For Detailed course syllabus: https://intranet.iitg.ac.in/acad/syllabi/

B.Tech (Biosciences and Bioengineering) Revised Course Curriculum
(July 2025 onwards)

Course No	Semester-I Course Name	L	T	P	C	Course No	Semester-II Course Name	L	T	P	C
CH1101H	Basic Inorganic Chemistry	3	0	0	3	CE1204	Engineering Drawing	1	0	3	5
CH1106H	Basic Organic Chemistry	3	0	0	3	CH1201H	Basic Physical Chemistry	3	0	0	3
CL1101	Fundamentals of Process Calculations	3	0	0	6	CH1204H	Basic Analytical Chemistry	3	0	0	3
DA1101H	Fundamentals of Data Science	3	0	0	3	CS1210	Programming and Data Structures Lab	0	0	3	3
MA1106H	Single Variable Calculus	3	1	0	4	CS1207	Programming and Data Structures	3	0	0	6
MA1118H	Multi Variable Calculus	3	1	0	4	EE1201H	Electric Circuits	3	0	0	3
ME1103	Engineering Mechanics	2	1	0	6	EE1206H	Digital and Analog Electronics	3	0	0	3
PH1110H	Modern Physics	2	1	0	3	EE1211	Basic Electronics Laboratory	0	0	3	3
BT1101	Biochemistry	3	0	0	6	MA1206H	Linear Algebra	3	1	0	4
					38	PH1205H	Introductory Electromagnetics	2	1	0	3
						BT1203	Biochemistry Lab	0	0	3	3
											39

Course No	Semester-III Course Name	L	T	P	C	Course No	Semester-IV Course Name	L	T	P	C
MA2305H	Ordinary Differential Equations	3	1	0	4	BT2201	Biophysics	2	1	0	6
MA2505H	Partial Differential Equations	3	1	0	4	BT2202	Genetics	3	0	0	6
BT2101	Bio-thermodynamics	2	1	0	6	BT2203	Bioinformatics	2	0	2	6
BT2102	Microbiology	3	0	0	6	BT2204	Biological Data Analysis	2	0	2	6
BT2103	Cell and Molecular Biology	3	0	0	6	BT2205	Genetic Engineering	3	0	0	6
BT2111L	Microbiology Laboratory	0	0	3	3	HS22xx	HSS Elective-II	3	0	0	6
HS21xx	HSS Elective-I	3	0	0	6						
					35						**36**

Course No	Semester-V Course Name	L	T	P	C	Course No	Semester-VI Course Name	L	T	P	C
BT3101	Immunology	3	0	0	6	BT3201	Biochemical Engineering	2	1	0	6
BT3102	Bio-reaction Engineering	2	1	0	6	BT3202	Bio-separation Engineering	3	1	0	8
BT3103	Transport Phenomenon in Bioprocesses	3	1	0	8	BT3211L	Biochemical Engineering Laboratory	0	0	6	6
BT3104	Computational Biology	2	0	2	6	BT3203H	Regenerative Medicine	3	0	0	3
						BT3204H	Biosensors	3	0	0	3
BT3111L	Analytical Biotechnology Laboratory	0	0	6	6	BT3212E	Bioentrepreneurship	0	0	2	2
HS31xx	HSS Elective-III	3	0	0	6	HS32xx	HSS Elective-IV	3	0	0	6
					38						**34**

Course No	Semester-VII Course Name	L	T	P	C	Course No	Semester-VIII Course Name	L	T	P	C
BT4111E	Project at External Organization*				24	BT4xxx	Departmental Elective-IV	3	0	0	6
OExxxx	Open Elective^	3	0	0	6	BT4xxx	Departmental Elective-V	3	0	0	6
OR						BT4xxx/BT4212P	Departmental Elective-VI / BTP	3	0	0	6
BT4xxx	Departmental Elective-I	3	0	0	6	OExxxx	Open Elective - III	3	0	0	6
BT4xxx	Departmental Elective-II	3	0	0	6	OExxxx	Open Elective - IV	3	0	0	6
BT4xxx/BT4112P	Departmental Elective-III / BTP	3	0	0	6	**OR**					
OExxxx	Open Elective – I	3	0	0	6	BT4211E	Project at External Organization*				24
OExxxx	Open Elective – II	3	0	0	6	OExxxx	Open Elective^	3	0	0	6
					30						**30**

*** A maximum of 24 credits is allowed for the project at an external organization in the entire B.Tech program. External project should be ATLEAST 14 weeks duration (including summer/winter vacation holiday period) and can be extended up to mid of Nov/April month of odd and even semesters, respectively.**

^ Student shall successfully complete any one of the Open electives/ the NPTEL online courses duly approved by the department (advanced completion starting from Sem I to Sem VI is also permitted).

Courses Offered by Academic Division Biosciences and Bioengineering

Type	Course Number	Course Name	L	T	P	C	Branches
D-Core-1	BT1101	Biochemistry	3	0	0	6	BSBE
Basic-2	BT1201H	Evolution and Genetics	3	0	0	3	EPH
Basic-2	BT1202H	Bioenergetics and Metabolism	3	0	0	3	EPH
D-Core-2	BT1203L	Biochemistry Lab	0	0	3	3	BSBE

