ChE Department Undergraduate Policy Note

Preamble: The following departmental undergraduate policies are based on the institute rules and past DUGC decisions.

1) Faculty advisors: Every batch (year-wise) has 4 faculty advisors, with approximately 30-32 students assigned to each faculty advisor. All academic related letters, applications, documents, etc. need to be routed through faculty advisors. **DUGC or department head (HOD) will not accept/entertain any academic related requests without the approval of the faculty advisor.**

2) Course registration:

a) Course curriculum: The new course curriculum which is in effect from 2013 after doing away with direct entry Dual degree program is provided in **Annexure 1**.

b) Course loading and categories: Students should strictly adhere to the category-based course loading prescribed by the institute. Students are categorized based on their academic standing. **Annexure 2** has details on student categories and the course loading norms. Overloading of courses can be done, as per existing norms set by the senate, only after approval from faculty advisor.

c) Minors/Honors/SLP/BTP: Substitution of honors courses with M. Tech. core courses is not permitted when the student has a chance to register for the honors courses before stipulated time for completion of their B. Tech. / Dual degree programs.

BTP is open only to final year B.Tech. students on an optional basis as an additional learning component. B.Tech. (Honours) students cannot register for both SLP and BTP in the same semester. SLP is open only to B.Tech. (Hons.) and dual degree students in the 4th year. Details of the BTP and SLP courses are provided as **Annexure 3**.

d) Courses from other departments: ChE core courses can be done only in the department. Courses done in any other department cannot be tagged as core courses. Other department courses cannot be tagged as departmental electives, except under special circumstances with **prior approval** from the department. Additionally, students doing their DD projects or BTP will be allowed to take other department courses as departmental elective with permission of their project advisor, provided the said course cannot be taken as an institute elective.

e) Course tagging: Every course is tagged by the student at the time of registration. After that, students can re-tag courses only twice during their stay at IITB. First re-tagging can be done in the second last semester and the second re-tagging can be done in the last semester. However, any course that has been once re-tagged will be unavailable for re-tagging at the second opportunity. Core courses can under no circumstances be re-tagged.

Tagging Rules

(i) Core -C, (ii) Department Elective -D, (iii)Institute Elective - I, (iv) Additional Learning Minors - M, (v) Additional Learning Honours - O/ E (Honours core/ elective), (vi) Additional Learning Others – T

The following re-tagging is allowed:

Tag code	Tag description	Can be re-tagged as
T	Additional Learning	{D,I,O,E}
C	Core Course	
D	Departmental Elective	{O,T,E}
O	Honours Course	{D,E,T}
E	Honours Elective	{ D,O,T}
H	Humanities Elective	{T}
I	Institute Elective	{T}
M	Minor Course	{I,T}

f) Summer courses: It is not mandatory for the department to run summer courses. All summer courses related requests should be made only through the department head. Faculty members will not entertain or discuss summer courses with any student. It is the prerogative of the individual faculty member to run or not run a summer course. Any canvassing for a course, by students could lead to the cancellation of that course, if deemed appropriate by the head.

g) Exchange program: Final year students, students with backlogs or CPI below 7.0 (at the time of application) are not allowed to go on a semester exchange program. Students wanting to apply for an exchange program are required to get the prior approval of DUGC. A course plan for the rest of their stay in IITB and a course mapping with the external university that is cleared by the respective faculty advisor needs to submitted to DUGC at least 2 weeks before institute deadline. A format for the application to be submitted to the DUGC is provided in **Annexure 4**. No changes in the courses will be allowed after the approval. Special allowance for overloading of courses in a subsequent semester at IITB, if needed, will be allowed only for Category I students.

3) BTech to Dual Degree conversion in the new curriculum:

a) Students interested in the Dual Degree program should register for and complete the additional Honours courses; and apply for the conversion only at the end of the seventh semester. This will also allow the Supervised Learning Project (SLP) I or the elective grade to be factored into the selection mechanism for conversion to DD.

b) CPI criteria for direct conversion to Dual Degree will be CPI > 7.0. Students with CPI below 7.0, who have completed three Honours courses, may apply for a conversion if a faculty member who has taught or supervised a project conducted by the concerned student is willing to recommend such a conversion, after which DUGC will decide on a case-by-case basis.

c) Request from concerned students to revert back to the BTech degree programme will be considered as per existing senate rules.

4) Academic Malpractice: All students joining the department are required to sign the honor code. A copy of the honor code is put as **Annexure 5**. Disciplinary action on students resorting to academic malpractice will be taken as per the honor code and the institute guidelines.

5) Theory course policies:

a) Attendance requirement in theory courses is faculty dependent.

b) End semester re-exam is allowed only on medical and family bereavement grounds.

6) Student grievance redressal: All student grievances related to academic matters should go through proper channel, i.e. through facad to HOD and then to DUGC.

<u>Annexure 1</u>

Chemical Engineering Course Curriculum for B.Tech+Dual Degree w.e.f. 2013 Batch

Oct 2013

Department of Chemical Engineering
Indian Institute of Technology, Bombay

Date Last Updated: 02 Nov 2015

Summary of Credits

BTech Credits:
Total Credits (sem-wise): 35+34+33+38+34+32+35+34= 275
Honors Credits:
275 (BTech credits) +24 (4 electives) = 299
Honors Courses:
Out of the four honors courses, two are core courses and two are electives.
Dual Degree Credits:
299 (Honors credits) + 24 (4 Electives) + 72 (DD Project) = 395

Semester-Wise Schedule

Semester 1

Code	Course	L	T	P	C
MA105	Calculus	3	1	0	8
PH105	Modern Physics	2	1	0	6
CH105+CH107	Organic/Inorganic Chemistry + Physical Chemistry (CH105, CH107 are half sem courses)	4	0	0	8
BB101	New Bio Course (check the structure)	3	0	0	6
CH117	Chemistry Lab	0	0	3	3
PH117	Physics Lab	0	0	3	3
ME113	Workshop Practice	0	0	4	4
					35

