Executive Summary of Department Review – Computer Science and Engineering

The review of the Computer Science and Engineering department covering the period 2008-2012 was done on 10th Jan 2014. The reviewers were Prof. Gautam Barua (IIT Guwahati, former Director IITG, also alumnus of IITB), Prof. Y Srikanth (IISc), Prof. Jaikumar Radhakrishnan (TIFR, winner of Bhatnagar Award), and Dr. Raghu Krishnapuram (Associate Director IBM India Labs, Bangalore, an eminent expert in the area of data mining).

The review process started with a meeting with all faculty members, where a department summary was presented by Head, following which a representative of each research group presented an overview of research in their area. The meeting was followed by visits to some laboratories. After lunch, the committee met students in the different programmes (separate meetings with B.Tech., M.Tech, and Ph.D. students), followed by a meeting with young faculty. The last item of the visit was a meeting with the CSE DPC members, for a discussion on the committees findings.

Department Highlights

We summarize below some of the key points about the department. The department has 40 faculty, and around 750 students, with 100 BTechs admitted each year, and 120 MTechs admitted each year. The total number of active PhD students has gone up from 55 in 2008 to around 100 currently. CSE Department, IIT Bombay continues to be the favoured destination for BTechs as well as MTechs, with very high JEE closing rank/GATE score cutoffs.

The department has a very active research programme, averaging 25 Journal papers each year, for a total of 130 papers in the last 5 years, out of which more than 50% are in journals that are ranked in the top 10%, and 90% of all the papers are in journals ranked in the top half. (Ranking of A* as per Australian CORE ranking is counted as top 10%, while A and B is counted as next 40%). Conferences in CSE are considered as hard to publish in as journals, and papers in top conferences get even more visibility than journal papers. CSE department has averaged over 60 conference papers each year, with a total of 330 in 5 years. About 50% of these papersare in top 10% conferences, and over 90% are in conferences ranked in the top half. Overall, the average number of publications per faculty is 2 per year.

Papers by CSE faculty have been highly cited, with a total of over 28,000 citations in the 2008-2012 period as per Google Scholar. While it is hard to get an exact number, it is clear that the bulk of these citations are for work done at IIT Bombay.

CSE Faculty have been editors of top level journals (19 editorships of international journals) and PC Chairs for major international conferences (5 conferences at the top 10\% level, and 5 at next level conferences). Our PhD students have won numerous awards including the ACM India Doctoral Dissertation award for 2012, and the Yahoo Key Scientific Challenges Award.

CSE faculty have won numerous awards including the Padma Shri (Prof. D. B. Phatak), Swarna Jayanti Fellowship and Vikram Sarabhai award, and 8 faculty are fellows of national and international academies.

Faculty members have authored over 12 books which are widely used across the world, not just in India, and several of the books have been translated into multiple languages.

The department has attracted over Rs. 150 crores of sponsored projects in the 2008-2012 period, across a variety of research areas. Technology developed in the department has been transferred to external agencies, including the design of network routers, which was transferred to ECIL, and significant developments in Indian language technology, such as Wordnets and linked Wordnets, that have been made available for projects across India. Department faculty regularly act as consultants to industries, in particular in the financial and government sector and some of this work has been recognized and praised by the industry collaborators.

The CSE department has a large number of projects in the area of educational outreach, as well as a large number of projects in the area of technology for rural development. The National Mission on Education through Information and Communication Technology (NMEICT) has its roots in the department, and has conducted distance education programmes (coupled with hands on lab experience) for tens of thousands of teachers across India as part of the Teach 10 thousand Teachers (T10KT) project. Software development for the Aakash tablet has been another area of focus. In the context of rural development, the department has developed numerous technologies such as a multilingual portal for agriculture related questions, networking technology for rural applications, systems for water management such as finding locations for dams and for optimizing water supply networks for villages.

Review Summary:

The average review scores were: Academics: B.Tech.: 7.95, M.Tech:. 8.42, PhD: 7.68. The Research score average was: 8.35, The average score on Infrastructure: 8.63. The average score on Admission and Recruitment: 7.38.

Review comments on the overall state of the department were very positive, with statements such as "The Department is the leading department in the country and its performance shines in comparison to other places. But there is no room for complacency.", "The CSE department of IITB is very strong in research and has excellent Btech, MTech, and PhD programs. I complement them on the excellent job they are doing in this respect." "Overall, in my opinion the department is strong and should flourish even more when the new building becomes available."

