



# Schedule of Courses

## Undergraduate Programmes (First Year)

2013-2014

Indian Institute of Technology Delhi



## VISION

To contribute to India and the World through excellence in scientific and technical education and research to serve as a valuable resource for industry and society: and to maintain a source of pride for all Indians.

## MISSION

To generate new knowledge by engaging in cutting-edge research and to promote academic growth by offering state-of-the-art undergraduate, postgraduate and doctoral programmes.

To identify, based on an informed perception of Indian, regional and global needs, areas of specialization upon which the institute can concentrate.

To undertake collaborative projects which offer opportunities for long-term interaction with academia and industry.

To develop human potential to its fullest extent so that intellectually capable and imaginatively gifted leaders can emerge in a range of professions.

## VALUES

- Academic integrity and accountability.
- Respect and tolerance for the views of every individual.
- Attention to issues of national relevance as well as of global concern.
- Breadth of understanding, including knowledge of the human sciences.
- Appreciation of intellectual excellence and creativity.
- An unfettered spirit of exploration, rationality and enterprise.

**Institute Timing : 0845 hrs. to 1730 hrs.**

# SCHEDULE OF COURSES

## 2013-2014

### First Year of Undergraduate programmes

Bachelor of Technology

Dual Degree

*(This booklet is an interim document and will be replaced by a regular 'Courses of Study' in due course.)*



**INDIAN INSTITUTE OF TECHNOLOGY DELHI**

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**Information in this book and more details are available at the IIT Delhi website:**

<http://www.iitd.ac.in>

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## 1. INTRODUCTION

### 1.1 Background

I.I.T. Delhi provides science-based engineering education with a view to produce quality engineer-scientists. The curriculum provides broad based knowledge and simultaneously builds a temper for the life long process of learning and exploring. At the undergraduate level, a student needs to do compulsory foundation courses in the areas of basic sciences, humanities and social sciences and engineering sciences apart from departmental requirements. Departmental courses (core and electives) constitute about half of the total curriculum. Further, students do open category electives to develop broad inter-disciplinary knowledge base or to specialize significantly in an area outside his parent discipline. At the postgraduate level, students are encouraged to look beyond their area of specialization to broaden their horizons through open electives.

The medium of instruction in the Institute is English.

The Institute follows the semester system. An academic year runs from July through June next year and is comprised of two semesters. Typically, the 1<sup>st</sup> semester starts in the last week of July and ends in the 1<sup>st</sup> week of December; the 2<sup>nd</sup> semester starts in the 1<sup>st</sup> week of January and ends in the 2<sup>nd</sup> week of May. Detailed schedule is given in the Semester Schedule that is available before the start of the semester.

### 1.2 Departments and Centres

Each course is offered by an academic unit which could be a department, a centre or a school. The various Departments, Centres and Schools and their two-letter code are given below. Some courses are offered jointly by multiple academic units and are classified as interdisciplinary courses; their codes are also given in table 1.

**Table 1. Academic Departments, Centres and Schools.**

Name of Academic Unit (alphabetical order)	Code
Applied Mechanics, Department of	<b>AM</b>
Applied Research in Electronics, Centre for	<b>CR</b>
Atmospheric Sciences, Centre for	<b>AS</b>
Biochemical Engineering and Biotechnology, Department of (dual degree entry no. 'BB')	<b>BE</b>
Biological Sciences, School of	<b>BL</b>
Biomedical Engineering, Centre for	<b>BM</b>
Chemical Engineering, Department of	<b>CH</b>
Chemistry, Department of	<b>CY</b>
Civil Engineering, Department of	<b>CE</b>
Computer Science and Engineering, Department of	<b>CS</b>
Electrical Engineering, Department of	<b>EE</b>
Energy Studies, Centre for	<b>ES</b>
Humanities and Social Sciences, Department of	<b>HU</b>
Industrial Tribology, Machine Dynamics and Maintenance Engineering Centre	<b>IT</b>
Information Technology, Amar Nath and Shashi Khosla, School of	<b>SI</b>
Instrument Design and Development Centre	<b>ID</b>
Management Studies, Department of	<b>SM</b>
Mathematics, Department of	<b>MA</b>
Mechanical Engineering, Department of	<b>ME</b>
Physics, Department of (Engineering Physics courses start with 'EP')	<b>PH</b>
Polymer Science and Technology, Centre for	<b>PS</b>
Rural Development and Technology, Centre for	<b>RD</b>
Telecommunication Technology and Management, Bharti School of	<b>BS</b>
Textile Technology, Department of	<b>TT</b>
Value Education in Engineering, National Resource Center for	<b>VE</b>

### 1.3 Undergraduate Programmes offered

IIT Delhi offers a variety of academic programmes for students with a wide range of backgrounds. Admission to many of these programmes are based on performance in national level tests / entrance examinations followed by interviews in some cases. Details are given in Prospectus booklet.

The programmes offered by IIT Delhi are presently classified as undergraduate and postgraduate programmes. This classification is based primarily on entry/admission qualification of students rather than the level of degree offered. For all undergraduate programmes, students are admitted after 10+2 schooling while for all postgraduate programmes, students are admitted after they have obtained at least a college level Bachelor's degree. The various undergraduate programmes and their specialization are listed below.

#### A. Bachelor of Technology: (B.Tech.)

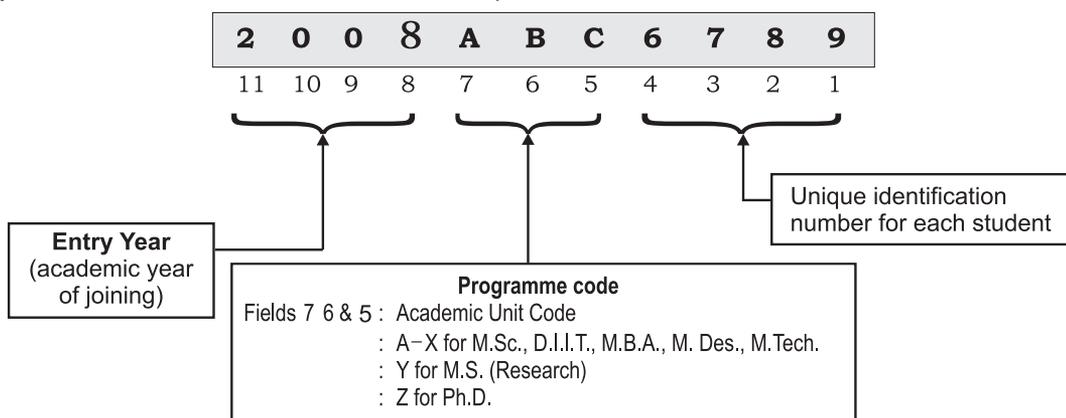
Department	Specialization	Code
Chemical Engg.	B.Tech. in Chemical Engineering	<b>CH1</b>
Computer Sc. and Engg.	B.Tech. in Computer Science and Engineering	<b>CS1</b>
Civil Engg.	B.Tech. in Civil Engineering	<b>CE1</b>
Electrical Engg.	B.Tech. in Electrical Engineering	<b>EE1</b>
	B.Tech. in Electrical Engineering (Power and Automation )	<b>EE3</b>
Mechanical Engg.	B.Tech. in Mechanical Engineering	<b>ME1</b>
	B.Tech. in Production and Industrial Engineering	<b>ME2</b>
Physics	B.Tech. in Engineering Physics	<b>PH1</b>
Textile Technology	B.Tech. in Textile Engineering	<b>TT1</b>