Semester 2

Code	Course	L	T	P	C
CS101	Computer Programming & Utilization	2	0	2	6
MA106+MA108	Linear Algebra + Di . Eqns I	3	1	0	8
PH108	Electricity and Magnetism	2	1	0	6
CL152	Introduction to Chemical Engg.	3	0	0	6
CH117	Chemistry Lab	0	0	3	3
PH117	Physics Lab	0	0	3	3
ME119	Engg. Graphics	0	1	3	5
					34

Semester 3

Code	Course	L	T	P	C
CL203	Intro to Transport Phenomena	2	1	0	6
MA207	Dif. Eqns II (MA207 is a half sem course)	3	1	0	4
CL255	Chemical Engineering Thermodynamics I	2	1	0	6
CL244	Introduction to Numerical	3	1	0	8

	Analysis				
HS202	Psych/Sociol/Lit/Phil	3	0	0	6
CL249	Computational Methods Lab	0	0	3	3
					33

Semester 4

Code	Course	L	T	P	C
CL254	Process Fluid Mechanics	2	1	0	6
	Chemical Engineering				
CL250	Thermodynamics II	2	1	0	6
CL246	Heat Transfer	2	1	0	6
CL202	Introduction to Data Analysis (CL202 is modified version of existing IC102)	3	1	0	8
HS101	Economics	3	0	0	6
CL232	ChE lab 1	0	0	6	6
					38

Semester 5

Code	Course	L	T	P	C
EE101	Intro to Electrical and Electronics Circuits	3	1	0	8
CL324	Chemical Reaction Engineering	3	1	0	8
CL319	Mass Transfer I	2	1	0	6
CL305	Solid Mechanics (Only course number change for existing solid mechanics: CL231)	2	1	0	6
CL333	ChE lab 2	0	0	0	6
					34
	(Honors course 1)				
CL336	Advanced Transport Phenomena	2	1	0	6
					40

Semester 6

Code	Course	L	T	P	C
CL310	Mass Transfer II	2	1	0	6
CL302	Process Control (Only course number change for existing process control: CL417)	3	1	0	8
CL306	Chemical Processes (Only course number change for existing chemical processes: CL408)	3	0	0	6
	Inst. elective 1	3	0	0	6
CL335	ChE lab 3	0	0	6	6
					32
	(Honors course 2)				
CL325	Chemical Reaction Engineering II	2	1	0	6
					38

Semester 7

Code	Course	L	T	P	C
	Dept. elective 1	3	0	0	6
	Inst. elective 2	3	0	0	6
CL4xxA+ CL4xxB	Process Equipment Selection + Process Economics	2	2	0	8
	(CL4xxA, CL4xxB are half semester courses each)				
CL4xx	Material Science	3	0	0	6
	(Only course number change for existing material science: CL326)				
CL455	Design Lab	0	0	3	3
	(Only name change for existing CL455: Design Lab I)				
CL433	ChE lab 4	0	0	6	6
					35
	(Honors course 3)				
	Honors elective 1	3	0	0	6
					41

Semester 8

Code	Course	L	T	P	C
	Dept. elective 2	3	0	0	6
	Dept. elective 3	3	0	0	6
CL451	Chemical Process Design	3	0	0	6
HS200/ES200	Environmental Studies	3	0	0	6
CL459	Design Project	0	0	6	6
CL4**	Process Engg. Design (Half semester course)	2	2	0	4
					34
	(Honors course 4)				
	Honors elective 2	3	0	0	6
					40

Semester 9 (DD)

Code	Course	L	T	P	C
	DDP I				36
	DD elective 1	3	0	0	6
	DD elective 2	3	0	0	6
					48

Semester 10
(DD)

Code	Course	L	T	P	C
	DDP II				36
	DD elective 3	3	0	0	6
	DD elective 4	3	0	0	6
					48

Course outlines

(Only for new courses or courses whose credits have been modified)

CL255: Chemical Engineering Thermodynamics I [2 1 0 6]

Volumetric Properties of Fluids; First and Second Laws: Steady and Unsteady State Analyses; Availability and Exergy Analysis; Thermodynamic Cycles; Maxwell Relations, Thermodynamic Properties of Real Fluids; Thermodynamics of Ideal Mixtures and Solutions; Concept & Criteria of Chemical Equilibria; Vapour-Liquid Equilibria for Ideal Systems (Raoult's Law); Thermodynamics of Real Mixtures: Use of Partial Molar Properties; Residual and Excess Properties: Fu-gacity and Activity Coe cients; Vapour-Liquid Equilibria for Non-ideal systems; High pressure Vapour-Liquid Equilibria.

Texts/References

1. S. Roy, E-book on Chemical Engineering Thermodynamics, NPTEL Phase II (2012)[Web Link: "http://nptel.iitm.ac.in/courses/103101004/"; last accessed on 8 Feb 2013].
2. S.I. Sandler, Chemical, Biochemical and Engineering Thermodynamics, 4th Edition, Wiley India, 2006.
3. J.M. Smith, H.C. Van Ness and M.M. Abbott, Introduction to Chemical Engineering Thermodynamics, 7th ed., McGraw-Hill, 2005.
4. J.M. Prausnitz, R.N. Lichtenthaler and E.G. Azevedo, Molecular Thermodynamics of Fluid-Phase Equilibria, 3rd ed., Prentice Hall, 1998.

