Course Curriculum for Spring 2022-23(2nd semester)

S. No.	Course Code	Course Name	L-T-P-C	Instructor(s)	Pre-mid/ post-mid/ entire-sem	Programmes crediting the course
1	CS 201	Data Structures and Algorithms	3-0-0-6	Prof. Koteswararao K	entire-sem	All
2	CS 211	Data Structures and Algorithms Laboratory	0-0-3-3	Prof. Koteswararao K	entire-sem	All
4	MA 103	Differential Equations - I	3-1-0-4	Prof. Dhriti Ranjan Dolai	post-mid	All
5	MA 102	Linear Algebra	3-1-0-4	Prof. Shreedevi Masuti	pre-mid	All except CIE
6	ME 111	Engineering Graphics Laboratory	1-0-3-5	Prof. Surya Prakash, Prof. Amar Gaonkar, Prof. Somashekara, Prof. Keerthi MC, Prof. VR Desai	entire-sem	All except BSMS
7	ME 113	Hands-on Engineering Laboratory	0-0-3-3	CE: Prof. Narasamma MMAE: Prof.Hiranya Deka EE: Prof. Satish, Prof. Saroj CSE: Prof. Gayathri/ Prof.Rajshekar	entire-sem	All except BSMS
8	EE 101	Introduction to Electrical Systems and Electronics	3-0-0-6	Prof. Satish Naik	entire-sem	All Except BSMS & CIE
9	PH 102	Elecricity and Magnetism	2-1-0-6	Prof. Kavita Devi	entire-sem	All Except ME, CIE, & CBE
10	ME 202	Engineering Materials	3-0-0-6	Prof. Rakesh Lingam	entire-sem	Only ME
11	ME 201	Engineering Mechanics	2-1-0-6	Prof. Aniket Kataware	entire-sem	Only CIE
12	MA 206	Introduction to Numerical Methods	3-1-0-4	Prof. Amlan Barua	pre-mid	Only CIE
13	CE 101	Introduction to Civil Engineering	2-1-0-6	Prof. Giridhar Rajesh Bande	entire-sem	Only CIE
14	CL 101	Introduction to Chemical Engineering/Process Calculations	3-0-0-6	Prof. Suvamay Jana	entire-sem	Only CBE
15	BB 201	Biomolecules	2-1-0-6	Prof. NS Punekar	entire-sem	Only BSMS & CBE
16	CH 201	Organic Chemistry	3-0-0-3	Prof. Nilkamal Mahanta	pre-mid	Only BSMS
17	CH 203	States of Matter	3-0-0-3	Prof. Sudhir K. Sahoo	post-mid	Only BSMS
18	CH 113	Hands-on-Science Laboratory - II	0-0-3-3	Prof. Rajeswara Rao (Chemistry), Prof. Koushik Saha (Physics), Prof. Sudhanshu Shukla (Biology)	entire-sem	Only BSMS
19	NO 102/NO 104	NSO/NSS	PP/NP	Mr. Ramesh, Dr. Keerthi Kumar	entire-sem	All

Syllabus

Name of Academic Unit: Computer Science and Engineering

Level: UG

i	**Title of the course**	CS 106 Data Structures and Algorithms
ii	**Credit Structure (L-T-P-C)**	(3-0-0-6)
iii	**Type of Course**	Core course
iv	**Semester in which normally to be offered**	Autumn
v	**Whether Full or Half Semester Course**	Full
vi	**Pre-requisite(s), if any (For the students) – *specify course number(s)***	Exposure to Computer Programming
vii	**Course Content**	**Introduction**: data structures, abstract data types, analysis of algorithms. **Creation and manipulation of data structures**: arrays, lists, stacks, queues, trees, heaps, hash tables, balanced trees, tries, graphs. Algorithms for sorting and searching, order statistics, depth-first and breadth-first search, shortest paths and minimum spanning tree.
viii	**Texts/References**	1. Introduction to Algorithms, 3rd edition, by T. Cormen, C. Leiserson, R. Rivest, C. Stein, MIT Press and McGraw-Hill, 2009. 2. Data structures and algorithms in C++, by Michael T. Goodrich, Roberto Tamassia, and David M. Mount, Wiley, 2004.
ix	**Name(s) of Instructor(s)**	
x	**Name(s) of other Departments/ Academic Units to whom the course is relevant**	NA
xi	**Is/Are there any course(s) in the same/ other academic unit(s) which is/ are equivalent to this course? If so, please give details.**	No
xii	**Justification/ Need for introducing the course**	Basic course in data structures and algorithms.