#### B. Dual-Degree: (B.Tech. and M.Tech.)

Department	Specialization	Code
Biochemical Engg. and Biotechnology	B.Tech. in Biochemical Engineering and Biotechnology, and M. Tech. in Biochemical Engineering and Biotechnology	<b>BE5</b>
Chemical Engg.	B.Tech. in Chemical Engineering, and M. Tech. in Chemical Engineering	<b>CH7</b>
Computer Sc. and Engg.	B.Tech. in Computer Science and Engineering, and M. Tech. in Computer Science and Engineering	<b>CS5</b>
Mathematics	B. Tech. in Mathematics & Computing and M. Tech. in Mathematics and Computing	<b>MT6</b>

### 1.4 Student's Entry Number

The entry number of a student consists of eleven alpha-numerals.



In case of a programme change, the three alphabets (fields 5, 6 and 7) will be changed. However, his/her unique numeric code will remain unchanged. Such students will have two entry numbers, one prior to programme change and one after the change. At any time, though, only one entry number, that corresponds to the students present status will be in use.

## 1.5 Honour Code

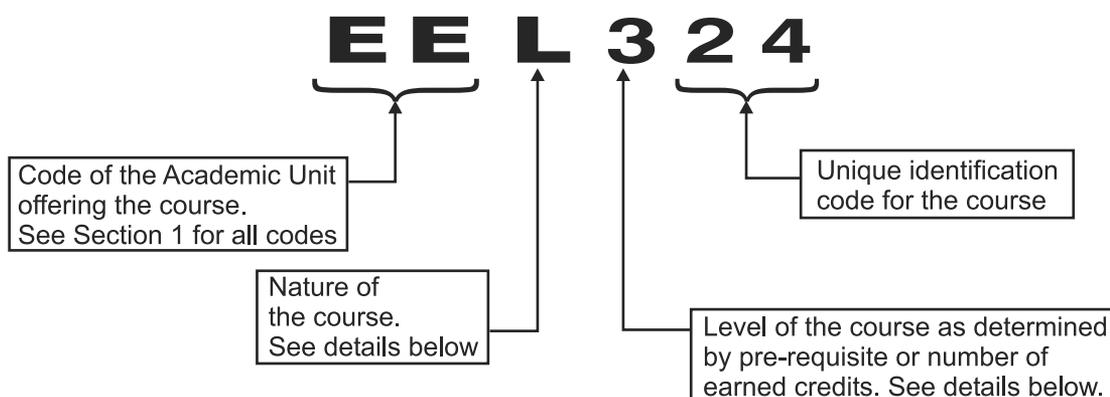
The *Honour Code* of IIT Delhi is given on the inside back cover of this booklet. Every student is expected to adhere to the *Honour Code*.

## 2. COURSE STRUCTURE AND CREDIT SYSTEM

### 2.1 Course Numbering Scheme

Normally every course at IIT Delhi runs for the full length of the semester. Only exception is for V-type courses which may run for part of the semester. At the beginning of the semester, a student registers for courses that he/she wants to study and at the end of the semester a grade is awarded. On obtaining a pass grade, the student earns all the credits associated with the course while a fail grade does not get any credit; partial credits are not awarded.

Each course number is denoted by six alpha-numerals, three alphabets followed by three numerals:



#### (a) Codes for the nature of the course

The nature of the course corresponding to the third alphabet in the course code is given in Table 2:

**Table 2. Codes for the nature of courses.**

Code	Description
<b>L</b>	Lecture courses (other than lecture hours, these courses can have Tutorial and Practical hours, e.g. L-T-P structures 3-0-0, 3-1-2-, 3-0-2, 2-0-0, etc.)
<b>P</b>	Laboratory based courses (where performance is evaluated primarily on the basis of practical or laboratory work with LTP structures like 0-0-3, 0-0-4, 1-0-3, 0-1-3, etc.)
<b>N</b>	Non-graded credit components

#### (b) Level of the course

The first digit of the numeric part of the course code indicates level of the course as determined by pre-requisite course and/or by the maturity required for registering for the course. The latter requirement is enforced through a requirement of minimum number of earned credits. In general,

- 100 – 400 level courses : Core and elective courses for UG programmes. These courses are not open to any PG student.
- 500 level courses : Courses for M.Sc. programmes. These courses are not open to other PG students.
- 600 level courses : Preparatory/introductory courses for M.Tech. programmes. These courses are normally not open to UG students.
- 700 - 800 level courses : Core and elective courses for M.Tech., M.Des., M.B.A., M.S.(Research) and Ph.D. programmes.  
usually 800 level courses are advanced courses for PG students.

## 2.2 Credit System

Education at the Institute is organized around the semester-based credit system of study. A student is allowed to attend classes in a course and earn credit for it, **only if** he/she has registered for that course. The prominent features of the credit system are a process of continuous evaluation of a student's performance/progress and flexibility to allow a student to progress at an optimum pace suited to his/her ability or convenience, subject to fulfilling minimum requirements for continuation.

A student's performance/progress is measured by the number of credits that he/she has earned, i.e. completed satisfactorily. Based on the course credits and grades obtained by the student, grade point average is calculated. A minimum grade point average is required to be maintained for satisfactory progress and continuation in the programme. Also a minimum number of earned credits and a minimum grade point average should be acquired in order to qualify for the degree. Details are given in the section on rules and regulations for UG students (Section 4) and PG students (Section 5).

All programmes are defined by the total credit requirement and a pattern of credit distribution over courses of different categories. Total credit requirement for different programmes are given in section 4 for UG students and section 5 for PG students. Category-wise break-up for each programme are given in sections 6 and 7 for UG and PG programmes, respectively.

## 2.3 Course Credits Assignment

Each course, except a few special courses, has a certain number of credits assigned to it depending upon its lecture, tutorial and laboratory contact hours in a week. This weightage is also indicative of the academic expectation that includes in-class contact and self-study outside of class hours.

*Lectures and Tutorials:* One lecture or tutorial hour per week per semester is assigned one credit.

*Practical/Laboratory :* One laboratory hour per week per semester is assigned half credit.

A few courses are without credit and are referred to as non-credit (NC) courses.