Course Number: CH1101H(BSBE), CH1102H(CL), CH1103H(EPH), CH1104H(MC), CH1105H(EN)	
Title: Basic Inorganic Chemistry	
L-T-P-C: 3-0-0-3	
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: BTech in BSBE,CL,EPH,MC,EN	
Offered in (Odd/ Even / Any): Odd	
Offered by (Name of Department/ Center): Chemistry	
Pre-Requisite: None	
Preamble / Objectives (Optional): The course is designed to teach fundamental inorganic chemistry.	
Course Content/ Syllabus*:* Chemical Bonding: Chemical Bonding: Ionic, Covalent, and Metallic. Molecular Orbital Theory for Polyatomic Molecules. Solid State Chemistry and Materials: Crystallography and Defects in Solids, Electronic Properties of Solids and Band Theory. Metal silicates, Zeolites, metals and alloys, ceramic materials. Coordination compounds. Bioinorganic and organometallic chemistry. Phosphorus and Nitrogen compounds.	
Texts:	
1.	F. A. Cotton, and G. Wilkinson, *Advanced Inorganic Chemistry*, 5th Ed., Wiley, 1999.
2.	D. J. Shriver, P. W. Atkins, and C. H. Langford, *Inorganic Chemistry*, 5th Ed., Oxford University Press, 2010.
References:	
1	J. E. Huheey, E. A. Keiter and R. L. Keiter, *Inorganic Chemistry: Principle, structure and reactivity*, 4th Ed., Harper Collins, 1993.

Detailed Course Content		
Sl. No.	Broad Title / Topics	Number of Lectures
1	Chemical Bonding	2
2	Molecular Orbital Theory for Polyatomic Molecules	4
3	Solid State Chemistry and Materials	3
4	Metal silicates, Zeolites, metals and alloys, ceramic materials	2
5	Coordination compounds	4
6	Bioinorganic and organometallic chemistry	3
7	Phosphorus and Nitrogen compounds	2
8	Quiz/Tests	1
Total Number of Lectures =		21

Course Number & Title: CH1106H(BSBE), CH1107H(CL), CH1108H(MC) Basic Organic Chemistry	
L-T-P-C: 3-0-0-3	
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: BTech in BSBE,CL,MC	
Offered in (Odd/ Even / Any): Odd	
Offered by (Name of Department/ Center): Chemistry	
Pre-Requisite: None	
Preamble / Objectives (Optional): The course is designed to teach fundamental organic chemistry.	
Course Content/ Syllabus*:* Fundamentals of Organic Chemistry: Functional groups and their significance; Isomerism: structural and stereoisomerism. Alkanes, Cycloalkanes, and Alkenes: Conformational analysis of cyclohexane; Structure, bonding. Basic Polymer Chemistry and Synthesis. Oxygen-Containing Compounds: Alcohols, ethers, and phenols; Structure and nomenclature of ethers; Acidity and reactions of phenols; Aldehydes and ketones: Structure, reactivity, and nucleophilic addition reactions; Aldol condensation. Carboxylic Acids, Derivatives, and Aromatic Compounds: Structure and acidity of carboxylic acids; Nucleophilic acyl substitution reactions; Electrophilic aromatic substitution reactions; Reactions of substituted benzenes.	
Texts:	
1.	H. Pine, *Organic Chemistry*, 5th Ed, McGraw-Hill, 1987.
2.	I. L. Finar, *Organic Chemistry*, Volume 1, Ed. 6, Pearson Education, 2009.
References:	
1	L. G. Wade (Jr.), *Organic Chemistry*, 8th Ed. Prentice Hall, 2011.

Detailed Course Content		
Sl. No.	Broad Title / Topics	Number of Lectures
1	Fundamentals of Organic Chemistry	2
2	Alkanes, Cycloalkanes, and Alkenes	4
3	Oxygen-Containing Compounds	4
4	Aldehydes and ketones	5
5	Carboxylic Acids, Derivatives, and Aromatic Compounds	5
7	Quiz/Tests	1
Total Number of Lectures =		21

Course Number: CL1102(BSBE), CL1103(CST), CL2201(ME)	
Title: 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: BTech in BSBE, CST, ME	
Offered in (Odd/ Even / Any): Any	
Offered by (Name of Department/ Center): CL	
Pre-Requisite: Nil	
Preamble / Objectives (Optional):	
Course Content/ Syllabus Unit conversion; processes and process variables; fundamentals of material balance; material balances on single and multi-unit processes without and with reaction, without and with recycle, bypass and purge; material balances on reactive processes, basic enthalpy balances without and with phase transitions; psychrometric chart; energy balances on non-reactive and reactive processes; calculations for ideal and real gas systems; equation of states; compressibility chart.	
Texts:	
1.	R.M. Felder, R.W. Rousseau and 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, 8th Edition, Prentice Hall of India, 2012.
References:	
1.	O.K.M. Watson and R.A.R. Hougen, Chemical Process Principles, Part 1: Material and Energy Balances, 2nd Edition, John Wiley & Sons, 2004.
2.	W.L. Badger and J.T. Bancheo, Introduction to Chemical Engineering, McGraw Hill Publications, 2006.
3.	N. Chopey, Handbook of Chemical Engineering Calculations, 4th Edition, McGraw Hill, 2012.

Course Number & Title: DA1101H (BSBE), DA1201H(EPH), DA1202H(CST), DA1203H(MC), DA1204H(EN) Title: Fundamentals of Data Science	
L-T-P-C: 3-0-0-3	
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: B.Tech.in BSBE, EPH,CST,MC,EN	
Offered in (Odd/ Even / Any): First Semester	
Offered by (Name of Department/ Center): Mehta Family School of Data Science and Artificial Intelligence	
Prerequisite: None	
Preamble / Objectives (Optional):	
Course Content/ Syllabus: Overview of Data Science; Data and Management: Nature of data, categories of data, data collection and curation, basics of SQL; Data Cleaning and Exploration: Reading and exporting data, cleaning data, handling missing values, outlier detection, data transformations; Data Visualization: Organizing and summarizing data using charts and graphs; Machine Learning in Data Science: Introduction to classification and regression, model selection, training, and evaluation; Examples of Data Science applications.	
Texts:	
1.	Rafael A. Irizarry, Introduction to Data Science: Data Analysis and Prediction Algorithms with R, 1st Edition, CRC Press, 2019.
2.	Hui Lin and Ming Li, Practitioner's Guide to Data Science, 1st Edition, Chapman & Hall/CRC, 2023.