CL249: Computational Methods Lab [0 0 3 3]

(1) Introduction to an Engineering Programming Software (Scilab/Matlab); (2) Error analysis: truncation, roundo , propa-gation; (3) Gaussian elimination and iterative methods for linear algebraic systems; (5) Newton-Raphson: root finding for single and simultaneous equations; (6) Polynomial interpolation, cubic splines; (7) Euler integration; (8) Multistep inte-gration methods; (9) Solving ODEs/PDEs using finite di erence and orthogonal collocation techniques; (10) Regression.

Texts/References

1. Robert J. Schilling, and Sandra L. Harris, Applied Numerical Methods for Engineers: Using Matlab and C, BrooksCole, 2000.
2. S. K. Gupta, Numerical Methods for Engineers, New Age International Publishers (earlier: Wiley Eastern, New Delhi), 2005.
3. Gilbert Strang, Linear Algebra and its Applications, Harcourth Brace Jovanovich, 3rd ed.

CL254: Chemical Engineering Thermodynamics II [2 1 0 6]

Prerequisite: CL25x Chemical Engineering Thermodynamics I

Stability of Thermodynamic Systems; Liquid-Liquid Equilibria; Vapor-Liquid-Liquid Equilibrium; Solid-Liquid Equilibria; Solid-Gas Equilibria; Heat E ects of Chemical Processes / Reaction Equilibria; Thermodynamics of Electrolyte Systems; Thermodynamics of Biosystems; Thermodynamic Analysis of Processes; Introduction to Molecular / Statistical Thermody-namics;

Texts/References

1. S. Roy, E-book on Chemical Engineering Thermodynamics, NPTEL Phase II (2012)[Web Link: “http://nptel.iitm.ac.in/courses/103101004/”; last accessed on 8 Feb 2013].
2. S.I. Sandler, Chemical, Biochemical and Engineering Thermodynamics, 4th Edition, Wiley India, 2006.
3. J.M. Smith, H.C. Van Ness and M.M. Abbott, Introduction to Chemical Engineering Thermodynamics, 7th ed., McGraw-Hill, 2005.
4. J.M. Prausnitz, R.N. Lichtenthaler and E.G. Azevedo, Molecular Thermodynamics of Fluid-Phase Equilibria, 3rd ed., Prentice Hall, 1998.

CL246: Heat Transfer [2 1 0 6]

Course objectives:
At the completion of this course student should be able to mathematically model heat transfer problems and solve them using analytical or numerical methods. A primary objective will be to be able to identify the type of heat transfer model that needs to be applied and solved.
Contents:
(1) Introduction: first law, origins, analysis; (2) Conduction: A quick review of conduction - 1D and 2D, Planar surface, Series, Spherical shell. Internal heat source. Extended surfaces. Unsteady state conduction. Numerical methods; (3) Heat exchangers: principles of process design LMTD, e ectiveness-NTU, Details of Heat Exchangers: Types such as shell and tube, plate, double pipe etc, Internal details in a heat exchanger (Ba es, passes on shell and tube side, etc), Operational issues in a Heat Exchanger (Fouling and Clogging, corrosion), Heuristics in Heat Exchangers, Kern Method, Bell-Delaware Method; (4) Convection: Natural and forced convection. Boundary layers. Forced convection- internal and external flow, in noncircular sections, in spherical particles. Film and overall heat transfer coe cients. Convection with phase change: boiling (pool and forced convection boiling) and film condensation; (5) Radiation: Black and gray body radiation. Exchange between surfaces. View factors.

Texts/References

1. Incropera, F.D. and DeWitt, D.P. 2006, 5th edition, Fundamentals of Heat and Mass Transfer, Wiley, New York.
2. Lienhard IV, J.H. and Lienhard V, J.H. 2001. A Heat Transfer Textbook, 3rd Edition, Phlogiston Press, Cambridge, Massachusetts.
3. Process Heat Transfer, Hewitt, G.F., Shires, G.L.,

   Bott, T.R., Begell House Publishers, 1994.

   Additional References:
4. McCabe, W.L., Smith, J. and Harriott, P. 1993. Unit Operations of Chemical Engineering, 5th Edition, Tata McGraw Hill, New Delhi.
5. Holman, J.P. 1986. Heat Transfer, 6th Edition, McGraw Hill, New Delhi.

6. Kern, D.Q. 1965. Process Heat Transfer, McGraw Hill, New Delhi.
7. Bird, R.B., Stewart, W.E. and Lightfoot, E.N. 1960. Transport Phenomena, Wiley, New York.
8. Coulson, J.M. and Richardson, J.F. 1996. Chemical Engineering, Vol. 1: Fluid Flow, Heat Transfer and Mass Transfer, 5th Edition, Butterworth-Heinemann, Oxford.

CL202: Introduction to Data Analysis [3 1 0 8]

(1) Descriptive statistics and data visualization: quantities frequently used to describe data (mean, median, mode, range, variance), Chebyshev's inequalities, correlation, data visualization tools/techniques such scatter plots, stem and leaf plots, histograms, quantiles, pie charts, use of dynamically changing plots to visualize evolving data; (2) Random variables and ex-pectations: discrete and continuous random variables, probability density/mass function, cumulative distribution function, conditional probability, Bayes rule, joint density, marginal density, expectation, moments, moment generating functions, special discrete random variables (bernoulli, binomial, geometric, negative binomial, poisson), special continuous random variables (exponential, gaussian, chi-squared, t, F); (3) Distribution of Sampling Statistics: sample mean and its distribution, sample variance and its distribution, central limit theorem; (4) Parameter Estimation and Confidence Intervals: maximum likelihood estimation, properties of estimators, concept of estimators as random variables, concept of confidence intervals for parameters based on estimators, confidence intervals on mean and variance of normal distribution for various cases, con-fidence intervals on di erence of means of normal distributions, confidence interval on success probability p in a binomial distribution; (5) Hypothesis testing: hypothesis testing framework, type I and type II errors, e ect of sample size on these errors, p-value, hypothesis testing for mean of normal distribution for some commonly encountered situations, hypothesis testing for variance of normal distribution, hypothesis testing for equality of means and variances of data coming from two normal distributions, paired t-tests, hypothesis testing on success probability p in a binomial distribution; (6) Regression: linear versus nonlinear regression, minimization of sum of squares of errors in linear regression, least squares estimators of slope and intercept and their properties, confidence intervals and hypothesis tests on slope and intercept, notion of mean response and individual prediction and corresponding confidence and prediction intervals, model adequacy checking using R^2 and residual plots, variable transformations, introduction to nonlinear regression; (7) Design of experiments: factorial design; (8) Introduction to non-parameteric tests for hypothesis testing;