Example: Course *EEL100 Fundamentals of Electrical Engineering*; 4 credits (3-0-2)

The credits indicated for this course are computed as follows:

$$\begin{array}{rcl}
 3 \text{ hours/week lectures} & = & 3 \text{ credits} \\
 0 \text{ hours/week tutorial} & = & 0 \text{ credit} \\
 2 \text{ hours/week practical} & = & 2 \times 0.5 = 1 \text{ credit}
 \end{array}
 \left. \vphantom{\begin{array}{rcl} 3 \text{ hours/week lectures} \\ 0 \text{ hours/week tutorial} \\ 2 \text{ hours/week practical} \end{array}} \right\} \text{Total} = 3 + 0 + 1 = 4 \text{ credits}$$

Also, (3-0-2) 4 credit course = (3 h Lectures + 0 h Tutorial + 2 h Practical) per week  
 = 5 contact hours per week

For each lecture or tutorial credit, the self study component is 1 hour/week (for 100-600 level courses) and 2 hours/week (for 700-800 level courses). In the above example, the student is expected to devote 3 + 1 = 4 hours per week on self study for this course, in addition to class contact of 5 hours per week.

On completing all the degree requirements, the degree grade point average, DGPA, will be calculated and this value will be indicated on the degree/diploma. The DGPA will be calculated on the basis of category-wise best valid credits required for graduation.

A student who has earned the requisite credits but does not meet the graduation DGPA requirement, may do additional courses in any elective category to meet the DGPA requirement within the maximum permissible time limit. Further details are given in the Courses of Study.

## 2.4 Earning Credits

At the end of every course, a letter grade is awarded in each course for which a student had registered. On obtaining a pass grade, the student accumulates the course credits as earned credits. A student's performance is measured by the number of credits that he/she has earned and by the weighted grade point average. A student has the option of auditing some courses. Grades obtained in these audit courses are not counted for computation of grade point average. However, a pass grade is essential for earning credits from an audit course; this does not apply to postgraduate

programmes. A minimum number of earned credits are required in order to qualify for a degree and continuation of registration at any stage. Currently students in the postgraduate programmes can audit courses but they do not count towards earned credits.

The credit system enables continuous evaluation of a student's performance, and allows the students to progress at an optimum pace suited to individual ability and convenience, subject to fulfilling minimum requirement for continuation.

## 2.5 Course Content Description

Course content description consists of following components: (i) Course Number, (ii) Title of the Course; (iii) Credit and L-T-P; and (iv) Description of the content. Content descriptions for all courses are given in Section 8. An example is given below:

### **MAL100 Calculus**

*(3-1-0) 4 Credits*

Review of Limit, Continuity and Differentiability, uniform continuity, Mean Value Theorems and applications, Taylor's Theorem, maxima and minima, Sequences and series, limsup, liminf, convergence of sequences and series of real numbers, absolute and conditional convergence. Riemann Integral, fundamental theorem of integral calculus, applications of definite integrals, improper integrals, beta and gamma functions. Functions of several variables, limit and continuity, partial derivatives and differentiability, gradient, directional derivatives, chain rule, Taylor's theorem, maxima and minima and method of Lagrange Multipliers. Double and triple integration, Jacobian and change of variables formula. Parametrization of curves and surfaces, vector fields, divergence and curl, Line integrals, Green's theorem, surface integral, Gauss and Stokes' theorems with applications.

## 2.6 Course Coordinator

Every course is usually coordinated by a member of the teaching staff of the Department/Centre/School which is offering the course in a given semester. For some courses, faculty from other departments/centres or even guest faculty participates in the teaching and/or coordination of a course. This faculty member is designated as the *Course Coordinator*. He/she has the full responsibility for conducting the course, coordinating the work of the other members of the faculty as well as teaching assistants involved in that course, holding the tests and assignments, and awarding the grades. For any difficulty related to a course, the student is expected to approach the respective course coordinator for advice and clarification. The distribution of the weightage for tests, quizzes, assignments, laboratory work, workshop and drawing assignment, term paper, etc. that will be the basis for award of grade in a course will be decided by the course coordinator of that course and generally announced at the start of the semester. For all non-100 level 'L' category courses, not more than 80% of the course aggregate can be associated with minor and major examination components. Course coordinator will have additional evaluation components over and above two minors and majors.

## 2.7 Grading System

The grading reflects a student's own proficiency in the course. While relative standing of the student is clearly indicated by his/her grades, the process of awarding grades is not based upon fitting performance of the class to some statistical distribution. The course coordinator and associated faculty for a course formulate appropriate procedure to award grades that are reflective of the student's performance *vis-à-vis* instructor's expectation.

### 2.7.1 Grade points

The grades and their equivalent numerical points are listed in Table 3.

**Table 3. Grades and their description.**

Grade	Grade points	Description
A	10	Outstanding
A (-)	9	Excellent
B	8	Very good
B (-)	7	Good
C	6	Average
C (-)	5	Below average
D	4	Marginal
E	2	Poor
F	0	Very poor
I	-	Incomplete
NP	-	Audit pass
NF	-	Audit fail
W	-	Withdrawal
X	-	Continued
S	-	Satisfactory completion
Z	-	Course continuation

### 2.7.2 Description of grades

#### **A** grade

An 'A' grade stands for outstanding achievement. The minimum marks for award of an 'A' grade is 80 %. However, individual course coordinators may set a higher performance requirement.

#### **C** grade

The 'C' grade stands for average performance. This average performance refers to "average" as per instructor's expectations in a holistic sense. This is the minimum grade required to pass in the Major Project Part 1 and Part 2 of Dual degree, Integrated M.Tech. and 2 year M.Tech. & M.S. Programmes.

#### **D** grade

The 'D' grade stands for marginal performance; i.e. it is the minimum passing grade in any course. The minimum marks for award of 'D' grade is 30 %, however, individual course coordinators may set a higher marks requirement.

#### **E** and **F** grades

A student who has scored at least 20% aggregate marks in a subject can be awarded an 'E' Grade. The Course Coordinators are, however, free to enhance this limit but should keep the percentage about 10% less than the cut-off marks for 'D' Grade. The Course Coordinators can also specify any additional requirements (to be specified at the beginning of the Semester) for awarding 'E' Grade. Students who obtain an 'E' Grade will be eligible to take a re-major test (an examination with weightage same as that of Major) for only 'L' Category Courses. If they perform satisfactorily, they become eligible for getting the grade converted to a 'D' Grade, otherwise they will continue to have 'E' Grade. However, the student will have only one chance to appear for re-major for an 'E' Grade. The re-major test will be conducted within the first week of the next semester. The date of re-major test of first year courses will be centrally notified by the Chairman, Time-Table Committee. A student can take a maximum of three such re-major tests in a given semester. If a student can not appear for the re-major test due to any reasons, he/she will not get any additional chance.

A student has to repeat all core courses in which he/ she obtains 'F' Grades until a passing grade is obtained. For 'E' Grade in a core course, a student has to repeat the same core courses or take a re-major test to obtain a passing grade. For the other (elective) courses in which 'E' or 'F' grade have been obtained, the student may take the same course or any other course from the same category or take re-major in case of 'E' Grade. 'E' & 'F' Grades are not counted in the calculation of the CGPA; however, these are counted in the calculation of the SGPA.

## I grade

An 'I' grade denotes incomplete performance in any L (lecture), P (practical), V (special module) category courses. It may be awarded in case of absence on medical grounds or other special circumstances, before or during the major examination period. The student should complete all requirements within

- (i) 10 days of the last date of Major Tests; the request is to be made to the head of the department of the student's programme who will notify the same to concerned course coordinators, or
- (ii) with permission of the Dean, Academics the period can be extended to the first week of the next semester. A student will be eligible for an 'I' grade provided he/she has met the attendance criterion.