Name of Academic Unit: Computer Science and Engineering

Level: UG

	Title of the course	CS 111 Data Structures and Algorithms Laboratory
ii	**Credit Structure (L-T-P-C)**	(0-0-3-3)
iii	**Type of Course**	Core course
iv	**Semester in which normally to be offered**	Autumn
v	**Whether Full or Half Semester Course**	Full
vi	**Pre-requisite(s), if any (For the students) – *specify course number(s)***	Exposure to Computer Programming (CS 102)
vii	**Course Content**	Laboratory course for CS 211 is based on creating and manipulating various data structures and implementation of algorithms.
viii	**Texts/References**	1. Introduction to Algorithms, 3rd edition, by T. Cormen, C. Leiserson, R. Rivest, C. Stein, MIT Press and McGraw-Hill, 2009. 2. Data structures and algorithms in C++, by Michael T. Goodrich, Roberto Tamassia, and David M. Mount, Wiley, 2004.
x	**Name(s) of Instructor(s)**	
x	**Name(s) of other Departments/ Academic Units to whom the course is relevant**	NA
xi	**Is/Are there any course(s) in the same/ other academic unit(s) which is/ are equivalent to this course? If so, please give details.**	No
xii	**Justification/ Need for introducing the course**	Basic Laboratory course in data structures andalgorithms.

Name of Academic Unit: Mathematics
Level: UG

i	**Title of the course**	MA 103 Differential Equations -I
ii	**Credit Structure (L-T-P-C)**	(3-1-0-4)
iii	**Type of Course**	Core course
iv	**Semester in which normally to be offered**	Spring
v	**Whether Full or Half Semester Course**	Half
vi	**Pre-requisite(s), if any (For the students) – *specify course number(s)***	Nil
vii	**Course Content**	Exact equations, integrating factors and Bernoulli equations. Orthogonal trajectories. Lipschitz condition, Picard's theorem, examples on non-uniqueness. Linear differential equations generalities. Linear dependence and Wronskians. Dimensionality of space of solutions, Abel-Liouville formula. Linear ODE's with constant coefficients, the characteristic equations. Cauchy-Euler equations. Method of undetermined coefficients. Method of variation of parameters. Laplace transform generalities. Shifting theorems. Convolution theorem.
viii	**Texts/References**	1. E. Kreyszig, Advanced engineering mathematics (10th Edition), John Wiley (1999) 2. W. E. Boyce and R. DiPrima, Elementary Differential Equations (8th Edition), John Wiley (2005)
ix	**Name(s) of Instructor(s)**	NSNS
x	**Name(s) of other Departments/ Academic Units to whom the course is relevant**	NA
xi	**Is/Are there any course(s) in the same/ other academic unit(s) which is/ are equivalent to this course? If so, please give details.**	No
xii	**Justification/ Need for introducing the course**	This is a fundamental mathematics course which is essential for any branch of engineering

Name of Academic Unit: Mathematics
Level: UG

i	**Title of the course**	MA 102 Linear Algebra
ii	**Credit Structure (L-T-P-C)**	(3-1-0-4)
iii	**Type of Course**	Core course
iv	**Semester in which normally to be offered**	Spring
v	**Whether Full or Half Semester Course**	Half
vi	**Pre-requisite(s), if any (For the students) – *specify course number(s)***	--
vii	**Course Content**	Vectors in R^n, notion of linear independence and dependence, linear span of a set of vectors, vector subspaces of R^n, basis of a vector subspace. Systems of linear equations, matrices and Gauss elimination, row space, null space, and column space, rank of a matrix. Determinants and rank of a matrix in terms of determinants. Abstract vector spaces, linear transformations, matrix of a linear transformation, change of basis and similarity, rank-nullity theorem. Inner product spaces, Gram-Schmidt process, orthonormal bases, projections and least squares approximation. Eigenvalues and eigenvectors, characteristic polynomials, eigenvalues of special matrices (orthogonal, unitary, hermitian, symmetric, skew-symmetric, normal). Algebraic and geometric multiplicity, diagonalization by similarity transformations, spectral theorem for real symmetric matrices, application to quadratic forms.
viii	**Texts/References**	1. H. Anton, Elementary linear algebra with applications (8th Edition), John Wiley (1995). 2. G. Strang, Linear algebra and its applications (4th Edition), Thomson (2006) 3. S. Kumaresan, Linear algebra - A Geometric approach, Prentice Hall of India (2000) 4. E. Kreyszig, Advanced engineering mathematics (10th Edition), John Wiley (1999)
ix	**Name(s) of Instructor(s)**	BVL
x	**Name(s) of other Departments/ Academic Units to whom the course is relevant**	NA
xi	**Is/Are there any course(s) in the same/ other academic unit(s) which is/ are equivalent to this course? If so, please give details.**	No
xii	**Justification/ Need for introducing the course**	This is a fundamental mathematics course which is essential for any branch of engineering

