



भारतीय प्रौद्योगिकी संस्थान गुवाहाटी

INDIAN INSTITUTE OF TECHNOLOGY GUWAHATI

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B Tech Chemical Engineering Course structure (July 2025 Onward)

Semester-I						Semester-II					
Course No	Course Name	L	T	P	C	Course No	Course Name	L	T	P	C
CH1102H	Basic Inorganic Chemistry	3	0	0	3	CE1205	Engineering Drawing	1	0	3	5
CH1107H	Basic Organic Chemistry	3	0	0	3	CH1202H	Basic Physical Chemistry	3	0	0	3
CH1109L	Chemistry Lab	0	0	3	3	CH1205H	Basic Analytical Chemistry	3	0	0	3
EE1103H	Electric Circuits	3	0	0	3	CS1211L	Programming and Data Structures Lab	0	0	3	3
EE1107H	Digital and Analog Electronics	3	0	0	3	CS1208	Programming and Data Structures	3	0	0	6
EE1111L	Basic Electronics Lab	0	0	3	3	MA1407H	Linear Algebra	3	1	0	4
MA1307H	Single Variable Calculus	3	1	0	4	ME1203L	Workshop Practice	0	0	3	3
MA1507H	Multi Variable Calculus	3	1	0	4	PH1215H	Introductory Electromagnetics	2	1	0	3
PH1113	Introductory Classical Mechanics	2	1	0	3	CL1201	Chemical Process Calculations	2	1	0	6
PH1101I	Physics Lab	0	0	3	3		Student activity course	0	0	2	2
CL1101	Chemical Engineering Fundamentals	2	1	0	6	CL1092 M	Fundamentals of Material Science	3	0	0	6
	Total credits				38		Total credits				36
CL1102 (For BSBE)	Fundamentals of Process Calculations	2	1	0	6						
CL1103 (For CST)	Fundamentals of Process Calculations	2	1	0	6						



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Semester-III					Semester-IV						
Course No	Course Name	L	T	P	C	Course No	Course Name	L	T	P	C
CL2101	Chemical Engineering Thermodynamics	2	1	0	6	CL 2201	Mass Transfer - I	2	1	0	6
CL2102	Fluid Mechanics	2	1	0	6	CL 2202	Mechanical and Solid-Fluid Operations	3	0	0	6
CL2103	Heat Transfer	2	1	0	6	CL 2203	Numerical Methods	2	1	0	6
MA 2301H	Ordinary Differential Equations	3	1	0	4	CL 2204	Chemical Reaction Engineering - I	2	1	0	6
MA 2501H	Partial Differential Equations	3	1	0	4	CL 2205H	Statistics in Chemical Engineering	2	1	0	3
ME 2XXX	Basic Engineering Mechanics	2	1	0	6	CL 2211L	Fluid Mechanics Lab	0	0	3	3
DS 1XXH	Fundamentals of Data Science	3	0	0	3	CL 2212L	Heat Transfer Lab	0	0	3	3
	HSS Elective	3	0	0	6	CL 2213L	Numerical Methods Lab	0	0	2	2
	Student activity course	0	0	2	2		HSS Elective 2	3	0	0	6
CL2104 (For CST)	Fluid Mechanics	2	1	0	6		Student activity course	0	0	2	2
CL2091M	Thermodynamics and Kinetics of Phase Transformations	3	0	0	6	CL209 2M	Computational and Experimental Techniques	3	0	0	6
	Total credits				41		Total credits				41
						CL2214 (For ME)	Fundamentals of Process Calculations	2	1	0	6
Semester-V					Semester-VI						
Course No	Course Name	L	T	P	C	Course No	Course Name	L	T	P	C
CL 3101	Mass Transfer - II	2	1	0	6	CL 3201	Transport Phenomena	2	1	0	6
CL 3102	Chemical Reaction Engineering - II	2	1	0	6	CL 3202	Chemical Process Technology	3	0	0	6
CL 3103	Process Control and Instrumentation	3	1	0	8	CL 3203	Process Engineering and Economics	3	0	0	6
CL 3104H	AI and ML in Chemical Engineering	2	0	2	3	CL 3204	Computer Aided Process Engineering Design	0	0	3	3
CL 3105	Process Equipment Design	1	0	3	5	CL 3211S	Technical Writing and Presentation	0	0	2	2
CL 3106H	Process Safety	3	0	0	3	CL 3212L	Mass Transfer Lab	0	0	3	3
CL 3111L	Mechanical and Solid-Fluid Operations Lab	0	0	3	3	CL 3213L	Reaction Engineering Lab	0	0	3	3
	HSS Elective 3	3	0	0	6	CL 3214L	Process Control Lab	0	0	3	3
	Student activity course	0	0	2	2		HSS Elective 4	3	0	0	6
CL3091M	Introduction to Functional Materials	3	0	0	6	CL3092 M	AI and ML in Material Engineering	3	0	0	6
	Total credits				40		Total credits				38



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Credits Distribution of B.Tech.(CL) Course (July 2025 Batch Onward):

Type of Courses	New Course Credits	Institute Recommendation for Credits
Basic Science and Engineering	79	76
Department Core	131	132
Department Elective	36	36
Open Elective	12	24
B.Tech Project (BTP)	24	24
Humanities and Social Sciences	24	
Total credits	282	292

Semester-wise Credits Distribution of B.Tech.(CL) Course (July 2025 Batch Onward):

Semester	Credits
Semester 1	38
Semester 2	36
Semester 3	41
Semester 4	41
Semester 5	40
Semester 6	38
Semester 7	24
Semester 8	24
Total	282



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**B Tech Chemical Engineering Course Syllabi
(July 2025 Onward)
(Excluding Minor Course)**

Indian Institute of Technology Guwahati
Proposal for Revision of a Course

Course Number & Title: CL1101 & Chemical Engineering Fundamentals	
L-T-P-C: 2-1-0-6	
Type of Letter Grading (Regular Letter Grades / PP or NP Letter Grades): Regular Letter Grades	
Kind of Proposal (New Course / Revision of Existing Course): Revision of Existing Course	
Offered as (Compulsory / Elective): Compulsory	
Offered to: B.Tech (Chemical Engineering 1st Year Students)	
Offered in (Odd/ Even / Any): Odd	
Offered by (Name of Department/ Center): Chemical Engineering	
Pre-Requisite: NIL	
Preamble / Objectives (Optional): This is a basic introductory course to the first year chemical engineering students. In this course, overview of chemical plant and its unit operations and unit processes are introduced to the students. In addition, some basic introduction of several important core subjects of chemical engineering is also taught. However, basic engineering thermodynamics will be taught in detail.	
Course Content/ Syllabus Role of chemical engineers; overview of chemical plants; unit operations and unit processes; basics of material and energy balance; basics of chemical kinetics; basics of reactors; basics of momentum, heat and mass transport processes; thermodynamic systems, variables and processes; equilibrium and phase rule; equations of state: ideal and non-ideal; volumetric properties of mixtures; internal energy and enthalpy; first law of thermodynamics and applications; second law of thermodynamics; concept of entropy; Heat engine and heat pump; Carnot cycle; power and refrigeration cycles.	
Books (In case UG compulsory courses, please give it as "Text books" and "Reference books". Otherwise give it as "References".	
Texts: (Format: Authors, <i>Book Title in Italics font</i> , Volume/Series, Edition Number, Publisher, Year.)	
1.	J.M. Coulson, J.F. Richardson, J.H. Harker and J.R. Backhurst, <i>Coulson & Richardson's Chemical Engineering</i> , Vol. 1, 6th Edition, Butterworth-Heinemann, 1999.
2.	J.M. Smith, H.C. van Ness and M.M. Abott, <i>Introduction to Chemical Engineering Thermodynamics</i> , 7th Edition, McGraw Hill, 2010.
3.	Y. V. C. Rao, <i>Chemical Engineering Thermodynamics</i> , Universities Press, 1997.
4.	O. Levenspiel, <i>Chemical Reaction Engineering</i> , 3rd Edition, Wiley, 2006.
References: (Format: Authors, <i>Book Title in Italics font</i> , Volume/Series, Edition Number, Publisher, Year.)	
1.	S.K. Ghosal, S.K. Sanyal and S. Datta, <i>Introduction to Chemical Engineering</i> , McGraw Hill, 1993.
2.	Milo D. Koretsky, <i>Engineering and Chemical Thermodynamics</i> , 2nd Edition, Wiley, 2012.
4.	W.L. Badger, and J.T. Banchero, <i>Introduction to Chemical Engineering</i> , McGraw-Hill, 2006.



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5.	W.L. McCabe, J.C. Smith and P. Harriott, <i>Unit Operations of Chemical Engineering</i> , 7th Edition, McGraw Hill, 2005.
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Detailed Course Content (Optional) It will not be included in the Courses of Study Booklet		
Sl. No.	Broad Title / Topics	Number of Lectures
1		
2		
3		
4		
5		
Total Number of Lectures =		

In case of revision of existing course, Please provide below the details of existing course. EXISTING COURSE
Course Number, Title, L-T-P-C: CL1101 & Chemical Engineering Fundamentals
Pre-Requisite (if any): Nil
Contents: Role of chemical engineers; overview of chemical plants; unit operations and unit processes; basics of material and energy balance; basics of chemical kinetics; basics of reactors; momentum, heat and mass transport processes; continuity equation, Newton's law of viscosity, Fourier's law of conduction, Fick's law of diffusion; thermodynamic systems, variables and processes; equilibrium and phase rule; equations of state; volumetric properties of mixtures; internal energy and enthalpy; first law of thermodynamics and applications; second law of thermodynamics; statistical interpretation of entropy; power and refrigeration cycles.
Texts: 1) R.M. Felder, R.W. Rousseau, L.G. Bullard, <i>Elementary Principles of Chemical Processes</i> , 4th Edition, John Wiley & Sons, Asia, 2017. 2) J.M. Smith, H.C. van Ness and M.M. Abott, <i>Introduction to Chemical Engineering Thermodynamics</i> , 7th Edition, McGraw Hill, 2010.
References: 1) S.K. Ghosal, S.K. Sanyal and S. Datta, <i>Introduction to Chemical Engineering</i> , McGraw Hill, 1993. 2) Milo D. Koretsky, <i>Engineering and Chemical Thermodynamics</i> , 2nd Edition, Wiley, 2012. 3) J.F. Richardson, J.H. Harker and J.R. Backhurst, <i>Coulson & Richardson's Chemical Engineering</i> , Vol. 1, 5th Edition, Butterworth-Heinemann, 2003. 4) W.L. Badger, and J.T. Banchero, <i>Introduction to Chemical Engineering</i> , McGraw-Hill, 2006 5) W.L. McCabe, J.C. Smith and P. Harriott, <i>Unit Operations of Chemical Engineering</i> , 7th Edition, McGraw Hill, 2005



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Indian Institute of Technology Guwahati
Proposal for a New Course / Revision of a Course

Course Number & Title: CL1102 (BSBE), CL1103 (CST), CL2214 (ME) – Fundamentals of Process Calculations	
L-T-P-C: 2-1-0-6	
Type of Letter Grading (Regular Letter Grades / PP or NP Letter Grades): Regular Letter Grades	
Kind of Proposal (New Course / Revision of Existing Course): New Course	
Offered as (Compulsory / Elective): Compulsory	
Offered to: B.Tech (1st Year–Mechanical Engineering Students)	
Offered in (Odd/ Even / Any): Even	
Offered by (Name of Department/ Center): Chemical Engineering	
Pre-Requisite: NIL	
Preamble / Objectives (Optional): This course provides basic understanding of process calculations of both non-reactive and reactive plants including isothermal and non-isothermal cases. That is material balance and energy balance for a process flowchart are taught.	
Course Content/ Syllabus: Overview of chemical plants; Importance of process calculations; unit conversion; processes and process variables; fundamentals of material balance; material balance: single and multi-unit processes, without and with reaction, without and with recycle, bypass and purge; material balance: reactive processes; enthalpy balance: without and with phase transitions; psychrometric chart; energy balance: non-reactive and reactive processes; calculations for ideal and real gas systems; equation of states; compressibility chart.	
Books (In case UG compulsory courses, please give it as “Text books” and “Reference books”. Otherwise give it as “References”).	
Texts: (Format: Authors, <i>Book Title in Italics font</i> , Volume/Series, Edition Number, Publisher, Year.)	
1.	R.M. Felder, R.W. Rousseau, L.G. Bullard, Elementary Principles of Chemical Processes, 4th Edition, John Wiley & Sons, Asia, 2017.
2.	D.M. Himmelblau and J. B. Riggs, Basic Principles and Calculations in Chemical Engineering, 8 th Edition, Prentice Hall of India, 2012.
3.	
References: (Format: Authors, <i>Book Title in Italics font</i> , Volume/Series, Edition Number, Publisher, Year.)	
1.	O.K.M. Watson and R.A.R. Hougen, Chemical Process Principles, Part 1: Material and Energy Balances, 2 nd Edition, John Wiley & Sons, 2004.
2.	W.L. Badger and J.T. Banchero, Introduction to Chemical Engineering, McGraw Hill, 2006.
3.	N. Chohey, Handbook of Chemical Engineering Calculations, 4 th Edition, McGraw Hill, 2012.

Detailed Course Content (Optional) It will not be included in the Courses of Study Booklet		
Sl. No.	Broad Title / Topics	Number of Lectures
1		



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2		
3		
4		
5		
Total Number of Lectures =		

In case of revision of existing course, Please provide below the details of existing course.

EXISTING COURSE

Course Number, Title, L-T-P-C:

Pre-Requisite (if any)

Contents:

References:



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Indian Institute of Technology Guwahati Proposal for a New Course / Revision of a Course

Course Number & Title: CL1201 – Chemical Process Calculations	
L-T-P-C: 2-1-0-6	
Type of Letter Grading (Regular Letter Grades / PP or NP Letter Grades): Regular Letter Grades	
Kind of Proposal (New Course / Revision of Existing Course): New Course	
Offered as (Compulsory / Elective): Compulsory	
Offered to: B.Tech (1st Year Chemical Engineering Students)	
Offered in (Odd/ Even / Any): Even	
Offered by (Name of Department/ Center): Chemical Engineering	
Pre-Requisite: NIL	
Preamble / Objectives (Optional): This course offers material and energy balance of a given chemical plant flowsheet. It includes various cases of material and energy balances such as steady state and transient calculations, non-reactive and reactive cases, single and multi-process units, etc.	
Course Content/ Syllabus : Introduction; unit systems and dimensions; general material balance equation; degree of freedom analysis; material balance: single and multi-unit processes, without and with chemical reactions, without and with recycle, bypass and purge; material balance: reactive processes; material balance: combustion reactions; enthalpy balance: without and with phase transitions; psychrometric chart; energy balance: non-reactive processes; energy balance on reactive systems: heat of formation, reaction, combustion, and solution; mass and energy balance: transient processes.	
Books (In case UG compulsory courses, please give it as “Text books” and “Reference books”. Otherwise give it as “References”).	
Texts: (Format: Authors, <i>Book Title in Italics font</i> , Volume/Series, Edition Number, Publisher, Year.)	
1.	R.M. Felder, R.W. Rousseau, L.G. Bullard, Elementary Principles of Chemical Processes, 4th Edition, John Wiley & Sons, Asia, 2017.
2.	D.M. Himmelblau and J. B. Riggs, Basic Principles and Calculations in Chemical Engineering, 8 th Edition, Prentice Hall of India, 2012.
3.	
References: (Format: Authors, <i>Book Title in Italics font</i> , Volume/Series, Edition Number, Publisher, Year.)	
1.	O.K.M. Watson and R.A.R. Hougen, Chemical Process Principles, Part 1: Material and Energy Balances, 2 nd Edition, John Wiley & Sons, 2004.
2.	W.L. Badger and J.T. Banchero, Introduction to Chemical Engineering, McGraw Hill, 2006.
3.	N. Chohey, Handbook of Chemical Engineering Calculations, 4 th Edition, McGraw Hill, 2012.