Upon completion of all course requirements, the 'I' grade is converted to a regular grade (A to F, NP or NF). 'I' grade does not appear permanently in the grade card.

Requests for I-grade should be made at the earliest but not later than the last day of major tests.

Attendance in the course for which I-grade is being sought will be certified by the course coordinator of the course. The course coordinators can instruct all students awarded I or extended I grade to appear for the re-major of the 'E' grade. On the basis of their performance a student having I grade or extended I grade can earn any permissible grade unlike students taking re-major after obtaining 'E' grade. Please see other requirements in *Regulations and Procedures*.

## NP and NF grades

These grades are awarded in a course that the student opts to audit. Only elective courses can be audited. Auditing a course is allowed until one week after the first Minor Tests. The audit pass (NP) grade is awarded if the student's attendance is above 75% in the class and he/she has obtained at least 'D' grade. Course coordinator can specify a higher criterion for audit pass at the beginning of the semester. If either of these requirements is not fulfilled, the audit fail (NF) grade is awarded. The grades obtained in an audit course are not considered in the calculation of SGPA or CGPA.

*For UG programmes: the credits will be counted in total earned credits in the respective category.*

*For PG programmes: the credits will not be counted towards degree completion credit requirements.*

## W grade

A 'W' grade is awarded in a course where the student has opted to withdraw from the course. Withdrawal from a course is permitted until one week after the first Minor Tests. Withdrawal from PG major project part 2 is allowed only if he/she is given semester withdrawal. The W grade stays on grade card.

## X grade

The 'X' grade is awarded for incomplete work typically in a project-type course based on a request by the student. The separate regulations for UG and PG students are given below.

*The 'X' grade is awarded for incomplete work in Independent Study, Mini Project, Minor Project, or Major Project Part 1 and Part 2, based on the request of the student. On completion of the work, X grade can be converted to a regular grade within the first week of the next semester. Otherwise, the student will be awarded 'X' grade on a permanent basis and it will appear in his/her grade card. Further, the student will be required to register for the course in the next semester. The credits of the course will be counted towards his total load for the semester. In case of Major Project Part 1, the student will not be permitted to register for Major Project Part 2 simultaneously as Major Part 1 is a pre-requisite for Major Project Part 2. A regular full-time student can be awarded 'X' grade only once in a course, other than the summer semester. A part-time M. Tech. student is permitted a maximum of two X-grades in the major project part-2.*

## S and Z grades

The 'S' grade denotes satisfactory performance and completion of a course. The 'Z' grade is awarded for non-completion of the course requirements, and if it is a core course, the student will have to register for the course until he/she obtains the 'S' grade. The specific courses in which S/Z grades are awarded for 2013 entry undergraduate students are:

- (i) Introduction to Engineering and Programme
- (ii) Language and writing skill
- (iii) NCC/NSO/NSS
- (iv) Professional Ethics and Social Responsibility
- (v) Communication skill/Seminar
- (vi) Design/Practical Experience

## 2.8 Evaluation of Performance

The performance of a student will be evaluated in terms of three indices, viz. the Semester Grade Point Average (SGPA) which is the Grade Point Average for a semester, Cumulative Grade Point Average (CGPA) which is the Grade Point Average for all the completed semesters at any point in time and Degree Grade Point Average (DGPA).

A student who completes the course and credit requirements but has CGPA below the minimum required for award of degree will be evaluated in terms of Degree Grade Point Average (DGPA) which is calculated on the basis of the best valid credits; for all the completed semesters at any point of time until the maximum permissible period.

The Earned Credits (E.C.) are defined as the sum of course credits for courses in which students have been awarded grades between A to D or NP or S; for UG students, credits from courses in which NP or S grade has been obtained are also added.

Points earned in a semester =  $\Sigma$  (Course credits x Grade point) for courses in which A - D or NP or S grade has been obtained)

The SGPA is calculated on the basis of grades obtained in all courses, except audit courses and courses in which S/ Z grade is awarded, registered for in the particular semester.

$$SGPA = \frac{\text{Points secured in the semester}}{\text{Credits registered in the semester, excluding audit and S/Z grade courses}}$$

The CGPA is calculated on the basis of all pass grades, except audit courses and courses in which S/Z grade is awarded, obtained in all completed semesters.

$$CGPA = \frac{\text{Cumulative points secured in all passed courses (A-D grade)}}{\text{Cumulative earned credits, excluding audit and S/Z grade courses}}$$

An example of these calculations is given in Table 4.

**Table 4 (a) Typical academic performance calculations - I semester**

Course no.	Course credits	Grade awarded	Earned credits	Grade points	Points secured
(column 1)	(column 2)	(column 3)	(column 4)	(column 5)	(column 6)
MALXXX	5	C	5	6	30
CSLXXX	4	C ( - )	4	5	20
PHLXXX	4	A	4	10	40
PHPXXX	2	B	2	8	16
MELXXX	4	E	0	2	08
TTNXXX	2	S	2	—	—

Credits registered in the semester (total of column 2) = 21

Credits registered in the semester excluding audit and S/Z grade courses = 19

Earned credits in the semester (total of column 4) = 17

Earned credits in the semester excluding audit & S/Z grade courses = 15

Points secured in this semester (total of column 6) = 114

Points secured in this semester in all passed courses (total of column 6 & A-D grade) = 106

$$SGPA = \frac{\text{Points secured in the semester}}{\text{Credits registered in the semester, excluding audit and S/Z grade courses}} = \frac{114}{19} = 6.000$$

$$CGPA = \frac{\text{Cumulative points secured in all passed courses (A-D grade)}}{\text{Cumulative earned credits, excluding audit and S/Z grade courses}} = \frac{106}{15} = 7.067$$

Semester performance: Earned credits (E.C.) = 17 SGPA = 6.000

Cumulative performance: Earned credits (E.C.) = 17 CGPA = 7.067

**Table 4(b). Typical academic performance calculations - II semester**

Course no.	Course credits	Grade awarded	Earned credits	Grade points	Points secured
(column 1)	(column 2)	(column 3)	(column 4)	(column 5)	(column 6)
MALXXX	5	B	5	8	40
EELXXX	4	A ( - )	4	9	36
CYLXXX	4	W	—	—	—
CYPXXX	2	B ( - )	2	7	14
MELXXX	4	C	4	6	24
AMLXXX	4	A	4	10	40
HUNXXX	1	S	1	—	—

Credits registered in the semester (total of column 2)	=	24
Credits registered in the semester excluding audit and S/Z grade courses	=	23
Earned credits in the semester (total of column 4)	=	20
Earned credits in the semester excluding audit & S/Z grade courses	=	19
Points secured in this semester (total of column 6)	=	154
Points secured in this semester in all passed courses (total of column 6 & A-D grade)	=	154
Cumulative points earned in all passed courses = 106 (past semesters) + 154 (this sem.)	=	260
Cumulative earned credits = 17 (past semesters) + 20 (this sem.)	=	37

$$\text{SGPA} = \frac{\text{Points secured in the semester}}{\text{Credits registered in the semester, excluding audit and S/Z grade courses}} = \frac{154}{19} = 8.105$$

$$\text{CGPA} = \frac{\text{Cumulative points secured in all passed courses (A-D grade)}}{\text{Cumulative earned credits, excluding audit and S/Z grade courses}} = \frac{106 + 154}{15 + 19} = 7.647$$

Semester performance : Earned credits (E.C.) = 20      SGPA = 8.105  
 Cumulative performance : Earned credits (E.C.) = 37      CGPA = 7.647

On completing all the degree requirements, the degree grade point average, DGPA, will be calculated and this value will be indicated on the degree/diploma. The DGPA will be calculated on the basis of category-wise best valid credits required for graduation.

