

Concept Paper: Revision of UG curriculum 2011

As Approved by the Senate in its 176th Meeting

1. Introduction

As part of the prevalent practice of reviewing UG curriculum once in every 10 years, senate has considered and approved certain new conceptual features of the UG curriculum, which are described in this concept paper. Basic recommendations of the present concept paper has been prepared based on the feedback from all stake holders (see Appendix-1) and extensive analysis of the current scenario and expected requirements.

The following have been identified as challenges in the current revision process:

- i. Very diverse career aspirations of graduating students
- ii. The increasing heterogeneity in student intake especially their analytical, language and communication abilities.
- iii. The changing nature of engineering education that is not only becoming more inter-disciplinary in nature but is also increasingly emphasizing innovation and entrepreneurship
- iv. The objective to nurture and encourage good students and at the same time to provide suitable support to the academically challenged students
- v. The necessity to attract our under-graduates to post-graduate programmes including Ph.D.

Further, it is recognized that any solution that is proposed should pragmatically take into account the constraints posed by the increased intake and current class sizes. Another constraint that has been recognized is that very high IIT branding has ensured that a vast majority of undergraduate students choose their disciplines based on JEE rank rather than on their inherent aptitude or interests. Basic degree from IIT is considered as the stepping stone for a variety of career options.

Motivated by these observations, a conceptual framework of the undergraduate programmes have been designed. The key theme has been to provide flexibility, time and space in the curriculum so that students can get maximum benefit from their education in IIT Delhi. The curriculum makes an attempt to enable the students to add maximum value to their own programme to suit their interest and abilities.

However, detailed and exhaustive rules and regulations required for implementation of the conceptual framework will be framed by the Curriculum Implementation Committee, to be appointed by Chairman, Senate.

2. Framework of Under-graduate Curriculum

2.1 Key issues

In the UG curriculum revision, the following key issues have been addressed:

2.1.1 Academic Load

The curriculum introduced in 2003 was formulated with the expectation that each student would invest about 54 hours/week for academic activities. This was based on the feedback from faculty, students and alumni. Feedback obtained as part of the current curriculum revision process also indicates that current expected academic load of 54 hours/week is adequate with ample opportunities for the students to pursue other activities.

It was assumed in the previous concept papers (1992 and 2003), that each credit requires a minimum of 2 hours of academic load (including contact hours). However, with the increased diversity of the student intake, CRC is of the opinion that depending upon the degree of preparedness a student may need to put in different amount of time per week for earning each credit. Therefore, it is obvious that we cannot have a uniform model of academic time budgeting for all students. The effort required by students may range from 2 hours per week to 3 hours per week. In case, a student needs to put in 3 hours (including contact hour), on an average, for adequately preparing for each credit, then per semester he/she can earn no more than 18 credits; in 8 semester the student can earn maximum of 144 credits. Also, it is recognized that a student may need to invest additional time, up to 60 hours in academic activities, to meet demands of the programme. In such a case a student can earn maximum of 160 (20 credits per semester, by investing 3 hours of academic work per credit) credits in 8 semesters. If a student, on an average, requires an effort of 2 hours for each credit, then he/she can earn even more than 180 credits in 8 semesters. However, based on demands of a course, time needed to earn each credit can vary even for academically well prepared students. To respond to this key challenge, a flexible framework has been designed to enable students with different abilities and interests to plan and qualify for the degree.

2.1.2 Flexibility in scope

We also have students joining IIT with different aspirations. Some of them would like to have B.Tech as the stepping stone for career in diverse non-technical fields like management, finance, administration etc. In the past, we have seen IITians professionally opting for journalism, film-making, literature and even politics. Some of them develop interest for areas which are not part of their parent discipline. Another group of students want to pursue entrepreneurial path. Yet another group is seriously interested to pursue research and development in their chosen field of interest. At the same time some student pursuing technology degree would also like to have adequate exposure to intricacies of science and humanities. Some students excel in creative independent pursuits, while some others perform extreme

well in standard class-room courses. This diversity of interests, capabilities and aspirations have added a new dimension to the present curriculum review process. The new curriculum, in its structure and credit distribution over different categories, has factored in this diversity of aspirations and interests along with the ability (and consequences for time budgeting, as discussed above) of the students. However, the core emphasis of the curriculum remains science based engineering education.