Detailed Course Content (Optional) It will not be included in the Courses of Study Booklet		
Sl. No.	Broad Title / Topics	Number of Lectures
1		



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2		
3		
4		
5		
Total Number of Lectures =		

In case of revision of existing course, Please provide below the details of existing course.

EXISTING COURSE

Course Number, Title, L-T-P-C:

Pre-Requisite (if any)

Contents:

References:



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Indian Institute of Technology Guwahati Proposal for a New Course

Course Number & Title: CL 2101 & Chemical Engineering Thermodynamics		
L-T-P-C: 3-0-0-6		
Type of Letter Grading (Regular Letter Grades / PP or NP Letter Grades): Regular Letter Grades		
Kind of Proposal (New Course / Revision of Existing Course): New Course		
Offered as (Compulsory / Elective): Compulsory		
Offered to: 2nd year B. Tech. students of Chemical Engineering		
Offered in (Odd/ Even / Any): Odd		
Offered by (Name of Department/ Center): Chemical Engineering		
Pre-Requisite: CL1101 (Chemical Engineering Fundamentals)		
Preamble / Objectives (Optional):		
Course Content/ Syllabus :		
Overview of the laws of thermodynamics; Property relations for single phase systems; Maxwell's relations; Residual property calculations; Extension to gas mixtures; Vapour-liquid equilibria and Raoult's law; Partial molar properties; Gibbs-Duhem equation, Chemical potential and fugacity; Fugacity of gaseous and liquid mixtures; Ideal and non-ideal solutions; Excess properties and activity coefficient models; Vapour-liquid, liquid-liquid, vapour-liquid-liquid, solid-liquid and chemical reaction equilibria; Introduction to molecular thermodynamics: potential energy functions and intermolecular forces, virial coefficients from potential functions, molecular theory of corresponding states.		
Books (In case UG compulsory courses, please give it as "Text books" and "Reference books". Otherwise give it as "References".		
Texts: (Format: Authors, <i>Book Title in Italics font</i> , Volume/Series, Edition Number, Publisher, Year.)		
1.	J. M. Smith, H. C. Van Ness and M. M. Abbott, <i>Introduction to Chemical Engineering Thermodynamics</i> , 7th Edition, McGraw Hill, 2010.	
2.	M. D. Koretsky, <i>Engineering and Chemical Thermodynamics</i> , 2 nd Edition, Wiley, 2012.	
References: (Format: Authors, <i>Book Title in Italics font</i> , Volume/Series, Edition Number, Publisher, Year.)		
1.	S. I. Sandler, <i>Chemical, Biochemical and Engineering Thermodynamics</i> , 5 th Edition, Wiley India, 2017.	
2.	Y. V. C. Rao, <i>An Introduction to Thermodynamics</i> , University Press, 2004.	
3.	Y. A. Cengel, M. A. Boles, <i>Thermodynamics: An Engineering Approach</i> , 8 th Edition, McGraw Hill Education, 2015.	
4.	J. M. Prausnitz, R. N. Lichtenthaler and E. G. de Azevedo, <i>Molecular Thermodynamics of Fluid-Phase Equilibria</i> , 3 rd Edition, Prentice Hall, 1999.	
Detailed Course Content (Optional) It will not be included in the Courses of Study Booklet		
Sl. No.	Broad Title / Topics	Number of Lectures
1		
Total Number of Lectures =		
In case of revision of existing course, Please provide below the details of existing course.		
EXISTING COURSE		
Course Number, Title, L-T-P-C:		
Pre-Requisite (if any)		
Contents:		
References:		

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Proposal for a New Course / Revision of a Course

Course Number & Title: CL2102 Fluid Mechanics	
L-T-P-C: 2-1-0-6	
Type of Letter Grading (Regular Letter Grades / PP or NP Letter Grades): Regular Letter Grades	
Kind of Proposal (New Course / Revision of Existing Course): New Course	
Offered as (Compulsory / Elective): Compulsory	
Offered to: B Tech Second Year	
Offered in (Odd/ Even / Any): Odd	
Offered by (Name of Department/ Center): Chemical Engineering	
Pre-Requisite: NIL	
Preamble / Objectives (Optional): All the unit operations and processes in Chemical Engineering involve handling of fluids of different nature. Therefore, efficient design of the processes requires a good understanding of the fundamentals of fluid mechanics. In this course, the students are introduced to the basic principles of fluid mechanics.	
Course Content/ Syllabus: Mathematical background, properties and classification of fluids, Newton's law of viscosity; Fluid statics: pressure, gravity and surface tension; Dimensional analysis and similitude, Buckingham Pi theorem; Integral analysis for fluid motion: Reynolds transport theorem and its application for mass and momentum conservation; Fluid Kinematics: material derivative, rate of strain and vorticity; Differential analysis: continuity and Navier-Stokes equation; Inviscid flow: potential flow, stream functions, Euler equation, Bernoulli's principle; Internal flows: friction factor, pipe flow, energy losses in fittings and valves; External flow: boundary layer theory; concepts of drag and lift; Flow measurement techniques and fluid machinery: pumps, blowers, fans and compressors; Introduction to turbulent flows; Applications of fluid mechanics: Microfluidics, complex fluids; Advanced topic: compressible flow.	
Books (In case UG compulsory courses, please give it as "Text books" and "Reference books". Otherwise give it as "References").	
Texts: (Format: Authors, <i>Book Title in Italics font</i> , Volume/Series, Edition Number, Publisher, Year.)	
1.	F. M. White, Fluid Mechanics, 8th Ed., McGraw Hill Publications, 2017.
2.	R. W. Fox and A. T. McDonald, J. W. Mitchell, Introduction to Fluid Mechanics, 10ed (An Indian Adaptation), John Wiley & Sons, 2021.
3.	Y. Cengel and J. Kimbala, Fluid Mechanics: Fundamentals and Applications, McGraw Hill Publication, 3rd Ed., 2014.
4.	Coulson and Richardson, Fluid Flow, Fundamentals and Applications, Chemical Engineering Volume 1A, 7 th Ed., 2017.
References: (Format: Authors, <i>Book Title in Italics font</i> , Volume/Series, Edition Number, Publisher, Year.)	
4.	W. M. Deen, Introduction to Chemical Engineering Fluid Mechanics, Cambridge University Press, New York, 2016.
5.	W. L. McCabe, J. Smith and P. Harriot, Unit Operations of Chemical Engineering, 7 th Ed., McGraw - Hill, International Edition, 2014.
6.	G. K. Batchelor, An Introduction to Fluid Dynamics, Cambridge University Press, 1967.

	Detailed Course Content (Optional)
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It will not be included in the Courses of Study Booklet			
Sl. No.	Broad Title / Topics	Lecture No	Tutorial No
1	Mathematical background, properties and classification of fluids, Newton's law of viscosity	2	1
2	Fluid statics: pressure, gravity and surface tension	2	1
3	Dimensional analysis and similitude, Buckingham Pi theorem	2	1
4	Integral analysis for fluid motion: Reynolds Transport theorem and its application for mass and momentum conservation	3	2
5	Fluid Kinematics: material derivative, rate of strain and vorticity	3	1
6	Differential analysis: continuity and Navier-Stokes equation	3	2
7	Inviscid flow: potential flow, stream functions, Euler equation, Bernoulli's principle	2	1
8	Internal flows: friction factor, pipe flow, energy losses in fittings and valves	3	1
9	External flow: boundary layer theory; concepts of drag and lift	2	1
10	Flow measurement techniques and fluid machinery: pumps, blowers, fans and compressors	2	1
11	Introduction to turbulent flows	1	1
12	Applications of fluid mechanics: Microfluidics, complex fluids	2	1
13	Advanced topic: compressible flow	1	0
Total Number of Lectures =		28	14

In case of revision of existing course, Please provide below the details of existing course.

EXISTING COURSE

Course Number, Title, L-T-P-C:

Pre-Requisite (if any)

Contents:

References:



भारतीय प्रौद्योगिकी संस्थान गुवाहाटी

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Indian Institute of Technology Guwahati Proposal for a New Course / Revision of a Course

Course Number & Title: CL2103 & Heat Transfer	
L-T-P-C: 2-1-0-6	
Type of Letter Grading (Regular Letter Grades / PP or NP Letter Grades): Regular Letter Grades	
Kind of Proposal (New Course / Revision of Existing Course): Revision of Existing New Course	
Offered as (Compulsory / Elective): Compulsory	
Offered to: UG 2 nd year	
Offered in (Odd/ Even / Any): Odd	
Offered by (Name of Department/ Center): Chemical Engineering	
Pre-Requisite:	
Preamble / Objectives (Optional): This course introduces fundamental and applied aspects of heat transfer, emphasizing conduction, convection, radiation, and phase-change mechanisms. It provides chemical engineering undergraduates with the ability to analyze transport of thermal energy in systems relevant to chemical and allied industries. Special emphasis is given to understanding applications in energy systems, desalination, process industries, and sustainable technologies, in alignment with NEP principles of experiential and multidisciplinary learning.	
Course Content/ Syllabus (<i>as a single paragraph if it is not containing more than one subject. Sub-topics/ Sections may be separated by commas(,). Topics may be separated by Semi-Colons(;). Chapters may be separated by Full-Stop(.). While starting with broad heading, it may be indicated with Colon symbol before the topics. For example: Multi-variable Calculus: Limits of functions, Continuity,</i>) Basic modes of heat transfer and engineering applications. Conduction: governing equations, boundary/initial conditions, critical thickness of insulation, lumped system, transient conduction. Convection: motion and energy equations, hydrodynamic and thermal boundary layers, natural vs. forced convection. Radiation: blackbody and graybody radiation, Planck's law, Wien's law, Stefan-Boltzmann law, Kirchhoff's law, view factors, radiation shields, combined modes. Boiling and condensation: mechanisms and industrial applications. Advanced applications: modern topics such as nanofluids, microchannels, electronics cooling, renewable energy systems.	
Books (In case UG compulsory courses, please give it as "Text books" and "Reference books". Otherwise give it as "References".	
Texts: (Format: Authors, <i>Book Title in Italics font</i> , Volume/Series, Edition Number, Publisher, Year.)	
1.	Holman J.P., <i>Heat Transfer</i> , 10th Edition, McGraw Hill, 2017
2.	Incropera F.P., DeWitt D.P., Bergman T.L., and Lavine A.S., <i>Fundamentals of Heat and Mass Transfer</i> , 8th Edition, Wiley, 2018.
3.	Carta G., <i>Heat and Mass Transfer for Chemical Engineers: Principles and Applications</i> , McGraw Hill, 1 st Edition, 2021.
4.	Dutta B.K., <i>Heat Transfer: Principles and Applications</i> , 2nd Edition, PHI, 2023.
References: (Format: Authors, <i>Book Title in Italics font</i> , Volume/Series, Edition Number, Publisher, Year.)	
1.	Kreith F. & Bohn M.S., <i>Principles of Heat Transfer</i> , 7 th Edition, Cengage Learning, 2018.
2.	Cengel Y.A., <i>Heat and Mass Transfer: A Practical Approach</i> , 3 rd Edition, McGraw Hill, 2006.



भारतीय प्रौद्योगिकी संस्थान गुवाहाटी

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Detailed Course Content (Optional)			
It will not be included in the Courses of Study Booklet			
Sl. No.	Broad Title / Topics	Lecture No	Tutorial No
1	Fundamentals: Modes of heat transfer, thermal resistance analogy, engineering applications	2	1
2	Conduction: 1D, 2D, conduction; boundary and initial conditions; critical thickness of insulation	6	3
3	Transient conduction: lumped system analysis, analytical solutions	4	2
4	Convection: governing equations, boundary layers, natural vs. forced convection, empirical overview	6	3
5	Radiation: laws (Planck, Wien, Stefan–Boltzmann, Kirchhoff), blackbody/graybody concepts, view factors, shields, combined modes	6	3
6	Phase-change heat transfer: boiling and condensation; industrial applications	2	1
7	Advanced applications: overview of heat exchangers (classification only), nanofluids, microchannels, electronics cooling, renewable energy systems	2	1
Total Number		28	14

In case of revision of existing course, Please provide below the details of existing course.
EXISTING COURSE
Course Number, Title, L-T-P-C: 2-1-0-6
Pre-Requisite (if any)
<p>Contents:</p> <p>Modes of heat transfer; Conduction: equations for 1D, 2D and 3D systems; steady-state conduction; critical thickness of insulation; analytical solutions for transient conduction; lumped systems; Convection: equations of motion and energy; hydrodynamic and thermal boundary layers; natural and forced convections; Boiling and Condensation: classifications and characterizations; Radiation: black and grey body radiation; Planck's law; Wein's displacement law; Stefan-Boltzmann law; Kirchhoff's law; view factor; radiation shields; radiation combined with conduction and convection; Types and design of evaporators</p>
<p>References:</p> <p>Texts:</p> <p>J. P. Holman, Heat Transfer, 10th Ed., McGraw-Hill, 2010. McGraw-Hill, New York, USA.</p> <p>B. K. Dutta, Heat Transfer: Principles and Applications, Prentice Hall of India, Delhi, 2009.</p> <p>References:</p> <p>D. Q. Kern, Process Heat Transfer, 2nd Ed., Tata McGraw-Hill, Delhi, 1997.</p> <p>Y. A. Cengel, Heat Transfer: A Practical Approach, 2nd Ed., McGraw-Hill, 2004. New York, USA.</p> <p>Y. A. Cengel and A.J. Ghajar, Heat and Mass Transfer: Fundamentals and Applications, 5th Ed., McGraw-Hill, 2014, New York, USA.</p> <p>W. L. McCabe, J. Smith and P. Harriot, Unit Operations of Chemical Engineering, 6th Ed., McGraw-Hill, International Edition, 2001, Singapore.</p>



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Indian Institute of Technology Guwahati Proposal for a New Course / Revision of a Course