A student who has earned the requisite credits but does not meet the graduation DGPA requirement, may do additional courses in any elective category to meet the DGPA requirement within the maximum permissible time limit. Further details are given in the Courses of Study.

### 3. REGISTRATION AND ATTENDANCE

#### 3.1 Registration

Registration is a very important procedural part of the academic system. The registration procedure ensures that the student's name is on the roll list of each course that he/she wants to study. No credit is given if the student attends a course for which he/she has not registered. Registration for courses to be taken in a particular semester will be done according to a specified schedule before the end of the previous semester. Each student is required to complete the registration form on the computer by indicating the slot-wise choice of courses. Web based registration facility is available only on the intranet of I.I.T. Delhi. The choice of courses must be approved by his/her adviser. The student must also take steps to pay his/her dues before the beginning of the semester by making use of internet banking facility of SBI through the intranet of I.I.T. Delhi. Students who do not make payments by a stipulated date will be de-registered for the particular semester.

In absentia registration or registration after the specified date will be allowed only in rare cases at the discretion of Dean, Academics. In case of illness or absence during registration, the student should intimate the same to his/her course adviser and Dean, Academics. A student must meet his/her advisor within the first week of the new semester for confirmation of his/her registration. A student's registration record will be available on-line for reference.

Various activities related to registration are listed below. The relevant dates are included in the *Semester Schedule* that is available before the start of the semester.

### 3.2 Registration and Student Status

Registration by a student confirms his/her status as student at the Institute. Failure to register before the last date for late registration will imply that the student has discontinued studies and his/her name will be struck-off the rolls.

Every registered student, except part-time postgraduate students, is considered as a full-time student at the institute. They are expected to be present at the Institute and devote full time to academics. Students registered only for a self-study course (only for undergraduates) or only for project or thesis are also considered as full-time students.

### 3.3 Advice on Courses

At the time of registration, each student must consult his/her student adviser/programme coordinator to finalize the academic programme, keeping in view factors, such as, minimum/maximum numbers of total and lecture credits, past performance, backlog of courses, SGPA/CGPA, pre-requisite, work load and student's interests, amongst others. Special provisions exist for academically weak students.

### 3.4 Registration Validation

Before the first day of classes, every student is required to be present on campus and validate his/her registration by logging in at the website. The updated registration record will be available on the website and the hard copy will be available with the student's advisor/programme coordinator. Students who do not do registration validation will not be permitted to add/drop courses.

### 3.5 Late Registration

Late registration is permitted under the following conditions:

- (a) A student, who was not in the campus during the period of registration in the previous semester, needs to complete the registration process on or before the first day of the semester before commencement of classes; or
- (b) For reasons beyond his/her control, if a student is not able to register or send an authorized representative with a medical certificate, he/she may apply to the Dean, Academics for late registration. Dean, Academics will consider and may approve late registration in genuine cases on payment of an extra fee called late registration fee. Late registration is permitted until one week after the start of the semester.

### 3.6 Semester Withdrawal

- a) Semester withdrawal and absence for a semester under different conditions viz. (i) medical and personal grounds (ii) industrial internship (iii) exchange / deputation to another academic institution in India or abroad, & (iv) disciplinary condition (for both UG and PG students) should be clearly identified.
- b) Semester Withdrawal (SW) is proposed to reflect the condition in which a student is forced to withdraw from all courses in the semester for medical conditions or for a part-time student when he/she is sent for an outstation assignment by his/her employer. A student can apply for semester withdrawal if he /she has missed at least 20 teaching days on these grounds. Under no circumstances an application for semester withdrawal be acceptable after the commencement of major. A student is not permitted to request for withdrawal with retrospective effect.
- (c) Semester Leave (SL) is proposed to indicate the situation in which a student is permitted to take one or more semester off for industrial internship or any other assignment with prior approval and planning. The application is to be routed through his/her advisor / programme coordinator and HOD or HOC and the final approving authority will be Dean, Academics. All such applications must be processed before the beginning of the semester in which the leave will be taken. At present, JEE-entry B.Tech., dual degree and integrated M.Tech. students are allowed one extra semester for completion of the programme for every semester leave for industrial internship. Such students are permitted maximum of two semesters of leave. The full-time 2 year M.Tech./M.S. students be permitted a maximum of one semester leave for industrial internship or other assignment as approved by the Dean. These semesters will not be counted towards the maximum permitted time period for completion of the degree similar to the provision of JEE entry students.
- (d) When a student (UG or PG) registers at another academic institution in India or abroad with the expectation of credit transfer or research work through a pre-approved arrangement including MoU, the student should be considered as being on a Semester Exchange (SE). The SE period will be counted towards the total period permitted for the degree.

- (e) When a student is suspended for one or more semesters on disciplinary grounds, the student status should be called Disciplinary Withdrawal period (DW). Time spent in DW status will be counted towards the total period permitted for completion of the degree.

### 3.7 Registration and Fees Payment

Every registered student must pay the stipulated fees in full before the specified deadlines. In the event that a student does not make these payments, he/she will be de-registered from all courses and his/her name will be struck-off the rolls.

### 3.8 Registration Record

In addition to web-based entries related to registration, the student should ensure that the same are entered on the *Registration Record*. Queries related to registration will be considered only when accompanied by the original Registration Record. This record must be preserved until the semester grade card is received by the student.

### 3.9 Continuous Absence and Registration Status

If a student, whether full time, sponsored or part time, is absent from the Institute for more than four weeks without notifying the Head of Department/Centre or Dean, Academics his/her registration will be terminated and name will be removed from the Institute rolls.

### 3.10 Attendance Rule

- (i) It is mandatory for the students to attend all classes. Attendance Records of all students for each course will be maintained.
- (ii) For all 1st year courses (100-level courses) the attendance will be taken and maintained by U.G. Section. If any student's attendance falls below 75% attendance in any of these courses, he/she will be put under academic probation. Henceforth, he/she will be governed by the rules for student under academic probation.
- (iii) For all other courses, the Course Coordinator will announce the class policy on attendance with respect to grading etc., at the beginning of the semester. This shall be done keeping in mind the importance of classroom learning in the teaching-learning process. Once the class attendance policy has been made clear to all the students registered for the course, the Course Coordinator will implement the same in totality.

For the purpose of attendance calculation, every scheduled practical class will count as one unit irrespective of the number of contact hours.

