

Restructuring Engineering Programmes

It is widely believed that Engineering programs are not nurturing engineers of the desired level. As a result, the employability of engineering graduates is rapidly going down, hitting as low as 20%. This has led to rise in the disillusionment about engineering education. Traditionally, the emphasis on engineering education has been on the technical side and not much has changed. Students are being taught engineering & only engineering.

However, one must realize that Engineering lies at the interface between Science & Society. Therefore, Engineering education should be broad based so much so that general education component is close to 50% of the total credits. This has been the experience of leading Engineering institutions around the world. Before we take up the designing of the engineering curriculum, let us look at the evolution of engineering discipline.

Pre-1950: Focus on engineering practice; design according to codes and well-defined procedures; limited use of mathematics; many faculty with industrial experience and/or strong ties with industry.

1950-1999: Focus on engineering sciences; fundamental understanding of phenomena; analysis; majority of faculty trained for teaching and some research.

2000 onwards: Focus on teamwork, collaborative working, integration in design and manufacturing, continuous improvement; high scientific caliber and analytical ability, adoptability and innovativeness.

Since the technology is changing profoundly just a few decades ago, the engineering curriculum needs to be reexamined and a new model is to be evolved from a new perspective. In this preview, CDIO has been developed by four leading engineering universities viz Massachusetts Institute of Technology (USA), Royal Institute of Technology (Sweden), Linköping University and Chalmers University of Technology. As per the CDIO benchmark the graduating engineers should be able to conceive – design, implement, operate – complex value added engineering systems in a modern team based environment.

The challenges before engineering education are technology shift, redundancy in curriculum, reluctance in learning new technologies, less interdisciplinary approach, producing technically proficient engineers and providing project based learning.

Table 1 shows the comparison of course composition of different universities in India and abroad.

Table 1: Comparison of Course Composition of Different Universities

Institution \ Course Composition	IIT Delhi	BITS	VIT	Banasthali University	Pennsylvania State University	University of Edinburgh	Oxford University
Basic Science	20	17.53	18.89	25.56	21.43	0	7.69
Project & Seminar	8.33	12.98	11.11	10.76	2.38	3.13	7.69
Disciplinary Courses	27.22	29.22	43.33	34.97	21.43	25	23.08
Engineering Art & Science	10.56	11.03	11.11	15.7	9.52	21.88	38.46
Foundation/Humanities & Social Science	8.33	13.63	7.77	8.97	30.22	31.25	3.85
Interdisciplinary Courses	8.33	7.79	4.44	4.04	4.76	6.25	0
Open Electives	17.22	7.79	3.33	0	14.29	12.5	19.23

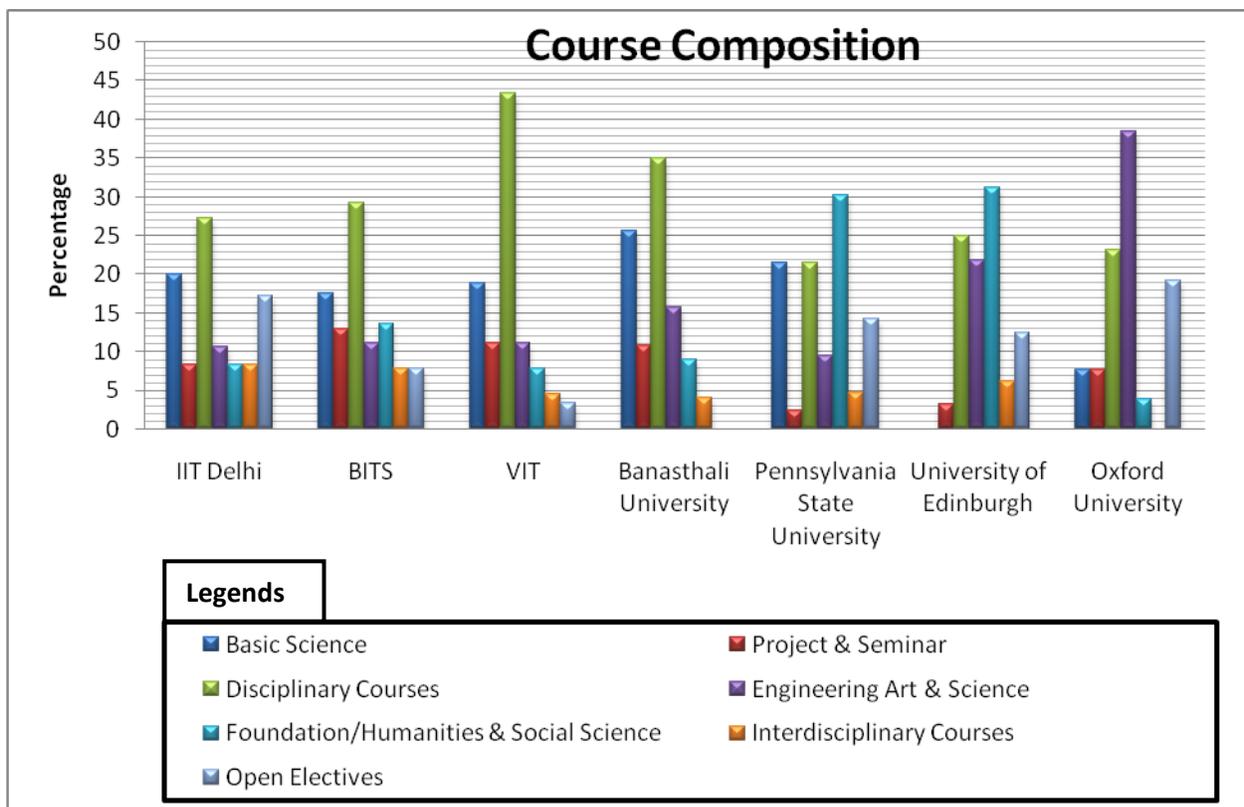


Figure 1: Comparison of Course Composition of Different Universities

Although, Banasthali has all the necessary courses which are at par with some of the best institutions of India and the world. The component of general education can be strengthened by offering rich basket of courses related to humanities, social sciences and allied areas. The uniqueness of education at Banasthali is strongly reflected in the bouquet of foundation courses which are being offered to engineering

graduates as well. On comparing the engineering curriculum of Banasthali University with national and international universities, following facts have been observed:

- Imbalance between general and engineering education
- Redundancy in curriculum
- Less inter-disciplinary approach
- Lack of open electives

However, the constraints on the engineering problem solving today are increasing, not technical, but rather lies on the societal and human side of engineering practice. So keeping in view of the engineering education, a need of restructuring of curriculum has been strongly needed.

We propose an engineering curriculum which emphasizes on societal issues to be addressed through engineering. The component of general education and engineering education has been kept almost equal. Open electives is the area of high concern and needs to incorporate “learning by doing” methodology. It is also proposed to include courses related to new emerging areas in engineering viz Design, Automation & Robotics. The proposed course composition of engineering education has been broadly categorized in terms of general education and engineering education.

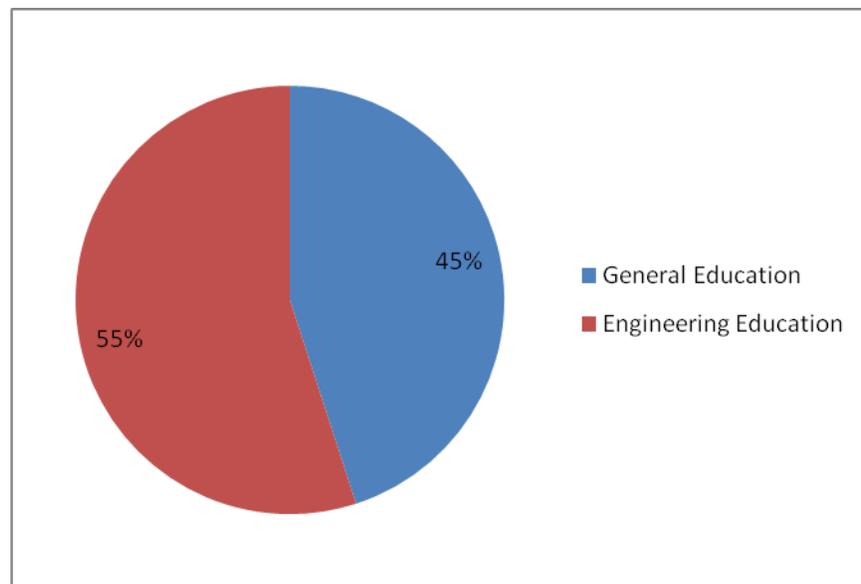


Figure 2: Broad categorization of proposed engineering curriculum.

General education comprises of Foundation Courses (10%), Humanities, Social Science and Allied courses (HSSA-5%) and Basic Sciences (30%). The engineering education includes Core Engineering courses (20%), Disciplinary Courses (30%) and Electives (5%).

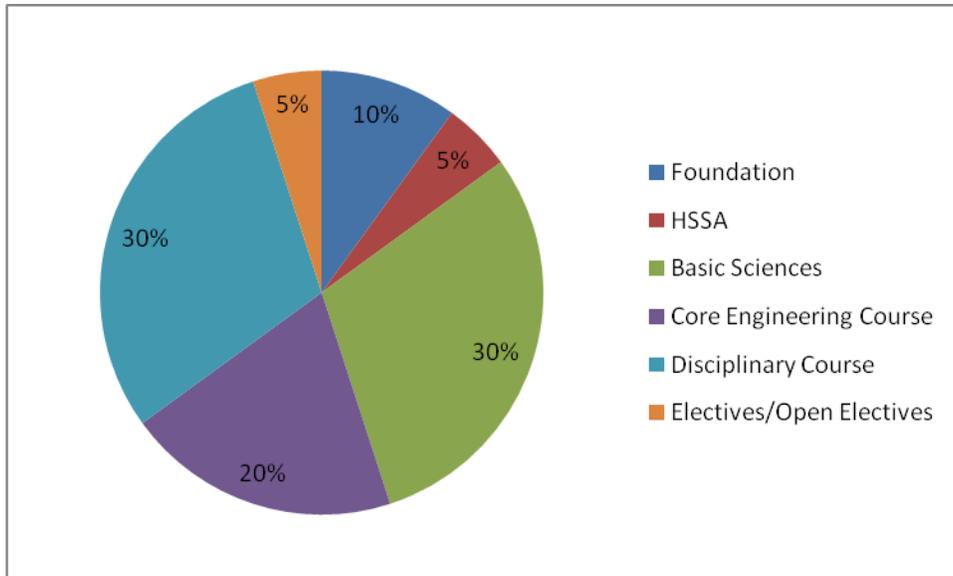


Figure 3: Detailed categorization of proposed engineering curriculum.

The proposed curriculum is having elective courses giving equal weightage to disciplinary as well as open electives. Open elective courses can be chosen from any engineering discipline. The Interdisciplinary courses (5-6%) are covered in the Disciplinary course component.