Name of Academic Unit: Mechanical Engineering
Level: UG

I	**Title of the course**	ME 111 Engineering Graphics Lab
Ii	**Credit Structure (L-T-P-C)**	(1-0-3-5)
Iii	**Type of Course**	Core course
Iv	**Semester in which normally to be offered**	Autumn
V	**Whether Full or Half Semester Course**	Full
Vi	**Pre-requisite(s), if any (For the students) – *specify course number(s)***	--
Vii	**Course Content**	**Engineering Graphics with mini-drafter**: Around half a semester and bit more with following topics to be covered. • Introduction to Engineering Graphics • Curves • Projections of Points • Projection of Lines • Projection of Planes • Projections on Auxiliary Planes • Projections of Solids • Sections of Solids • Intersections of Solids **Engineering Graphics with 2D Drafting Software**: 5 weekly computer laboratory sessions covering above using AutoCAD® as a drafting software, 5th session on Isometric Projections.
Viii	**Texts/References**	1. N. D. Bhatt, revised and enlarged by V. M. Panchal and P. R. Ingle, Engineering Drawing, 53rd Edition, 2014, Charotar Publishers, Anand. 2. Warren J. Luzadder and Jon M. Duff, Fundamentals of Engineering Drawing, Prentice-Hall of India. 3. Gopalakrishna K. R., Engineering Drawing Vol. I & II Combined., Subhas Stores, 25th Edition, 2017. 4. Narayana. K. L., and Kannaiah, P. E., Text Book on Engineering Drawing, 2nd Edition, 2013, Scitech Publications, Chennai. 5. Venugopal K. and Prabhu Raja V., Engineering Drawing + AutoCAD, New Age International Publishers, 5th Edition, 2011.
Ix	**Name(s) of Instructor(s)**	SS, TPG, DVP
X	**Name(s) of other Departments/ Academic Units to whom the course is relevant**	NA
Xi	**Is/Are there any course(s) in the same/ other academic unit(s) which is/ are equivalent to this course? If so, please**	No

	give details.	
Xii	**Justification/ Need for introducing the course**	This is a fundamental course which is essential for appreciating the engineering drawings and compulsory for all B.Tech. majors.

Name of Academic Unit: Mechanical Engineering

Level: UG

I	**Title of the course**	ME 113 Hands on Engineering Lab
Ii	**Credit Structure (L-T-P-C)**	(0-0-3-3)
Iii	**Type of Course**	Core course
Iv	**Semester in which normally to be offered**	Autumn
V	**Whether Full or Half Semester Course**	Full
Vi	**Pre-requisite(s), if any (For the students) – *specify course***	--
Vii	**Course Content**	**List of Experiments (Mechanical Workshop)** • To make a Square-fit from the given mid steel pieces (Fitting) • To make a V-fit from the given mid steel pieces (Fitting) • To make a rectangular tray as per required dimensions (Sheet Metal) • To build a transition piece (Sheet Metal) • To make a Butt joint using the given two M.S pieces (Arc welding) • To make a lap joint using the given two M.S pieces (Arc welding) • To build a pipe-line using fittings for given flow circuit (Plumbing) **List of Experiments (Electrical Workshop)** • To control one lamp by a one switch with provision for plug socket with switch control (Electrical wiring) • To do stair case wiring (i.e. control of one lamp by two switches fixed at two different places) (Electrical wiring) • Measurement of hot and cold resistance of filament • Improvement of Power Factor • Calibration of Energy meter • Measurement of Power using three ammeter/voltmeter method **List of Experiments (Electronics)** • Understanding breadboard, One-way traffic • Introduction to Arduino and Buzzer • Using Arduino speed measurement of motor/ glowing of LED • Control of water level using Arduino • Line follower using Arduino

viii	**Texts/References**	Elements of Workshop Technology Vol. 1 (2015), S. K. Hajra Choudhary, A. K. Hajra Choudhary and Nirjhar Roy, Media Promoters and Publishers Pvt. Ltd. W. A. J. Chapman, Workshop Technology, Vol. 1 (2006), Vol 2 (2007), and (1995), CBS Publishers.
ix	**Name(s) of Instructor(s)**	DVP, SSR, TPG, AKM, RG, BBN
X	**Name(s) of other Departments/ Academic Units to whom the course is relevant**	NA
xi	**Is/Are there any course(s) in the same/ other academic unit(s) which is/ are equivalent to this course? If so, please give details.**	No
xii	**Justification/ Need for introducing the course**	This is a fundamental course which is essential for appreciating the hands-on aspects for a general engineering and compulsory for all B.Tech. majors.

Name of Academic Unit: Electrical engineering
Level: UG

i	**Title of the course**	EE101 Introduction to Electrical Systems and Electronics
ii	**Credit Structure (L-T-P-C)**	(3-0-1-7)
iii	**Type of Course**	Core course
iv	**Semester in which normally to be offered**	Spring
v	**Whether Full or Half Semester Course**	Full
vi	**Pre-requisite(s), if any (For the students) – *specify course number(s)***	Exposure to Calculus
vii	**Course Content**	**From Physics to Electrical Engineering** (a) Lumped matter discipline (b) Batteries, resistors, current sources and basic laws (c) I-V characteristics and modeling physical systems **Basic Circuit Analysis Methods** (a) KCL and KVL, voltage and current dividers (b) Parallel and serial resistive circuits (c) More complicated circuits (d) Dependent sources, and the node method (e) Superposition principle (f) Thevenin and Norton method of solving linear circuits (g) Circuits involving diode. **Analysis of Non-linear Circuits** (a) Toy example of non-linear circuit and its analysis (b) Incremental analysis (c) Introduction to MOSFET Amplifiers (d) Large and small signal analysis of MOSFETs (e) MOSFET as a switch **Introduction to the Digital World** (a) Voltage level and static discipline (b) Boolean logic and combinational gates (c) MOSFET devices and the S Model (d) MOSFET as a switch; revisited (e) The SR model of MOSFETs (f) Non-linearities: A snapshot **Capacitors and Inductors** (a) Behavior of capacitors, inductors and its linearity (b) Basic RC and RLC circuits (c) Modeling MOSFET anomalies using capacitors (d) RLC circuit and its analysis (e) Sinusoidal steady state analysis (f) Introduction to passive filters