Attendance record will be maintained based upon roll calls (or any equivalent operation) in every scheduled lecture, tutorial and practical class. The course coordinator will maintain and consolidate attendance record for the course (lectures, tutorials and practicals together, as applicable).

A faculty may choose any one or more of the following as attendance policy (approved by the Senate):

1. Faculty can assign 10% of the total marks to surprise quiz. If attendance of the student is greater than 90%, result of the best three quizzes will be considered else average of all quizzes will be considered.
2. Faculty can allocate specific marks for participation in discussions in the class on a regular basis.
3. If a student's attendance is less than 75%, the student will be awarded one grade less than the actual grade that he (she) has earned. For example, a student who has got A grade but has attendance less than 75% will be awarded A-grade.
4. A student can not get NP for an audit course if his attendance is less than 75%.

A faculty can implement any other attendance policy provided the policy is approved by the Dean, Academics.

Attendance statistics will also be used in the following way:

- (i) If a student's attendance is less than 75% in more than two courses without any valid reason in a semester will be issued warning and put under probation. If this is repeated, he/she will not be allotted a hostel seat in the next semester.
- (ii) If a student's attendance is less than 75% in any course and CGPA is less than 7.0, then he (she) will not be eligible to hold any position of responsibility in the hostel/institute in the next semester.

## 4 UNDERGRADUATE DEGREE REQUIREMENTS , REGULATIONS AND PROCEDURES

### 4.1 Overall requirements

#### 4.1.1 B.Tech.

The total credit requirement for the B. Tech. (4-year programme) is 145-155 credits (exact requirement in discipline specific). For B. Tech. programmes, the total credits are distributed over following categories :

- (i) Institute Core (IC) : includes
  - Basic Sciences (BS) : Mathematics, Physics, Chemistry and Biology courses
  - Engineering Arts and Science (EAS): Fundamental engineering courses
- (II) Departmental Core (DC): includes courses of relevant discipline and some additional BS/EAS courses that are specified by the Department as Programme Linked (PL) courses.
- (III) Departmental Electives (DE): electives related to the parent discipline.
- (IV) Open Category (OC) : electives can be taken outside or within the discipline ; these credits can be used towards departmental specialization or minor area also (see Sec 4.6).
- (V) Non graded Core (OC) units : These are core requirements and can be earned through formal academic activity and informal co-curricular or extra-curricular activities.

#### 4.1.2 Dual degree programmes :

The B.Tech. requirements for a dual degree are same as that given in 4.1.1. along with departmental specialization. However , the project course will not be part of the credits for the departmental specialization. Further details of the M. Tech. part will be available at a later stage.

### 4.2 Degree Requirement Breakup

The minimum earned credit/unit requirements for B. Tech. degree are given in Table 5.

**Table 5 : Degree requirements of undergraduate programs (see section 4.2.5 for additional information)**

	Category	Symbol	B. Tech. Requirements	Remarks
1	Institute Core	IC	55 Credits	Common to all disciplines
2	Programme Linked EAS/BS	PL	0-15 Credits	Discipline specific as decided by the Department
3	Departmental core	DC	65-80 with min 10 as	Discipline specific
4	Departmental Elective	DE	DE	
5	Open Category	OC	10 Credits	Open to student's choice
6	Nongraded Core	NG	15 units	See Sec. 4.5
	Total		145-155 Credits + 15 nongraded units	

### 4.3 Absence During the Semester

- (a) A student must inform the Dean, Academics immediately of any instance of continuous absence from classes.
- (b) A student who is absent due to illness or any other emergency, up to a maximum of two weeks, should approach the course coordinator for make-up quizzes, assignments and laboratory work.
- (c) A student who has been absent from a minor test due to illness should approach the course coordinator for a make-up test immediately on return to class. The request should be supported with a medical certificate from institute's medical officer. A certificate from a registered medical practitioner will also be acceptable for a student normally residing off-campus provided registration number of the medical practitioner appears explicitly on the certificate.
- (d) In case a student cannot appear in a minor test on the same day in which he/she has appeared in a test, a medical certificate only from the institute's medical officer will be acceptable.

- (e) In case of absence on medical grounds or other special circumstances, before or during the major examination period, the student can apply for I-grade. 75 % attendance in a course is necessary for being eligible for request of I-grade in that course. An application requesting I-grade should be made at the earliest but not later than the last day of major tests. The application should be made to the Head of the Department of the student's programme who will grant approval depending on the merit of the case and inform course coordinators and U.G section. The student should complete all course requirements within ten days of the last date of Major Tests. The I-grade will then be converted to a proper grade ( A to F, NP or NF).
- (f) In special situations arising due to the student's inability to be present at the institute during the stipulated period, in (e) above, the period for conversion of I grade can be extended to the first week of the next semester. Approval for this extension can be granted by Dean Academics on recommendations of the concerned Head of the department, course coordinators and concerned warden. A request to this effect must be included in the application for I-grade.
- (g) In case the period of absence on medical grounds is more than 20 working days during the semester, a student may apply for withdrawal from the semester, i.e. withdrawal from all courses registered that semester. Such application must be made as early as possible and latest before the start of the major tests. No applications for semester withdrawal will be considered after the major tests have commenced. Dean Academics, depending on the merit of the case, will approve such applications. Partial withdrawal from courses registered in a semester is not allowed.
- (h) If a student is continuously absent from the institute for more than four weeks without notifying the Dean Academics, his/her name will be removed from institute rolls.

## 4.4 Conditions for Termination of Registration, Probation and Warning

### 4.4.1. Students admitted through JEE

If the performance at the end of first two registered semesters (not including summer semester) is poor, then the student can opt to start a fresh, or else his/her registration will be terminated. The criteria "poor" performance is defined in Table 6.

**Table 6. Rules for termination of registration at the end of the 2<sup>nd</sup> registered semester.**

Quality of performance	Earned credits		Decision
	GE/OBC	SC/ST/PD	
Poor performance	≤ 22	≤ 18	Re-start (once only) or Termination of registration

If a student chooses to restart after the first two registered semesters, then his/her credits earned and semesters registered will not be carried over. The re-start will be indicated on the transcript. The re-start will be permitted only once. If at the end of two registered semesters after re-start, the earned credits are less than or equal to 22 for GE/OBC or less than or equal to 18 for SC/ST/PD students, then the registration will be terminated.

## 4.5 Non-graded and Core Requirement

As part of the curriculum, non-graded 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.

Following are the components of Non-grade units (core)

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

These 15 units will be core requirement for all undergraduate programmes. A student will need to earn these 15 credits over the complete duration of the programme with special considerations and requirement 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 Engineering (NIN100) (1 unit)**

All students will be required to undergo exercises in the first semester, for earning the 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.

**(b) Introduction to Programme (1 unit)**

This would be discipline specific introduction to programme. This would run in the third semester.

**(c) Language and Writing Skill (NLN100) (2 units)**

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. Students involvement, during regular semester, will not be more than two hours per week.

