

ENGINEERING EDUCATION - SOME THOUGHTS

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ABSTRACT

The output by an engineer or for that matter by any professional depends on many factors. The important one is quality of education provided to the student. The student, to receive the quality education should also be compatible with the inputs being provided. This paper aims at presenting an outline guidelines for the engineering education in India. It discusses the various sub-systems in engineering education to greater length.

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The wealth and prosperity of a nation depends on the effective utilization of its human and material resources through industrial and agricultural production. The use of MAN-POWER for industrialization demands education and knowledge in science and technology. India's enormous resources of manpower can only become an asset in the modern world when trained and educated. It is said that "Engineering is a learning profession rather than a learned profession." Engineering education is the subject of society. It has to respond to the needs and aspirations of the society, in discharging its duties of training technical manpower. The main component of engineering education is a "student".

The steps in engineering education can be divided into the following subheads as :

- (a) Admission Procedures
- (b) Infrastructure

- (c) Staff
- (d) Curriculum

(A) Admission Procedure :

Quality of a student can not be measured mechanically by any instrument. Many institutions admit the students on the basis of the marks obtained by him/her in the qualifying higher secondary examinations. It is rather difficult to judge the performance in just one examination wherein student is given only one chance to qualify the same with flying colour. In case a student fails to score, it is his/her end for Technical or Engineering Education opportunities. This seems to be logically wrong. Maximum three opportunities should be there. Therefore it is suggested that the selection of students at entry point should be based on some talent test and selection criteria backed by personal interview. To remove the regional imbalance and provision of equal opportunities to all, there should be common admission test for all regions within a state.

Entrance examination and selection procedure must be done by an independent autonomous apex body from another state which should be comprising of outstanding, renowned professors from different colleges, universities with excellent academic background. Paper will be of objective type carrying ample number of questions. To remove human factor, evaluation of paper should be done by using modern technology tools like OMR/OCR (Optical Mark Reader/ Optical Character Reader) negative marking should be there. The cost of the entire system should be charged on to the student on no profit no loss basis. There should be some concessional provision for backward and reserved class student. Supervision and evaluation should be conducted under the machinery of honest sincere administrative officers and renowned professors, etc. This will ensure that only quality students get in who would have better aptitude and basic skills for engineering profession. If the raw material is not good, one can not expect the product to be a good. All these procedures must be free from corruption and political influence.

Objectives of the Engineering Education System :

An Engineering education is a problem solving education, therefore it's aim must be to prepare the students for professionally productive life. Technical education of tomorrow must train professionals who have an interdisciplinary approach to problem solving.

- Development of innovative and creative mind.
- Development of technical exper-

tise and competency.

- Development of professional skill
- Infusion of self confidence and self reliance.
- Promotion of analytical mind and administrative capability.
- Entrepreneurship development.
- Promotion of inherent talent.

(B) Infrastructure :

Colleges should have well established infrastructure including furnished class rooms, staff rooms, laboratories with modern equipments and tools, workshop, conference and seminar halls, training and placement centre, library having latest information, with modern amenities, sports club, playground, stadium, auditorium, full fledged computer centre, gymkhana, hostel, co-operative stores, bank, post office etc. Latest communication equipment like VCR, slide projector, overhead projector, micro-film reader and printer, Audio-video cassettes containing lectures by renowned faculties on important subject for ease of understanding. Laboratory equipments should be maintained in working conditions always. In many institutions the facilities remain totally under utilized, 33% of the time i.e. morning 10 o'clock to evening 6 o'clock (8 hours out of 24 hours of a day) which is gross under utilization of the investment and in fact many services like library, laboratory, computer centres etc. should be open, accessible round the clock and throughout the year.

(C) Staff :

For healthy functioning of the technical institution, there is a need to maintain healthy co-ordination among

the three components i.e. management, students and teachers.

The staff selection should be carefully done. The staff selected should be fully trained, knowledgeable, qualified and having sufficient experience in his/her subject, possessing excellent communication skill. There should be sufficient number of staff for every subject. The candidate should be required to have at least four to five years of teaching or industrial experience in the relevant subject. A teacher's profession is a noble one as he/she moulds or shape the future generation. Due respect and recognition should be given to him by way of remuneration and salary. The clay takes its form according to the skill and the creativity of the potter. In the same way, the quality of our students coming out of the universities and colleges depends, largely upon the quality of the staff employed.

The engineering education being special requires involvement of head, heart and hands together not only mind and mouth. The frontiers of science and technology are doubling by leaps and bounds in the present age and in order to cope up with the developments, the faculty should be constantly in touch with the same and try to update themselves through :

- Qualification improvement programme (M.Tech, Ph.D etc.)
- Industrial training
- Organizing & participating in seminars, workshops, conferences.
- Continuing education programme with industrial staff.
- Planning and executing distance

learning programmes.

- Organizing and participating in summer and winter school on various technical courses.
- Engineering in professional development programme such as
 - * Consulting services.
 - * Publication of papers.
 - * Industrial advice.
 - * Joint projects with industries.
 - * Project formulation for entrepreneur development programme and its execution.
 - * Innovative ventures in the field of alternative sources of energy for rural development.

For normal teaching and industrial experience for teachers, there should be close contact with research organizations and industries for a student's projects which will create a better coordination between educational institutions & industrial requirements.

In order to achieve the above mentioned task, it is the responsibility of the institution to provide a proper conducive atmosphere for the teachers. Much of teacher's time is lost in routine unproductive administrative work which can be reduced to a minimum by proper planning. Adequate preparation of lesson is an imperative for a teacher or else he/she is forced to waste a way his/her time in idle and non essential jabbering.