Course Number & Title: CL2201 Mass Transfer - I	
L-T-P-C: 2-1-0-6	
Type of Letter Grading (Regular Letter Grades / PP or NP Letter Grades): Regular Letter Grades	
Kind of Proposal (New Course / Revision of Existing Course): New Course	
Offered as (Compulsory / Elective): Compulsory	
Offered to: UG, 2 nd Year CL students	
Offered in (Odd/ Even / Any): Even	
Offered by (Name of Department/ Center): CL	
Pre-Requisite: None	
Preamble / Objectives (Optional):	
Course Content/ Syllabus (<i>as a single paragraph if it is not containing more than one subject. Sub-topics/ Sections may be separated by commas(,). Topics may be separated by Semi-Colons(;). Chapters may be separated by Full-Stop(.). While starting with broad heading, it may be indicated with Colon symbol before the topics. For example: Multi-variable Calculus: Limits of functions, Continuity,</i>)	
Diffusion: Molecular diffusion in gases and liquids; Multicomponent diffusion; Convective mass transfer; Boundary layers; Correlations for laminar and turbulent flows; Dimensionless numbers in mass transfer.; Interphase Mass Transfer: Two-film theory, penetration theory, surface renewal theory; Mass transfer coefficients: estimation and experimental methods.; Gas-Liquid Operations: Equilibria in gas-liquid systems; Gas-Liquid contacting equipments.; Gas Absorption and Stripping: Equilibrium and operating line concepts, minimum liquid rate; Design of packed towers (HTU-NTU method, HETP, pressure drop, flooding and loading); Absorption in plate columns (Murphree efficiency and overall efficiency).; Distillation: Phase equilibria, relative volatility, T-x/y and x-y diagrams; Flash, batch, and steam distillation; Continuous distillation (McCabe-Thiele and Ponchon-Savarit methods, limiting cases); Design of packed and tray columns; Introduction to multicomponent, azeotropic and extractive distillation	
Books (In case UG compulsory courses, please give it as "Text books" and "Reference books". Otherwise give it as "References".	
Texts: (Format: Authors, <i>Book Title in Italics font</i> , Volume/Series, Edition Number, Publisher, Year.)	
1.	R. E. Treybal, Mass Transfer Operations, 3rd Ed., McGraw-Hill, 1981.
2.	B. K. Dutta, Principles of Mass Transfer and Separation Processes, PHI, 2007.
3.	
References: (Format: Authors, <i>Book Title in Italics font</i> , Volume/Series, Edition Number, Publisher, Year.)	
1	W. L. McCabe, J. Smith, P. Harriott, Unit Operations of Chemical Engineering, 7 th Ed., McGraw-Hill, 2014
2	C. J. Geankoplis et al., Transport Processes and Separation Process Principles, 5 th Ed., Pearson, 2018
3	J. D. Seader, Ernest J. Henley, D. Keith Roper, Separation Process Principles with Applications Using Process Simulators, 4th Ed., Wiley, 2016



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Detailed Course Content (Optional) It will not be included in the Courses of Study Booklet		
Sl. No.	Broad Title / Topics	Number of Lectures
1		
2		
3		
4		
5		
Total Number of Lectures =		

In case of revision of existing course, Please provide below the details of existing course. EXISTING COURSE
Course Number, Title, L-T-P-C:
Pre-Requisite (if any)
Contents:
References:

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Proposal for a New Course / Revision of a Course



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Course Number & Title: CL 2202: Mechanical and Solid-Fluid Operations	
L-T-P-C: 3-0-0-6	
Type of Letter Grading (Regular Letter Grades / PP or NP Letter Grades): Regular Letter Grades	
Kind of Proposal (New Course / Revision of Existing Course): New Course	
Offered as (Compulsory / Elective): Compulsory	
Offered to: UG	
Offered in (Odd/ Even / Any): Even	
Offered by (Name of Department/ Center): Chemical Engineering	
Pre-Requisite: Nil	
<p>This course offers a detailed exploration of particle technology, essential for solid handling in chemical, mineral, and related industries. It covers particle characterization, transport mechanisms, storage, and conveying of materials in process systems. Learners will begin with fundamentals such as particle properties, size analysis, and the behavior of particulate systems. The course progresses to solid-fluid operations, including drag force, flow resistance, sedimentation, slurry mixing, fluidization, and froth flotation—key for understanding particle behavior in dynamic systems. It concludes with separation and pollution control methods involving gravitational and centrifugal separation, electrostatic precipitation, filtration, reverse osmosis, membrane separation. Emphasis is placed on theoretical concepts, supported by practical examples and exercises, including numerical problems. The course equips learners to analyze, optimize, and innovate particle processing technologies.</p>	
<p>Course Content/ Syllabus: Introduction and characteristics of solids; size reduction and enlargement of solids; Mixing of solids: degree of mixing and mixing index; Transport and storage of solid; Motion of particles through fluid: terminal, settling, free and hindered settling velocity; Flow past obstacles (cylindrical and spherical particle), porous or granular bed; Fluidization; Froth flotation; Separation of particles: sieving, gravity chambers, cyclone separators, industrial bag filters, electrostatic precipitators, wet scrubbers and clarifiers; Filtration: dead-end and continuous filtration, cross-flow microfiltration and forward osmosis; Agitation and mixing: mixing agitators, standard design components of mixing vessel with agitators, flow number, power number.</p>	
Text Books:	
1.	J.F. Richardson, J.H. Harker, J.R. Backhurst, <i>Coulson and Richardson's Chemical Engineering Volume 2 – Particle Technology and Separation Processes</i> , 5th Edition, Butterworth-Heinemann, 2002.
2.	W.L. McCabe, J.C. Smith, P. Harriot, <i>Unit Operations of Chemical Engineering</i> , 6th Edition, McGraw-Hill, International Edition, 2001.
3.	S. K. Majumder, <i>Mechanical and Solid-Fluid Operations, Volume 1, 2 & 3</i> , CRC Press, 2025.
Reference Books:	
1.	Greg Foley, <i>Membrane Filtration: A Problem-Solving Approach with MATLAB</i> , Cambridge University Press, 2013.
2.	Richard C. Flagan, John H. Seinfeld, <i>Fundamentals of Air Pollution Engineering</i> , Prentice Hall, 1988.

Detailed Course Content (Optional): Not Applicable It will not be included in the Courses of Study Booklet		
Sl. No.	Broad Title / Topics	Number of Lectures
1		



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2	
Total Number of Lectures =	

In case of revision of existing course, Please provide below the details of existing course.

EXISTING COURSE

Course Number, Title, L-T-P-C: CL 2202: Solid-Fluid Operations; 3-0-0-6

Pre-Requisite (if any): Nil

Existing Course Contents: Single particle characterization, motion of particles through fluid (terminal settling velocity, free and hindered settling), fluid flow past obstacles, fluidization, particle size reduction and enlargement, sieving, froth flotation, transport of solids, clogging in hoppers and reduction of clogging, dynamical quantities characterizing hopper flows, vibrating media, rotating suspensions and granular media; Gravity chambers, cyclone separators, industrial bag filters, electrostatic precipitators, wet scrubbers and clarifiers; Dead-end and continuous filtration, cross-flow microfiltration and forward osmosis; Agitation and mixing.

Text Book:

J.F. Richardson, J.H. Harker, J.R. Backhurst, Coulson and Richardson's Chemical Engineering Volume 2 – Particle Technology and Separation Processes, 5th Edition, Butterworth-Heinemann, 2002.

W.L. McCabe, J.C. Smith, P. Harriot, Unit Operations of Chemical Engineering, 6th Edition, McGraw-Hill, International Edition, 2001.

Reference Book:

Greg Foley, Membrane Filtration: A Problem Solving Approach with MATLAB, Cambridge University Press, 2013.

Richard C. Flagan, John H. Seinfeld, Fundamentals of Air Pollution Engineering, Prentice Hall, 1988.

Indian Institute of Technology Guwahati
Proposal for a New Course / Revision of a Course



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Course Number & Title: CL2203 Numerical Methods	
L-T-P-C: 2-1-0-6	
Type of Letter Grading (Regular Letter Grades / PP or NP Letter Grades): Regular	
Kind of Proposal (New Course / Revision of Existing Course): New Course	
Offered as (Compulsory / Elective): Compulsory	
Offered to: B.Tech Chemical Engineering	
Offered in (Odd/ Even / Any): Even	
Offered by (Name of Department/ Center): Chemical Engineering	
Pre-Requisite:	
Preamble / Objectives (Optional)	
Course Content/ Syllabus: Introduction to Numerical Analysis & Applications; Solution of Simultaneous Linear Equations: direct and indirect methods; Solution of Non-Linear Equations: bracketing and open methods, System of non-linear equations, Roots of Polynomials; Optimization: Constrained and Unconstrained Optimization; linear and non-linear programming. Interpolation: Direct Method, Newton's Divided-Difference Interpolating Polynomials, Lagrange Interpolating Polynomials, Inverse Interpolation; Approximation of Functions; Numerical Differentiation; Numerical Integration: Newton-Cotes Integration Formulas, Multi Segment and Composite Applications; Solution of Ordinary Differential Equations: Euler and Runge-Kutta Methods, Multistep Predictor-Corrector Methods, Differential Algebraic Equations; Boundary Value Problems: Overshooting & Finite Difference Method; Determination of Eigen Values and Eigen vectors; Partial Differential Equations: Elliptic Equations: Direct and Libenmann's method, Irregular Grids and Neumann Boundary Condition; 1D and 2D Parabolic Equations using Explicit, Implicit, Crank-Nicholson Method, and Alternating Direction Implicit Method; Hyperbolic Equations	
Books (In case UG compulsory courses, please give it as "Text books" and "Reference books". Otherwise give it as "References".	
Texts: (Format: Authors, <i>Book Title in Italics font</i> , Volume/Series, Edition Number, Publisher, Year.)	
1.	S. C. Chapra and R. P. Canale, Numerical Methods for Engineers, McGraw-Hill Education, 2015
2.	P. Ghosh, Numerical Methods with Computer Programs in C++, Prentice-Hall of India Private Limited, 2006
References: (Format: Authors, <i>Book Title in Italics font</i> , Volume/Series, Edition Number, Publisher, Year.)	
1	S. C. Chapra, Applied Numerical Methods with MATLAB for Engineers and Scientists, 3rd Edition, 2012
2	P. Ghosh, Numerical, Symbolic and Statistical Computing for Chemical Engineers Using MATLAB, Prentice-Hall of India Private Limited, 2018
3	S. K. Gupta, Numerical Methods for Engineers, 3rd Edition, New Age International, 2015.
4	J.H. Mathews & K.D. Finks, Numerical Methods Using Matlab, 4 th Edition, Pearson, 2004

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Course Number & Title: CL2204 Chemical Reaction Engineering – I		
L-T-P-C: 2-1-0-6		
Type of Letter Grading (Regular Letter Grades / PP or NP Letter Grades): Regular Letter Grades		
Kind of Proposal (New Course / Revision of Existing Course): New Course		
Offered as (Compulsory / Elective): Compulsory		
Offered to: BTech		
Offered in (Odd/ Even / Any): Even		
Offered by (Name of Department/ Center): CL		
Pre-Requisite: Nil.		
Preamble / Objectives (Optional):		
Course Content/ Syllabus: Kinetics of homogeneous reactions; Analyses of kinetic data in batch and differential reactors; Design of ideal batch, plug and mixed flow reactors; Design of series and parallel reactions; Temperature and pressure effects: energy balance, optimum temperature progression, adiabatic and heat exchange operations, multiple steady states in mixed flow reactors; Basics of non-ideal flow reactor: residence time distribution, conversion in non-ideal flow reactors, compartment, dispersion and tanks-in-series models; Segregation and maximum mixedness.		
Books (In case UG compulsory courses, please give it as “Text books” and “Reference books”. Otherwise give it as “References”).		
Texts: (Format: Authors, <i>Book Title in Italics font</i> , Volume/Series, Edition Number, Publisher, Year.)		
1.	H. S. Fogler, Elements of Chemical Reaction Engineering, 5 th Ed., Prentice Hall, New Jersey, 2016.	
2.	O. Levenspiel, Chemical Reaction Engineering, 3 rd Ed., Wiley Eastern, 2006.	
References: (Format: Authors, <i>Book Title in Italics font</i> , Volume/Series, Edition Number, Publisher, Year.)		
1	J. M. Smith, Chemical Engineering Kinetics, 3 rd Ed., McGraw-Hill Education India Pvt. Ltd - New Delhi, 2014.	
2	M. L. Schuler and F. Kargi, Bioprocess Engineering: Basic Concepts, 2nd Ed., Prentice Hall, International Series, 2002.	
3	S. I. Sandler, Chemical, Biochemical, and Engineering Thermodynamics, 4th Ed., John Wiley & Sons, 2006.	
Detailed Course Content (Optional) It will not be included in the Courses of Study Booklet		
Sl. No.	Broad Title / Topics	Number of Lectures
1		
Total Number of Lectures =		
In case of revision of existing course, Please provide below the details of existing course.		
EXISTING COURSE		
Course Number, Title, L-T-P-C:		
Pre-Requisite (if any)		
Contents:		
References:		

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Course Number & Title: CL2205H, Statistics in Chemical Engineering	
L-T-P-C: 2 – 1 – 0	
Type of Letter Grading (Regular Letter Grades / PP or NP Letter Grades): Regular Letter Grades	
Kind of Proposal (New Course / Revision of Existing Course): New Course	
Offered as (Compulsory / Elective): Compulsory	
Offered to: Undergraduate students of chemical engineering	
Offered in (Odd/ Even / Any): Even semester (i.e., 4 th)	
Offered by (Name of Department/ Center): Chemical Engineering	
Pre-Requisite: Nil	
Preamble / Objectives: A sound knowledge of statistics is essential for a chemical engineer. It is required in applications such as curve fitting, quality control, and stochastic modeling and optimization. Courses on mathematics and numerical methods do not cover this subject. In addition, a good exposure to the use of software (e.g., MATLAB®, MINITAB®, and Design-Expert®) for the statistical computations is essential. This course attempts to fulfil these requirements.	
Course Content/ Syllabus: Random variables; Probability theory; Expectation; Probability distributions; Sampling theory; Estimation theory; Hypothesis testing; Least squares curve fitting; Analysis of variance; Design of experiments (e.g., factorial and response-surface methods); Use of software (e.g., MATLAB®, MINITAB®, and Design-Expert®) for the solution of chemical engineering problems	
Books	
Texts:	
1.	M. R. Spiegel, J. J. Schiller, R. A. Srinivasan, and D. Goswami, <i>Probability and Statistics</i> , McGraw-Hill Education, 2017.
2.	G. G. Vining, <i>Statistical Methods for Engineers</i> , Brooks/Cole Publishing, 1998.
3.	S. Ross, <i>A First Course in Probability</i> , Pearson Education, 2022.
References:	
1.	D. C. Montgomery, <i>Design and Analysis of Experiments</i> , John Wiley and Sons, 2013.
2.	R. E. Walpole, R. H. Myers, S. L. Myers, and K. Ye, <i>Probability and Statistics for Engineers and Scientists</i> , Pearson Education, 2024.

Detailed Course Content It will not be included in the Courses of Study Booklet		
Sl. No.	Broad Title / Topics	Number of Lectures
1.	Random variables; Probability theory	2
2.	Expectation; Probability distributions	2
3.	Sampling theory; Estimation theory; Hypothesis testing	4
4.	Least squares curve fitting	2
5.	Analysis of variance; Design of experiments	4
Total Number of Lectures =		14
In case of revision of existing course, Please provide below the details of existing course.		



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EXISTING COURSE
Course Number, Title, L-T-P-C:
Pre-Requisite (if any)
Contents:
References:

***Note:** "Use of software (e.g., MATLAB®, MINITAB®, and Design-Expert®) for the solution of chemical engineering problems" will be covered within some of the lectures, and practice sessions will be held in some of the tutorials. There will be approximately seven tutorials (each of one hour's duration).

Indian Institute of Technology Guwahati
Proposal for a New Course / Revision of a Course

Course Number & Title: **CL 2211L & Fluid Mechanics Lab**



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L-T-P-C: 0 - 0 - 3 -3	
Kind of Proposal (New Course / Revision of Existing Course(s)): Revised	
Offered as (Compulsory / Elective): Compulsory	
Offered to: BTech in Chemical Engineering	
Offered in (Odd/ Even / Any): Even	
Offered by (Name of Department/ Center): Chemical Engg	
Pre-Requisite: Fluid Mechanics subject knowledge	
Preamble / Objectives (Optional):	
Course Content/ Syllabus: Experiment 1: Cavitation Apparatus; Experiment 2: Closed Circuit Impact Of Jet On Vane Apparatus; Experiment 3: Submersible Pump Test Rig (Hd-151); Experiment 4: Notches Tank Apparatus; Experiment 5: Reynolds Apparatus (Horizontal); Experiment 6: Centrifugal Pump Test Rig; Experiment 7: Closed Circuit Rotameter Test Rig; Experiment 8: Flow Through Fluidized Bed Apparatus; Experiment 9: Nozzle Meter Test Rig; Experiment 10: Flow Meter Demonstration; Experiment 11: Drag Coefficient Apparatus; Experiment 12: Reynold's Apparatus (Vertical).	
Textbooks:	
1.	
2.	
References:	
1	Streeter, V. L., Wylie, E. B., & Bedford, K. W. (2007). <i>Fluid mechanics</i> (9th ed., pp. 403–404). McGraw-Hill.
2	Garde, R. J. (1997). <i>Fluid mechanics through problems</i> (2nd ed., p. 133). New Age International.
3	Çengel, Y. A., & Cimbala, J. M. (2007). <i>Fluid mechanics: Fundamentals and applications</i> (2nd ed., pp. 39–40). McGraw-Hill.