**(d) NCC/NSO/NSS (NCN100/NSN100/NPN100) (2 units)**

NCC/NSO/NSS will form part of core requirement of the degree. Students will be required to earn 2 units from these activities. The faculty coordinator will devise a scheme for awarding these units.

**(e) Professional Ethics and Social Responsibilities (NEN100) (2 units)**

There is increasing consensus worldwide that engineering ethics need 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. Workshops, discussions/debates will be organized to sensitize students about Professional Ethics and Social Responsibility. This course will be also associated with 2 units implying total involvement of about 100 hours. Involvement of students in these activities will be monitored by the coordinator for awarding the S grade. Any act of plagiarism and the unfair practice in the examination reported against the students will require him/her to undergo additional exercise to qualify for the S grade.

**(f) Communication Skills (NQN100) (2 units)**

Communication skill is an essential requirement for a modern engineer. As a part of the degree requirement the students will have to earn 2 units for exercises in communication skill.

A student will be required to earn these credits in their 3<sup>rd</sup> and /or 4<sup>th</sup> year. The details will be available in due course.

**(g) Design/Practical Experience (NDN100) (2 units)**

Objective of this non graded core component is to give opportunities to students to acquire substantial design/practical experience both as a part of formal course as well in an informal setting before they graduate. Second and even more important objective of this course is to inculcate design thinking among students and facilitate them to gain some design immersion experience. As a part of this requirement, every student is expected to earn a minimum of 5 units of design/practical experience to complete the degree requirement. These units can be earned in multiple ways during the semester as well as during vacation period. Design / practical experience can be acquired in many ways such as through courses with design focus; regular courses which involve optional design/practical experience component requiring additional effort; summer /semester internship in R&D/industry/under the guidance of Institute Faculty; participation in design/innovation projects; participation in short-term modules of certain minimum duration offered by industry/institute/visitors/visiting Faculty; minor/major projects.

## 4.6 Capability Linked Opportunities for Undergraduate Students

A student who clears all the first year credit requirements with CGPA 7.0 and above will be permitted to register for additional credits from 3<sup>rd</sup> 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 till then and
- (ii) his/ her CGPA is 7 or above

In case, a student does not meet this requirement but has cleared 20XN 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 course 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

- (i) Minor/Interdisciplinary Area Specialization
- (ii) Departmental Specialization

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 Specialization will be indicated on the degree.

When a student opts for a departmental specialization and/or a minor area, he/she can use 10 open category credits (mandatory degree requirement) towards departmental specialization and/or minor area requirements. 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/she will need to do additional 10 credits in the minor area to be eligible for Minor area specialization 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 Specialization 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/her transcript.

## 4.7 Change of Programme at the End of the First Year

The following regulations apply for change of programme at the end of first year, i.e. end of the 2<sup>nd</sup> semester.

- (a) A student is eligible to apply for change of discipline at the end of first year only, provided he/she satisfies the following criteria:-
  - (i) CGPA for general category student : 07.50
  - (ii) CGPA for SC/ST/PH category student : 06.50
  - (iii) Earned credits at the end of first academic session : 40
- (b) Change of the discipline will be permitted strictly in the order of merit as determined by their CGPA at the end of first year subject to the limitation that the actual number of students in the third semester in the discipline to which the transfer is to be made, should not exceed the sanctioned strength and the strength of the discipline from which transfer is being sought does not fall below 90% of existing strength.
- (c) For a student with CGPA 9.0 or more, even if a vacancy does not exist, he/she will be permitted to change provided the strength in the discipline to which the change is being sought does not exceed by 5 % of the approved strength.
- (d) A student with CGPA 9.0 or more will be permitted to change discipline even if strength of discipline from which change is being sought falls below 90 % of the existing strength.
- (e) Stipulation of minimum credits and CGPA requirements will not be insisted upon for change of discipline to a branch in which a vacancy exists and the concerned student was eligible for admission to that discipline at the time of entry to IIT Delhi. However, requirements of credits and CGPA will continue to apply in case of both general and SC/ST category students seeking change to a discipline to which the concerned student was not eligible for admission at the time of entry to IIT Delhi.

More liberal rules are being worked out. If these are approved, these rules may become effective for the students admitted in 2013-14.

## 4.8 Measures for helping SC/ST Students

A number of measures exist for helping students belonging to SC and ST categories. A senior faculty member is appointed as adviser to SC/ST students for advising them on academic and non-academic matters. Financial measures for helping SC and ST student are described in the Prospectus.

## 4.9 Course Schedule & Course Descriptions

All the students would be divided in two batches A & B. The courses to be done by the batches are given below.

### Ist Semester

	A slot	B slot	C slot	D slot	lab classes	5p.m.- 7p.m.
Batch A (9.5-1-15) + (0-0-3)	EEL100 (3 hrs)	MEP100 (.5 hrs)	PHL100 (3hrs)(a/n in EP slot)	MAL100 (3+1 hrs)	EEL100(2hrs) PHP100(4hrs) MEP100(3hrs) MEP101(4hrs) NLN100(2 hrs)	All students  Intro. To Engg: Once a week; PE&SR :once in two week.
Batch B (12-2-8) + (0-0-3)	AML100 (3+1 hrs)	CSL100 (3 hrs)	CYL100 (3hrs) (a/n in EP slot)	MAL101 (3+1 hrs)	CSL100(2hrs) CYP100(4hrs) NLN100(2 hrs)	

### IInd Semester

	A slot	B slot	C slot	D slot	lab classes	5p.m.- 7p.m.
BatchB (9.5-1-15) + (0-0-1)	EEL100 (3 hrs)	MEP100 (.5 hrs)	PHL100 (3hrs)(a/n in EP slot)	MAL100 (3+1 hrs)	EEL100(2hrs) PHP100(4hrs) MEP100(3hrs) MEP101(4hrs) NLN100(2 hrs)	All students  PE&SR :once in two week.
Batch A (12-2-8) + (0-0-1)	AML100 (3+1 hrs)	CSL100 (3 hrs)	CYL100 (3hrs) (a/n in EP slot)	MAL101 (3+1 hrs)	CSL100(2hrs) CYP100(4hrs) NLN100(2 hrs)	

### 4.9.1 Description of Courses

#### AML100 Engineering Mechanics

(3-1-0) 4 Credits

NLN100 Kinematics, Statics, Equations of motion, Rigid body dynamics, Introduction to variational mechanics.

#### CSL100 Introduction to Computer Science

(3-0-2) 4 Credits

Concept of an algorithm; termination and correctness. Algorithms to programs: specification, top-down development and stepwise refinement. Iterative versus recursive style; problem solving using a functional style; correctness issues in programming; efficiency issues in programming; time and space measures. Structured style of imperative programming; assertions and loop invariants; programming in an imperative language using advanced features: procedures, functions. Data types, representational invariants. Encapsulation, abstractions,

interaction, modularity. Identifying and exploiting inherent concurrency.

#### CYL100 Introduction to Chemistry

(3-0-0) 3 Credits

Quantum mechanical principles of structure and bonding. Free energy and entropy changes in chemical processes. Phase diagram. Coordination chemistry. Bioinorganic chemistry. Organometallic chemistry. Materials of interest in chemistry. Stereochemistry. Reactivity of molecules. Strategies for carbon-carbon bond formation.