3.1.3 First-year teaching

The first-year curriculum is critical in many ways since it sets the stage for the remainder of the students' academic experience. It builds the foundation for the rest of the curriculum, yet many students feel that there is little connection between the first-year courses and the remainder of the coursework. Therefore, along with the basic science and engineering arts and science courses, it was felt that it is important to have a course that exposes students to the essence of engineering while igniting their passion about the world of science and technology. Lastly, a common curriculum in the first year will not only smoothen departmental changes but also build community amongst the students.

2.2 Proposed B.Tech Degree Requirements

2.2.1 Credit Distribution

Motivated by these observations and feedback from different stake holders, CRC proposes following credit distribution for the B.Tech Programme

Departmental Credits (Core + Elective):	65 – 80
	(with at least 10 credits as electives)
Outside Department (BS,EAS, HuSS) credits	55-70
Open Category credits	10
Non-graded Core Requirement	15
Total	145-155 credits + 15 non-graded core

This total credit requirement has been worked out with reference to the time budget model of the students who may require variable number of preparation hours for earning each credit based upon the student's academic preparation and demands of courses/programmes. Individual programmes may have different departmental credit requirements based on the breadth and scope of the degree, hence a range from 65 to 80 credits have been provisioned. Consistent with the philosophy of broad-based B.Tech curriculum, It is also expected that, approximately, 50% of the total credits will be allocated to courses outside the parent discipline.

2.2.2 Departmental credits

Departmental credits will have following division

Departmental Requirement	:65 - 80 credits
Elective	:10 credits minimum

Departments need to formulate degree requirements based upon this credit distribution model.

2.2.3 Outside Department Requirement

The outside Departmental credits will have the following components:

Institute Core Requirement:

- Basic Sciences	: 22 credits
- Engineering Arts and Science	: 18 credits
- Humanities & Social Sciences	: 15 credits
TOTAL	: 55 credits

Programme Requirement

– linked Basic Sciences/EA/ES : 15 credits (maximum)

A. Consistent with the core philosophy of science based engineering curriculum, following is suggest a possible model of credit allocation for Basic science courses as core component of the d requirement:

1. Mathematics : 8 credits (distributed over two courses of 4 credits each)
2. Physics: 5 credits (a course of 5 credits with a laboratory component of 2 credits)
3. Chemistry: 5 credits (a course of 5 credits with a laboratory component of 2 credits)
4. Biology: 4 credits (a course of 4 credits with laboratory component of 1 credit)

These courses should be the same for all programmes.

B. Similarly for Engineering Arts and Science following model is proposed:

1. Electrical Engineering Fundamentals (a course of 4 credits with lab component of at least 1 credit)
2. Computer Science Fundamentals (a course of 4 credits with lab component of at least 1 credit)
3. Fundamentals of Engineering Mechanics (a course of 4 credits)
4. Engineering Drawing / Engineering Communication (a course of 2 credits)
5. Product Realization/ Manufacturing (a course of 2 credits)
6. Environmental Studies (a course of 2 credits)

These courses should also be the same for all programmes.

Typically, in the first year students will be doing 36 common credits from Institute Core. Remaining credits of institute core will be done by the students in the 3rd semester.

C. For Humanities, Social Sciences and Management courses, it has been decided to allocate 15 credits (minimum, e.g. 3 courses of 4 credits and 1 course of 3 credits). These courses should be organised into logically coherent baskets. Course offering must enable students to do well-balanced mix of courses based upon their choice and pre-requisites so that he/she gets a comprehensive exposure to different aspects of Humanities and Social Sciences as an essential component of Engineering Education.