		Operational Amplifier Abstraction (a) Introduction to Operational Amplifier (b) Analysis of Operational amplifier circuits (c) Op-Amp as active filters (d) Introduction to active filter design **Transformers and Motors** (a) AC Power circuit analysis (b) Polyphase circuits (c) Introduction to transformers (d) Introduction to motors
viii	**Texts/References**	1. Anant Agarwal and Jefferey H. Lang, "Foundations of Analog and Digital Electronics Circuits," Morgan Kaufmann publishers, 2005 2. Wlilliam H. Hayt, Jr., Jack E. Kemmerly and Steven M. Durbin, "Engineering Circuit Analysis," Tata McGraw-Hill 3. Theodore Wildi, "Electrical Machines, Drives and Power Systems," Pearson, 6-th edition. 4. V. Del. Toro, "Electrical Engineering Fundamentals," Pearson publications, 2nd edition.
ix	**Name(s) of Instructor(s)**	BNB
x	**Name(s) of other Departments/ Academic Units to whom the course is relevant**	Core course for first year B.Tech
xi	**Is/Are there any course(s) in the same/ other academic unit(s) which is/ are equivalent to this course? If so, please give details.**	No
xii	**Justification/ Need for introducing the course**	To introduce students to basics of electrical engineering.

Name of Academic Unit: Physics
Level: UG

I	**Title of the Course**	PH102 Electricity and Magnetism
Ii	**Credit Structure (L-T-P-C)**	(2-1-0-6)
Iii	**Type of Course**	Core course
Iv	**Semester in which normally to be offered**	Spring
V	**Whether Full or Half Semester Course**	Full
Vi	**Pre-requisite(s), if any (For the students) – *specify course number(s)***	--
Vii	**Course Content**	• Review of vector calculus: Spherical polar and cylindrical coordinates; gradient, divergence and curl; • Divergence and Stokes` theorems; • Divergence and curl of electric field, Electric potential, properties of conductors; • Poisson's and Laplace's equations, uniqueness theorems, boundary value problems, separation of variables, method of images, multipoles; • Polarization and bound charges, Gauss` law in the presence of dielectrics, Electric displacement D and boundary conditions, linear dielectrics; • Divergence and curl of magnetic field, Vector potential and its applications; • Magnetization, bound currents, Ampere`s law in magnetic materials, Magnetic field H, boundary conditions, classification of magnetic materials; • Faraday's law in integral and differential forms, Motional emf, Energy in magnetic fields, Displacement current, Maxwell's equations, • Electromagnetic (EM) waves in vacuum and media, Energy and momentum of EM waves, Poynting`s theorem; • Reflection and transmission of EM waves across linear media.
Viii	**Texts/References (separate sheet may be used, if necessary)**	(1) Introduction to Electrodynamics (4th ed.), David J. Griffiths, Prentice Hall, 2015. (2) Classical Electromagnetism, J. Franklin, Pearson Education, 2005.
Ix	**Name(s) of Instructor(s)**	DN, RP, KS
X	**Name(s) of other Departments/ Academic Units to whom the course is relevant**	NA
Xi	**Is/Are there any course(s) in the same/ other academic unit(s) which is/ are equivalent to this course? If so, please give details.**	No

Xii	**Justification/ Need for introducing the course**	The course introduces the principles of electricity and magnetism. This is a fundamental and necessary course in physics, which all students have to undergo at least once during their B.Tech.

Name of Academic Unit: Mechanical Engineering

Level: UG

I	**Title of the course**	ME 202 Engineering Materials
Ii	**Credit Structure (L-T-P-C)**	(2-1-0-6)
Iii	**Type of Course**	Core course
Iv	**Semester in which normally to be offered**	Spring
V	**Whether Full or Half Semester Course**	Full
Vi	**Pre-requisite(s), if any (For the students) – *specify course number(s)***	Nil
Vii	**Course Content**	**Economic, Environmental and Societal Issues in Materials Science & Engineering** **Basic Materials Science**: Crystallography, phase diagrams, grain boundaries, dislocation movements and their effects on Properties **Material properties**: Stress-strain relationships, Tensile strength, Toughness, Impact Strength, Ductility, Malleability, Stress intensity, Fatigue **Failure:** by Oxidation, Corrosion (Types, impact on material