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Proposal for a New Course / Revision of a Course

Course Number & Title: CL 2212L & Heat Transfer Lab	
L-T-P-C: 0 – 0 – 3 – 1.5	
Kind of Proposal (New Course / Revision of Existing Course(s)): Revised	
Offered as (Compulsory / Elective): Compulsory	
Offered to: BTech in Chemical Engineering	
Offered in (Odd/ Even / Any): Even	
Offered by (Name of Department/ Center): Chemical Engg	
Pre-Requisite:	
Preamble / Objectives (Optional):	
Course Content/ Syllabus: Experiment 1: Emissivity Measurement Apparatus; Experiment 2: Unsteady State Heat transfer; Experiment 3: Thermal Conductivity of Metal Rod; Experiment 4: Extended Surface Heat Exchanger; Experiment 5: Stefan Boltzmann's Apparatus; Experiment 6: Shell and Tube Heat Exchanger; Experiment 7: Heat Transfer through Lagged pipe; Experiment 8: Heat Pipe Demonstrator; Experiment 9: Heat transfer from pin-fin; Experiment 10: Heat Transfer Through Composite.	
Textbooks:	
1.	
2.	
References:	
1	Holman, J. P. (1976). Heat transfer (8th ed.). McGraw-Hill.
2	Kern, D. Q. (1965). Process heat transfer (1st ed.). McGraw-Hill.
3	Perry, R. H., & Green, D. (Eds.). (1985). Perry's chemical engineers' handbook (6th ed.). McGraw-Hill.
4	McCabe, W. L., Smith, J. C., & Harriott, P. (1985). Unit operations of chemical engineering (4th ed., pp. 360–362). McGraw-Hill.
5	Coulson, J. M., & Richardson, J. F. (1996). Coulson & Richardson's chemical engineering: Vol. 1 (5th ed., pp. 388–389). Asian Books Ltd.
6	Dutta, B. K. (2006). Heat transfer: Principles and applications. PHI Learning.
7	Çengel, Y. A. (2007). Heat and mass transfer (3rd ed., pp. 28, 667–671). Tata McGraw-Hill.



भारतीय प्रौद्योगिकी संस्थान गुवाहाटी

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Indian Institute of Technology Guwahati
Proposal for a New Course / Revision of a Course

Course Number & Title: CL2213L & Numerical Methods Lab	
L-T-P-C: 0-0-3-3	
Type of Letter Grading (Regular Letter Grades / PP or NP Letter Grades): Regular	
Kind of Proposal (New Course / Revision of Existing Course): New Course	
Offered as (Compulsory / Elective): Compulsory	
Offered to: B.Tech Chemical Engineering	
Offered in (Odd/ Even / Any): Even	
Offered by (Name of Department/ Center): Chemical Engineering	
Pre-Requisite:	
Preamble / Objectives (Optional)	
Course Content/ Syllabus: Implementation of numerical algorithms for Solution of Linear Equations; Non-linear Equations; Ordinary Differential Equations; Partial Differential Equations; Numerical Differentiation & Integration; Polynomial Interpolation; Linear Programming; and Non-linear Programming	
Books (In case UG compulsory courses, please give it as "Text books" and "Reference books". Otherwise give it as "References").	
Texts: (Format: Authors, <i>Book Title in Italics font</i> , Volume/Series, Edition Number, Publisher, Year.)	
1.	S. C. Chapra and R. P. Canale, Numerical Methods for Engineers, McGraw-Hill Education, 2015
2.	P. Ghosh, Numerical Methods with Computer Programs in C++, Prentice-Hall of India Private Limited, 2006
References: (Format: Authors, <i>Book Title in Italics font</i> , Volume/Series, Edition Number, Publisher, Year.)	
1	S. C. Chapra, Applied Numerical Methods with MATLAB for Engineers and Scientists, 3rd Edition, 2012
2	P. Ghosh, Numerical, Symbolic and Statistical Computing for Chemical Engineers Using MATLAB, Prentice-Hall of India Private Limited, 2018
3	S. K. Gupta, Numerical Methods for Engineers, 3rd Edition, New Age International, 2015.
4	J.H. Mathews & K.D. Finks, Numerical Methods Using Matlab, 4 th Edition, Pearson, 2004

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Proposal for a New Course / Revision of a Course



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Course Number & Title: CL3101 & Mass Transfer - II	
L-T-P-C: 2-1-0-6	
Type of Letter Grading (Regular Letter Grades / PP or NP Letter Grades): Regular Letter Grades	
Kind of Proposal (New Course / Revision of Existing Course): New Course	
Offered as (Compulsory / Elective): Compulsory	
Offered to: UG, 3 rd Year CL students	
Offered in (Odd/ Even / Any): Odd	
Offered by (Name of Department/ Center): CL	
Pre-Requisite: None	
Preamble / Objectives (Optional):	
Course Content/ Syllabus (<i>as a single paragraph if it is not containing more than one subject. Sub-topics/ Sections may be separated by commas(,). Topics may be separated by Semi-Colons(;). Chapters may be separated by Full-Stop(.). While starting with broad heading, it may be indicated with Colon symbol before the topics. For example: Multi-variable Calculus: Limits of functions, Continuity,</i>)	
Simultaneous Heat and Mass Transfer: Analogy between heat, mass, and momentum transfer; Psychrometry, humidification, and dehumidification processes; Design of cooling towers.; Drying: Mechanisms of moisture movement in solids; Batch and continuous dryers, drying rate curves.; Adsorption and Ion-Exchange: Adsorption equilibria, isotherms (Langmuir, Freundlich, BET); Breakthrough curves; Fixed-bed adsorption (PSA, TSA, VSA), and regenerations; Ion-exchange equilibria and applications in water treatment.; Liquid-Liquid Extraction: Equilibria and triangular diagrams; Single and multistage extraction; LLE equipments. ; Leaching: Principles of solid-liquid extraction, stage-wise design.; Crystallization: Solid-Liquid phase equilibria, nucleation and crystal growth kinetics; Design of crystallizers, yield, and purity considerations.; Membrane Separations: Fundamentals, microfiltration, ultrafiltration, nanofiltration and reverse osmosis	
Books (In case UG compulsory courses, please give it as "Text books" and "Reference books". Otherwise give it as "References".	
Texts: (Format: Authors, <i>Book Title in Italics font</i> , Volume/Series, Edition Number, Publisher, Year.)	
1.	R. E. Treybal, Mass Transfer Operations, 3rd Ed., McGraw-Hill, 1981.
2.	B. K. Dutta, Principles of Mass Transfer and Separation Processes, PHI, 2007.
3.	
References: (Format: Authors, <i>Book Title in Italics font</i> , Volume/Series, Edition Number, Publisher, Year.)	
1	W. L. McCabe, J. Smith, P. Harriott, Unit Operations of Chemical Engineering, 7 th Ed., McGraw-Hill, 2014
2	C. J. Geankoplis et al., Transport Processes and Separation Process Principles, 5 th Ed., Pearson, 2018
3	J. D. Seader, Ernest J. Henley, D. Keith Roper, Separation Process Principles with Applications Using Process Simulators, 4th Ed., Wiley, 2016
4	M. H. Mulder, Basic Principles of Membrane Technology, Springer, 2004.

Detailed Course Content (Optional)



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It will not be included in the Courses of Study Booklet		
Sl. No.	Broad Title / Topics	Number of Lectures
1		
2		
3		
4		
5		
Total Number of Lectures =		

In case of revision of existing course, Please provide below the details of existing course. EXISTING COURSE
Course Number, Title, L-T-P-C:
Pre-Requisite (if any)
Contents:
References:



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Indian Institute of Technology Guwahati Proposal for a New Course / Revision of a Course

Course Number & Title: CL3102 & Chemical Reaction Engineering – II	
L-T-P-C: 2-1-0-6	
Type of Letter Grading (Regular Letter Grades / PP or NP Letter Grades): Regular Letter Grades	
Kind of Proposal (New Course / Revision of Existing Course): New Course	
Offered as (Compulsory / Elective): Compulsory	
Offered to: BTech	
Offered in (Odd/ Even / Any): Odd	
Offered by (Name of Department/ Center): CL	
Pre-Requisite: CRE-I (CL-XXX)	
Preamble / Objectives (Optional):	
Course Content/ Syllabus: Introduction to heterogeneous reactions; Fluid-solid catalytic reactions: mechanism and rate-limiting step, external and internal diffusion effects; Design of packed bed reactor: Staged adiabatic reactors, single and two packed bed systems; Catalyst deactivation: Types and mechanisms, rate and performance equations with various flow arrangements, pore diffusion effects, design principles; Multi-phase reaction kinetics: Performance equations with various flow regimes; Fluid-fluid non-catalytic reaction kinetics and reactor design: Mass transfer with and without reaction, instantaneous reaction and fast reaction; Fluid-solid non-catalytic reaction kinetics and reactor design: Performance equations; Progressive conversion model; Shrinking-core model; Time of operation under various controlling regimes. Introduction to biochemical reaction kinetics.	
Books (In case UG compulsory courses, please give it as “Text books” and “Reference books”. Otherwise give it as “References”).	
Texts: (Format: Authors, <i>Book Title in Italics font</i> , Volume/Series, Edition Number, Publisher, Year.)	
1.	H. S. Fogler, <i>Elements of Chemical Reaction Engineering</i> , 5 th Ed., Prentice Hall, New Jersey, 2016.
2.	O. Levenspiel, <i>Chemical Reaction Engineering</i> , 3 rd Ed., Wiley Eastern, 2006.
3.	
References: (Format: Authors, <i>Book Title in Italics font</i> , Volume/Series, Edition Number, Publisher, Year.)	
1	J. M. Smith, <i>Chemical Engineering Kinetics</i> , 3 rd Ed., McGraw-Hill Education India Pvt. Ltd - New Delhi, 2014.

Detailed Course Content (Optional)		
It will not be included in the Courses of Study Booklet		
Sl. No.	Broad Title / Topics	Number of Lectures
1		
Total Number of Lectures =		

In case of revision of existing course, Please provide below the details of existing course.	
EXISTING COURSE	
Course Number, Title, L-T-P-C:	
Pre-Requisite (if any)	
Contents:	
References:	



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Indian Institute of Technology Guwahati Proposal for a New Course / Revision of a Course

Course Number & Title: CL 3103 & Process Control and Instrumentation	
L-T-P-C: 3-1-0-8	
Type of Letter Grading (Regular Letter Grades / PP or NP Letter Grades): Regular Letter Grades	
Kind of Proposal (New Course / Revision of Existing Course): Revision of Existing New Course	
Offered as (Compulsory / Elective): Compulsory	
Offered to: BTech Chemical Engineering	
Offered in (Odd/ Even / Any):	
Offered by (Name of Department/ Center): Chemical Engineering	
Pre-Requisite: None	
Preamble / Objectives (Optional):	
Course Content/ Syllabus : <i>First principles model development; dynamics of first, second and higher order linear systems, open loop and closed loop systems; linearization; Laplace transform; feedback control; stability analysis; root locus diagram; frequency response analysis; Bode stability criterion; Nyquist stability criterion. Design of controller; dynamics of complex processes; control valves; cascade, feed forward, adaptive control, ratio control. Introduction to process instrumentation Process Flow Diagram (PFD), Process & Instrumentation Diagram (P&ID), Actuators: Pneumatic Valve, Hydraulic actuator, Electric actuator; Sensors: Temperature Measuring Devices, Pressure Measuring Devices; Flow Measuring Devices.</i>	
Books (In case UG compulsory courses, please give it as "Text books" and "Reference books". Otherwise give it as "References".	
Texts: (Format: Authors, <i>Book Title in Italics font</i> , Volume/Series, Edition Number, Publisher, Year.)	
1.	G. Stephanopoulos, <i>Chemical Process Control: An Introduction to Theory and Practice</i> , Prentice-Hall, 1984.
2.	Nakra, B. C. and Chaudhry, K. K. (2017). <i>Instrumentation, Measurement and Analysis</i> , 4th Edition. McGraw Hill Education (India) Pvt. Ltd., New Delhi. ISBN: 978-93-85880-62-9
3.	D. R. Coughanowr, and S. E. LeBlanc, <i>Process Systems Analysis and Control</i> , 3rd Edition, McGraw-Hill, 2009.
References: (Format: Authors, <i>Book Title in Italics font</i> , Volume/Series, Edition Number, Publisher, Year.)	
1.	L. Luyben, <i>Process Modelling Simulation and Control for Chemical Engineers</i> , 2nd Edition, McGraw-Hill, 1990.
2.	Eckman, Donal P. (2004). <i>Industrial Instrumentation</i> . CBS Publishers & Distributors. ISBN: 9788123908106
3.	C. D. Johnson, <i>Process Control Instrumentation Technology</i> , 8th Edition, Pearson Education, 2005.
4.	Doebelin, Ernest O. (1990). <i>Measurement Systems: Application and Design</i> , 4th Edition. McGraw Hill Publishing Company.

Detailed Course Content (Optional)
It will not be included in the Courses of Study Booklet



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Sl. No.	Broad Title / Topics	Number of Lectures
1		
2		
3		
4		
5		
Total Number of Lectures =		

In case of revision of existing course, Please provide below the details of existing course.

EXISTING COURSE

Course Number, Title, L-T-P-C: CL 303. Process Control and Instrumentation 3-1-0-8

Pre-Requisite (if any)

Contents: First principles model development; dynamics of first, second and higher order linear systems, open loop and closed loop systems; linearization; feedback control; stability; root locus diagram; frequency response analysis; Bode stability criterion; Nyquist stability criterion. Design of controller; dynamics of some complex processes; control valves and introduction to real time computer control of process equipment; cascade, feed forward, adaptive control, ratio control. Introduction to advance control strategies; Introduction to process instrumentation Process Flow Diagram (PFD), Actuators: Pneumatic Valve, Hydraulic actuator, Electric actuator; Sensors: Temperature Measuring Devices, Pressure Measuring Devices; Flow Measuring Devices.

Texts:

1. D. R. Coughanowr, and S. E. LeBlanc, Process Systems Analysis and Control, 3rd Edition, McGraw-Hill, 2009.
2. G. Stephanopoulos, Chemical Process Control: An Introduction to Theory and Practice, Prentice-Hall, 1984.

References:

1. L. Luyben, Process Modelling Simulation and Control for Chemical Engineers, 2nd Edition, McGraw-Hill, 1990.
2. C. D. Johnson, Process Control Instrumentation Technology, 8th Edition, Pearson Education, 2005.