Texts/References

1. Douglas C. Montgomery, G. C. Runger, Applied Statistics and Probability for Engineers, John Wiley and Sons, 2003.
2. Sheldon M. Ross, Introduction to Probability and Statistics for Engineers and Scientists, Elsevier, 4^{th} Edition.

CL319: Mass Transfer I [2 1 0 6]

Principles of Mass transfer: Constitutive laws of di usion; unsteady state di usion; Convective mass transfer. Interphase mass transfer and mass transfer coe cients; Mass transfer theories/models; E ect of chemical reaction on mass transfer. Equilibrium stages and transfer units: number and height of transfer units; stage e ciency. Gas absorption: plate and packed column design; reactive absorption. Distillation: batch distillation, continuous fractionation, other types of distillation (eg azeotropic); introduction to multi-component mixtures.

Texts/References

1. R.E.Treybal, Mass Transfer Operations, 3rd Edition, McGraw Hill, New Delhi, 1983.
2. E.D. Cussler, Di usion - Mass Transfer in Fluid Systems, Cambridge University Press, Cambridge 1984.
3. A. S. Foust, Principles of Unit Operations, 2nd Edition, Wiley, New York, 1980.
4. C.J. Geankoplis, Transport Processes and Unit Operations, 3rd Edition, Prentice Hall, India, 1993.

CL310: Mass Transfer II [2 1 0 6]

Prerequisite: CL31x Mass Transfer I

Perspective on Unit Operations; Liquid-Liquid extraction; Leaching; Adsorption and Ion-exchange; Simultaneous Heat and Mass Transfer: Humidification and Dehumidification, Design of cooling towers, Drying, Crystallization; Membrane processes: Ultra-filtration and reverse osmosis.

Texts/References

1. R.E.treybal, Mass Transfer Operations, 3rd Edition. McGraw ill. New Delhi. 1983.
2. A.S.Foust, Principles of Unit Operations, 2nd Edition, Wiley, New York. 1980.
3. C.J.Geankoplis, Transport Processes and Unit Operations, 3rd Edition. Prentice Hall. India, 1993.
4. W.L.McCabe, J.Smith and P.Harriot, Unit Operations of Chemical Engineering, 5th Edition, Tata McGraw Hill, India, 1993.

CL4xxA: Process Equipment Selection [2 2 0 4] (half sem course)

Design variations, Selection criteria, process calculations and representative industrial applications for the following will be covered. (1) Pumps: Types of pumps and selection criteria, Typical calculations of a pumping circuit and pump rating, Pump characteristic curves, Cavitation and NPSH. (2) Compression and Expansion: blowers and compressors, Single or multistage compressing, Typical multistage compressor calculations. (3) Furnaces: Types of furnaces, simple 1-D, 2-D heat transfer models of furnaces. (4) Gas-Solid Catalytic Reactors: Fluidized Bed. (5) Evaporator: Multiple E ect Evaporator Design, Optimum number of e ects; Plant Design: PFD, P&ID, Plant Layout, Safety

Texts/References

1. M.S. Peters and K.D. Timmerhaus, Plant Design and Economics for Chemical Engineers, McGraw Hill, 1991.
2. D.F. Rudd and C.C. Watson, Strategy of Process Engineering, John Wiley, 1969.
3. S. Walas, Chemical Process Equipment Selection and Design, Butterworth, 1988.
4. R.K. Sinnot, An Introduction to Chemical Engineering Design, Pergamon Press, Oxford, 1989.
5. R. Smith, Chemical Process Design, McGraw Hill, 1995

CL4xxB: Process Economics [2 2 0 4] (half sem course)

Essentials of Process Economics: Time value of money, Simple and compound interest, Capital Cost Estimation, Location and Inflation corrections, Capacity exponents of major equipment, Annualized Capital Cost and Capitalized annual cost, Least Annual Cost, Amortization, Depreciation and taxes, Profitability Chart, Return on investment, Payback Period.

1. W.D. Seider and J.D. Seader, Product and Process Design Principles: Synthesis, Analysis and Evaluation, 2nd ed., John Wiley, 2004
2. M.S. Peters and K.D. Timmerhaus, Plant Design and Economics for Chemical Engineers, McGraw Hill, 1991

CL451: Chemical Process Design [3 0 0 6]

Prerequisite: CL4xxA (Process Equipment Selection), CL4xxB (Process Equipment Design)

Process Design and Development: General Design Considerations; The Hierarchy of Chemical Process Design; The Na-ture of Process Synthesis and Analysis; Reactor networks in process flowsheets: Attainable region; Separation systems in process flowsheets: multi-component distillation for ideal + non-ideal systems, distillation column sequences, heat integration in distillation columns; Heat exchange networks synthesis and utilities: Energy targets; Introduction to optimization approaches to optimal design, role of simulations in process design; Design under uncertainty and failure tolerance; Engineering around variations; Introduction to process integration; Essentials of Process Economics: Time value of money, Simple and compound interest, Capital Cost Estimation, Location and Inflation corrections, Capacity exponents of major equipment, Annualized Capital Cost and Capitalized annual cost, Least Annual Cost, Amortization, Depreciation and taxes, Profitability Chart, Return on investment, Payback Period.

