Council (NAAC) and recently National Institutional Ranking Framework (NIRF), when pass percentage became one of the criteria, pass percentage of several colleges shot up.
- After the advent of NAAC and NIRF, all the colleges are obsessed with securing ‘A+’ grade by NAAC and a decent ranking in NIRF. The objective of UGC, NAAC and NIRF is to improve the quality of Higher Educational Institutions by measuring the institutions using a set of Performance Indicators.

However, the indicators created to judge have not served their intended purpose; the solutions became problems. No matter how well intended and brilliant a scheme was/ is to improve the quality of Indian higher Education, it would in all likelihood backfire because of loopholes in the system. Hence better instruments of quality assessment need to be devised since mechanical methods are prone to manipulation.

## IMPROVING ENGINEERING EDUCATION FOR FUTURE

Various review reports have pointed out that there exists a misalignment between engineering education and practice. Engineering educators hardly understand engineering practice beyond design and technical theory. The large gap that exists between engineering education and practice has become traumatic for young engineers resulting in lack of confidence. Some of the critical issues that need to be addressed have been brought out by different agencies, they are:

- Students at school level be exposed to multiple vocations/ alternatives so that they could discover professions of their own liking rather than head towards the engineering or the medical profession.
- Knowledge and capabilities of engineering graduates and post-graduates need great improvement. Routine engineering jobs would be reduced in the future as automation and AI become more pervasive in the future.
- Various application oriented skills and innovative approaches must be addressed in the design of engineering curriculum. The system of instruction, examination/ evaluation has to undergo drastic change for inculcating critical, analytical attributes and higher order thinking.
- The twelve desirable attributes of engineering graduates as per the Washington Accord (WA) should be addressed for engineering educational institutions. Namely: Engineering knowledge, Problem analysis, Design/

development of solutions , Conduct investigations of complex problems, Modern tool usage, The engineer and society, Environment and sustainability, Ethics, Individual and team work, Communication, Project management & finance and lifelong learning.

GAs, particularly the professional skills, should be integrated and embedded in engineering education. Universities should interpret subsets of the graduate attributes as requirements for each course, rather than a requirement to be satisfied only once or twice during the overall curriculum delivery

- Greater use to be made of the web-based engineering course materials and open-source learning materials.
- The tools/ software available in the industry should also be made available to the academics. There may be a good number of collaborative assignments that expose the students on various interdisciplinary requirements. The tools should be used for familiarity and not to substitute the “learning” side of defining and solving problems manually from first principles.
- Engineering accrediting authorities must be created on the lines of NAAC/ National Board of Accreditation (NBA) to get the engineering educational institutions to modify their program.
- Qualification levels, experience and expectations from teaching staff for engineering/ professional degree programmes should be different from those with non professional degree programmes run in general Colleges and Universities. The best talent in engineering have good job opportunities after graduation and do not need to spend more time to pursue higher degrees. Therefore, those who initially go upto PhD are most often the ones who while trying for jobs, keep on acquiring degrees. Teaching and research are no longer the preferred career option of job seekers in engineering and at times it is the last resort. One cannot expect great quality in engineering education unless faculty is top quality and is motivated to inspire, involve and transform students into outstanding engineers with great minds and positive mind-sets.
- There needs to be an active orientation of students towards R&D, designing and creating their own thought processes or solutions. The industry may need to share their persistent issues/ problems with the academics and the students should be encouraged to come up with their own thinking about providing solutions.
- Engineering education systems are part of the supply chain for the industry. There needs to be industry wide cognizance of these aspects. This could potentially pave the way for larger investments by the industry in the education systems. Ways to enhance the industrial sponsorships and investments may also be explored at policy levels e.g. tax incentives, etc to fund Industry relevant research and courses.

## CONTINUING EDUCATION FOR PROFESSIONAL ENGINEERS

Technology landscape is evolving fast, driving the ever changing demand in the skill/ competency level of engineers. The engineering education should also be dynamically adaptive to these changing requirements. Changes in the engineering education need to be continuous and agile to serve the industry better. Hence the drive for competency improvement should also be continuous. There needs to be concerted, focused and coordinated efforts by all related stakeholders, to maintain relevance and alignment of engineering education, with the new technological requirements. This big task cannot be accomplished by the engineering institutes alone; there is a requirement of proactive participation of the industry as well.

Merely ensuring a good talent pipeline to the industry through good engineering degree education is not enough. The engineer has to apply the knowledge acquired in real life and there needs to be learning, un-learning and re-learning processes as well - life-long learning needs to be inculcated in all. That is the only way to keep up with the pace of technological changes.

The education system must equip all the students to become proficient in independent study and learning. Educational institutions should also gear themselves to offer refresher courses and advanced continuing education programmes for updating the academic base of professional Engineers. Engineering educators also need industry internships to stay relevant.

Re-validation and re-certification of engineers engaged in professional fields would ensure requisite learning efforts by all working engineers. It would ensure that they remain updated and abreast in latest technologies. It may necessitate a system of registration and/ or licensing for practising engineering profession as being followed in many other countries e.g. Professional Engineer (PE) in USA.

## CONCLUSION

- If India's Higher Education establishment desires to rise up to international level, some rigorous norms of faculty recruitment and promotion followed by reputed universities in US and Europe must be followed. In the Indian context, there should be a National Qualifying test ( on the lines of NET but more comprehensive and tougher ) to get entry level faculty positions in Engineering .Firstly, hiring faculty should be on Tenure or contract basis(> 50 % of total strength), these faculty members should be paid 20% higher emoluments. Promotions should be granted only after independent Peer review/ appraisal of reputation and not by a mechanical administrative criteria.
- To encourage research, the funded Research projects should have a remuneration component for the Principal Investigator. To have relevance of research for industry, all Engineering Post graduate research Projects should be Industry funded.
- The student intake should be aligned with projected market demand.
- Pay scales of Faculty to be linked to knowledge and capability of the person and the demand of that discipline and subject. Further, General Science and humanities faculty and those imparting Professional education cannot be equated. AICTE need not replicate UGC norms for faculty recruitment, promotion and pay.

### **BUDGET 2019: INDUSTRY BODY CALLS FOR GST RATIONALISATION, SIMPLIFIED REGISTRATION PROCESS**

*NDTV: 1 JULY 2019*

Stating that the Goods and Services Tax (GST) had been a “huge success”, industry body Confederation of Indian Industry (CII) on Saturday called for implementation of its next version. The call for further evolving GST comes as it completes two years in operation.

“The Indian model of dual GST is unique in the world and represents a paradigm of partnership between the Central and state governments, and between the government and the industry,” CII President Vikram Kirloskar said.

According to CII, India, with a strong federal polity, managed to get two GSTs to flow together in a unique structure which was not seen in other countries and one which succeeded without many hiccups.

“The GST Council is proactively examining all issues facing the industry and providing solutions. GST 2.0 will take the Indian economy to the next growth level,” Mr Kirloskar said.

According to the industry body, further rationalisation of taxes and simplification of registration process among others will usher in GST 2.0.

<https://www.ndtv.com/business/budget-2019-industry-body-calls-for-gst-rationalisation-simplified-registration-process-2062035>