Detailed Course Content (Optional)		
Sl. No.	Broad Title / Topics	Number of Lectures
1	Overview of Data Science (1)	1
2	Data and Management: Nature of data, categories of data, data collection and curation (2) Basics of relational database & SQL (3)	5
3	Data Cleaning and Exploration: Reading and exporting data, cleaning data, handling missing values, outlier detection, and data transformations (2), Examples of exploratory data analysis (2)	4
4	Data Visualization: Data visualization principles (1), Organizing and summarizing data using charts and graphs (2)	3
5	Machine Learning in Data Science: Introduction to ML (1), Basics of classification and regression (1+1), Model selection, training, and evaluation (2)	5
6	Examples of Data Science Applications (2)	2
	Total Number of Lectures =	20

Course Number: MA1301H(CSE), MA1302H(ECE), MA1303H(EEE), MA1304H(ME), MA1305H(CE), MA1306H(BSBE), MA1307H(CL), MA1308H(EPH), MA1309H(CST), MA1310H(MC), MA1311H(DA), MA1312H(EN) – MA1312H	
Title: Single Variable Calculus	
L-T-P-C: 3-1-0-4	
Full Semester Course (Yes/No): No	
Half Semester Course (Yes/No): Yes Offered During: Pre Mid Semester	
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 in CSE,ECE,EEE,ME,CE,BSBE,CL,EPH,CST,MC,DA,EN	
Offered in (Monsoon/ Winter / Any): Monsoon	
Offered by (Name of Department/ Center): MATHEMATICS	
Pre-Requisite: NIL	
Preamble / Objectives (Optional):	
Course Content/ Syllabus: Convergence of sequences and series of real numbers; Limits, Continuity of functions; Differentiability, Rolle's theorem, mean value theorem, Taylor's theorem; Power series; Riemann integration, fundamental theorem of calculus, improper integrals; Application to length, area, volume, and surface area of revolution.	
Texts:	
1.	G. B. Thomas, Jr. and R. L. Finney, *Calculus and Analytic Geometry*, Pearson India, 9th Edition, 2006.
References:	
1.	R. G. Bartle and D. R. Sherbert, *Introduction to Real Analysis*, Wiley India, 4th Edition, 2014.
2.	S. R. Ghorpade and B. V. Limaye, *A Course in Calculus and Real Analysis*, Springer India, 2006.

Course Number: MA1501H(CSE), MA1502H(ECE), MA1503H(EEE), MA1504H(ME), MA1505H(CE), MA1506H(BSBE), MA1507H(CL), MA1508H(EPH), MA1509H(CST), MA1510H(MC), MA1511H(DA), MA1512H(EN)	
Title: Multi Variable Calculus	
L-T-P-C: 3-1-0-4	
Full Semester Course (Yes/No): No	
Half Semester Course (Yes/No): Yes Offered During: Post Mid Semester	
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 in CSE,ECE,EEE,ME,CE,BSBE,CL,EPH,CST,MC,DA,EN	
Offered in (Monsoon/ Winter / Any): Monsoon	
Offered by (Name of Department/ Center): MATHEMATICS	
Pre-Requisite: NIL	
Preamble / Objectives (Optional):	
Course Content/ Syllabus: Vector functions of one variable - continuity and differentiability; Scalar valued functions of several variables, continuity, partial derivatives, directional derivatives, gradient, differentiability, chain rule; Tangent planes and normals, maxima and minima, Lagrange multiplier method; Repeated and multiple integrals with applications to volume, surface area; Change of variables; Vector fields, line and surface integrals; Green's, Gauss and Stokes theorems and their applications.	
Texts:	
1.	G. B. Thomas, Jr. and R. L. Finney, *Calculus and Analytic Geometry*, Pearson India, 9th Edition, 2006.
References:	
1.	S. R. Ghorpade and B. V. Limaye, *A Course in Multivariable Calculus and Analysis*, Springer India, 2010.
2.	T. M. Apostol, *Calculus*, Volume 2, Wiley India, 2003.
3.	J. E. Marsden, A. J. Tromba and A. Weinstein, *Basic Multivariable Calculus*, Springer India, 2002.

Course Number: ME1101(ECE), ME1102(EEE), ME1103(BSBE), ME1104(EPH), ME1105(CST), ME1106(MC), ME1107(EN)
Title: Engineering 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: BTech ECE,EEE,BSBE,EPH,CST,MC,EN
Offered in (Odd/ Even / Any): Odd
Offered by (Name of Department/ Center): Mechanical Engineering
Pre-Requisite: Nil
Preamble / Objectives (Optional): This is the first course in mechanics from engineering point of view. It aims to impart essential knowledge of mechanics to students of disciplines other than mechanical engineering. It is intended to introduce them to the general approach to statics and dynamics with emphasis on engineering applications. It is recommended that concepts be introduced by giving examples of engineering systems and demonstrations using models. After completing the course, a student is expected to be able to solve elementary two- and three-dimensional engineering problems involving particles and rigid bodies.
Course Content/ Syllabus Equivalent Force Systems: concentrated and distributed force systems, simplest resultant (wrench), centre of pressure, centroid, and centre of gravity. Equilibrium of Rigid Bodies: free body diagram, reactions, equations of equilibrium, static indeterminacy. Analysis of Structures: analysis of trusses, method of joints and method of sections, analysis of frames and beams, shear force and bending moment, Friction: concept of friction, applications of friction to simple machines; rolling resistance. Virtual Work: principle of virtual work and its application to machines. Moment of Inertia: moments of inertia of simple and composite bodies, moments of inertia under transformation of axes, principle axes and principle moments of inertia, Mohr's circle. Kinematics of Particles and Rigid Bodies: rectilinear motion, curvilinear motion, velocity and acceleration in cylindrical and path coordinate system, relative and constrained motion, rate of change of a vector in a rotating frame, three-dimensional motion of a particle relative to a rotating frame, rigid body kinematics.
Texts:

1.	H. Shames, *Engineering Mechanics: Statics and Dynamics,* 4th Edition, Pearson Education India, 2005.
2.	F. P. Beer, E. R. Johnston Jr., D. F. Mazurek, P. J. Cornwell, S. Sanghi, *Vector Mechanics for Engineers: Statics and Dynamics,* 10th Edition, McGraw-Hill Education, 2017.
3.	J. L. Meriam, L. G. Kraige, J. N. Bolton, *Engineering Mechanics: Statics and Dynamics,* 9th Edition, An Indian Adaptation, Wiley India, 2021.

Detailed Course Content (Optional)		
Sl. No.	Broad Title / Topics	Number of Lectures

1	Equivalent Force Systems	3
2	Equilibrium of Rigid Bodies	2
3	Analysis of Structures	5
4	Friction	4
5	Virtual Work	2
5	Moment of Inertia	4
6	Kinematics of Particles and Rigid Bodies	8
Total Number of Lectures =		28

Course Number: PH1310H(ECE), PH1311H(EEE), PH1312H(BSBE), PH1313H(CST), PH1314H(MC), PH1315H(DA)	
Title: Modern Physics	
L-T-P-C: 2-1-0-3	
Kind of Proposal (New Course / Revision of Existing Course(s)):	
Offered as (Compulsory ~~/ Elective~~):	
Offered to: BTech in ECE,EEE,BSBE,CST,MC,DA	
Offered in (Odd/ Even / Any): Odd	
Offered by (Name of Department/ Center): Physics	
Pre-Requisite:	
Preamble / Objectives (Optional):	
Course Content/ Syllabus: Theory of Relativity: Postulates of special theory of relativity; The Michelson-Morley experiment; Time dilation; Doppler effect; Length contraction; Velocity addition; Mass and energy; Energy and Momentum; Particle properties of waves: Electromagnetic waves; Blackbody radiation; Photoelectric effect; X-rays; X-ray diffraction; Compton effect; Pair production; Wave properties of particles: De Broglie waves; Describing a matter wave; Phase and Group velocities; Particle diffraction; Particle in a box; Uncertainty principle; Concept of wave function. Structure of Atom: Rutherford scattering; Bohr's Atomic model; Energy levels and spectra; Correspondence principle; Nuclear mass effect on spectral lines; Sommerfeld's model, Atomic excitation; Basic mechanism of Laser.	
Texts:	
1.	Arthur Beiser, *Concepts of Modern Physics*, McGraw Hill, Eigth Ed. (2024).
References:	
1	Robert Eisberg and Robert Resnick, *Quantum Physics*, Wiley India Private Ltd. (2006).
2	J.R. Taylor, C.D. Zafiratos and M.A. Dubson, Modern Physics: For Scientists and Engineers, PHI Learning Pvt. Ltd,2nd Ed. (2009).
3	R. Resnick, *Introduction to Special Relativity*, John Wiley, Singapore (2000).

Detailed Course Content (Optional)		
Sl. No.	Broad Title / Topics	Number of Lectures (in hours)
1.	Theory of Relativity	6
2	Particle properties of waves	2
3	Wave properties of particles	3
4	Structure of Atom	3
		14

Course Number & Title: BT1101 Biochemistry	
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: BTech in BSBE	
Offered in (Odd/ Even / Any): Any	
Offered by (Name of Department/ Center): BSBE	
Pre-Requisite: Nil	
Preamble / Objectives (Optional):	
Course Content/ Syllabus Structure and function of biomolecules : Protein, carbohydrate, lipid; Enzymes: structure, mechanism and reaction kinetics; Basic concept and design of metabolism; carbohydrate metabolism: glycolysis, gluconeogenesis, citric acid cycle, pentose phosphate pathway, glycogen metabolism, oxidative phosphorylation; photosynthesis; Nitrogen fixation; fatty acid metabolism; protein: synthesis, targeting and turnover; biosynthesis of amino acids and nucleotides; Integration of metabolisms; hormones; Introduction to signal transduction pathways	
Texts:	
1.	D.L.Nelson and M.M.Cox, Lehninger, Principles of Biochemistry, 8th Ed., W H Freeman & Co., 2021.
2.	J. L. Tymoczko, J. M. Berg and L. Stryer, Biochemistry, 10th Ed., W. H. Freeman, 2023.
References:	
1.	W. W. Parson, D. E. Vance and G.L.Zubay, Principles of Biochemistry, Wm. C. Brown Publishers, 1995.
2.	K. Murray, D. K. Granner, P.A. Mayes and V. W. Rodwell, Harper's Biochemistry, 30th Ed McGraw Hill, 2015.

Course No: CE1201(ECE), CE1202(EEE), CE1203(ME), CE1204(BSBE), CE1205(CL), CE1206(EPH), CE1207(EN), CE1208(DD)

Title: Engineering Drawing

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): New Course

Offered as (Compulsory / Elective): Compulsory

Offered to: B.Tech in ECE, EEE, ME, BSBE, CL, EPH, EN and BDes

Offered in (Odd/ Even / Any): Even

Offered by (Name of Department/ Center): Civil Engineering

Pre-Requisite: None

Preamble/Objectives (Optional): To develop the fundamental skills of engineering graphics and visualization, enabling students to communicate technical information effectively through standard drawing and computer aided practices.