Texts/References

1. J. Douglas, Conceptual Design of Chemical Processes, McGraw Hill, 1989.
2. R. Smith, Chemical Process Design, McGraw Hill, New York, 1995.
3. D.F. Rudd and C.C. Watson, Strategy of Process Engineering, John Wiley, 1969.
4. R.K. Sinnot, An Introduction to Chemical Engineering Design, Pergamon Press, Oxford, 1989.
5. L.T. Biegler, E.I. Grossmann, and A.W. Westerberg, Systematic Methods of Chemical Process Design, Prentice Hall International Inc. Series in the Physical and Chemical Engg. Sciences, 1997.
6. W.D. Seider and J.D. Seader, Product and Process Design Principles: Synthesis, Analysis and Evaluation, 2nd ed., John Wiley, 2004
7. M.S. Peters and K.D. Timmerhaus, Plant Design and Economics for Chemical Engineers, McGraw Hill, 1991

CL4xxB: Process Equipment Design [2 2 0 4] (half sem course)

(1) Materials for vessel construction,corrosion and mechanical strength criteria, Alloy Steel, Specimen Test, Yield/Ultimate/Proof/Code Stresses, Elastic and Plastic Deformation, Strain Hardening; (2) Pressure vessels, International Pressure Vessel

Design Codes, Various shapes of revolution as employed in shell and closure design of pressure vessels, membrane theory or simple free body diagrams, Safety Factors and Allowable Stress Weld Quality Factor, Shape or Y fac-tor, Design Temperature, Design Pressure, Design Life, Corrosion Allowance, Mill Tolerance, Dimensional Standards for Nominal plate thicknesses and pipe size and schedules; (3) Design for vacuum service, External pressure design, Buckling Failure, Iterative thickness calculation using Factor A - Factor B approach in codes, Sti ener interval calculation; (4) Stress field modification and intensification around openings, nozzle reinforcement calculations as per area compensation method

(5) Additional thickness requirement for tall vessels due to gravity induced, wind induced, vibration induced and eccentric loading induced stresses, Multi-thickness design of tall vessels (6) Typical Mechanical Data Sheet (MDS)

Texts/References

1. M.V. Joshi, Process Equipment Design, McMillan India, New Delhi, 1976.
2. R.K. Sinnot, An Introduction to Chemical Engineering Design, Pergamon Press, Oxford, 1989.
3. Relevant Design Codes BS, IS and ASME.

Annexure 2

4. SPECIAL FEATURES IN REGISTRATION

The curriculum has special features that a student must be aware of while registering for courses. These include institute core courses, department core and elective courses, non-departmental courses, minor and honours options. Registration for courses depend on the academic standing of the student, as explained in this section. The registration for backlog courses and audit courses are also explained in this section.

4.1 Academic Standing :

Depending on the overall academic performance of a student till date, especially in the two preceding regular semesters (Autumn and Spring) registered, academic standing of the student is decided. **The performance in courses registered in addition to the prescribed minimum requirement for the degree is not taken into consideration while determining the academic standing.** (Here, failed courses refer to courses in which a FR or a XX grade has been awarded. A NP (not passed) grade is not counted towards failed courses in the context of determining the academic standing)

Categorization of the academic standing of a student is as follows :

Category I : Excellent Standing : A student who has no backlog courses (failed courses which have not been cleared subsequently or dropped courses), and has a CPI equal to or greater than 8.0, subject to having cleared the total number of credits prescribed upto that semester in his/her discipline..

Category II : Satisfactory Standing : A student who has registered for at least 18 credits in each of the two preceding regular registered semesters and not failed in any course in these two semesters.

Category III : A student who has not failed in more than one course in the two preceding regular registered semesters, subject to having earned at least 18 credits in each of the semesters.

Category IV : A student who has failed in more than one course in the two preceding regular registered semesters, but has earned at least 18 credits in each of the semesters.

Category V : A student who has not earned at least 18 credits in either one of the previous two regular registered semesters.

Only students of standing of Category I, II or III are permitted to register for normal load described below (Sec.4.2). Category IV and Category V students should register for lower credits as described in Sec.4.3.

4.2 Normal load

The total requirement of credits for the B. Tech. is between 252 and 264, depending on the discipline. The average prescribed credits per semester is therefore around 33 credits. Similar semester credits are prescribed for Integrated M.Sc. students too.

In the first semester of the first year, the normal semester load is 33 or 34 credits depending upon whether a student has registered for ME 119 (5 credits) or ME 113 (4 credits). Every student registers for all the prescribed courses.

In the second semester of the first year, a student of Category III, and category IV (if not recommended for termination, see Sec.7.3) as a special case, will be permitted to take one backlog course in addition to the prescribed minimum, with the specific recommendation of the Faculty Advisor. No student will be allowed to take courses from later years in this semester. Category V students will register for reduced load as advised by the Faculty Advisor (See Sec. 4.3)

In subsequent semesters, every student must register for a minimum of 18 credits each semester. In case a student with backlogs has completed most of the minimum credit requirements, she/he may register for the remaining courses which are available in that semester, which may be less than 18 credits.