D. It is also recognised that there would be programme specific requirements of Basic Sciences and Engineering Arts and Science Courses. In order to accommodate these requirements maximum of 15 credits have been allocated for departments to specify programme specific requirements in addition to the institute requirement.

E. CRC recommends that a course on Materials should be an integral component of the B.Tech/Dual Degree curriculum. However, this course must be tailored differently for meeting requirements of different programmes. Hence, a course on Materials, in a programme specific fashion should form part of this 15 credits requirement. Departments may make suggestions about content of the course which can meet requirements of their programme.

F. Depending on the departmental curricular requirement, students can also be given the option of doing one or two electives in Basic Sciences and Engineering Arts and Science categories to meet the requirement of this programme specific 15 credits. For example, B.Tech (EE) may require students to do (i) a course on Probability and Stochastic processes (may be 4 credits) and (ii) a course on Material Science (may be 3 credits) and (iii) electives from a list prescribed by the department.

2.2.4 Non-grade Core Requirement

In addition, additional non-grade units have been prescribed as core requirements for the undergraduate degree. It is proposed that these units can be earned through a combination of formal academic activity and informal co-curricular or extra-curricular activities. To-day students actively participate in co-curricular and extra-curricular activities. Feedbacks from alumni and students have indicated that these aspects of campus life have also helped all round personality development. In order to integrate formal academics with informal outside class-room learning experience, in the following a new mechanism for earning these units has been prescribed based upon recommendations of the curriculum review committee (CRC). Obviously, in order to earn these units, a student will need to involve himself/herself into activities beyond 54 hours/week. CRC assumes that activities planned for these components will not require differential preparation time for different students. Hence, for earning 1 unit a student will be involved for not more than 2 hour per week. In order to meet time requirements for these components, a student will also make use of remaining 30 or 24 hours/week available to him (under the assumption

that weakly $12 \times 7 = 84$ hours are available to a student) for other activities. Hence, these units will be counted in a different way and will not be considered as part of formal academic requirements.

Following components of Non-grade units (core) have been proposed:

1. Introduction to the Engineering & Programme	: 02
2. Language and Writing Skill	: 02
3. NCC/NSO/NSS	: 02
4. Professional ethics & Social Responsibilities	: 02
5. Communication skill/seminar	: 02
6. Design/Practical experience	: 05
Total	: 15

These 15 units will be core requirement for all the programmes. In summary, B.Tech degree requirement will be, therefore, 145-155 credits + 15 non-graded unit/credits.

A student will need to earn these 15 credits over the complete duration of the programme with special considerations and requirements for each component. A student will need to get an S grade to earn these credits. Incomplete performance in such components will be indicated by a Z grade.

A. Introduction to the Engineering & Programme

All students will be required to undergo exercises in the first year, spanning over two semesters, for earning these units. These may involve listening to lectures, developing project reports based upon self-study, visit to laboratories (in and outside the institute) and industry, executing simple scientific or engineering projects. A detailed framework for such a course has been presented subsequently. Student's involvement will not be more than two hours per week.

B. Language and Writing skill

All students will be required to undergo exercises in the first year, spanning over two semesters. These exercises will be designed to impart language skills - enhancing their ability of listening comprehension, reading and writing in English. Further, students will be exposed to principles of English grammar and nuances of technical writing. Textual material and lectures will focus on the relationship between Engineering and Humanities and Social Sciences. These exercises will be tailored according to the background of the students. The background of the students will be assessed through a test to be conducted at the beginning of the semester. These exercises can be organized either during normal academic hours or outside. A student can be prescribed self learning exercises or additional practice sessions during vacations as requirement for his/her S grade. Student's involvement, during regular semester, will not be more than two hours per week.