		Strengthening mechanisms: Solute Hardening, chemical hardening, dispersion hardening, cold working, strain Hardening
		Aluminium alloys: Properties, phase diagrams and uses **Copper alloys**: Properties phase diagrams and uses **Ferrous Alloys (Steels):** Types, properties, iron-carbon phase diagrams **Material Selection:** Ashby Charts **Ceramics:** Structure and Properties, Mechanical Properties of Ceramics, Types and Application of Ceramics, Fabrication and Processing of Ceramics **Polymers:** Molecules, Structures and Shapes, Thermosetting & Thermoplastic, Polymer Crystals, Polymer Characteristics and Applications, Synthesis, Processing and Degradation. **Composites:** Processing of Fiber Reinforced Composites, Structural Composites, Application of Composites
Viii	**Texts/References**	TEXTBOOKS 1.W.D. Callister, Jr. & D.G. Rethwisch: 'Materials science and Engineering: An Introduction', 9th Ed., John Wiley (2014)

Name of Academic Unit: Mechanical Engineering

Level: UG

I	**Title of the course**	ME 201 Engineering Mechanics
Ii	**Credit Structure (L-T-P-C)**	(2-1-0-6)
Iii	**Type of Course**	Core course
Iv	**Semester in which normally to be offered**	Autumn
V	**Whether Full or Half Semester Course**	Full
Vi	**Pre-requisite(s), if any (For the students) – *specify course number(s)***	--
Vii	**Course Content**	**Module 1:** Introduction to Engineering Mechanics covering, Force Systems Basic concepts, Particle equilibrium in 2-D & 3-D; Rigid Body equilibrium; System of Forces, Coplanar Concurrent Forces, Components in Space – Resultant- Moment of Forces and its Application; Couples and Resultant of Force System, Equilibrium of System of Forces, Free body diagrams, Equations of Equilibrium of Coplanar Systems and Spatial Systems; Static Indeterminacy **Module 2:** Friction covering, Types of friction, Limiting friction, Laws of Friction, Static and Dynamic Friction; Motion of Bodies, wedge friction, screw jack & differential screw jack; **Module 3:** Basic Structural Analysis covering, Equilibrium in three dimensions; Method of Sections; Method of Joints; How to determine if a member is in tension or compression; Simple Trusses; Zero force members; Beams & types of beams; Frames & Machines; **Module 4:** Centroid and Centre of Gravity covering, Centroid of simple figures from first principle, centroid of composite sections; Centre of Gravity and its implications; Area moment of inertia- Definition, Moment of inertia of plane sections from first principles, Theorems of moment of inertia, Moment of inertia of standard sections and composite sections; Mass moment inertia of circular plate, Cylinder, Cone, Sphere, Hook; **Module 5:** Virtual Work and Energy Method- Virtual displacements, principle of virtual work for particle and ideal system of rigid bodies, degrees of freedom. Active force diagram, systems with friction, mechanical efficiency. Conservative forces and potential energy (elastic and gravitational), energy equation for equilibrium. Applications of energy

		method for equilibrium. Stability of equilibrium. **Module 6:** Particles dynamics- Kinematics of Particles: Rectilinear motion, Plane curvilinear motion - rectangular coordinates, normal and tangential coordinates, polar coordinates, Space curvilinear - cylindrical, spherical (coordinates), Relative and Constrained motion. Kinetics of Particles: Force, mass and acceleration – rectilinear and curvilinear motion, work and energy, impulse and momentum – linear and angular; Impact – Direct and Oblique. Kinetics of System of Particles: Generalized Newton's Second Law, Work-Energy, Impulse-Momentum, Conservation of Energy and Momentum **Module 7:** Introduction to Rigid body dynamics Kinematics of Planar Rigid Bodies: Equations for rotation of a rigid body about a fixed axis, General plane motion, Instantaneous Center of Rotation in Plane Motion Plane Motion of a Particle Relative to a Rotating Frame. Coriolis Acceleration Kinetics of Planar Rigid Bodies: Equations of Motion for a Rigid Body, Angular Momentum of a Rigid Body in Plane Motion, Plane Motion of a Rigid Body and D'Alembert's Principle, Systems of Rigid Bodies, Constrained Plane Motion; Energy and Work of Forces Acting on a Rigid Body, Kinetic Energy of a Rigid Body in Plane Motion, Systems of Rigid Bodies, Conservation of Energy, Plane Motion of a Rigid Body - Impulse and Momentum, Systems of Rigid Bodies, Conservation of Angular Momentum. **Module 8:** Mechanical Vibrations covering, Basic terminology, free and forced vibrations, resonance and its effects; Degree of freedom; Derivation for frequency and amplitude of free vibrations without damping and single degree of freedom system, simple problems, types of pendulum, use of simple, compound and torsion pendulums
Viii	**Texts/References**	**Textbooks:** 1. J. L. Meriam and L. G. Kraige, Engineering Mechanics, Vol I – Statics, Vol II – Dynamics, 6th Ed, John Wiley, 2008. 2. F. P. Beer and E. R. Johnston, Vector Mechanics for Engineers, Vol I - Statics, Vol II – Dynamics, 9th Ed, Tata McGraw Hill, 2011. 3. R. C. Hibbler, Engineering Mechanics: Principles of Statics and Dynamics, Pearson Press, 2006.