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Indian Institute of Technology Guwahati Proposal for a New Course / Revision of a Course

Course Number & Title: CL3104H – AI/ML in Chemical Engineering	
L-T-P-C: 2–0–2–3	
Type of Letter Grading (Regular Letter Grades / PP or NP Letter Grades): Regular Letter Grades	
Kind of Proposal (New Course / Revision of Existing Course): New Course	
Offered as (Compulsory / Elective): Compulsory	
Offered to: UG, 3 rd year Students of CL	
Offered in (Odd/ Even / Any): Odd	
Offered by (Name of Department/ Center): CL	
Pre-Requisite: None	
Preamble / Objectives (Optional): This course equips chemical engineering undergraduates with the knowledge to apply AI/ML methods in real-world chemical engineering domains, focusing on decision support systems (DSS), advanced process control (APC), digital twins, and condition monitoring. Students will learn to integrate chemical engineering knowledge with AI/ML tools, emphasizing hybrid modeling, reinforcement learning for process control, predictive maintenance, and explainable AI for safe and interpretable deployment	
Course Content/ Syllabus: Applications of AI/ML in Chemical Engineering: Process data handling and feature engineering; Hybrid modeling – integration of first-principles and data-driven models; AI/ML in process monitoring, fault detection, and condition monitoring; Soft sensors for process variables; Data-driven decision support systems; AI-enhanced advanced process control (APC) strategies; Reinforcement learning in dynamic process optimization and control; Digital twins for chemical plants; Predictive maintenance and reliability engineering; Explainable AI and uncertainty quantification for safe decision-making.	
Books (In case UG compulsory courses, please give it as “Text books” and “Reference books”. Otherwise give it as “References”).	
Texts: (Format: Authors, <i>Book Title in Italics font</i> , Volume/Series, Edition Number, Publisher, Year.)	
1.	Romagnoli J.A., Briceño-Mena L., Manee V., <i>AI in Chemical Engineering: Unlocking the Power Within Data</i> , CRC Press, 2024
2.	Sanchez Medina, del Rio Chanona & Ganzer, <i>Machine Learning in Chemical Engineering (Open-access JupyterBook)</i> , 2023
3.	
References: (Format: Authors, <i>Book Title in Italics font</i> , Volume/Series, Edition Number, Publisher, Year.)	
1	Roffel B. & Betlem B., <i>Process Dynamics and Control: Modeling for Control and Prediction</i> , Wiley, 2006
2	Kano M. & Nagao K., “Data-based process monitoring, process control, and quality improvement,” <i>Computers & Chemical Engineering</i> , Elsevier
3	Wang Q., <i>Machine Learning in Chemical Safety and Health: Fundamentals with Applications</i> , Wiley, 2022

Detailed Course Content (Optional)



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It will not be included in the Courses of Study Booklet		
Sl. No.	Broad Title / Topics	Number of Lectures
1	Role of AI/ML in chemical engineering; DSS, APC, digital twins; Overview of process data characteristics	2
2	Hybrid modeling – coupling first-principles with data-driven models	4
3	AI/ML for process monitoring and fault detection (PCA, ICA, anomaly detection pipelines)	6
4	Soft sensors & surrogate models for property estimation and real-time monitoring	4
5	Reinforcement learning for chemical process control (example distillation, reactors, batch processes)	4
6	Condition monitoring & predictive maintenance (rotating equipment, pumps, compressors, membranes)	4
7	Introduction to Explainable AI and uncertainty quantification in chemical process DSS	2
8	Case studies: digital twins, AI-assisted APC in industries	2
Total Number of Lectures =		28

In case of revision of existing course, Please provide below the details of existing course.

EXISTING COURSE

Course Number, Title, L-T-P-C:

Pre-Requisite (if any)

Contents:

References:



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Indian Institute of Technology Guwahati Proposal for a New Course / Revision of a Course

Course Number & Title: CL3105 Process Equipment Design	
L-T-P-C: 1-0-3-5	
Type of Letter Grading (Regular Letter Grades / PP or NP Letter Grades): Regular Letter Grades	
Kind of Proposal (New Course / Revision of Existing Course): REVISION OF EXISTING NEW COURSE	
Offered as (Compulsory / Elective): COMPULSORY	
Offered to: Second year chemical engineering	
Offered in (Odd/ Even / Any): IV (Even)	
Offered by (Name of Department/ Center): Chemical Engineering	
Pre-Requisite: CL 204 (Heat Transfer)	
Preamble / Objectives (Optional):	
Course Content/ Syllabus: Design preliminaries including material selection, theory of hoop, longitudinal and radial stress; Vessel's enclosures; Nozzle design; Vessel under external pressure; Tall vessel; Design of supports; High-pressure vessel; Heat exchanger design including Double pipe, Shell and tube, Plate type; Design of evaporator, reboiler, condenser; Heat exchanger network design using pinch method.	
Books (In case UG compulsory courses, please give it as "Text books" and "Reference books". Otherwise give it as "References".	
Texts: (Format: Authors, <i>Book Title in Italics font</i> , Volume/Series, Edition Number, Publisher, Year.)	
1.	B. C. Bhattacharyya, Introduction to Chemical Equipment Design, CBS Publishers & Distributors, New Delhi, 2009.
2.	B. K. Dutta, Heat transfer, Principles and Application, PHI Pvt. Ltd., 2006.
3.	R. Smith, Chemical Process Design and Integration, Authorized reprint by Wiley India (P) Ltd., New Delhi, 2012.
References: (Format: Authors, <i>Book Title in Italics font</i> , Volume/Series, Edition Number, Publisher, Year.)	
1	L. E. Brownell and E. H. Young, Process Equipment Design, John Wiley and Sons, Inc., New York, 2010.
2	E. Ludwig, Chemical Process Equipment Design, Gulf Pub., 3rd Ed., 2002.
3	M. V. Joshi & V. V. Mahajani, Process Equipment Design, Macmillan India Ltd., 2009, CAD.
4	J. Douglas, Conceptual Design of Chemical Processes, McGraw-Hill, 1988.
5	Chemical Engineers Handbook by R. H. Perry and C. H. Chilton.
6	J. M. Coulson, J. F. Richardson and R. K. Sinnott, Coulson and Richardson's Chemical Engineering: Chemical Engineering Design (vol. 6), 3rd. Ed., Butterworth - Heinemann, (Indian Print) 2004.



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Detailed Course Content (Optional)		
It will not be included in the Courses of Study Booklet		
Sl. No.	Broad Title / Topics	Number of Lectures
1		
2		
3		
4		
5		
Total Number of Lectures =		

In case of revision of existing course, Please provide below the details of existing course.
EXISTING COURSE
Course Number, Title, L-T-P-C: CL 209 Process Equipment Design 1-0-3-5
Pre-Requisite (if any) CL 204 Heat Transfer
Contents: Design preliminaries including material selection, theory of hoop, longitudinal and radial stress; Design of vessel's enclosures: Flat, Conical, Torispherical and Ellipsoidal; Nozzle design; Design of vessel under external pressure; Design of tall vessel; Design of supports; Design of high-pressure vessel; Design of double pipe, shell and tube, and plate heat exchangers; Design of reboiler; Design of condenser; Design of heat exchanger network using pinch method.
References: Text Books: 1. B. C. Bhattacharyya, Introduction to Chemical Equipment Design, CBS Publishers & Distributors, New Delhi, 2009. 2. B. K. Dutta, Heat transfer, Principles and Application, PHI Pvt. Ltd., 2006. 3. R. Smith, Chemical Process Design and Integration, Authorized reprint by Wiley India (P) Ltd., New Delhi, 2012. Reference Books: 1. L. E. Brownell and E. H. Young, Process Equipment Design, John Wiley and Sons, Inc., New York, 2010. 2. E. Ludwig, Chemical Process Equipment Design, Gulf Pub., 3rd Ed., 2002. 3. M. V. Joshi & V. V. Mahajani, Process Equipment Design, Macmillan India Ltd., 2009, CAD. 4. J. M. Coulson, J. F. Richardson and R. K. Sinnott, Coulson and Richardson's Chemical Engineering: Chemical Engineering Design (vol. 6), 3rd. Ed., Butterworth - Heinemann, (Indian Print) 2004. 5. S. M. Walas, Chemical Process Equipment Selection and Design, Butterworth-Heinemann, 2010. 6. D. Q. Kern, Process Heat Transfer, McGraw Hill Book Company, 2010. 7. J. Douglas, Conceptual Design of Chemical Processes, McGraw-Hill, 1988. 8. Chemical Engineers Handbook by R. H. Perry and C. H. Chilton.



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Indian Institute of Technology Guwahati Proposal for a New Course / Revision of a Course

Course Number & Title: CL3106H & Process Safety		
L-T-P-C: 3-0-0-3		
Type of Letter Grading (Regular Letter Grades / PP or NP Letter Grades): Regular		
Kind of Proposal (New Course / Revision of Existing Course): New Course		
Offered as (Compulsory / Elective): Compulsory		
Offered to: B.Tech (Third Year)		
Offered in (Odd/ Even / Any): Odd		
Offered by (Name of Department/ Center): Chemical Engineering		
Pre-Requisite: Nil		
<p>Preamble: A chemical engineer needs to be aware of different risks and safety protocols associated with various processes, and relevant regulations. The identification, evaluation and mitigation of the associated risk is an integral part of chemical process design. This course aims to introduce the important aspects of chemical process safety to the undergraduate students.</p>		
<p>Course Content/Syllabus: Overview of process safety, Concerns and remediations; Effect of toxicants, dose versus response, threshold limits and elimination; Government regulations and codes; Evaluation of industrial hygiene; Toxic release and dispersion; Fires and explosions; Introduction to Reliefs; Hazard identification and risk assessment- Hazard and Operability Study (HAZOP), Layers of Protection Analysis (LOPA).</p>		
<p>Textbooks: Crowl D A and Louvar J F, Chemical Process Safety: Fundamentals with Applications, 4th Edition, Pearson India, 2019.</p>		
References:		
1	Kletz T, What went wrong: Case Histories of Process Plant Disasters and How They Could Have Been Avoided, 6th Edition, Butterworth-Heinemann 2019	
2	Kletz T and Amyotte P, Process Plants: A Handbook for Inherently Safer Design, 2nd Edition, CRC Press, 2010.	
3	Lees F, Loss Prevention in the Process Industries: Hazard Identification, Assessment and Control, 4th Edition, Butterworth-Heinemann, 2012.	
4	Krishnan, R., Saxena, A.K., Chemical process safety and hazard management, JNANADA PRAKASHAN (P&D) · ISBN-13. 978-8171397952.2017	
Detailed Course Content (Optional) It will not be included in the Courses of Study Booklet		
Sl. No.	Broad Title / Topics	Number of Lectures
1	Overview of process safety	2
2	Toxicology	4
3	Industrial hygiene	4
4	Toxic release and dispersion	2
5	Fires and explosions	4



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6	Introduction to Reliefs	1
7	HAZOP	2
8	LOPA	2
Total Number of Lectures =		21

In case of revision of existing course, Please provide below the details of existing course.

EXISTING COURSE

Course Number, Title, L-T-P-C:

Pre-Requisite (if any)

Contents:

References:



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Indian Institute of Technology Guwahati
Proposal for a New Course / Revision of a Course

Course Number & Title: CL 3111L & Mechanical and Solid-Fluid operations Lab	
L-T-P-C: 0 - 0 - 3 - 3	
Kind of Proposal (New Course / Revision of Existing Course(s)): Revision of Existing Course	
Offered as (Compulsory / Elective): Compulsory	
Offered to: BTech in Chemical Engineering	
Offered in (Odd/ Even / Any): Odd	
Offered by (Name of Department/ Center): Chemical Engg	
Pre-Requisite: Solid Fluid Operations subject knowledge	
Preamble / Objectives (Optional):	
Course Content/ Syllabus: Experiment 1: Roll Crusher; Experiment 2: Jaw & Vibrating screen; Experiment 3: Rotary Drum Vacuum Filter; Experiment 4 Sedimentation; Experiment 5 Plate & Frame_ Filter Press; Experiment 6 Cyclone Separator; Experiment 7 Cyclone Scrubber; Experiment 8 Hammer Mill; Experiment 9 Elutriator; Like for all experiments	
Textbooks:	
1.	
2.	
References:	
1	Foust, A. S. (1980). Principles of unit operations (2nd ed., pp. 621–622). Wiley.
2	Coulson, J. M., & Richardson, J. F. (1991). Chemical engineering: Vol. 2 (4th ed., pp. 39–42). Asian Books Pvt. Ltd.
3	McCabe, W. L., & Smith, J. C. (2005). Unit operations of chemical engineering (7th ed., pp. 1066–1069). McGraw-Hill.
4	Perry, R. H., & Chilton, C. H. (Eds.). (1977). The chemical engineers' handbook (5th ed., pp. 12/13–12/15). McGraw-Hill.
5	Brown, G. G. (1995). Unit operations (1st ed., p. 32). CBS Publishers & Distributors.



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Indian Institute of Technology Guwahati
Proposal for a New Course / Revision of a Course

Course Number & Title: CL3201 & Transport Phenomena		
L-T-P-C: 2-1-0-6		
Type of Letter Grading (Regular Letter Grades / PP or NP Letter Grades): Regular Letter Grades		
Kind of Proposal (New Course / Revision of Existing Course): Revision New Course		
Offered as (Compulsory / Elective): Compulsory		
Offered to: BTech Third Year		
Offered in (Odd/ Even / Any): Even		
Offered by (Name of Department/ Center): Chemical Engineering		
Pre-Requisite: None		
Preamble / Objectives (Optional):		
Course Content/ Syllabus: Introduction to transport phenomena, Vector and tensor calculus; Mechanisms of momentum transport: shell momentum balances, conservation equations for isothermal systems; Laminar flow applications; Potential flow, Boundary layer theory; Introduction to non-Newtonian fluid dynamics; Transport equations of turbulence; Mechanisms of energy transport-shell energy balances, temperature distribution in solids and laminar flow, Equations of change for non-isothermal systems and applications; Mechanisms of mass transport-shell mass balances, mass transport with and without reaction, multicomponent systems; Simultaneous heat, mass, and momentum transfer..		
Books (In case UG compulsory courses, please give it as "Text books" and "Reference books". Otherwise give it as "References".		
Text: (Format: Authors, <i>Book Title in Italics font</i> , Volume/Series, Edition Number, Publisher, Year.)		
1.	R. Bird, E. W. Stewart, N. E. Lightfoot, <i>Transport Phenomena</i> , 2 nd Edition, John Wiley & Sons, 2003.	
References: (Format: Authors, <i>Book Title in Italics font</i> , Volume/Series, Edition Number, Publisher, Year.)		
1	William M. Dean, <i>Analysis of Transport Phenomena</i> , 2 nd Edition, Oxford University Press, 2010.	
2	G. Leal, <i>Advanced Transport Phenomena</i> , Cambridge University Press, 2007.	
3	K. S. Gandhi, <i>Heat and Mass Transfer: A Transport Phenomena Approach</i> , New Age International Publishers, 2011.	
4	V. Kumaran, <i>Fundamentals of Transport Processes with Applications</i> , Cambridge IISc Series, 2022	
Detailed Course Content (Optional) It will not be included in the Courses of Study Booklet		
Sl. No.	Broad Title / Topics	Number of Lectures
1		
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Total Number of Lectures =

In case of revision of existing course, Please provide below the details of existing course.

EXISTING COURSE

Course Number, Title, L-T-P-C: **CL 305, Transport Phenomena** **2-1-0-6**

Pre-Requisite (if any): **NIL**

Contents: Introduction to transport phenomena; Vector and tensor calculus; Mechanisms of momentum transport: shell momentum balances, mass and momentum conservation equations for isothermal systems; Applications of differential equations of mass and momentum conservation for laminar flow; Potential flow; Boundary Layer theory; Mechanisms of energy transport: shell energy balances, temperature distribution in solids and in laminar flow; Equations of change for non-isothermal systems; Applications of equations of change; Mechanisms of mass transport: shell mass balances and its applications, multi-component systems; Simultaneous heat, mass and momentum transfer.