C. NCC/NSO/NSS

NCC/NSO/NSS will form part of core requirement of the degree. Students will be required to earn 2 units from these activities. These are notional credits. The faculty coordinator will devise a scheme for awarding these credits. Currently followed requirement of 100 hours, translates to 2 units (14x4x2) distributed approximately over two semesters. However, in the proposed curriculum, a student will be allowed to earn these credits over the entire duration of the under-graduate programme and can make use of his/her participation in sports and social welfare activities for earning these credits.

D. Professional Ethics and Social Responsibility

There is increasing consensus worldwide that engineering ethics needs to be incorporated into the engineering curriculum to provide students exposure to the kind of professional ethical dilemmas they might face on an individual basis as well as the larger ethical aspects of technology development. As succinctly noted in a well-known essay by Harris and colleagues, "Engineering ethics [are] professional ethics, as opposed to personal morality...and sets the standards for professional practice." Case-study based approaches are often used for illustration and discussion of engineering ethics and such material could be presented in a stand-alone fashion or integrated into existing courses (or both). We suggest a combination of these approaches supplemented by other materials/discussion forum to ensure that IITD graduates ethical engineers.

Workshops, discussions/debates will be organised to sensitize students about Professional Ethics and Social Responsibility. Use of theatre-in-education will be explored for achieving the same. NRCVE, BSW and Student Counseling Cell are expected to be involved in these activities. Like NCC/NSS/NSO a faculty coordinator will be appointed for Professional Ethics. This course will be also associated with a notional 2 units implying total involvement of about 100 hours. Involvement of students in these activities, to be held outside regular class hours, will be monitored by the coordinator for awarding the S grade. Any act of plagiarism and unfair practice in the examination reported against the student will require him/her to undergo additional exercises to qualify for the S grade. A student can earn an S grade in Professional ethics through his involvement in these activities over first three years of his stay in the institute.

E. Communication Skills

Communication skills is an essential requirement for a modern engineer. CRC proposes to allocate 2 units for exercises in communication skill. Instead of colloquium, CRC proposes that departments introduce a set of topic specific seminar courses for students (for example - EEN401 - Seminar on Embedded Systems - 1 unit). These courses will be elective, offered in each semester. These seminar sessions will be held for two hours per week. Multiple such courses can run in parallel. These seminars will also be open for all. These seminars can be scheduled outside office hours. ***Students need to register for at least one such course in his/her parent department for earning one unit.***

Further, students can earn remaining one unit through any one of the following means

1. By successfully undergoing Communication Skill course/workshop organized as an activity approved by DUGS

2. By documentary evidence of excellence in debating and/or writing as certified by faculty in-charge of these activities.
3. By participating in course seminars of regular courses; for example regular L courses can have optional seminar component (e.g EEL707 Multimedia Systems can have optional seminar component of 1 unit.).
4. Registering and completing an additional seminar course offered by any department or centre.

A student will be required to earn these credits in their 3rd and/or 4th year.

D. Design Experience

CRC proposes to encourage students to involve themselves into different technical and engineering projects during their stay in the institute to earn the design experience units. CRC hopes that opportunity to a student to earn this Design Experience units in an informal setting also will usher in processes and mechanisms that will support the spirit of innovation and creativity among students. CRC recommends the following means through which a student can earn design experience units:

1. Participating in design activities linked to courses;
2. Participating in co-curricular design/project activities;
3. Internship in an industry/research lab including research projects at IIT Delhi

CRC proposes that while designing a regular course, other than the LTP structure, departments can clearly indicate Design Load of a course. A regular course can have maximum of 2 unit of Design Load. This would typically correspond to projects/exercises to be executed by the students on their own, under the supervision of the course coordinators. A faculty, based on the academic capability/performance of the student, can permit him to opt for Design Load in his/her course. This may encourage academically inclined students to take up interesting challenges as part of course work

A student can claim Design Experience credits through sustained and substantive innovative work as part of recognized co-curricular activities. Faculty in charge of these activities will certify the Design Units earned through this process. This will also cover projects undertaken at the Innovation Centre.