Course Content/ Syllabus (*Theory*)

Introduction to engineering drawing: Conventions and dimensions; Scales; Engineering curves; Orthographic projections: points, lines, planes, and solids; Sections of solids; Introduction to a Computer Aided Drafting software: AutoCAD; Isometric projection

Course Content/ Syllabus (*Practical*)

From scales to sections of solids using drawing instruments; Isometric projection using AutoCAD

Texts:

1. N. D. Bhatt and V. M. Panchal, *Engineering Drawing Plane and Solid Geometry*, 53rd Edition Charator Publishing House, 2014
2. K. Venugopal and V. Prabhu Raja, *Engineering Drawing+ AutoCAD*, 5th Edition, New Age International, 2011
3. D. A. Jolhe, *Engineering Drawing with an Introduction to AutoCAD*, McGraw Hill Education 2017

References:

1. W. J. Luzadder and J. M. Duff, *Fundamentals of Engineering Drawing*, 11th Edition, PHI, 2012
2. F. E. Giesecke, A. Mitchell, H. C. Spencer, I. L. Hill, R. O. Loving, J. T. Dygdon and J. E. Novak, *Engineering Drawing*, 8th Edition, Person Prentice Hall, 2000

Detailed Course Content (Optional)

Sl. No.	Broad Title / Topics	Number of Lectures
1	Introduction to engineering drawing: Conventions and dimensions	01
2	Scales	01
3	Engineering curves	02
4	Orthographic projections: points, lines and planes	02
5	Orthographic projections of solids	01
6	Sections of solids	01
7	Introduction to a Computer Aided Drafting software: AutoCAD	03
8	Isometric projection	01
	Total Number of Lectures =	12

Course Number & Title: CH1201H(BSBE), CH1202H(CL), CH1203H(MC) Basic Physical Chemistry	
L-T-P-C: 3-0-0-3	
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: BTech in BSBE,CL,MC	
Offered in (Odd/ Even / Any): Even	
Offered by (Name of Department/ Center): Chemistry	
Pre-Requisite: None	
Preamble / Objectives (Optional): The course is designed to teach fundamental physical chemistry.	
Course Content/ Syllabus*:* Quantum Chemistry: Origin of quantum theory, postulates of quantum mechanics, Schrodinger wave equation: operators and observables, superposition theorem and expectation values, solutions for a particle in a box, harmonic oscillator, rigid rotator, hydrogen atom. Basic thermodynamics, Kinetics, and Reaction Mechanisms: Energy profiles, transition state theory, and reaction coordinate diagrams.	
Texts:	
1.	P. Atkins and J. De Paula, "Physical Chemistry," 8th Edition, Oxford University Press, New York, 2006
2.	Physical Chemistry, Ira N. Levine, 5th Edition, McGraw-Hill, 2002
References:	
1	Quantum chemistry, Ira N. Levine, 5th ed., New Delhi, Prentice Hall, 2000.
2	Molecular quantum mechanics, P.W. Atkins and R.S. Friedman., 3rd ed., Oxford University Press, 1997

Detailed Course Content		
Sl. No.	Broad Title / Topics	Number of Lectures
1	Quantum Chemistry	13
2	Basic thermodynamics, Kinetics, and Reaction Mechanisms	7
3	Quiz/Tests	1
Total Number of Lectures =		21

Course Number & Title: CH1204H(BSBE), CH1205H(CL) Basic Analytical Chemistry	
L-T-P-C: 3-0-0-3	
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: BTech in BSBE, CL	
Offered in (Odd/ Even / Any): Even	
Offered by (Name of Department/ Center): Chemistry	
Pre-Requisite: None	
Preamble / Objectives (Optional): The course is designed to teach fundamental Analytical chemistry.	
Course Content/ Syllabus*:* Basic concepts of analytical chemistry. Principles of spectroscopic techniques (UV-Vis, IR); NMR techniques (1D, basic concept of 2D NMR); Mass Spectrometry for complex molecules; Applications in structure elucidations. Basic concepts of microscopic techniques (SEM, TEM, and AFM).	
Texts:	
1.	C. N. Banwell, and E. M. McCash, *Fundamentals of Molecular Spectroscopy*, 4th Ed., Tata McGraw-Hill, 1994.
2.	D. A. Skoog, D. M. West, F. J. Holler, S. R. Crouch, *Fundamentals of Analytical Chemistry*, 10th Ed., Cengage, 2023.
References:	
1	D. Harvey, *Modern Analytical Chemistry*, McGraw-Hill, 2000.