In these semesters, normal load for a **B.Tech. or an Integrated M.Sc.** student is defined as the prescribed load for the minimum requirement of the degree for that semester **and credits for an additional course (6-8 credits), subject to**

* **total credit not exceeding 42 credits (44 credits in case the additional course is of 8 credits)**, and
* **theory courses not exceeding 6.**

For example, the prescribed credits in semester 3 for a particular discipline may be 33. The normal load for that discipline in the semester is 39-41. This load is calculated by adding the prescribed credits and credits for an additional course (6 or 8 credits). The normal loads for other semesters are to be computed along similar lines. **Students with academic standing of Category I, II or III are permitted to take normal load.**

Those with excellent academic standing (Category I) can, in addition, overload themselves to the extent of one theory course equivalent (6 or 8 credits). That is, they can register for two courses in addition to the prescribed load, subject to

* **total credit not exceeding 48 credits (50 credits in case the additional course is of 8 credits)**, and
* **theory courses not exceeding 6.**

Students belonging to excellent (Category I) and satisfactory academic standing (Category II) therefore can reasonably aspire to utilize the additional learning opportunities to the fullest extent.

Category III students should use the additional course permitted to clear the backlog courses if available in the semester. If backlog courses are not available, they can also use the opportunity for additional learning in that semester.

Students belonging to Category IV and V can only register for reduced loads as described in Sec. 4.3 below.

A summary of normal load for **B.Tech. and Int.M.Sc students** in different semesters is given below. The symbol X_j denotes the credits prescribed for the semester j, 3 <= j < = 10 in her/his branch; and C is the maximum credits assigned to any course.

Permissible academic loads for B.Tech./Int.M.Sc students of various academic standing.			
Semester	***1***	***2***	***3 to 10***
Reduced load (Category V, Sec5.3))	33 or 34	33 or 34, less one theory course	X_j, less one theory course
Prescribed Credits (For Category I,II,III,IV)	33 or 34	33 or 34	X_j
Normal load (For Category I,II,III,IV)	33 or 34	33 or 34 **41 or 42 Only for Cat.III and IV for clearing backlog**	X_j + C (subject to :see text)
Overload (Category I only) (Sec. 4.4)	33 or 34	33 or 34	**X_j + 2C**

Dual Degree students are typically prescribed an additional theory course every semester towards the mandatory honours and dual degree requirements. Therefore the normal load for these students will be the prescribed load itself. Category II and III students from the dual degree cannot therefore register for courses towards additional learning.

However, from the 5th semester onwards Dual Degree students belonging to Category II and III and a CPI >6.5 may be allowed to take one additional course in a semester, only for the purpose of clearing backlog courses. This is done in consulation with the faculty advisor and prior approval of the UGAPEC.

Students belonging to Category IV and V can only register for reduced loads as described in Sec. 5.3 below.

Category I students can take one course extra as an over load towards additional learning (Sec.5.5)

A summary of normal load for **Dual Degree** students in different semesters is given below. The symbol Y_j denotes the credits prescribed for the semester j, 3 <= j < = 10 in her/his branch; and C is the maximum credits assigned to any course.

Permissible academic loads for Dual Degree students of various academic standing.

Semester	***1***	***2***	***3 to 10***
Reduced load (Category V, Sec5.3))	33 or 34	33 or 34, one theory course	Y_j, less two theory less courses
Prescribed Credits (For Category I,II,III,IV)	33 or 34	33 or 34	Y_j , less one theory course
Normal load (For Category I, II, III IV)	33 or 34	33 or 34 **41 or 42 Only for Cat.III and IV for clearing backlog**	Y_j (Catergory II and III permitted to register for 1 backlog course
Overload (Category I only) (Sec4.4)	33 or 34	33 or 34	**Y_j + C**

4.3. Reduced Load for Category IV and Category V students

B.Tech. and Int.M.Sc. students belonging to category IV status can only register for a total of credits equivalent to the prescribed credits for that semester in her/his discipline (X_j in the table above). (This normally would mean four theory courses and one or two labs. etc.). They cannot register for the additional 6-8 credits permitted for students with Category I, II and III standing.

Students belonging to category V status can only register for those many credits which are at least one theory course equivalent less than the credits prescribed for that semester in her/his discipline, subject to a minimum of 18 credits. (This normally would mean three theory courses and one or two labs. etc.).

Dual degree students of Category IV and Category V are advised to register for one and two theory courses, respectively, less than their prescribed load, and as advised by the faculty advisor.

All students in Category V should submit a revised schedule along with the course registration form, in consultation with the Faculty Advisor, for the succeeding semesters stating how the backlog courses will be cleared.

Students have to register for the backlog courses before registering for other courses, if those courses are available in that semester. However, Faculty Advisor can recommend exceptions to avoid cascading effects due to prerequisites for other courses.

All students in Category III, IV and V will do manual registration.

4.4 Overload

Student with Excellent Academic Standing (Category I) may be permitted to take one course per semester, in addition to the normal load, as overload, subject to a maximum of 6 theory courses. There shall be no relaxation of the CPI criterion for the additional overload. A change of status from Credit to Audit in respect of such courses may be allowed up to the mid-semester examination with the prior approval of the UGAPEC. Overloading of courses is subject to time-table constraints.

Since this overloading can lead to poor overall performance in terms of SPI, CPI etc., this should be done after careful consideration and discussion with the Faculty Advisor.

Annexure 3

Mechanism for Supervised Learning Project (SLP)

SLP topics include computational projects, experimental projects and learning projects.

Allotment

1. SLP is open to B.Tech. (Hons.) and DD students in the fourth year. The prerequisites for registering for SLP are that the student should have successfully completed CL 260, CL 336 and CL 325. B.Tech. (Hons) students cannot register for both SLP and BTP in the same semester.
2. Faculty may float SLP topics in the prior semester by a certain deadline. The details to be provided include a specified scope of work and method of evaluation.
3. After DUGC approval, the SLP topics are circulated to the students.
4. The students meet the faculty members and decide topics based on mutual agreement between student and faculty member. It is the faculty member's prerogative to decide whether or not to supervise a student; subject to a maximum of two students.
5. The students should submit printouts of the form (with the signature of the faculty and the student) in the Head's office in the specified format by the specified deadline.
6. Faculty decision on accepting or not accepting a student would be final.