There has been a feedback from both faculty and students, that undergraduate students should get actively involved in the research projects at IIT Delhi. In order to create an enabling mechanism, CRC has recommended that the students will also have the opportunity to participate in research projects at IIT Delhi (outside regular curricular work) in summer and regular semesters to earn Design Experience Units.

A successful summer internship in an industry/research laboratory of 40 days will enable a student to earn 2 units of Design Experience. On the other hand, a student can opt for an internship with an industry/research organisation for 120 days to earn 5 credits of design experience. It would require departmental faculty supervisors of internships to certify that work done during internship is worthy of requisite units of design experience.

Obviously, summer internship with industry will no longer be an integral core requirement for the degree.

A student can earn Design Experience Units through industrial/research internships once he/she has earned 70 credits.

A student may finish academic credits at the rate of 18 credits per semester and spend additional 120 days for industrial internship to earn 5 Design Experience credits - internship over extended period will also enhance the student's employability. This facility can also be used by the student to explore innovative and challenging projects in an industry or research organisation.

2.3 Capability Linked Opportunities for Undergraduate Students

Students demonstrating superior academic performance and better capability obviously requires less than 3 hours as preparation time for earning each credit. These students must be encouraged to take additional credits in a disciplined fashion so that they can add more value to their B.Tech degree.

A student who clears all first year credit requirements (36 credits) with CGPA 7 and above will be permitted to register for additional credits from 3rd semester onwards. A student will be permitted to register up to 26 credits per semester provided

- (i) The student has cleared all courses for which the student has registered so far and
- (ii) His/her CGPA is 7 or above

In case, a student does not meet this requirement but has cleared $20 \times N$ credits, where N is the total number of semesters spent, then he/she can register up to a maximum of 24 credits.

A student registering for 26 credits in each semester can complete additional 36 credits (8 credits x 6 semester) maximum. A student registering for 24 credits in each semester can complete additional 24 credits maximum. Hence, it will be feasible for a student, who is performing reasonably, to do additional courses and add value to his/her degree depending on his choice.

Students can make use of these additional credits in two blocks of 20 credits to opt for

1. Minor/Interdisciplinary Area Specialisation
2. Departmental Specialisation

A student based up on his/her performance and interest can choose **either one or both**. Successful completion of minor area credits and/or departmental specialisation will be indicated on the degree.

When a student opts for departmental specialisation and/or minor area, he can use 10 open category credits (mandatory degree requirement) towards departmental specialisation and/or minor area requirement. For example, a student registered for B.Tech (Chemical Engg.) and opting for minor area in Computer Science and Engg, can opt for courses prescribed for minor area in Computer Science and Engg., as part of mandatory 10 credits requirements under OC. He will need to do additional 10 credits in the minor area to be eligible for Minor Area specialisation in the degree.

A student may not opt for either of the two but can do additional credits through open choice of courses. In case a student cannot meet requirements of a minor area or departmental specialisation, additional credits earned by the student over and above his/her degree requirement will be used for DGPA calculation and will be indicated on his transcript.

A. Departmental Specialisation

Departments can design one or more baskets of departmental courses of 20 credits for offering Departmental specialisation. A department may offer more than one specialisation. Typically, departments offering multiple B.Tech programmes can choose to offer one B.Tech programme with option of multiple departmental specialisations corresponding to the different B.Tech programmes being run now. CRC strongly urges departments to offer a single B.Tech programme with the option of multiple areas of departmental specialisation.

CRC suggests that the departmental specialisation baskets may include a project course of 6 to 8 credits. Departments are free to design organisation of courses for departmental specialisation. Departments may decide to indicate some of the courses in the specialisation basket as core. If a department includes a 3 or 4 credit project course in the set of Core courses for the B.Tech programme, then project course in the departmental specialisation can be continuation of the core project.