Detailed Course Content		
Sl. No.	Broad Title / Topics	Number of Lectures
1	Basic concepts of analytical chemistry	5
2	Principles of spectroscopic techniques	9
3	Basic concepts of microscopic techniques	6
4	Quiz/Tests	1
	Total Number of Lectures =	21

Course Number: CS1105L (ECE), CS1106L (EEE), CS1107L (ME), CS1108L (EPH), CS1210L (BSBE), CS1211L (CL), and CS1212L (CST)
Title: Programming and Data structures Lab
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): New Course
Offered as (Compulsory / Elective): Compulsory
Offered to: B.Tech ECE, EEE, ME, EPH, BSBE, CL, CST
Offered in (Odd/ Even / Any): Any
Offered by (Name of Department/ Center): CSE
Pre-Requisite: No Prerequisites
Preamble / Objectives (Optional):
Course Content/ Syllabus: Lab Introduction and Linux Environment: Terminal usage, file navigation, using gcc, basic shell commands; C Programming Environment: Writing, compiling (gcc), and executing basic C programs using terminal/IDE; Data Types, Variables, Operators: Declaring variables, using arithmetic/logical operators, type casting; Conditional Statements: if, if-else, nested conditions, switch-case; Loops and Control Structures: for, while, do-while, break/continue statements; Functions and Parameter Passing: Function definition, return types, call by value; Arrays: Single dimensional and multi-dimensional arrays; Pointers and Dynamic Memory Allocation: Pointer basics, malloc, calloc, free, pointer arithmetic; Structures and File Operations: Defining structures, file I/O using fopen, fprintf, fscanf, fclose; Recursion and Multi-file Programming: Writing recursive functions, #include, header files, splitting code into files; Sorting and Searching Algorithms: Implementing bubble sort, selection sort, linear and binary search; Stacks and Queues using Arrays: Implementing ADTs with arrays: push/pop, enqueue/dequeue; Linked Lists and their Applications: Singly linked list: insert, delete, traverse; stack/queue using linked list.
Texts:

1.	Yale Pratt and Sanjay Patel, Introduction to Computing Systems: From bits & gates to C/C++ & beyond, McGraw Hill Education (India), 2022.
2.	Stephen Kochan, Programming in C, Pearson Education (India), 2015.
3.	Ellis Horowitz, Sartaj Sahni, and Susan Anderson Freed, Fundamentals of data structures in C, Universities Press, 2008.

Detailed Course Content (Optional)		
Sl. No.	Broad Title / Topics	Week #
1	Introduction to Lab Environment	1
2	Data Types, Variables, Operators	2

3	Conditional Statements	3
4	Loops and Control Structures	4
5	Functions and Parameter Passing	5
6	Arrays	6
7	Pointers and Dynamic Memory Allocation	7
8	Structures	8
9	File operations	9
10	Recursion and Multi-file Programming	10
11	Sorting and Searching Algorithms	11
12	Stacks and Queues using Arrays	12
13	Linked Lists and their Applications	13

Course Number: CS1101 (ECE), CS1102 (EEE), CS1103(ME), CS1104 (EPH), CS1207 (BSBE), CS1208 (CL), and CS1209 (CST)
Title: Programming and Data Structures
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: B.Tech ECE, EEE, ME, EPH, BSBE, CL, CST
Offered in (Odd/ Even / Any): Any
Offered by (Name of Department/ Center): CSE
Pre-Requisite: No Prerequisites
Preamble / Objectives (Optional):
Course Content/ Syllabus: Understanding the Computing System: Using computing system, Introduction to Number system and representation, Von Neumann architecture, Machine language, Assembly language, Operating system; Building abstractions: High level programming language, Compiled vs Interpreted languages, Loader, Linker, Debugger, Integrated Development Environment, Remote storage and execution; Introduction to procedural programming through C: Flowchart, Pseudocode, Data types, Variables, Operators, Control structure, Conditionals and Loops. Intermediate programming; Functions, Pointers, Dynamic memory allocation, Structures, File operations, Advanced programming, Call by address, Recursion, Code across multiple files; Data structures and algorithms: Abstract data types: List, Stack, Queue; Linear data structures: Array, Linked list, Implementation of ADTs using Array and Linked list, Tree data structures: Binary tree, Binary search tree, Height balanced tree; Linear and Binary Sorting and Search algorithms.
Texts:

1.	Yale Pratt and Sanjay Patel, Introduction to Computing Systems: From bits & gates to C/C++ & beyond, McGraw Hill Education (India), 2022.
2.	Ellis Horowitz, Sartaj Sahni, and Susan Anderson Freed, Fundamentals of data structures in C, Universities Press, 2008.
3.	Stephen Kochan, Programming in C, Pearson Education (India), 2015.

Detailed Course Content (Optional)		
Sl. No.	Broad Title / Topics	Number of Lectures
1	Understanding the Computing System	3
2	Introduction to Procedural Programming	21
3	Data Structures and Algorithms	18
Total Number of Lectures =		42

Course Number: EE1101H(CSE), EE1102H(ME), EE1103H(CL), EE1104H(EN) EE1201H(BSBE), EE1202H(EPH), EE1203H(CST), EE1204H(MC), EE1205H(DA)	
Title: Electric Circuits	
L-T-P-C: 3-0-0-3	
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): Basic Course	
Offered to: BTech CSE, ME, CL, EN, BSBE, EPH, CST, MC, DA	
Offered in (Odd/ Even / Any): Any	
Offered by (Name of Department/ Center): EEE	
Pre-Requisite: NA	
Preamble / Objectives (Optional):	
Course Syllabus DC Analysis: Dependent and independent Voltage and current sources, Nodes, Paths, Loops and Branches, Nodal and Mesh Analysis, Superposition, Source Transformations, Thevenin's and Norton's Theorems, Maximum Power Transfer, RL, RC and RLC Circuit. AC Circuit Analysis:Sinusoidal Forcing Function, Phasor Relationship for R, L and C, Impedance and Admittance, Phasor Diagrams. Instantaneous Power, Average Power, Complex Power, Apparent Power and Power Factor.	
Texts:	
1	M. E. V. Valkenburg, Network Analysis, 3rd edition. Pearson, 2015.
2	F. F. Kuo, Network Analysis and Synthesis, 2nd edition. Wiley India, 2006.