Scheme for Evaluation

1. Student is to be examined at the end of the semester by a panel consisting of the supervisor and at least one examiner (another faculty member of our institute) based on the report and presentation. Each of them gives marks to the students out of 50, and an overall grade is recommended in the SLP evaluation from .
2. For Dual degree students taking SLP, the grade will be counted towards their core CPI. For B.Tech (Hons.) students, the grade will be counted towards their Honors CPI.
3. The department will not be creating common panels, and it will be up to individual supervisors to arrange for examiners for their students.

Mechanism for B. Tech. Project (BTP)

BTP topics include computational and experimental projects only.

Allotment

1. BTP is open only to final year B.Tech. students on an optional basis as an additional learning component. B.Tech. (Honours) students cannot register for both SLP and BTP in the same semester.
2. Faculty may float BTP topics in the prior semester by a certain deadline. The details to be provided include a specified scope of work and method of evaluation.
3. The students will approach the faculty to discuss these topics. It is the faculty member's prerogative to decide whether or not to supervise a student; subject to a maximum of two students.

4. Faculty will give the details of the BTP in the given format. The student submits the form in the Head's office after taking the supervisor's signature before the specified deadline.
5. Faculty decision on accepting or not accepting a student would be final.

Scheme for Evaluation

1. The student is to be examined at the end of the semester by a panel consisting of the supervisor and at least one examiner (another faculty member of our institute) based on the report and presentation. Both guide and examiner will specify marks to the students out of 50, and an overall grade is recommended in the BTP evaluation form.
2. BTP grades will not be considered for the CPI evaluation.
3. The department will not be creating common panels, and the individual supervisors will have to arrange for examiners for their students.

Annexure 4

Application for Semester Exchange in ______________ for the ______ Semester, 20__

To,
Head of the Department
Chemical Engineering Department
IIT Bombay

Respected Sir,
I, ____________currently in my 3rd year, CPI ___ pursuing the B. Tech. programme in Chemical Engineering Department, wish to go to ____________ during my _____semester, i.e. _____ semester, 20___ as part of the Semester Exchange Programme Agreement.

Here are the required details:

	Without Semester Exchange			**With Semester Exchange**	
				Courses already done-	
				Institute Elective 1	6
				Institute Elective 2	6
					12
6th Sem			**6th Sem**		
CL 3xx	**Mass Transfer II**	6	CL 3xx/ **ChE441**	Mass Transfer II /**Advanced Heat and Mass Transfer**	6
CL 3yy	Process Control	8	CL 4xx/ **ESC110.1**	Material Sciences/**Material Sciences for Chemical Engineers**	6
CL 3zz	Chemical Processes	6	CL 451/ **ChE460**	Chemical Process Design/ **Process Heat Equipment Design**	8
CL 335	Chemical Engineering Lab 3	6		**Department Elective 1**	6
	Institute Elective 1	6			
		32			**26**
7th Sem			**7th Sem**		
CL 451	**Material Sciences**	6	HS200/ES200	Environmental Studies	6
CL 4aa+ CL 4bb	Process Equipment Selection + Process Equipment Design	8	CL 4aa+ CL 4bb	Process Equipment Selection + Process Equipment Design	8
CL433	Chemical Engineering Lab 4	6		Department elective 2	6
CL455	Design Lab 1	6	CL433	Chemical Engineering Lab 4	6
	Department Elective 1	6	CL455	Design Lab 1	6
	Institute Elective 2	6			
		38			**32**
8th Sem			**8th Sem**		
CL4xx	**Process Design Project**	6	CL4xx	Process Design Project	6
CL451	Chemical Process Design	8	CL 3yy	Process Control	8
HS200/ES200	Environmental Studies	6	CL 455	Chemical Processes	6
	Department elective 2	6	CL 335	Chemical Engineering Lab 3	6
	Department elective 3	6		Department Elective 3	
		32			**32**

Cooper Union module code	Name	IITB course code	Name
ESC110.1	Material Science for Chemical Engineers	CL4xx	Material Science
ChE460	Process Heat Equipment Design	CL451	Chemical Process Design
ChE441	Advanced Heat and Mass Transfer	CL3xx	Mass Transfer II
	Department Elective 1	ChE 447	Sustainability and Pollution Prevention

IIT Bombay	______________University
CL-4xx: Material Science Atomic Bonding, Crystal Structure and Defects, Mechanical and Thermal Behaviour: Failure Analysis and prevention, Phase Diagrams; Metals and alloys, Polymers (Plastics), Semiconductors, Ceramics & Glasses, Corrosion and its prevention, Environmental Effects, Nanotechnology, and Biomaterials.	**ESC110.1 Material Sciences for Chemical Engineers** Understanding relationships among atomic or molecular structures, physical properties and performances of substances. Bonding, Crystallinity, metals, alloys and polymers. Mechanical properties of inorganic and composite materials. Selection of materials for process equipment design, its effect on economics. Design concerning effect of corrosion and its prevention.
CL3xx: Mass Transfer II Perspective on Unit Operations; Liquid-Liquid extraction; Leaching; Adsorption and Ion-exchange; Simultaneous Heat and Mass Transfer: Humidification and Dehumidification, Design of cooling towers, Drying, Crystallization; Membrane processes: Ultra-filtration and reverse osmosis.	**ChE441 : Advanced Heat and Mass Transfer** Simultaneous heat and mass transfer. Mass transfer with simultaneous homogeneous or heterogeneous reaction. Transport in electrolyte solutions. Special topics include: membrane separation processes, drug delivery and controlled release, turbulent heat and mass transfer, boundary layer heat and mass transfer, and chemically reacting flows. Energy transport in flowing media, free convection, Conservation of species equation. Fick's law of binary diffusion. Multi-component heat and mass transfer. Stefan-Maxwell equations for multi-component diffusion.