B. Minor/Interdisciplinary area of Specialisation

Departments and/or Centres and/or Schools can offer Minor area or Inter-disciplinary specialization as per currently approved provisions. In addition to the existing rules, CRC suggests that a minor area/ interdisciplinary area can have a set of courses (instead of one or two fixed core courses) out of which one or two must be done as core requirement of the programme.

It is desirable that cross departmental linkages in various activities and even emerging areas must be consolidated in the form of minor areas as well as inter-disciplinary areas. Success of minor/inter-disciplinary area specialisation scheme will depend on the availability of a large number of interesting and useful options to the students. Departments, Centres, Schools and Inter-disciplinary research groups should feel motivated to offer such programmes for benefit of the students as well as for the growth of newer areas of innovative technology. In order to facilitate and streamline the process of introduction of minor/inter-disciplinary specialisations, CRC recommends that senate approves a special committee for recommending proposals for introduction as well as termination of minor/ interdisciplinary areas to the senate for its consideration so that such proposals need not go through the time consuming process of approvals through individual faculty boards of departments and centres. Further, CRC recommends that such programmes should receive institutional support in terms of finance and space, if necessary.

3.0 Dual Degree : Seamless Integration of UG and PG programmes

CRC has proposed and senate has approved, based upon feedbacks obtained from different sources and careful analysis of current challenges and demands of industry and academic research, frameworks for defining a wide variety of dual degree programmes. Departments and Centres on their own or in collaboration with others can decide to adapt these frameworks for defining new programmes or re-model existing programmes. Some of these programmes can be offered as option to JEE entry students.

The proposed framework of Dual degree programmes involving combination of an UG and PG degree is expected to be used by the departments and centres to create mechanisms to attract our UGs to join and complete post-graduate programmes in fast-track mode consuming less time (for e.g. M.Tech./M.S in one additional year instead of two). Sustained effort is required on the part of the faculty to popularise such programmes and incentivize this migration process.

Senate has, in principle, approved following Dual Degree Schemes. Details of these schemes in terms of credit requirements, etc. will be considered later, if possible, in conjunction with the revision of PG curriculum. A broad framework of the programmes, as described in the following, has been approved.

3.1 Dual Degree (B.Tech + M.Tech) in the same department

Departments, if they so desire, can offer dual degree programmes (B.Tech + M.Tech) for JEE entry students. Dual degree requirement should be built upon departmental specialisation credits. A dual degree student will not be doing a project course as part of departmental specialisation. Instead the student will do additional regular courses specified as part of departmental specialisation.

A B.Tech student, while pursuing departmental specialisation can opt for the dual degree at the end of third year and continue for the same provided he completes departmental honours/specialisation with CGPA 7.5 or above.

3.2 5-yr Integrated M.Tech

It is decided to discontinue with the 5-year integrated M.Tech programme for the sake of uniformity in the structure of the PG programmes. Further, integrated M.Tech programme does not provide an interface to naturally built the programme on the foundation of a relevant under-graduate programme. It also does not provide an exit option for non-performing students. An existing 5-yr integrated M.Tech programme may be replaced by a dual degree programme.

3.3 Dual Degree (B.Tech + M.Tech in any Specialisation by Choice at the end of third year)

A student capable of doing additional credits with CGPA 7.5 or more can apply at the end of 6th semester for joining any approved M.Tech programme (2 yr or Dual Degree) in a discipline for which he is eligible on the basis of his B.Tech programme and minor/interdisciplinary area or departmental specialisation he/she is pursuing. The student has to qualify for minor area or departmental specialisation to become eligible for the dual degree. Departments will notify additional eligibility conditions, if any. If admitted the student

can earn M.Tech degree by doing additional credits. DRC/CRC will approve the course plan for the M.Tech degree for an approved specialisation of the department/centre in a student specific fashion based on his/her background.