Course Number: EE1105H(CSE), EE1106H(ME), EE1107H(CL), EE1108H(EN) EE1206H(BSBE), EE1207H(EPH), EE1208H(CST), EE1209H(MC), EE12010H(DA)	
Title: Digital and Analog Electronics	
L-T-P-C: 3-0-0-3	
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): Basic Course	
Offered to: BTech CSE, ME, CL, EN, BSBE, EPH, CST, MC, DA	
Offered in (Odd/ Even / Any): Any	
Offered by (Name of Department/ Center): EEE	
Pre-Requisite:NA	
Preamble / Objectives (Optional):	
Course Syllabus Logic Gates and Combinational Circuits: Number Systems and Binary Codes, Boolean Algebra and Logic Gates, DeMorgan's Theorems, Sum-of Product and Product-of-Sum Forms, Algebraic Simplification, Karnaugh-Map Method, Combinational Logic Circuits, Binary Half and Full adder-subtractor, Parity Generator-Checker, Sequential Circuits, Storage Elements; NAND and NOR gate Latches, S-R Flip-Flop, J-K Flip-Flop, D Flip-Flop, T- Flip- Flop, Counters. Diodes: Semiconductor Diode, V-I characteristics of Diode, Half-Wave and Full-Wave Rectifier Circuits, Wave Shaping Circuits, Clippers and Clampers, Zener Diodes. Transistors: Bipolar Junction Transistor, MOSFET: Biasing, Small Signal model, Amplifiers. Operational Amplifiers: Ideal Op-Amp, Application of Op-Amp: Comparator, Inverting and non-Inverting Amplifiers, Differential and Integral Amplifier, Adder-Subtractor.	
Texts:	
1	R. L. Boylestad and L. Nashelsky, *Electronic Devices and Circuit Theory*, 11th edition. Pearson, 2012.
2	N. S. Widmer, G. L. Moss, and R. J. Tocci, *Digital Systems*, 12th edition. Pearson, 2017.

Course Number: EE1109L(CSE), EE1110L(ME), EE1111L(CL), EE1112L(EN) EE1211L(BSBE), EE1212L(EPH), EE1213L(CST), EE1214L(MC), EE12015L(DA)
Title: Basic Electronics Lab
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): New Course
Offered as (Compulsory / Elective): Basic Course
Offered to: BTech CSE, ME, CL, EN, BSBE, EPH, CST, MC, DA
Offered in (Odd/ Even / Any): Any
Offered by (Name of Department/ Center): EEE
Pre-Requisite:NA
Preamble / Objectives (Optional):
Course Syllabus Experiments based on the courses: electric circuits, and digital and analog electronics.
Texts:

Course Number: MA1401H(CSE), MA1402H(ECE), MA1403H(EEE), MA1404H(ME), MA1405H(CE), MA1406H(BSBE), MA1407H(CL), MA1408H(EPH), MA1409H(CST), MA1410H(MC), MA1411H(DA), MA1412H(EN)	
Title: Linear Algebra	
L-T-P-C: 3-1-0-4	
Full Semester Course (Yes/No): No	
Half Semester Course (Yes/No): Yes Offered During: Pre Mid Semester	
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 in CSE,ECE,EEE,ME,CE,BSBE,CL,EPH,CST,MC,DA,EN	
Offered in (Monsoon/ Winter / Any): Winter	
Offered by (Name of Department/ Center): MATHEMATICS	
Pre-Requisite: NIL	
Preamble / Objectives (Optional):	
Course Content/ Syllabus: Systems of linear equations, matrices, Gaussian elimination, echelon form, column space, null space, rank of a matrix, inverse and determinant; Vector spaces over the field of real and complex numbers, subspaces, spanning set, linear independence, basis and dimension; Linear transformations, rank-nullity theorem, matrix of a linear transformation, change of basis and similarity; Eigenvalues and eigenvectors, algebraic and geometric multiplicity, diagonalization by similarity; Inner-product spaces, Gram-Schmidt process, orthonormal basis; Orthogonal, Hermitian and symmetric matrices, spectral theorem for real symmetric matrices.	
Texts:	
1.	D. Poole*, Linear Algebra: A Modern Introduction*, Cengage Learning India Private Limited, 4th Edition, 2015.
References:	
1.	G. Strang, *Linear Algebra and Its Applications*, Cengage Learning, 4th Edition, 2006.
2.	J. Gilbert and L. Gilbert, *Linear Algebra and Matrix Theory*, Academic Press, 1995.
3.	K. Hoffman and R. Kunze, *Linear Algebra*, Pearson India, 2nd Edition, 2015.

Course Number: PH1210H(CSE, PH1211H(ECE), PH1212H(EEE), PH1213H(ME), PH1214H(BSBE), PH1215H(CL), PH1216H(CST), PH1217H(MC), PH1218H(DA), PH1219H(EN)	
Title: Introductory Electromagnetics	
L-T-P-C: 2-1-0-3	
Kind of Proposal (New Course / Revision of Existing Course(s)):	
Offered as (Compulsory ~~/ Elective~~):	
Offered to: BTech in CSE,ECE,EEE,ME,BSBE,CL,CST,MC,DA,EN	
Offered in (Odd/ Even / Any): Even	
Offered by (Name of Department/ Center): Physics	
Pre-Requisite:	
Preamble / Objectives (Optional):	
Course Content/ Syllabus: Electrostatics: Gradient, divergence, and curl in curvilinear coordinates; Gauss law in integral form (review) and differential form, calculation of Divergence of E; Curl of E, Scalar potential, potential due to charges and Laplace/Poisson equation; Statements of Uniqueness theorems, boundary value problems and method of images; Dielectrics, Polarization, bound charges (review) and boundary conditions. Magnetism: Review of Biot-Savart's law, Lorentz Force. Divergence and curl of magnetic field, vector potential, and forces on magnetic dipoles; Magnetic materials and magnetic fields in the matter (magnetostatic case), bound currents. Steady currents and electromagnetic fields: Review of Ohm's law, Faraday's law, Lenz's law and Electromotive force; Ampere's law and Displacement current.; Maxwell's equations.	
Texts:	
1.	*Purcell, Edward M. Electricity and magnetism. Cambridge university press, 2013*
2.	Griffiths, David J. *Introduction to electrodynamics.* Cambridge University Press, 2023.
References:	
1	Verma, H.C. *Classical Electromagnetism*, Bharati Bhawan,2022.
2	Feynman, Richard P. *The Feynman Lectures on Physics*, Volume 2, Pearson, 2013.