In the context of faculty and research, review comments were again very positive, with comments such as "The department has excellent faculty and they are carrying out excellent research", "Overall, a strong program. Can improve further by choosing specific areas where the dept wants to excel." "I was very impressed with the work in the areas of data mining/machine learning) databases, in language translation and efficient indigenous routers." However, there were also suggestions for changes, including: "The number of assistant professors in the department is very small. The department should use its excellent alumni base

to assist them in recruiting APs aggressively" and "End-to-end time for recruitment needs improvement.", and "It would help the department if interactions with other departments areinitiated, say based on joint students in the areas of large data, bioinformatics etc." Reviewers also mentioned that the department should do more to ensure new faculty members are able to get PhD students early in their career.

Comments in the context of the PhD programme were also positive, but with several important suggestions: "The PhD program is very good in quality and the PhD students produce goodpublications.", "The PhD program will certainly benefit by the addition of a full-fledgedcomprehensive examination as is prevalent in other institutions in India and abroad. In my opinion, not enough care is being taken to ensure that the students who graduate from IIT have sufficient breadth." "A department of this calibre should produce more Ph.Ds."

Comments in the context of the M.Tech. programme were very positive, including "The MTech program is conducted very well and appears to be robust due to well-balanced course and project (thesis) components." "The students feel that their expectations are being met by the Master's program at IIT."   There were suggestions to allow students to do a primarily course based MTech if they were not cut out for research.   This would however only be possible if the number of credits for MTech project is reduced, so parts of the project (such as Stage 2) can be replaced by courses for those who do not perform well in earlier stages of the project.

Comments on the BTech programme were significant. On the positive side, the comments included "Students appear to be largely satisfied with efforts of the faculty members to impart education of the highest quality".   However, there were several suggestions for changes. These included "The BTech program certainly needs revamping. The students are not keen towards higher studies (neither in India nor abroad) and are interested only in good jobs. This is disturbing. The students claim that they are not exposed to research early enough, with the result most of them do not wish to take up higher studies. They also feel that the courses they do in the first year are not at all useful (mostly a repetition of the JEE material). The course structure right from the first semester may be made more department-specific and not common across disciplines (as it exists now)."

Many of the above comments need to be addressed at the institute level and must be taken up seriously by IIT as a whole since similar comments were made in other departments.

Other academic related comments include "The academic rehabilitation and faculty advisor system needs to be made more effective (by involving more faculty members) and should identify the students who face difficulties early."

Action Plans:

The department intends to continue to reach out to top-notch people that it would like to recruit as faculty members. The recruitment process at the IIT level has improved greatly over the past few years in terms of agility, and the department will continue make use of this agility to speed up recruitment of outstanding candidates.   We would however not wish to compromise on quality, favouring smaller number of top-notch faculty over a   larger number of weak faculty.   We

believe the move of faculty scattered across the campus into two adjacent building will improve interaction and cohesion within the department.

The department intends to revamp the PhD admissions process, to increase the admissions without compromising on quality.   It plans to better use existing IRCC funding for PhD students for new faculty, to ensure that new faculty get good PhD students.   It also intends to take up the issue of comprehensive exams and breadth of knowledge of PhD students mentioned by the review committee, and come up with practical solutions.

The department would like to explore an MTech structure that allows students with an aptitude for R&D to do a full M.Tech. Project, while weaker students can do more courses or software development projects instead.   A revamp of the MTech project credit structure is essential for this change, since it is not possible to replace a 90 credits project by 15 courses.   The department will follow up to push for this change at the IIT level.

The department has recently revamped its BTech curriculum to allow more departmental courses to be taken in year 2, reducing the core course load in year 3, allowing time for students to take elective courses from year 3 onwards.   We intend to take up the issue of 1st year BTech curriculum at the IIT level to ensure that first year students can take more departmental courses from year 1 (taking into account the impact on branch-change students).   Finally, department faculty have been at the forefront in the institute in terms of exploring learning methodologies which have been tested in a number of CSE courses, such as active learning, flipped classrooms, and so on.   We intend to continue these experiments to improve student participation and interest levels in courses.