		References: 1. S. P. Timoshenko and D. H. Young, Engineering Mechanics. Fourth Edition. McGraw-Hill, New York, 1956. 2.I. H. Shames, Engineering Mechanics: Statics and dynamics, 4th Ed, PHI, 2002. 3.Robert W. Soutas-Little; Daniel J. Inman; Daniel Balint, Engineering Mechanics: Dynamics – Computational Edition, 1st Ed., Cengage Learning, 2007 4.Robert W. Soutas-Little; Daniel J. Inman; Daniel Balint, Engineering Mechanics: Statics-Computational Edition, 1st Ed., ,Cengage Learning,
Ix	**Name(s) of Instructor(s)**	TPG, PS
X	**Name(s) of other Departments/ Academic Units to whom the course is relevant**	NA
xi	**Is/Are there any course(s) in the same/ other academic unit(s) which is/ are equivalent to this course? If so, please give details.**	No
xii	**Justification/ Need for introducing the course**	This is a fundamental and core course which is essential for appreciating the influence of forces and force systems on particles/rigid bodies for all mechanical engineering students. This basic engineering course forms the base on which other course like Mechanics of Solids and Theory of Machines.

Name of Academic Unit: Mathematics

Level: UG.

1	**Title of the course**	MA 406 Introduction to Numerical Methods
2	**Credit Structure (L-T-P-C)**	L: **3** T: **1** P: 0 C: **4**
3	**Mention academic programme(s) for which this course will be a core course** (Write "elective" if not core for any)	Mechanical Engineering
4	**Semester in which normally it is offered** Tick mark (or underline) appropriate option(s)	☐ ~~Autumn (August-Nov)~~ ☐ Spring (Jan-Apr) ☐ Summer (May-July)
5	**Whether full or half semester course** Tick mark (or underline) appropriate option	☐ ~~Full Semester~~ ☐ Half Semester
6	**Course content**	Interpolation by polynomials, divided differences, error of the interpolating polynomial, piecewise linear and cubic spline interpolation. Numerical integration, composite rules, error formulae. Solution of a nonlinear equation, bisection and secant methods. Newton's method, rate of convergence, solution of a system of nonlinear equations, Numerical solution of ordinary differential equations, Euler and Runge-Kutta methods, multi-step methods, predictor-corrector methods, order of convergence, Finite difference methods, numerical solutions of elliptic, parabolic, and hyperbolic partial differential equations. Exposure to MATLAB
7	**Texts/References**	S. D. Conte and Carl de Boor, Elementary Numerical Analysis- An Algorithmic Approach (3rd Edition), McGraw-Hill, 1980

8	**Name (s) of the instructor (s)**	Amlan K. Barua, Sagnik Sen
9	**Name (s) of other departments / Academic Units to whom the course is relevant**	Any branch of science and engineering
10	**Is/Are there any course(s) in the same/ other academic unit(s) which is/ are equivalent to this course? If so, please give details.**	No
11	**Mandatory Pre-requisite(s) - specify course number(s)**	Calculus, MA101 & Linear Algebra, MA 106
12	**Recommended Pre-requisite(s) - specify course number(s)**	None
13	**Mention 8 to 12 keywords/phrases about this course that would facilitate automated course recommendation and course interdependency** (These may or may not be from the syllabus content)	Scientific computing, numerical methods, interpolation, numerical integration, nonlinear equations, numerical ordinary differential equations
14	**Justification/ Need for introducing the course**	This is a first course in numerical methods and introduces topics like interpolation, numerical integration and solution of nonlinear equations. These topics, along with numerical linear algebra, formulate the basis for computer aided engineering (CAE), therefore, any student motivated to learn and work in CAE would benefit from this course. Also this course serves as a pre-requisite for more advanced courses like finite element, finite volume etc. where the ideas formulated in this course is used routinely.

CE 101: Introduction to Civil Engineering

Proposed Syllabus

What is Civil Engineering/ Infrastructure, History of Civil Engineering, Overview of ancient & modern civil engineering marvels, current national planning for civil engineering/ infrastructure projects, scope of work involved in various branches of Civil Engineering – Architecture & Town planning, Surveying & Geomatics, Structural Engineering, Construction Management, Construction materials, Hydrology and Water Resources Engineering, Hydraulic Engineering, Environmental Engineering &Sustainability, Pavement Engineering and construction, Traffic & Transportation Engineering and Management, Geotechnical Engineering, Ocean Engineering, Building Energy Efficiency, Basics of Contract Management, Professional Ethics, Avenues for entrepreneurial working, Creativity & Innovativeness in Civil Engineering,

Text/Reference Books:

1. Patil, B.S.(1974), Legal Aspects of Building and Engineering Contract
2. The National Building Code, BIS, (2017)
3. RERA Act, (2017)
4. Meena Rao (2006), Fundamental concepts in Law of Contract, 3rd Edn. Professional
5. T. Ramappa (2010), Intellectual Property Rights Law in India, Asia Law House
6. Vee, Charles & Skitmore, Martin (2003) Professional Ethics in the Construction Industry, Engineering Construction and Architectural management, Vol.10, Iss. 2, pp 117-127, MCB UP Ltd
7. American Society of Civil Engineers (2011) ASCE Code of Ethics – Principles Study and Application
8. www.ieindia.org

Name of Academic Unit : Chemical Engineering

Level : UG

i	**Title of the course**	**CL 101 Introduction to Chemical Engineering**
ii	Credit Structure (**L-T-P-C**)	**(3-0-0-6)**
iii	**Type** of Course	
iv	Semester in which normally to be offered	
v	Whether **Full or Half Semester** Course	Full semester
vi	**Pre-requisite(s)**, if any (For the students) – *specify course number(s)*	Nil
vii	Course **Content***	Historical overview of Chemical Engineering: Concepts of unit operations and unit processes, and more recent developments, Features of organized chemical processing- from chemistry to chemical engineering. The Chemical Industry-scope, features & characteristics. and scope. Principles of balancing with examples to illustrate differential and integral balances, lumped and distributed balances. Material balances in simple systems involving physical changes and chemical reactions; systems involving recycle, purge. and bypass. Properties of substances: single component & multicomponent, single and multiphase systems. Use of Compressibility charts, vapour pressure correlations/charts & Psychometric charts. Ideal liquid and gaseous mixtures. Energy balance calculations in simple systems. Introduction to Computer aided calculations-steady state material and energy balances
Viii	Texts/References	1. R. M. Felder and R.W. Rousseau, Elementary Principles of Chemical Processes, 3rd ed., John Wiley, New York, 2004. 2. D. M. Himmelblau and J. B. Riggs, Basic Principles and Calculations in Chemical Engineering. 7th ed., Prentice Hall, 2003. 3. B. I. Bhatt and S. M. Vora, Stoichiometry. 4th ed., McGraw Hill, 2004.
ix	Name(s) of **Instructor(s)** ***	
x	Name(s) of **other Departments/ Academic Units to whom** the course is **relevant**	Chemical Engineering
xi	Is/Are there any course(s) in the same/ other academic unit(s) which is/ are **equivalent** to this course? If so, please give details.	No
xii	**Justification/ Need** for introducing the course	

Name of Academic Unit: Biosciences and Bioengineering
Level:UG

1	**Title of the course**	BB 201 Biomolecules
2	**Credit Structure (L-T-P-C)** (e.g. L:2, T:1, P:0, C:6)	L:2 T: 1 P: 0 C: 6
3	**Whether full or half semester course** Tick mark (or underline) appropriate	Full Semester
4	**Course content**	**Major classes of biological molecules:** Comparison of the alphabets and sources of structural diversity of proteins, nucleic acids, carbohydrates and lipids. **Proteins:** Ramachandran plot, evolution of protein structure, structure-function relationships: myoglobin and adaptations in myoglobin structure in deep diving mammals; allostery in hemoglobin; Bohr effect (for pH and carbon dioxide); adult and foetal hemoglobin**.** **Post-translational modifications**: special types of covalent bonds found in proteins. Protein folding: Natively folded and natively disordered proteins; miniproteins and peptide toxins; Anfinsen's observations, Levinthal paradox, cooperativity in protein folding, free energy landscape of protein folding and pathways of protein folding, molten globule state, diseases associated with protein folding. **Carbohydrates:** Sources of structural diversity; structure- function relationshipin glycogen and cellulose, Difficulty associated with sequencing of glycans. **Lipids:** Structure and properties of storage and membrane lipids. Self-assembly of lipids: packing parameter; Biomembrane organization - sidedness and function; membrane bound proteins - structure, properties and function; transport phenomena. **Nucleic acids:** Historical perspective leading up to the proposition of DNA double helical structure with emphasis on the innovativeness of experimental design; Secondary structure of RNA; chromatin organization.

		Pauling's intuition and proposal, catalytic antibodies; Catalytic strategies; Isozymes: Haldane relationship between kinetic constants and equilibrium constant; Zymogens. **Bioenergetics:** basic principles; equilibria and concept of free energy; coupled interconnecting reactions in metabolism; oxidation of carbon fuels; recurring motifs in metabolism. Relevant metabolic pathways may be included to discuss relevant concepts.
5	**Texts/References**	1. Rodney F Boyer, Concepts in Biochemistry. John Wiley & Sons; 3rd Ed (2 December 2005). 2. Thomas Miilar, Biochemistry Explained: A Practical Guide to Learning Biochemistry CRC Press; 1 edition (30 May 2002) 3. Lubert Stryer et al., Biochemistry.W. H. Freeman; 6th Edition edition (14 July 2006) 4. David L Nelson, and Michael M Cox et al., Lehninger principles of biochemistry WH Freeman; 7th ed. 2017 edition (1 January 2017)
6	**Name (s) of other departments / Academic Units to whom the course is relevant**	Bioscience and Bioengineering, Chemistry, Chemical Engineering
7	**Is/Are there any course(s) in the same/ other academic unit(s) which is/ are equivalent to this course? If so, please give details.**	None
8	**Mandatory Pre-requisite(s) - specify course**	None
9	**Recommended Pre-requisite(s) - specify course number(s)**	None
10	**Justification / Need for introducing the course**	To understand the importance of biomolecules (carbohydrates, lipids, proteins and nucleic acids) and its chemical diversity in shaping the biological structure and function. Students can appreciate how complex living systems are built from a handful of simple atoms and how their molecular interactions in the aqueous environment of the cells interior bring about unique functions to life matter which is essential to sustain diverse life forms in our planet.