Text:

1. R. Bird, E. W. Stewart, N. E. Lightfoot, *Transport Phenomena*, 2nd Edition, John Wiley & Sons, 2003.

References:

1. M. Dean, *Analysis of Transport Phenomena*, 2nd Edition, Oxford University Press, 2010.
2. G. Leal, *Advanced Transport Phenomena*, Cambridge University Press, 2007.
3. S. Gandhi, *Heat and Mass Transfer: A Transport Phenomena Approach*, New Age International Publishers, 2011.



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Indian Institute of Technology Guwahati Proposal for a New Course / Revision of a Course

Course Number & Title: CL 3202 & Chemical Process Technology	
L-T-P-C: 3-0-0-6	
Type of Letter Grading (Regular Letter Grades / PP or NP Letter Grades): Regular Letter Grades	
Kind of Proposal (New Course / Revision of Existing Course): New Course	
Offered as (Compulsory / Elective): Compulsory	
Offered to: III rd Year B Tech Students	
Offered in (Odd/ Even / Any): Even	
Offered by (Name of Department/ Center): Department of Chemical Engineering	
Pre-Requisite: N/A	
Preamble / Objectives (Optional):	
Course Content/ Syllabus Overview of process flow-sheeting; Prominence of process utilities, Petroleum process technology: Overview of crude oil refinery processes, Crude distillation, Hydro processing, Reforming, Isomerization, Alkylation, Vis-breaking and Asphaltting; Petrochemical industries: Methanol (C1), Naphtha steam cracking and Ethanol(C2), Propylene (C3), Butadiene, Acrylonitrile and Styrene (C4), PVC, PE, PP, polyester, Styrene butadiene rubber (SBR); Introduction to bio-refineries. Biobased chemicals, Sugar and edible oil industries, Sulphur production and sulphuric acid industries; nitrogen industries: ammonia, nitric acid, urea; Phosphorous industries: production of elemental phosphorous, P ₂ O ₅ , H ₃ PO ₄ , mixed fertilizers; Chlor-Alkali industries; Cement industries, Glass and ceramics industries, Soaps and detergents; Pulp and paper industries; Coal and coal chemicals; Nuclear Fuel Cycles; Integrated process and product Innovation and design.	
Books (In case UG compulsory courses, please give it as "Text books" and "Reference books". Otherwise give it as "References".	
Texts: (Format: Authors, <i>Book Title in Italics font</i> , Volume/Series, Edition Number, Publisher, Year.)	
1.	G. Rao and M. Sittig, <i>Dryden's Outlines of Chemical Technology</i> , WEP East-West Press, 3rd Edition, 2010.
2.	A. Moulijn, M. Makkee, A. E. V. Diepen, <i>Chemical Process Technology</i> , John Wiley, 2nd Edition, 2013
References: (Format: Authors, <i>Book Title in Italics font</i> , Volume/Series, Edition Number, Publisher, Year.)	
1.	H. Groggins, <i>Unit Processes in Organic Synthesis</i> , 5th Edition, McGraw Hill, 1984. 2.
2.	D. Mall, <i>Petrochemical Process Technology</i> , McMillan India.
3.	K. Doraiswamy, <i>Organic Synthesis Engineering</i> , Oxford University Press, 2001
4.	T. Austin, <i>Chemical Process Industries</i> , 5th Edition, Tata McGraw-Hill, New Delhi, 1984.
5.	L. Cussler and G.D. Moggridge, <i>Chemical Product Design</i> , University of Cambridge, 6th Edition, 2011.

Detailed Course Content (Optional)
It will not be included in the Courses of Study Booklet



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Sl. No.	Broad Title / Topics	Number of Lectures
1		
2		
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Total Number of Lectures =		

In case of revision of existing course, Please provide below the details of existing course.

EXISTING COURSE

Course Number, Title, L-T-P-C: 3-0-0-6

Pre-Requisite (if any) NIL

Contents: Introduction to chemical process technology; Overview of process flow-sheeting; Petroleum process technology: Overview of crude oil refinery processes, Crude distillation, Hydro processing, Vis-breaking and Solvent Asphaltting; Petrochemical industries: Methanol (C1), Naphtha steam cracking (C2), Propylene (C3), Butadiene and Styrene (C4), PVC, PP & PE processes; Sulphur production and sulphuric acid industries; nitrogen industries: ammonia, nitric acid, urea; Phosphorous industries: production of elemental phosphorous, P_2O_5 , H_3PO_4 , mixed fertilizers; Chlor-Alkali industries; Cement industries; Soaps and detergents; Pulp and paper industries; Coal and coal chemicals; integrated and energy efficient flow-sheeting; Integrated process and product design; Introduction to bio-refineries.

Texts:

1. G. Rao and M. Sittig, *Dryden's Outlines of Chemical Technology*, WEP East-West Press, 3rd Edition, 2010.
2. T. Austin, *Chemical Process Industries*, 5th Edition, Tata McGraw-Hill, New Delhi, 1984.
3. L. Cussler and G.D. Moggridge, *Chemical Product Design*, University of Cambridge, 6th Edition, 2011.

References:

1. H. Groggins, *Unit Processes in Organic Synthesis*, 5th Edition, McGraw Hill, 1984.
2. D. Mall, *Petrochemical Process Technology*, McMillan India.
3. K. Doraiswamy, *Organic Synthesis Engineering*, Oxford University Press, 2001
4. A. Moulijn, M. Makkee, A. E. V. Diepen, *Chemical Process Technology*, John Wiley, 2nd Edition, 2013.



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Indian Institute of Technology Guwahati Proposal for a New Course / Revision of a Course

Course Number & Title: CL 3203 & Process Engineering and Economics	
L-T-P-C: 2-1-0-6	
Type of Letter Grading (Regular Letter Grades / PP or NP Letter Grades): REGULAR	
Kind of Proposal (New Course / Revision of Existing Course): Revision of existing course	
Offered as (Compulsory / Elective): Compulsory	
Offered to: Third Year BTech Chemical Engineering	
Offered in (Odd/ Even / Any): VI (EVEN)	
Offered by (Name of Department/ Center): CHEMICAL ENGINEERING	
Pre-Requisite: CL 3101 and CL 3105	
Preamble / Objectives (Optional):	
Course Content/ Syllabus Input Information for-batch and continuous system; Input-output structure of the flow sheet; Recycle structure of the flow sheet; Application of separation system principles for case studies; Cost diagrams and screening of process alternatives; Preliminary process optimization; process retrofitting; Equipment sizing and costing for different process units; Cost information; Estimating capital and operating costs; Total capital investment and total product costs; Time value of money; Measures of process profitability; Simplifying economic analysis for conceptual designs; Techno-economic feasibility report writing.	
Books (In case UG compulsory courses, please give it as "Text books" and "Reference books". Otherwise give it as "References".)	
Texts: (Format: Authors, <i>Book Title in Italics font</i> , Volume/Series, Edition Number, Publisher, Year.)	
1.	Timmerhaus, <i>Plant Design and Economics for Chemical Engineers</i> , 5 th Edition, McGraw-Hill, 2011.
2.	Smith, J.M. <i>Chemical Process Design and Integration</i> , 8 th Edition, Wiley, 2006.
3.	
References: (Format: Authors, <i>Book Title in Italics font</i> , Volume/Series, Edition Number, Publisher, Year.)	
	T. Biegler, I.E. Grossmann, A.W. Westerberg, <i>Systematic Methods of Chemical Process Design</i> , Prentice Hall International Series, 1997.
	Douglas, <i>Conceptual Design of Chemical Processes</i> , McGraw Hill, 1989.
	E. Ludwig, <i>Applied Project Engineering</i> , 2 nd Edition, Gulf Publishing Company, 1988.

Detailed Course Content (Optional)		
It will not be included in the Courses of Study Booklet		
Sl. No.	Broad Title / Topics	Number of Lectures
1		
2		
3		
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5		
Total Number of Lectures =		



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EXISTING COURSE

Course Number, Title, L-T-P-C:

Pre-Requisite (if any)

Contents:

References:



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Indian Institute of Technology Guwahati
Proposal for a New Course / Revision of a Course

Course Number & Title: CL3204 & Computer Aided Process Equipment Design	
L-T-P-C:0-0-3-3	
Type of Letter Grading (Regular Letter Grades / PP or NP Letter Grades): Regular Letter Grades	
Kind of Proposal (New Course / Revision of Existing Course): Revision New Course	
Offered as (Compulsory / Elective): Compulsory Laboratory Course	
Offered to: BTech Third Year	
Offered in (Odd/ Even / Any): Even	
Offered by (Name of Department/ Center): Chemical Engineering	
Pre-Requisite: None	
Preamble / Objectives (Optional):	
Course Content/ Syllabus	
<p>Computer-aided design, flowsheet formulation and analysis of chemical process equipment and processes involving Distillation, Extraction, Absorption, Adsorption, Heat Transfer and Reaction Kinetics, Internal flows, Flow around a cylinder and Cavity flow using required computational tools such as ASPEN/MATLAB/ ANSYS CFD/COMSOL etc.</p>	
Books (In case UG compulsory courses, please give it as “Text books” and “Reference books”. Otherwise give it as “References”).	
Texts: (Format: Authors, <i>Book Title in Italics font</i> , Volume/Series, Edition Number, Publisher, Year.)	
1.	
2.	
3.	
Text/References: (Format: Authors, <i>Book Title in Italics font</i> , Volume/Series, Edition Number, Publisher, Year.)	
1	M. Kamal, Al-Malah, <i>ASPEN PLUS®: Chemical Engineering Applications</i> , John Wiley & Sons, Inc., Hoboken, New Jersey, 2017
2	Juma Haydary, <i>Chemical Process Design and Simulation: Aspen Plus and HYSYS Applications</i> – John Wiley & Sons, Inc., Hoboken, New Jersey, 2019
3	Jiyuan Tu, Guan Heng Yeoh, Chaoqun Liu, Yao Tao, <i>Computational Fluid Dynamics: A Practical Approach</i> (4th Edition) – (Elsevier, 2024)
4	Schefflan, Teach Yourself, <i>The Basics of ASPEN PLUS</i> , 2nd Edition, John Wiley & Sons, Inc., Hoboken, New Jersey, 2016

Detailed Course Content (Optional)		
It will not be included in the Courses of Study Booklet		
Sl. No.	Broad Title / Topics	Number of Lectures



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1		
2		
Total Number of Lectures =		

In case of revision of existing course, Please provide below the details of existing course.

EXISTING COURSE

Course Number, Title, L-T-P-C:0-0-0-3, Computer Aided Process Equipment Design

Pre-Requisite (if any): NIL

Contents: Computer aided design of chemical process engineering equipment and processes using ASPEN and MATLAB. Computer aided analysis of chemical process equipment and processes using Computational fluid dynamics software

References:

1. Schefflan, Teach Yourself, The Basics of ASPEN PLUSTM, 2nd Edition, John Wiley & Sons, Inc., Hoboken, New Jersey, 2016
2. M. Kamal, Al-Malah, ASPEN PLUS®: Chemical Engineering Applications, John Wiley & Sons, Inc., Hoboken, New Jersey, 2017.
3. Sharma, Introduction to Computational Fluid Dynamics - Development, Application and Analysis, John Wiley & Sons, 2017.
4. Versteeg, W. Malalasekara, Introduction to Computational Fluid Dynamics, 2nd Edition, Pearson Education India, 2007.



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Indian Institute of Technology Guwahati Proposal for Revision of a Course

Course Number & Title: CL 3211L/S & Technical Presentation and Writing	
L-T-P-C: 0-0-2-2	
Type of Letter Grading (Regular Letter Grades / PP or NP Letter Grades): Regular Letter Grades	
Kind of Proposal (New Course / Revision of Existing Course): New course	
Offered as (Compulsory / Elective): Compulsory	
Offered to: B.Tech (Chemical Engineering 2nd Year Students)	
Offered in (Odd/ Even / Any): Even	
Offered by (Name of Department/ Center): Chemical Engineering	
Pre-Requisite: NIL	
Preamble / Objectives (Optional): The course aims to develop students' proficiency in both technical presentation and technical writing. It focuses on the principles and methodologies for effectively communicating technical information, including the concise presentation of background, materials and methods, results and discussion, conclusions, and future perspectives. In parallel, the course emphasizes technical writing skills, including structuring reports, sequencing content coherently, adhering to standard formats for various sections, optimizing flow, and applying proper referencing and captioning styles.	
Course Content/ Syllabus Technical Presentation: Principles of Oral Technical Presentation; Methodologies for the concise presentation of background/overview of the field of study; materials & methods; results & discussion, conclusions & future perspectives; Rules associated to Visuals, Tables and Bulleted text; Literature comparison table preparation; optimizing content and presentation; mock presentation and feedback based improvements; troubleshooting communication, technical depth, and timing issues; case studies and laboratory exercises for technical presentation. Technical Writing: Principles of technical writing; technical presentation as a note summary of technical report; structure of a technical writing report; sequencing content within a section as per the themes of paragraphs; standard formats for the presentation of introduction, materials & methods; results & discussion, conclusions & future perspectives of a technical report; optimizing flow; reference formatting and styling; style of writing captions for sections, figures and tables; case studies and laboratory exercises.	
Books (In case UG compulsory courses, please give it as "Text books" and "Reference books". Otherwise give it as "References".	
Texts: (Format: Authors, <i>Book Title in Italics font</i> , Volume/Series, Edition Number, Publisher, Year.)	
1.	K. G. Budinsk, <i>Engineer's Guide to Scientific Writing</i> , ASM International, 2001.
2.	W. Sullivan, <i>Technical Presentation Workbook: Winning Strategies for Effective Public Speaking</i> , 3rd Edition (revised), American Society for Mechanical Engineers, 2010.
References: (Format: Authors, <i>Book Title in Italics font</i> , Volume/Series, Edition Number, Publisher, Year.)	
1.	Alley, M. (2018). <i>The Craft of Scientific Presentations: Critical Steps to Succeed and Critical Errors to Avoid</i> . 2nd Edition. Springer.