#### CYP100 Chemistry Laboratory

(0-0-4) 2 Credits

Experiments involve the following: Titrations, Surface Tension and Viscosity, Potentiometry, Conductometry, Preparation of metal complexes and important organic

compounds, Kinetics, Chromatography, Qualitative and quantitative estimation of organic compounds.

Special emphasis is laid on application of the theoretical knowledge that the students have learned before to practical use; the experiments have been so selected that the importance and utility of chemistry in our daily life is well reflected.

### **EEL100 Introduction to Electrical Engineering**

*(3-0-2) 4 Credits*

Elements in an Electrical circuit: R, L, C, Diode, Voltage and current sources (independent and dependent / controlled sources with examples); DC circuits, KCL, KVL, Network theorems, Mesh and nodal analysis; Step response in RL, RC, RLC circuits; Phasor analysis of AC circuits; Single-phase and 3-phase circuits; Two port networks, BJT: CE and small signal model, Operational amplifiers: Model and applications; Introduction to Digital circuits; Magnetic circuits, Transformers: Modeling and analysis; parameter determination; Energy in magnetic field; Electromechanical energy conversion principles with examples; Principles of measurement of voltage, current and power.

*Laboratory component and the List of experiments :*

CRO (mechanism and usage); KCL, KVL, Network theorem verification; Step / transient response of RL, RC, RLC circuits; Steady state response of RLC circuits for sinusoidal excitation; Diode experiment (clipping, clamping and rectification); Basic circuits using opamp; Transformer OC and SC tests; BH loop in an iron core, DC and AC motor – for observation only; A small mini-project.

### **MAL100 Calculus**

*(3-1-0) 4 Credits*

Review of Limit, Continuity and Differentiability, uniform continuity, Mean Value Theorems and applications, Taylor's Theorem, maxima and minima, Sequences and series, limsup, liminf, convergence of sequences and series of real numbers, absolute and conditional convergence.

Reimann Integral, fundamental theorem of integral calculus, applications of definite integrals, improper integrals, beta and gamma functions.

Functions of several variables, limit and continuity, partial derivatives and differentiability, gradient, directional derivatives, chain rule, Taylor's theorem, maxima and minima and method of Lagrange Multipliers.

Double and triple integration, Jacobian and change of variables formula. Parametrization of curves and surfaces, vector fields, divergence and curl, Line integrals, Green's theorem, surface integral, Gauss and Stokes' theorems with applications.

### **MAL101 Linear Algebra and Differential Equations**

*(3-1-0) 4 Credits*

Vector Spaces over Q, R and C, subspaces, linear independence, linear span of a set of vectors, basis and dimension of a vector space, sum and direct sum.

System of linear (homogeneous and non-homogeneous) equations, matrices and Gauss elimination, elementary row operations, row space, column space, null space and rank of a matrix.

Linear transformation, rank-nullity theorem and its applications, matrix representation of a linear transformation, changes of basis and similarity.

Eigen Values and eigenvectors, characteristic and minimal polynomials, Cayley-Hamilton theorem (without proof) and applications.

Review of first order differential equations, Picard's theorem; linear dependence and Wronskian. Dimensionality of space of solutions, linear ODE with constant coefficients of second order and higher order, Cauchy-Euler Equations, Method of undetermined coefficients and method of variation of parameters. Boundary value problems: Sturm-Liouville eigen value problems. System of linear differential equations with constant coefficients, fundamental matrix, matrix methods. Power series and its convergence, power series method, Fourier Series, Laplace transform method.

### **MEP100 Introduction to Engineering Visualization**

*(.5-0-3) 2 Credits*

Sketching of engineering objects and interpretation of drawings as a visualisation and communication tool. Creating 3D components through the use of a CAD package. Generation of drawings from CAD package. Simple assemblies, generation of assembly views from part drawings, animation of simple assemblies.

### **MEP101 Product Realization by Manufacturing**

*(0-0-4) 2 Credits*

Exposing role of manufacturing processes in product realization; Understanding product realization by hands on activities; Experience of product realization by undertaking manufacturing exercises and assembly activity in teams.

### **PHL100 Electromagnetic Waves and Quantum Mechanics**

*(3-0-0) 3 credits*

Electric and magnetic field vectors in a medium, Susceptibility and Conductivity, Maxwell's equations, Boundary conditions; EM wave equation, Plane wave solutions, Polarization of the EM waves, Poynting vector and intensity of the EM wave; Wave packet, Phase and Group velocities; Reflection and refraction of EM waves at a dielectric interface; Brewster angle; Total internal reflection at a dielectric interface; EM waves in a conducting medium and plasma; Wave-particle duality, de-Broglie waves; Quantum mechanical operators; Schroedinger equation, Wave function, Statistical interpretation, Superposition Principle, Continuity Equation for probability density; Stationary states, Bound states, Free-particle solution, 1-D infinite potential well, Expectation values and uncertainty relations; 1-D finite potential well, Quantum mechanical tunneling and alpha-decay, Kronig-Penny model and emergence of bands.

**PHP100 Physics Laboratory**

*(0-0-4) 2 credits*

Experiments based on Design & Study of Power sources, Charging & Discharging of a capacitor, Electromagnetic Induction, Phase measurement.

Experiments on geometrical and wave optics including interference, diffraction, dispersion and polarization.

Experiments based on mechanics, heat, sound, fluids, resonance, like linear air track, coupled pendulum and oscillators, thermal conductivity, elasticity.

Experiments in the area of modern physics, like Planck's constant, Lasers, semiconductor band gap, wave motion, mechanical transmission line.







# INDIAN INSTITUTE OF TECHNOLOGY DELHI

## THE HONOUR CODE

I \_\_\_\_\_, entry no. \_\_\_\_\_

do hereby undertake that as a student at IIT Delhi :

- (1) I will not give or receive aid in examinations; that I will not give or receive unpermitted aid in class work, in preparation of reports, or in any other work that is to be used by the instructor as the basis of grading; and
- (2) I will do my share and take an active part in seeing to it that others as well as myself uphold the spirit and letter of the Honour Code.

I realize that some examples of misconduct which are regarded as being in violation of the Honour Code include :

- ☞ copying from another's examination paper or allowing another to copy from one's own paper;
- ☞ unpermitted collaboration;
- ☞ plagiarism;
- ☞ revising and resubmitting a marked quiz or examination paper for re-grading without the instructor's knowledge and consent;
- ☞ giving or receiving unpermitted aid on take-home examinations;
- ☞ representing as one's own work the work of another, including information available on the Internet;
- ☞ giving or receiving aid on an academic assignment under circumstances in which a reasonable person should have known that such aid was not permitted; and
- ☞ committing a cyber offence, such as, breaking passwords and accounts, sharing passwords, electronic copying, planting viruses, etc.

I accept that any act of mine that can be considered to be an Honour Code violation will invite disciplinary action.

Date : \_\_\_\_\_

Student's signature \_\_\_\_\_

Name \_\_\_\_\_

Entry no. \_\_\_\_\_



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