Semester II						
Sr No	**Course Code**	**Course Name**	**L**	**T**	**P**	**C**
1	MA 102	Linear Algebra	3	1	0	4
2	BB 201	Biomolecules	2	1	0	6
3	ME 111	Engineering Graphics Lab	1	0	3	5
4	EE 101	Introduction to Electrical Systems and Electronics	3	0	1	6
5	CS 106	Data Structures and Algorithms	3	0	0	6
6	CS 111	Data Structures and Algorithms Laboratory	0	0	3	3
7	ME 113	Hands-on Engineering Laboratory	0	0	3	3
8	CL 101	Introduction to Chemical Engineering	3	0	0	6
9	NO 102/ NO 104	National Sports Organization (NSO)/National Service Scheme (NSS)				PP/NP
		Total Credits				39

1	**Title of the course (L-T-P-C)**	**Linear Algebra (3-1-0-4)**
2	**Pre-requisite courses(s)**	--
3	**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. .
4	**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)

1	**Title of the course (L-T-P-C)**	**Engineering Graphics Lab (1-0-3-5)**
2	**Pre-requisite courses(s)**	--
3	**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.
4	**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., Textbook 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.

1	**Title of the course (L-T-P-C)**	**Biomolecules (2-1-0-6)**
2	**Pre-requisite courses(s)**	**None**
3	**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 relationship in 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. **Enzymes:** General principles of catalysis; quantitation of enzyme activity and efficiency; Henri-Michaelis-Menten and Briggs-Haldane relationships. **Transition state:** definition Pauling's intuition and proposal, catalytic antibodies; Catalytic strategies. **Isozymes:** Haldane relationship between kinetic constants and equilibrium constants; 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.
4	**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)

1	**Title of the course (L-T-P-C)**	**Introduction to Electrical Systems and Electronics (3-0-0-6)**
2	**Pre-requisite courses(s)**	**Exposure to Calculus**
3	**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

4	**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.

1	**Title of the course (L-T-P-C)**	**Data Structures and Algorithms (3-0-0-6)**
2	**Pre-requisite courses(s)**	**Exposure to Computer Programming**
3	**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.
4	**Texts/References**	**1.** Introduction to Algorithms, 3rd edition, by T. Cormen, C. Leiserson, R. Rivest, C. Stein, MIT Pressand McGraw-Hill, 2009. **2.** Data structures and algorithms in C++, by MichaelT. Goodrich, Roberto Tamassia, and David M. Mount,Wiley, 2004.

1	**Title of the course (L-T-P-C)**	**Data Structures and Algorithms Laboratory (0-0-3-3)**
2	**Pre-requisite courses(s)**	**Exposure to Computer Programming (CS 102)**
3	**Course content**	Laboratory course for CS 211 is based on creatingand manipulating various data structures and implementation of algorithms.
4	**Texts/References**	1. Introduction to Algorithms, 3rd edition, by T. Cormen, C. Leiserson, R. Rivest, C. Stein, MIT Pressand McGraw-Hill, 2009. 2. Data structures and algorithms in C++, by Michael T.Goodrich, Roberto Tamassia, and David M. Mount, Wiley, 2004.

1	**Title of the course (L-T-P-C)**	**Introduction to Chemical Engineering (3-0-0-6)**
2	**Pre-requisite courses(s)**	**Nill**
3	**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.
4	**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.