Name of Academic Unit: Chemistry

Level: UG

i	**Title of the course**	**CH 201 Organic chemistry**
ii	Credit Structure (**L-T-P-C**)	**(3-0-0-3)**
iii	Type of Course	Core course
iv	Semester in which normally to be offered	Fall/Spring
v	Whether **Full or Half Semester** Course	Half
vi	**Pre-requisite(s)**, if any	Fundamental concepts and applications of chemistry (CH101)
vii	Course **Content***	**Reactive Intermediates**: An overview of the chemistry of carbenes, nitrenes, radicals, carbocations, carbanions and benzynes. Introduction to substitution, elimination, addition, oxidation, reduction, rearrangement types of reactions **Epoxidation named reactions**: Jacobsen and Sharpless. **Olefination named reactions**: Wittig, Julia, Wharton, Peterson, Tebbe. **Cross-Coupling named reactions**: Buchwald-Hartwig, Negishi, Sonogashira, Suzuki, Wurtz, Ullmann, McMurry, Heck, Stille. **Pericyclic reactions**: Diels-alder cycloaddition, Ene reaction, Cope rearrangement, Claisen rearrangement (Johnson, Ireland and Eschenmoser). **Organic chemistry in industry**: Pharmaceuticals, dye, and agrochemicals
Viii	Texts/References	1. Jerry March and Michael Smith, "Advanced Organic Chemistry", 7th Ed., Wiley, 2015. 2. F. A. Carey and R. J. Sundberg, "Advanced Organic Chemistry, Part A and B", 5th Ed., Springer, 2008. 3. J. Clayden, N. Greeves, and S. Warren, "Organic Chemistry", 2nd Ed., Oxford University Press, 2014. 4. W. Carruthers and I. Coldham, "Modern Methods of Organic Synthesis", 4th Ed., Cambridge University Press, 2015.

		5. Laszlo Kurti and Barbara Czako, "Strategic applications of named reactions in organic synthesis", 1st Ed., Elsevier, 2005. 6. R. B. Grossman, "Art of writing reasonable organic reaction mechanisms", 2nd Ed., Springer, 2010. 7. P. Bruice, "Organic Chemistry" 7th Ed., Pearson, 2013. 8. Penny Chaloner, "Organic chemistry: A mechanistic approach, CRC Press; 1st edition, 2014
ix	Name(s) of **Instructor(s)** ***	TBD
x	Name(s) of **other Departments/ Academic Units to whom** the course is **relevant**	BS-MS
xi	Is/Are there any course(s) in the same/ other academic unit(s) which is/ are **equivalent** to this course? If so, please give details.	NA
xii	**Justification/ Need** for introducing the course	This course provides foundation for organic chemistry and reaction mechanisms for B.Tech students to carry out further advanced courses as well as it is relevant to different fields of research in sciences and engineering.

Name of Academic Unit : Chemistry

Level : UG

i	**Title of the course**	**CH 203 States of matter**
ii	Credit Structure (**L-T- P-C**)	**(3-0-0-3)**
iii	**Type** of Course	
iv	Semester in which normally to be offered	Spring/Autumn
v	Whether **Full or Half Semester**	Half-semester
vi	**Pre-requisite(s)**, if any (For the students) – *specify*	Fundamental concepts and applications of chemistry (CH101)
vii	Course **Content***	The Gaseous State: Gas laws, Equation of state, Concept of temperature, pressure, partial pressure, density, Mole concept. Kinetic Theory of Gases: Maxwells distribution of molecular velocities, Collisions theory. Viscosity of gases. Energy distribution function, Phase rule and equilibria. Real Gases: Deviations from ideal behaviour, Compressibility factors, van der Waals and Virial equation, Reduced equation of state, Law of corresponding states, Critical phenomena, Intermolecular forces. The solid and liquid states and their properties.
Viii	Texts/References	1. K. L. Kapoor, A Textbook of Physical Chemistry, States of Matter and Ions In Solution (SI Units) - Vol. 1 | 6th Edition 2. P. Atkins, Julio de Paula, J. Keeler, Atkins' Physical Chemistry: International Eleventh Edition
ix	Name(s) of **Instructor(s)** ***	
x	Name(s) of **other Departments/ Academic Units to whom** the course is **relevant**	BS-MS
xi	Is/Are there any course(s) in the same/ other academic unit(s) which is/ are **equivalent** to this course? If so, please give details.	No
xii	**Justification/ Need** for	