3.4 Dual Degree (B.Tech + M.S(R))

A student capable of doing additional credits with CGPA 7.5 or more can apply at the end of 6th semester for joining any M.S (research) programme in a discipline for which he is eligible on the basis of her/his B.Tech programme and minor/interdisciplinary area or departmental specialisation he/she is pursuing. Courses done under minor/inter disciplinary area or departmental specialisation will be mandatory requirement. The student must complete minor/inter-disciplinary area with CGPA 7.5 to become eligible for the M.S degree. Departments will notify additional eligibility conditions.

3.4.1 Special Case (B.Tech + Ph.D)

A student admitted for a M.S degree can also be considered as a candidate admitted for Ph.D. Perhaps, a better student can be given the option even to register for a Ph.D degree. The requirements of M.S can be considered as the requirement of the student's comprehensive. The student may be permitted to continue and complete Ph.D requirement in minimum two additional semesters. Typically, a student will be expected to complete Ph.D after four additional semesters. Effectively, the student will be in a position to meet the needs of his doctoral work, in typically 4+3 years at. The possibility of obtaining a Ph.D degree in less time may motivate students to join. Special incentive scheme can be designed for willing students. In case, a student likes to discontinue, he/she can exit with M.S after B.Tech, provided he/she has cleared the requirement. Detail rules and credit requirements will be framed later.

5.0 Other Recommendations

5.1 Laboratory Courses

The Committee took cognizance of the fact that feed-back obtained from students as well as alumni have indicated the low effectiveness of many laboratory courses. CRC identified some of the reasons for this to be (i) sub-optimal utilization of funds (especially PLN03 grant) for modernisation of laboratory infrastructure (ii) attitude of many faculty members towards laboratory courses as 'extra' teaching load (iii) inadequacies in the design of the experiments. *The Committee felt that proper credits must be given to faculty members designing laboratory courses and conducting lab sessions in an effective fashion.* Also, there should be clear differentiation between demonstration experiments, lecture-linked experiments and projects where the student uses his/her classroom-acquired knowledge to design an experiment or do something new. CRC recommends that each laboratory must include an opportunity for the students to design experiment to find out things on their own.

5.2 B.Tech Project

CRC recommends that departments can include a 4 credit project course as a core component of the departmental credit. This course can be followed by a 6-8 credit project course for the students pursuing departmental specialisation. This structuring will enable faculty to interact closely with academically inclined students in guiding their projects.

Objective of the core B.Tech project will be to train students so that they can handle a reasonably scoped developmental work from conceptualisation to design and implementation as a team effort.

5.3 First Year Courses

CRC recommends that First year courses should be common for all programmes. It recommends that in first year, a student will be registering for not more than 18 credits per semester (other than non-grade credits). Detailed scheduling of courses will be worked out after finalisation of the course plan.

5.3.1 Introduction to Engineering and Programme

CRC decided to recommend a modification of the current Introduction to the Programme Course to an "Introduction to Engineering & Programme" course to be conducted spanning across two semesters.

Main aim of this course will be to enhance technological literacy among the first year students and gradually introduce their own programme.

Accordingly this course should:

- ⇒ relate in a direct manner to the student's day-to-day lives
- ⇒ provide a broad overview of the tenets of engineering (i.e., synthesis, integration, design, build) that lead to solutions for real-world problems through the design of devices or systems that meet certain needs through specific performance characteristics
- ⇒ provide an exposure to various disciplines of science and engineering and their interconnections (and the interaction of technology with society)

Some examples which can be used in the course are

Topic	Tech/engineering issues	Society issues
iPod	CS/EE: Data compression for music Phys: Displays EE: Device miniaturization ME: Product design	Intellectual property/music sharing Human interface

Toyota Prius	ME: Automobile design EE/ME: Hybrid control systems Phys: Batteries Chem: Air pollution/climate change	Climate change Local air pollution Resource conservation/energy efficiency
Ultrasound	CS/EE: Image processing Phys: Imaging Bio: Biomaterials/tissues ME: Fluid mechanics/waves	Bioethics/genetic screening Health

This would form the first part of the course which will be conducted in an interdisciplinary fashion.