<u>CL451: Chemical Process Design:</u> Process Design and Development: General Design Considerations; The Hierarchy of Chemical Process Design; The Nature of Process Synthesis and Analysis; Reactor networks in process flowsheets: Attainable region; Separation systems in process flowsheets: multicomponent distillation for ideal + non-ideal systems, distillation column sequences, heat integra-tion in distillation columns; Heat exchange networks synthesis and utilities: Energy targets; Introduction to optimization approaches to optimal design, role of simulations in process design; Design under uncertainty and failure tolerance; En-gineering around variations; Introduction to process integration; Essentials of Process Economics: Time value of money, Simple and compound interest, Capital Cost Estimation, Location and Inflation corrections, Capacity exponents of major equipment, Annualized Capital Cost and Capitalized annual cost, Least Annual Cost, Amortization, Depreciation and taxes, Profitability Chart, Return on investment, Payback Period.	**<u>ChE460 : Process Heat Equipment Design</u>** The chemical engineer must develop, design and engineer both the complete process and the equipment used; choose the proper raw materials; operate the plant efficiently, safely and economically; and see to it that products meet the requirements set by the customer. Chemical engineering is both an art and a science. Whenever science helps the engineer to solve a problem, science should be used. When, as is usually the case, science does not give a complete answer, it is necessary to use experience and judgment. The professional stature of an engineer depends on skill in utilizing all sources of information to reach practical solutions to processing problems. This series of courses will concentrate specifically on the theoretical and practical principles of detailed design of major unit operation equipment. Attempts will be made to emphasize modern technologies used in these operations.
Department Elective 1	**<u>ChE 447 Sustainability and Pollution Prevention</u>** The first part of this course discusses in detail a methodology for defining and assessing the sustainability of an entity. The course then proceeds with more traditional topics in pollution prevention for chemical processes, outlining concepts on the macro-scale, (life-cycle assessment) and meso-scale (pollution prevention for unit operations). By the end of this course, you should be able to use a fuzzy-logic based methodology to define and assess sustainability, perform a sensitivity analysis which identifies the most critical components of sustainability for a given corporation, perform a life-cycle assessment on a product or process, identify and apply chemical process design methods for waste minimization, energy efficiency, and minimal environmental impact and design, size, and cost a simple waste treatment process.

Annexure 5

Department of Chemical Engineering
Indian Institute of Technology Bombay

Department Academic Honor Code

Preamble: Students are expected to practice highest ethical and moral standards. In order to maintain the sanctity of these standards, students are expected to sign this declaration after reading and understanding the honor code. The Department reserves the right to amend this code as and when required. Amendments will be brought to the notice of all stakeholders.

I) "Declaration of Academic Honesty" statement signed by you at the time of joining

"I declare that I will adhere to all principles of academic honesty and integrity throughout my stay in the Institute. I will not seek or give unauthorized assistance in tests, quizzes, examinations or assignments. I will not misrepresent, fabricate or falsify any idea/data/fact/source in my project submissions. I understand that any violation of the above will be cause for disciplinary action as per the rules and regulations of the Institute."

II) In elaboration of the above declaration, the Department has defined the following honor code and the associated penalties

A) Honor code for Individual academic activities

Individual activities include, but are not limited to course home works, in-class/take home exams, individual course projects, presentations, individual research projects, presentations. A student will

- work independently, with utmost sincerity on these activities.
- not copy/falsify/fabricate information/ideas in any of these activities.
- not disseminate information gathered/submitted in the course of these activities with a view to facilitate unfair practices.
- accept sole responsibility for the entire work.

B) Honor code for Group activities

Group activities are those conducted by more than one student. These include, but are not limited to in-class/take-home group course projects/lab experiments, data collection, reports, presentations, research projects, research presentations. All members of a group will

- participate in all aspects of the group activity with utmost sincerity.
- obtain consent of all members of the group with regard to division of work.
- not copy/falsify/fabricate information/ideas in any aspect of these activities.
- not disseminate information gathered/submitted towards any of these activities with a view to facilitate unfair practices.
- accept equal responsibility for all the activities and all information/ideas gathered/submitted towards these activities, in their entirety.

C) Breach of the honor code

Breach of one or more of the above honor codes will be reported to DUGC/DPGC, as appropriate.

In considering cases involving copying from other students, whether between individuals (in individual activities) or between groups (in group activities), the information giver and receiver will **NOT** be distinguished from each other, in terms of punishment awarded.

Copying from reports of previous years, books and journals or plagiarism of any kind will be construed as breach of this code.

For group activities, every member of the group will be held equally responsible for the work in its entirety. Claiming ignorance about another group member's misdemeanor will not be accepted as grounds to escape punishment.

D) <u>Potential consequences</u>

- Student will not be allowed to take up any administrative post such as CR, GSec across the Institute;
- If the student is found guilty while holding an administrative position, the student will step down;
- No Objection Certificate (NOC) for any further assignment/internship will be denied.
- For individual activities:
  - First proved instance of breach, FR grade will be awarded in the respective course.
  - Second proved instance of breach, student will be referred to Disciplinary Action Committee (DAC) with a suitable recommendation such as rustication for a certain period or even expulsion from the Institute.
- For group activities:
  - DUGC/DPGC will make specific punishment recommendations which will be of the same order of magnitude as that for individual activities.

III) <u>Declaration & Signing of Honor Code:</u>

On my honor as a student of the Indian Institute of Technology Bombay, I hereby declare that

a) I have read and understood the "Declaration of Academic Honesty" I signed at the time of joining.
b) I have read and understood the Department Honor Code
c) I am aware that if found guilty of breaching this honor code, I will be penalized as per due process, **<u>without any further warning</u>**.

Full Name:

Roll No:

Date: **Signature of the student**