Detailed Course Content (Optional)		
Sl. No.	Broad Title / Topics	Number of Lectures (in hours)
1.	Electrostatics	7
2	Magnetism	4
3	Steady currents and electromagnetic fields	3
		14

Course Number & Title: BT1203L Biochemistry Lab	
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): New course	
Offered as (Compulsory / Elective): Compulsory	
Offered to: BTech in BSBE	
Offered in (Odd/ Even / Any): Any	
Offered by (Name of Department/ Center): BSBE	
Pre-Requisite: Nil	
Preamble / Objectives (Optional): This is a matching lab course for the Biochemistry theory course.	
Course Content/ Syllabus Operation of instruments and lab safety protocol; Estimation of carbohydrate; Estimation of DNA in solution; Estimation of protein in solution; Study of enzyme kinetics; Gel electrophoresis of protein; and Molecular weight determination of proteins	
Texts:	
1.	R. Boyer, Modern Experimental Biochemistry, 3rd Ed., Pearson Education (Singapore) Pvt. Ltd., 2001
2.	S. J. Karcher, Molecular Biology: A Project Approach, Academic Press, 2001.
References:	
1.	J. Sambrook, D. W. Russell and J. Sambrook, Molecular Cloning, A laboratory Manual, Cold Spring Harbor Laboratory, USA, 1999.

Course Number & Title: BT1201H Evolution and Genetics	
L-T-P-C: 3-0-0-3	
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	
Offered as (Compulsory / Elective): Compulsory	
Offered to: BTech in EPH	
Offered in (Odd/ Even / Any): Both Odd and Even	
Offered by (Name of Department/ Center): BSBE	
Pre-Requisite: NIL	
Preamble / Objectives (Optional): Understanding evolution and genetics is essential to studying life sciences. This course explores the origin of life, the principles of evolution as proposed by Charles Darwin, and the fundamental concepts of genetics. It covers the structure and organization of cells, their components, and the biomolecules that make up living organisms. Students will learn about genes, chromosomes, and Mendelian genetics, which explain how traits are inherited. The course also introduces DNA structure, replication, and the central dogma of molecular biology, which describes the processes of transcription and translation. Finally, the students will gain insights into genetic diseases.	
Course Content/ Syllabus Origin of life; Darwin's theory of evolution; Cell as the structural and functional unit of life: cell and tissue organization, cell organelles, and their structures; Basic biomolecules of the cell. Genes and chromosomes: Mendelian genetics, DNA structure; Central dogma of molecular biology: DNA replication, transcription and translation; Genetic diseases	
Texts:	
1.	B. Alberts, *Molecular Biology of the Cell*, 7th Edition, W.W. Norton & Company, 2022
2.	D. P. Snustad, M. J. Simmons, *Principles of Genetics*, 7th Ed, Wiley, 2015.
References:	
1	N. Hopkins, J. W. Roberts, J. A. Steitz, J. Watson and A. M. Weiner, *Molecular Biology of the Gene*, 7th Ed, Benjamin Cummings, 1987.
2	Hall, B.K., *Evolution: Principles and Processes*, 1st Ed, Jones & Bartlett, 2011.
3	M. M. Cox, J. A. Doudna, M. O'Donnell, *Molecular Biology: Principles and Practice*, 2nd Ed, W. H. Freeman, 2015.

Course Number & Title: BT1202H Bioenergetics and Metabolism	
L-T-P-C: 3-0-0-3	
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: BTech in EPH	
Offered in (Odd/ Even / Any): Any	
Offered by (Name of Department/ Center): BSBE	
Pre-Requisite: Nil	
Preamble / Objectives (Optional): This course is designed to introduce engineering students to the fundamental principles of biological sciences, with a focus on molecular and energetic processes that sustain life. It bridges concepts from life sciences and medicine with engineering, enabling students to appreciate how biological systems operate and adapt efficiently in nature. The syllabus covers essential bioenergetics, and the students will also gain insights into the biochemical basis of diseases. By integrating biological knowledge with engineering perspectives, the course equips students to recognise and apply bioengineering principles within their own disciplines, fostering interdisciplinary innovation and relevance.	
Course Content/ Syllabus: Nutrients and bioenergetics: Essential nutrients to sustain life, biological energy and laws of thermodynamics; Metabolism: aerobic, anaerobic, fermentative and photosynthetic; Metabolic diseases	
Texts:	
1.	J. L. Tymoczko, J. M. Berg and L. Stryer, Biochemistry, 10th Ed., W. H. Freeman, 2023.
2.	Daniel D. Chiras, *Human Biology*, 7th Edition, Jones & Bartlett Pub, 2010
References:	
1.	Phillips, R., Kondev, J., Theriot, J., and Garcia, H. G., *Physical Biology of the Cell*, 2nd Edition, Garland Science, 2012.
2	Denise R Ferrier, *Lippincott® Illustrated Reviews: Biochemistry*, South Asian Edition, Wolters Kluwer (I) Pvt. Ltd., 2021