The second part of the course which is expected to be conducted in the second semester will familiarize the students with their own programme. This may involve visit to departmental laboratories, industries, interaction with faculty, simple experiments/projects.

This course is also expected to expose students with the relationship of Science, Technology and Society.

CRC suggests that a detailed course manual for this course should be produced so that this course can be conducted in a standardised fashion across departments.

5.3.2 Pedagogical Issues

CRC would like to make following recommendations about first year teaching

1. Course coordinators for first year courses should be preferably a faculty who is interested in teaching first year courses. It should not be allocated through a roster process. Faculty handling first year courses effectively should receive special recognition and encouragement.
2. The course coordinator should be given the freedom of choosing his team of teachers and TAs from a given pool in consultation with the Head.
3. The section teachers, tutorial teachers and TAs should have a meeting in the beginning of the semester and at regular intervals to keep everybody on the same page.
4. Use of technology for large classes: Use of Tablet PCs is really helpful for large classes. It solves the problem of visibility of blackboard writing and also the lectures can be saved and uploaded after the class.
Biometric devices can be used to record attendance in large classes. Clickers can be used for taking quizzes.

5. A graded question paper is helpful for ranking the students better. Also, sometimes, a question can actually guide the student towards the solution, and this way, a student may be able to solve an apparently difficult problem and have the joy of learning even during exam.
6. It may be a good idea to fork out a separate mode of non-exam component (different sets of assignments etc.) to cater for students of different abilities.
7. Help sessions by TAs may be more effective in informal setting such as in Ex-Hall or in hostels.

5.4 Core Design Course

CRC recognises importance of the design experience and practice as integral part of engineering curriculum. It has proposed a new scheme for earning design experience units. Given this new formulation, CRC recommends that departments may or may not continue with the design course in 4th or 5th semester as a core requirement.

5.5 Evaluation and Grading

Since, in recent past there has been extensive debate on the evaluation scheme, CRC recommends continuation of the senate approved evaluation scheme of two minors and one major with total weightage of these examination linked components not to exceed 80%. Faculty can devise other components for the remaining 20%.

CRC recommends that the evaluation process should assess students based on their understanding of the subject and their ability to apply the learnt concept.

The basic grading scheme and the grading philosophy remains unchanged.

5.6 Course Structure

CRC proposes to continue with the current course categorisation and the course numbering scheme based upon pre-requisites with suitable update of the requirements after formulation of the detailed curriculum. All courses for non-grade requirement will have xyNuvw format (i.e course category -N - non-graded).

Tutorials in a course provide opportunity for the students to clarify their doubts and learn problem solving through application of concepts under the guidance of instructors through intimate interactions. At a senior level, through self study and occasional interaction with TA's and course coordinator a student is expected to acquire such skill. Hence, CRC would like to propose discontinuation of tutorial component for courses at higher level - 300 level or above. This can be replaced by office hours by faculty and/or TA during which they will be available for clarifying doubts of the students.

Further, it is expected that each course will explicitly indicate how many design experience or communication skill units (other than credits) a student can earn from the course, if he/she opts and is permitted for a design project or a seminar in the course.

Once new courses are formulated, we need to explore mechanisms for management of courses which will have overlap across departments so that faculty load can be optimized.

5.7 TA Utilisation

CRC proposes that TA's should be utilised effectively in UG courses as per the currently approved guidelines. Further, performance of TA's should be formally linked to continuation/disbursement of their assistantship. CRC requests BPGS to formulate measures so that TA's can be more effectively utilised.

6. Conclusions

Senate has approved this conceptual framework for under-graduate programmes. Details of the programme will be worked out by Curriculum Implementation Committee to be appointed by Chairman senate. Senate deferred decisions on the following proposals of CRC : (i) B.Tech + MBA Dual Degree Programme (ii) B.S Programmes (and related dual degree schemes).