As far as possible each institution should endeavour to develop a 'Learning Resource Center' which will enable the teachers to improve their quality of instructions through the use of aids as well as innovative techniques.

Staff appraisal programme should be geared to assess the current capabilities of all these tasks, identify the gap

between knowledge, skills, attitudes and arrange suitable staff development programme, which is linked to total development efforts i.e. simultaneous improvement in the quality of policy making, administration, curriculum processes, teaching and other supporting services like library facilities, guidance counseling and evaluation techniques.

There should be friendly rapport between the students and teachers. Now a days, victimization has become common phenomenon in many institutions because of indifferet type of negative attitude on the part of the teacher towards students. An effective faculty can gain the confidence of the students without watering down discipline and personal responsibility.

(D) Curriculum :

Designing of curriculum in any education system is a pivotal task. The curriculum of technical institutions has been updated in tune with development in science and technology. Therefore, the change from grass root level is required. Provide academic autonomy to many institutions so that they can freely design their own curricula as needed. In order to nullify the gap between the content of the courses that are taught in educational institutions and basic knowledge that industries expect from an engineer, there should be an active participation from industry and other user agencies in curriculum development process. In order to bring about a co-ordination between the content taught in the institution and the requirement outside, the involvement of the Governement in the curriculum planning is essential.

'Creativity and ability for innovations can not come unless you have sound foundations'. So emphasis should be given during the design of the first year of the curriculum on creating a sound fundamentals in the subject related to drawing, applied mechanics, electrical science, workshop technology and exclusively dedicated to elecronics and computer fundamentals. Mathematics subject should be compulsory in the entire curricula. In contemporary scene, it has been observed that students are learning mathematics for first two yers of the degree, this should be completely avoided. It has already been mentioned that 'engineering is a problem solving profession'. In order to solve any problem, carry out any project for analysis, the knowledge of mathematics and various numerical methods, optimization techniques etc. is a must which should be emphasized in engineering curriculum on continuous basis.

Today's need is multidisciplinary engineers with a business understanding. In industry, the engineer who is operating in an environment that does not partition the development and production department, production and logistics function, logistics distribution and marketing activities. In short what is needed is a 'manufacturing system engineer'. Many times without having a fundamental knowledge about the subject, students are loaded with advanced topics along with fundamentals very heavily in the form of the syllabus of the one subejct, which should be broken down into different number of subjects as part I, part II, part III etc. Right from the second year onwards, seminars should be arrnged on varoius topics. Students should be

forced to talk, discuss, question and answer. Continuous evaluation of the students should be carried out through the tests, assignments, tutorials and representation. Strict action should be taken against weak, incompetent students. We spend a lot of time in examination and vacation, that should be cut short; further, many unnecessary holidays which hamper the continuity of learning and teaching should be eliminated. Presently we have generally 6-7 subjects per semester which is rather a heavy load from learning as well as teaching point of view. This could be reduced to maximum of five. In order to cover all the subjects in the curriculum, increase present course duration from four year to 5¹/₂ to 6 years. Out of which last year should be reserved for compulsory mandatory industry training in any one of the registered organisations with the universities, colleges, board of technical education for this purpose. Courses in the agricultural and industrial production, roads and transport, environmental engineering, unconventional energy, product design engineering, FRP and GRP (fiber re-enforced plastics and glass re-enforced plastics) should also be promoted. India is rich in natural resources. Engineers should exploit them fullest by effectively making the use of the solar power, hydel power, tidal power, wind power. Students in prefinal and final year should be compelled to go to rural areas and arrange for workshop exhibition, camps etc. there, to spread up technologies.

Election for students council should not be there at all. There should be students advisory committee for differ-

ent purposes comprising of students, teachers, some industrial personalities from private and government sectors.

As books give information, teachers give knowledge, the experience gives wisdom but the training gives confidence which is most important to all. Engineering education is more of applied nature. It demands practical along with the theoretical concepts and hence the requirement of industrial training is a must. Training and placement center should arrange :

- Quality improvement programme.
- Industrial visit, tour for students practical outlook and fruitful utilization of time.
- Career development programme
- Training of staff/student./workers.
- Campus interviews.
- Extra-mural lectures from the guest faculty from industries as well as other educational organizations.
- Special courses for the competitive exams, interviews.
- Programme for personality development and improvement in communication skill.
- Regular industry and institute interaction.

For all this, data about industries and related personalities should be collected and continuously updated on computerized system. Basically engineering institutions are industries producing well qualified engineers. This product has to be as per the needs of the (market) industry. This can be done by establishing.

- Proper networking with different institutions through the

exchange of faculty, sharing of resources, continuing education activities.

- 'Industrial Lison Cell' with the objectives of promoting collaborations between industry & institution.
- Promote extension service to the local community through training programmes, technology and support services.

So as to keep up the relevance of the education process, it is necessary to make business and industry as an equal partner in the management and running of technical institutions. Therefore both technical institutes and industries should realize that the engineering education is the joint responsibility and their roles are complementary and compatible to each other. The self interest of both will be served by meaningful co-operation. Engineering graduate should turn out to be good

citizens so that with imparted education he/she acquires a capability to analyze the technical problem before arriving at a possible solution. Economic development is technology driven. The limiting factor for a growth and prosperity of a nation is not oil, minerals, land, water. But it is the scientific and technological capability of people.

We can confidently conclude that a student who has gone through all the present requirements in his/her period of training will come out as a full fledged, competent, mature (knowledgeble) engineer, willing to accept challenges, and ready to fulfill the requirements, demands of the society, ultimately the nation i.e. INDIA.

(This article is published with a view to present the thinking of an young engineer who has taken to the teaching profession : - Editor)

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