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2.	Gerson, S. J., & Gerson, S. M. (2017). Technical Writing: Process and Product. 5th Edition. Pearson.
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Detailed Course Content (Optional)		
It will not be included in the Courses of Study Booklet		
Sl. No.	Broad Title / Topics	Number of Lectures
1		
2		
3		
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Total Number of Lectures =		

In case of revision of existing course, Please provide below the details of existing course.
EXISTING COURSE
Course Number, Title, L-T-P-C:
Pre-Requisite (if any)
Contents:



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Proposal for Revision of a Course

Course Number & Title: CL 3212L & Mass Transfer Lab	
L-T-P-C: 0-0-3-3	
Kind of Proposal (New Course / Revision of Existing Course(s)): Revision of Existing Course	
Offered as (Compulsory / Elective): Compulsory	
Offered to: BTech in Chemical Engineering	
Offered in (Odd/ Even / Any): Even/ Session: Jan- May (Winter)	
Offered by (Name of Department/ Center): Chemical Engg.	
Pre-Requisite:	
Preamble / Objectives (Optional): The objective is to bridge theoretical knowledge of mass transfer with practical skills in experimentation, data handling, equipment operation, and industrial applications.	
Course Content/ Syllabus: Experiment 1: Rotary Dryer; Experiment 2: Water Cooling Tower; Experiment 3: Packed Bed Distillation Column; Experiment 4: Humidification & Dehumidification; Experiment 5: Liquid-liquid Extraction in Packed Tower; Experiment 6: Forced Draft Tray Dryer; Experiment 7: Mass Transfer with/without Chemical Reaction; Experiment 8: Absorption in Packed Bed; Experiment 9: Vapor in Air Diffusion; Experiment 10: Batch Crystallization; Experiment 11: Fluidized bed dryer; Experiment 12: Bubble Cap Distillation	
Textbooks:	
1.	<i>Mass Transfer Operations</i> (McGraw Hill)-Treybal, R.E.
2.	<i>Unit Operations of Chemical Engineering</i> (McGraw Hill)-McCabe, W.L., Smith, J.C., & Harriott, P.
References:	
1	<i>Transport Processes and Separation Process Principles</i> (Prentice Hall / Pearson)-Geankoplis, C.J.
2	Principles of Mass Transfer and Separation Processes (Prentice Hall of India, Eastern Economy Edition)-B.K. Dutta



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Indian Institute of Technology Guwahati
Proposal for Revision of a Course

Course Number & Title: CL 3213L & Reaction Engineering Lab
L-T-P-C: 0-0-3-1.5
Kind of Proposal (New course/Revision of Existing course(s): Revised
Offered as Compulsory/Elective: Compulsory
Offered to: B Tech in Chemical Engineering
Offered in (odd/Even/any): Even
Offered by (Name of Department/Center) : Chemical Engineering
Pre-Requisite:
Preamble/Objectives (Optional):
Course Content/Syllabus: Experiment 1: Hydrodynamics studies in Trickle Bed Reactor; Experiment 2: RTD study in a CSTR; Experiment 3: RTD studies in a PFR; Experiment 4: Study the effect of non-catalytic homogeneous reaction in a series arrangement of PFTR and CSTR (Combined flow reactor); Experiment 5: Study the performance of a cascade of three equal volume CSTRs in series for the saponification reaction; Experiment 6: Study a non-catalytic homogeneous reaction in a Packed Bed Reactor; Experiment 7: RTD study in a Packed Bed Reactor; Experiment 8: Study of a non-catalytic homogeneous reaction in an Isothermal Batch Reactor.
Textbooks:
References: Levenspiel, O. (2001). Chemical reaction engineering (3rd ed., pp. 90–97, 101–103, 111–112). John Wiley & Sons. Coulson, J. M., & Richardson, J. F. (1991). Chemical engineering: Vol. 3 (4th ed., pp. 34–37, 43–45, 61, 64–65). Asian Books Pvt. Ltd.



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Indian Institute of Technology Guwahati
Proposal for Revision of a Course

Course Number & Title: CL 3214L & Process Control Lab	
L-T-P-C: 0-0-3-1.5	
Kind of Proposal (New Course / Revision of Existing Course(s)): Revision	
Offered as (Compulsory / Elective): Compulsory	
Offered to: BTech in Chemical Engineering	
Offered in (Odd/ Even / Any): Even	
Offered by (Name of Department/ Center): Chemical Engineering	
Pre-Requisite: Theory of Process Control	
Preamble / Objectives (Optional):	
Course Content/ Syllabus: Experiment 1: Control Valve Characteristic; Experiment 2: Two-Tank Non-Interacting System; Experiment 3: Two-Tank Interacting System; Experiment 4: Temperature Control Trainer; Experiment 5: Pressure Control Trainer; Experiment 6: Level Control Trainer; Experiment 7: Flow Control Trainer; Experiment 8: First & Second Order System; Experiment 9: Cascade Control Trainer; Experiment 10: Multi-Process Trainer; Experiment 11: Multi-Variable Control Trainer; Experiment 12: PLC Trainer; Experiment 13: Study of I-P and P-I Converter; Like for all experiments.	
Textbooks:	
1.	
2.	
References:	
1	Coughanowr, D. R. (1991). <i>Process systems analysis and control</i> (2nd ed.). McGraw-Hill.
2	Ogata, K. (2010). <i>Modern control engineering</i> (5th ed.). Prentice Hall.
3	Marlin, T. E. (2000). <i>Process control: Designing processes and control systems for dynamic performance</i> (2nd ed.). McGraw-Hill.
4	University of Michigan. (n.d.). <i>Chemical process dynamics and controls</i> [Open textbook]. https://doi.org/10.3998/etext/



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Indian Institute of Technology Guwahati Proposal for Revision of a Course

Course Number & Title: CL 4101P & Internal BTP – I		
L-T-P-C: 0-0-0-12		
Type of Letter Grading (Regular Letter Grades / PP or NP Letter Grades): Regular Letter Grades		
Kind of Proposal (New Course / Revision of Existing Course): New course		
Offered as (Compulsory / Elective): Any one basket needs to be selected and cannot choose external project in both 7th and 8th semesters.		
Offered to: B.Tech (Chemical Engineering, 4th Year Students)		
Offered in (Odd/ Even / Any): as per options described in course curriculum structure		
Offered by (Name of Department/ Center): Chemical Engineering		
Pre-Requisite: NIL		
Preamble / Objectives (Optional): As per guidelines by supervisor.		
Course Content/ Syllabus As per guidelines by supervisor.		
Books (In case UG compulsory courses, please give it as “Text books” and “Reference books”. Otherwise give it as “References”).		
Texts: (Format: Authors, <i>Book Title in Italics font</i> , Volume/Series, Edition Number, Publisher, Year.)		
1.	As per guidelines by supervisor.	
2.		
References: (Format: Authors, <i>Book Title in Italics font</i> , Volume/Series, Edition Number, Publisher, Year.)		
1.	As per guidelines by supervisor.	
2.		
Detailed Course Content (Optional) It will not be included in the Courses of Study Booklet		
Sl. No.	Broad Title / Topics	Number of Lectures
1		
2		
3		
Total Number of Lectures =		
In case of revision of existing course, Please provide below the details of existing course.		
EXISTING COURSE		
Course Number, Title, L-T-P-C:		
Pre-Requisite (if any)		
Contents:		



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Indian Institute of Technology Guwahati Proposal for Revision of a Course

Course Number & Title: CL 4102P & Project at External Organization		
L-T-P-C: 0-0-0-24		
Type of Letter Grading (Regular Letter Grades / PP or NP Letter Grades): Regular Letter Grades		
Kind of Proposal (New Course / Revision of Existing Course): New course		
Offered as (Compulsory / Elective): Any one basket needs to be selected and cannot choose external project in both 7th and 8th semesters.		
Offered to: B.Tech (Chemical Engineering, 4th Year Students)		
Offered in (Odd/ Even / Any): as per options described in course curriculum structure		
Offered by (Name of Department/ Center): Chemical Engineering		
Pre-Requisite: NIL		
Preamble / Objectives (Optional): To provide students with exposure to real-world practices, advanced methodologies, and professional work environments beyond the parent institute. The objective is to enhance technical knowledge, develop problem-solving and communication skills, and foster industry-academia interaction through hands-on experience, collaborative projects, and practical application of classroom learning.		
Course Content/ Syllabus As per guidelines by external organization		
Books (In case UG compulsory courses, please give it as "Text books" and "Reference books". Otherwise give it as "References".		
Texts: (Format: Authors, <i>Book Title in Italics font</i> , Volume/Series, Edition Number, Publisher, Year.)		
1.	As per guidelines by external organization	
2.		
References: (Format: Authors, <i>Book Title in Italics font</i> , Volume/Series, Edition Number, Publisher, Year.)		
1.	As per guidelines by external organization	
2.		
Detailed Course Content (Optional) It will not be included in the Courses of Study Booklet		
Sl. No.	Broad Title / Topics	Number of Lectures
1		
2		
3		
Total Number of Lectures =		
In case of revision of existing course, Please provide below the details of existing course.		
EXISTING COURSE		
Course Number, Title, L-T-P-C:		
Pre-Requisite (if any)		
Contents:		



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Indian Institute of Technology Guwahati Proposal for Revision of a Course

Course Number & Title: CL 4201P & Internal BTP – II		
L-T-P-C: 0-0-0-12		
Type of Letter Grading (Regular Letter Grades / PP or NP Letter Grades): Regular Letter Grades		
Kind of Proposal (New Course / Revision of Existing Course): New course		
Offered as (Compulsory / Elective): Any one basket needs to be selected and cannot choose external project in both 7th and 8th semesters.		
Offered to: B.Tech (Chemical Engineering, 4th Year Students)		
Offered in (Odd/ Even / Any): as per options described in course curriculum structure		
Offered by (Name of Department/ Center): Chemical Engineering		
Pre-Requisite: NIL		
Preamble / Objectives (Optional): As per guidelines by supervisor.		
Course Content/ Syllabus As per guidelines by supervisor.		
Books (In case UG compulsory courses, please give it as “Text books” and “Reference books”. Otherwise give it as “References”).		
Texts: (Format: Authors, <i>Book Title in Italics font</i> , Volume/Series, Edition Number, Publisher, Year.)		
1.	As per guidelines by supervisor.	
2.		
References: (Format: Authors, <i>Book Title in Italics font</i> , Volume/Series, Edition Number, Publisher, Year.)		
1.	As per guidelines by supervisor.	
2.		
Detailed Course Content (Optional) It will not be included in the Courses of Study Booklet		
Sl. No.	Broad Title / Topics	Number of Lectures
1		
2		
3		
Total Number of Lectures =		
In case of revision of existing course, Please provide below the details of existing course.		
EXISTING COURSE		
Course Number, Title, L-T-P-C:		
Pre-Requisite (if any)		
Contents:		



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Indian Institute of Technology Guwahati Proposal for Revision of a Course

Course Number & Title: CL 4202P & Project at External Organization		
L-T-P-C: 0-0-0-24		
Type of Letter Grading (Regular Letter Grades / PP or NP Letter Grades): Regular Letter Grades		
Kind of Proposal (New Course / Revision of Existing Course): New course		
Offered as (Compulsory / Elective): Any one basket needs to be selected and cannot choose external project in both 7th and 8th semesters.		
Offered to: B.Tech (Chemical Engineering, 4th Year Students)		
Offered in (Odd/ Even / Any): as per options described in course curriculum structure		
Offered by (Name of Department/ Center): Chemical Engineering		
Pre-Requisite: NIL		
Preamble / Objectives (Optional): To provide students with exposure to real-world practices, advanced methodologies, and professional work environments beyond the parent institute. The objective is to enhance technical knowledge, develop problem-solving and communication skills, and foster industry-academia interaction through hands-on experience, collaborative projects, and practical application of classroom learning.		
Course Content/ Syllabus As per guidelines by external organization		
Books (In case UG compulsory courses, please give it as "Text books" and "Reference books". Otherwise give it as "References".		
Texts: (Format: Authors, <i>Book Title in Italics font</i> , Volume/Series, Edition Number, Publisher, Year.)		
1.	As per guidelines by external organization	
2.		
References: (Format: Authors, <i>Book Title in Italics font</i> , Volume/Series, Edition Number, Publisher, Year.)		
1.	As per guidelines by external organization	
2.		
Detailed Course Content (Optional)		
Sl. No.	Broad Title / Topics	Number of Lectures
1		
2		
3		
Total Number of Lectures =		
In case of revision of existing course, Please provide below the details of existing course.		
EXISTING COURSE		
Course Number, Title, L-T-P-C:		
Pre-Requisite (if any)		
Contents:		



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Indian Institute of Technology Guwahati Proposal for Revision of a Course

Course Number & Title: CL 4XXX & Open Elective 1, 2, 3		
L-T-P-C: 3-0-0-6		
Type of Letter Grading (Regular Letter Grades / PP or NP Letter Grades): Regular Letter Grades		
Kind of Proposal (New Course / Revision of Existing Course): New course		
Offered as (Compulsory / Elective): Any one basket needs to be selected and cannot choose external project in both 7th and 8th semesters.		
Offered to: B.Tech (Chemical Engineering 4th Year Students)		
Offered in (Odd/ Even / Any): as per options described in course curriculum structure		
Offered by (Name of Department/ Center): Chemical Engineering		
Pre-Requisite: NIL		
Preamble / Objectives (Optional): As per the approved elective course		
Course Content/ Syllabus: As per the approved elective course		
Books (In case UG compulsory courses, please give it as "Text books" and "Reference books". Otherwise give it as "References".		
Texts: (Format: Authors, <i>Book Title in Italics font</i> , Volume/Series, Edition Number, Publisher, Year.)		
1.	As per the approved elective course	
2.		
References: (Format: Authors, <i>Book Title in Italics font</i> , Volume/Series, Edition Number, Publisher, Year.)		
1.	As per the approved elective course	
2.		
Detailed Course Content (Optional) It will not be included in the Courses of Study Booklet		
Sl. No.	Broad Title / Topics	Number of Lectures
1	Nil	
2		
3		
4		
5		
Total Number of Lectures =		
In case of revision of existing course, Please provide below the details of existing course.		
EXISTING COURSE		
Course Number, Title, L-T-P-C:		
Pre-Requisite (if any)		
Contents:		



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Indian Institute of Technology Guwahati Proposal for Revision of a Course

Course Number & Title: CL 4XXX & Departmental Elective 1, 2, 3		
L-T-P-C: 3-0-0-6		
Type of Letter Grading (Regular Letter Grades / PP or NP Letter Grades): Regular Letter Grades		
Kind of Proposal (New Course / Revision of Existing Course): New course		
Offered as (Compulsory / Elective): Any one basket needs to be selected and cannot choose external project in both 7th and 8th semesters.		
Offered to: B.Tech (Chemical Engineering 4th Year Students)		
Offered in (Odd/ Even / Any): as per options described in course curriculum structure		
Offered by (Name of Department/ Center): Chemical Engineering		
Pre-Requisite: NIL		
Preamble / Objectives (Optional): As per the approved elective course		
Course Content/ Syllabus: As per the approved elective course		
Books (In case UG compulsory courses, please give it as "Text books" and "Reference books". Otherwise give it as "References".		
Texts: (Format: Authors, <i>Book Title in Italics font</i> , Volume/Series, Edition Number, Publisher, Year.)		
1.	As per the approved elective course	
2.		
References: (Format: Authors, <i>Book Title in Italics font</i> , Volume/Series, Edition Number, Publisher, Year.)		
1.	As per the approved elective course	
2.		
Detailed Course Content (Optional) It will not be included in the Courses of Study Booklet		
Sl. No.	Broad Title / Topics	Number of Lectures
1	Nil	
2		
3		
4		
5		
Total Number of Lectures =		
In case of revision of existing course, Please provide below the details of existing course. EXISTING COURSE		
Course Number, Title, L-T-P-C:		
Pre-Requisite (if any)		
Contents:		



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Course Structure for Minor [for new course curriculum effective from 2025]

1. Name of the Academic Division: Chemical Engineering
2. Discipline (Title) of the Minor Programme: Materials Science and Engineering
3. Preamble of the Minor Programme:

Brief description of the programme. The coverage, target and outcomes, etc.

The minor programme in “Material Engineering” deals with knowledge on fundamentals and applications of different types of materials, including both conventional and advanced materials. Some of the advanced and functional materials include energy materials, sustainable polymers, nanocomposites, and smart materials. On completion of this minor, the students may find career in energy, polymers, composites and other material processing industries.

4. Curriculum of the Minor Programme

Semester	Course Number	Course Title	Credit Structure	Brief Description of the Course
II	CL1092M	Fundamentals of Materials Science	3 – 0 – 0 – 6	Classification of materials and processing techniques.
III	CL2091M	Thermodynamics and Reaction Engineering	3 – 0 – 0 – 6	Basics of thermodynamics, phase diagrams, kinetics of material transformations.
IV	CL2092M	Computational and Experimental Techniques	3 – 0 – 0 – 6	Fundamental teaching on computational tools (such as Material Studio) and experimental tools (such as XRD, FESEM, TEM, TGA, etc.) used for material characterization
V	CL3091M	Introduction to Functional Materials	3 – 0 – 0 – 6	Basics of advanced materials such as biomaterials, nanomaterials, composites, biopolymers, etc.
VI	CL3092M	AI and ML in Materials Engineering	3 – 0 – 0 – 6	Basics of AI/ML and their applications in material processing.

5. List of undergraduate programmes for which the proposed Minor programme CANNOT be offered.

S. No.	UG Programme	Justification



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Syllabi of Minor Courses

Indian Institute of Technology Guwahati
Proposal for a New Course / Revision of a Course

Course Number & Title: CL1092M & Fundamentals of Materials Science	
L-T-P-C: 3-0-0-6	
Type of Letter Grading (Regular Letter Grades / PP or NP Letter Grades): Regular Letter Grades	
Kind of Proposal (New Course / Revision of Existing Course): New Course	
Offered as (Compulsory / Elective): Compulsory	
Offered to: UG students opting "Minor in Materials Science and Engineering"	
Offered in (Odd/ Even / Any): Even	
Offered by (Name of Department/ Center): Chemical Engineering	
Pre-Requisite: None	
Preamble / Objectives (Optional): The knowledge of the material structure, behaviour and their classification is essential for selection of proper material for specific applications. This course emphasizes on the fundamentals of materials structure, properties, classification and their interrelation in material engineering.	
Course Content/ Syllabus (<i>as a single paragraph if it is not containing more than one subject. Sub-topics/ Sections may be separated by commas(,). Topics may be separated by Semi-Colons(;). Chapters may be separated by Full-Stop(.). While starting with broad heading, it may be indicated with Colon symbol before the topics. For example: Multi-variable Calculus: Limits of functions, Continuity,</i>) Introduction to material science; atomic structure and bonding; crystalline structure; imperfection in solids; basics of metals and alloys, polymers, ceramics and glasses, composites, corrosion; material properties – stress-strain behaviour, hardness, elasticity, plasticity, toughness, fatigue, creep, fracture, and their strengthening mechanisms; thermal properties – melting, crystallization, glass transition; electrical and magnetic properties; phase rule; binary phase diagram; eutectic systems; lever rule; phase transformation – nucleation, heat and other treatments.	
Books (In case UG compulsory courses, please give it as "Text books" and "Reference books". Otherwise give it as "References".	
Texts: (Format: Authors, <i>Book Title in Italics font</i> , Volume/Series, Edition Number, Publisher, Year.)	
1.	V. Raghavan, <i>Materials Science and Engineering – A First Course</i> ; 6 th Edition, PHI Learning, 2015.
2.	William D. Callister Jr. & David G. Rethwisch, <i>Materials Science and Engineering: An Introduction</i> , 9 th Edition, Wiley, 2014. (Indian Edition)
3.	
References: (Format: Authors, <i>Book Title in Italics font</i> , Volume/Series, Edition Number, Publisher, Year.)	



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1	William F. Smith and J. Hashemi, <i>Foundations of Materials Science and Engineering</i> , 4 th Edition, McGraw Hill, 2006.
2	James Shackelford, <i>Introduction to Materials Science for Engineers</i> , 9 th Edition, Pearson, 2022.

Detailed Course Content (Optional)		
It will not be included in the Courses of Study Booklet		
Sl. No.	Broad Title / Topics	Number of Lectures
1		
2		
3		
4		
5		
Total Number of Lectures =		

In case of revision of existing course, Please provide below the details of existing course.
EXISTING COURSE
Course Number, Title, L-T-P-C:
Pre-Requisite (if any)
Contents:
References:



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Indian Institute of Technology Guwahati Proposal for a New Course / Revision of a Course

Course Number & Title: CL2091M & Thermodynamics and Reaction Engineering	
L-T-P-C: 3-0-0-6	
Type of Letter Grading (Regular Letter Grades / PP or NP Letter Grades): Regular Letter Grades	
Kind of Proposal (New Course / Revision of Existing Course): New Course	
Offered as (Compulsory / Elective): Compulsory	
Offered to: UG students opting "Minor in Materials Science and Engineering"	
Offered in (Odd/ Even / Any): Odd	
Offered by (Name of Department/ Center): Chemical Engineering	
Pre-Requisite: None	
Preamble / Objectives (Optional):	
<p>The knowledge of thermodynamic principles explaining the transitions and stability of materials is essential. In addition, along with the thermodynamics, the kinetics of phase transformations of materials is also essential from material engineering viewpoint. This course emphasizes on thermodynamics and kinetics of materials transformation from material engineering viewpoint.</p>	
<p>Course Content/ Syllabus (as a single paragraph if it is not containing more than one subject. Sub-topics/ Sections may be separated by commas(.). Topics may be separated by Semi-Colons(;). Chapters may be separated by Full-Stop(.). While starting with broad heading, it may be indicated with Colon symbol before the topics. For example: Multi-variable Calculus: Limits of functions, Continuity,)</p>	
<p>Thermodynamic laws; chemical potential; phase equilibria; Gibbs phase rule; thermodynamics of solutions; free energy and phase stability; binary phase diagrams; phase transformations and driving forces; reaction rate and order; types of reactions; kinetics of homogenous reactions; introduction to reactor design; ideal reactors for single reactions; thermodynamics and kinetics of nucleation, growth mechanism, solidification, diffusional transformation</p>	
<p>Books (In case UG compulsory courses, please give it as "Text books" and "Reference books". Otherwise give it as "References".</p>	
<p>Texts: (Format: Authors, <i>Book Title in Italics font</i>, Volume/Series, Edition Number, Publisher, Year.)</p>	
1.	JM Smith, HC van Ness, MM Abbott, <i>Introduction to Chemical Engineering Thermodynamics</i> , 7 th Edition, McGraw Hill, 2010.
2.	Octave Levenspiel, <i>Chemical Reaction Engineering</i> , Wiley, 2019
3.	David A Porter, Kenneth E Easterling, Mohamed Y Sherif, <i>Phase Transformations in Metals and Alloys</i> . CRC Press, Taylor & Francis Group, 2022.
4.	David R Gaskell, David E Laughlin, <i>Introduction to the Thermodynamics of Materials</i> . 6 th Edition, CRC Press, 2017.
<p>References: (Format: Authors, <i>Book Title in Italics font</i>, Volume/Series, Edition Number, Publisher, Year.)</p>	
1	Robert W Balluffi, Samuel M Allen, W. Craig. Carter, Rachel A Kemper, <i>Kinetics of materials</i> . Wiley, 2005.
2	



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Detailed Course Content (Optional)		
It will not be included in the Courses of Study Booklet		
Sl. No.	Broad Title / Topics	Number of Lectures
1		
2		
3		
4		
5		
Total Number of Lectures =		

In case of revision of existing course, Please provide below the details of existing course. EXISTING COURSE
Course Number, Title, L-T-P-C:
Pre-Requisite (if any)
Contents:
References:



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Indian Institute of Technology Guwahati Proposal for a New Course / Revision of a Course

Course Number & Title: CL2092M & Computational and Experimental Techniques	
L-T-P-C: 3-0-0-6	
Type of Letter Grading (Regular Letter Grades / PP or NP Letter Grades): Regular Letter Grades	
Kind of Proposal (New Course / Revision of Existing Course): New Course	
Offered as (Compulsory / Elective): Compulsory	
Offered to: UG students opting "Minor in Materials Science and Engineering"	
Offered in (Odd/ Even / Any): Even	
Offered by (Name of Department/ Center): Chemical Engineering	
Pre-Requisite: None	
Preamble / Objectives (Optional): Knowledge of various properties of materials is essential to analyze their suitability and/or design of new materials of specific applications. This course aims to teach fundamentals of different types of experimental and computational characterization of materials from engineering prospective. It also Integrate computational modeling with experimental findings for enhanced material/system understanding. Some applications of computational tools shall also be demonstrated.	
Course Content/ Syllabus (<i>as a single paragraph if it is not containing more than one subject. Sub-topics/ Sections may be separated by commas(,). Topics may be separated by Semi-Colons(;). Chapters may be separated by Full-Stop(.). While starting with broad heading, it may be indicated with Colon symbol before the topics. For example: Multi-variable Calculus: Limits of functions, Continuity,</i>) Overview of characterization techniques; basics of surface and structural characterization; fundamentals of thermal and mechanical characterization techniques; introduction of spectroscopic techniques; introduction to molecular simulation; basics of Monte Carlo and molecular dynamics simulations; case studies using relevant tools.	
Books (In case UG compulsory courses, please give it as "Text books" and "Reference books". Otherwise give it as "References").	
Texts: (Format: Authors, <i>Book Title in Italics font</i> , Volume/Series, Edition Number, Publisher, Year.)	
1.	Y. Leng, <i>Materials Characterization: Introduction to microscopic and spectroscopic methods</i> , Ed., John Wiley & Sons, 2008.
2.	A.J. Milling, <i>Surface Characterization Methods: Principles, techniques & applications</i> , Marcel Dekker, 1999
3.	Frenkel, D., Smit, B., <i>Understanding Molecular Simulation: From Algorithms to Applications</i> , Second Edition, Academic Press, 2001
References: (Format: Authors, <i>Book Title in Italics font</i> , Volume/Series, Edition Number, Publisher, Year.)	
1	
2	

Detailed Course Content (Optional)



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It will not be included in the Courses of Study Booklet		
Sl. No.	Broad Title / Topics	Number of Lectures
1		
2		
3		
4		
5		
Total Number of Lectures =		

In case of revision of existing course, Please provide below the details of existing course. EXISTING COURSE
Course Number, Title, L-T-P-C:
Pre-Requisite (if any)
Contents:
References:



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Indian Institute of Technology Guwahati Proposal for a New Course / Revision of a Course

Course Number & Title: CL3091M & Introduction to Functional Materials	
L-T-P-C: 3-0-0-6	
Type of Letter Grading (Regular Letter Grades / PP or NP Letter Grades): Regular Letter Grades	
Kind of Proposal (New Course / Revision of Existing Course): New Course	
Offered as (Compulsory / Elective): Compulsory	
Offered to: UG students opting "Minor in Materials Science and Engineering"	
Offered in (Odd/ Even / Any): Even	
Offered by (Name of Department/ Center): Chemical Engineering	
Pre-Requisite: None	
Preamble / Objectives (Optional):	
<p>The functional materials exhibit specialized physical and chemical properties which enables them for their use in various engineering applications such as in biotechnology, micro- and nano-fluidics, etc. This course aimed to provide students with basics of smart materials, their properties tailoring and engineering applications.</p>	
<p>Course Content/ Syllabus (as a single paragraph if it is not containing more than one subject. Sub-topics/ Sections may be separated by commas(.). Topics may be separated by Semi-Colons(;). Chapters may be separated by Full-Stop(.). While starting with broad heading, it may be indicated with Colon symbol before the topics. For example: Multi-variable Calculus: Limits of functions, Continuity,)</p>	
<p>Functional materials and their properties and classifications; basics of mechanical and electrical systems; basics of electronic and semiconducting materials; basics of energy functional materials –electrodes, electrolytes, fuel cells, capacitors; piezoelectric materials; self-healing materials; shape memory alloy; nanomaterials; functionalized 2D materials; chromogenic materials; bio materials; polymers and composites.</p>	
<p>Books (In case UG compulsory courses, please give it as "Text books" and "Reference books". Otherwise give it as "References".</p>	
<p>Texts: (Format: Authors, <i>Book Title in Italics font</i>, Volume/Series, Edition Number, Publisher, Year.)</p>	
1.	D. J. Leo, <i>Engineering Analysis of Smart Materials Systems</i> , Wiley, 2007.
2.	M.V. Ghandi and B.S. Thompson, <i>Smart Materials and Structures</i> , Chapman & Hall, 1992
3.	A.V. Srinivasan and D.M. McFarland, <i>Smart Structures</i> , Cambridge University Press, 2001
4.	
<p>References: (Format: Authors, <i>Book Title in Italics font</i>, Volume/Series, Edition Number, Publisher, Year.)</p>	
1	
2	

Detailed Course Content (Optional) It will not be included in the Courses of Study Booklet		
Sl. No.	Broad Title / Topics	Number of Lectures
1		



भारतीय प्रौद्योगिकी संस्थान गुवाहाटी

INDIAN INSTITUTE OF TECHNOLOGY GUWAHATI

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Email: clhod@iitg.ac.in
Tel: +91-9954864735 (M)
+91-3612582251 (O)

2		
3		
4		
5		
Total Number of Lectures =		

In case of revision of existing course, Please provide below the details of existing course.

EXISTING COURSE

Course Number, Title, L-T-P-C:

Pre-Requisite (if any)

Contents:

References:



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Indian Institute of Technology Guwahati Proposal for a New Course / Revision of a Course

Course Number & Title: CL3092M & AI and ML in Materials Engineering	
L-T-P-C: 3-0-0-6	
Type of Letter Grading (Regular Letter Grades / PP or NP Letter Grades): Regular Letter Grades	
Kind of Proposal (New Course / Revision of Existing Course): New Course	
Offered as (Compulsory / Elective): Compulsory	
Offered to: UG students opting "Minor in Materials Science and Engineering"	
Offered in (Odd/ Even / Any): Odd	
Offered by (Name of Department/ Center): Chemical Engineering	
Pre-Requisite: None	
Preamble / Objectives (Optional):	
Artificial Intelligence and Machine Learning are almost unavoidable in today's technological growth of any nation. This course provides a basic understanding of AI and ML along with their applications in material engineering.	
Course Content/ Syllabus (as a single paragraph if it is not containing more than one subject. Sub-topics/ Sections may be separated by commas(.). Topics may be separated by Semi-Colons(;). Chapters may be separated by Full-Stop(.). While starting with broad heading, it may be indicated with Colon symbol before the topics. For example: Multi-variable Calculus: Limits of functions, Continuity,)	
Definitions and impact of machine learning and artificial intelligence; types of learning and overview of machine learning pipeline; source and pre-processing of materials data; supervised learning applications such as regression models; clustering and dimensionality reduction; basics of unsupervised learning; basics of neural networks in materials engineering; AI in materials discovery and design and manufacturing.	
Books (In case UG compulsory courses, please give it as "Text books" and "Reference books". Otherwise give it as "References".	
Texts: (Format: Authors, <i>Book Title in Italic font</i> , Volume/Series, Edition Number, Publisher, Year.)	
1.	Rajan, K. <i>Materials Informatics</i> . Elsevier, 2015
2.	Agrawal, A., and Choudhary, A. <i>Perspective: Materials Informatics and Big Data</i> . APL Materials, (2016).
3.	Zhang, T. <i>An Introduction to Materials Informatics: The Elements of Machine Learning</i> , Springer, 2024.
4.	Krishnan, N. M. A., Kodaman, H., Bhattoo, A. <i>Machine Learning for Materials Discovery: Numerical Recipes and Practical Applications</i> , Springer, 2024.
References: (Format: Authors, <i>Book Title in Italic font</i> , Volume/Series, Edition Number, Publisher, Year.)	
1	
2	

Detailed Course Content (Optional)
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Sl. No.	Broad Title / Topics	Number of Lectures
1.		
2.		
3.		
4.		
5.		
Total Number of Lectures =		

In case of revision of existing course, Please provide below the details of existing course.

EXISTING COURSE

Course Number, Title, L-T-P-C:

Pre-Requisite (if any)

Contents:

References: