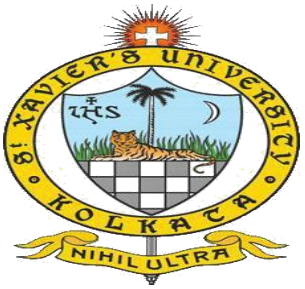
St. Xavier's University, Kolkata



Syllabus for

B. Tech. in Electronics and Communication Engineering (ECE)

Course Curriculum

Semester I						
S.No	**Course Type**	**Course Title**	**Hours per Week**			**Credits**
			L	**T**	**P**	
1.	BSC	Chemistry	3	1	2	5
2.	BSC	Mathematics-I	3	1	0	4
3.	ESC	Programming and Problem solving	3	0	2	4
4.	ESC	Workshop	1	0	4	3
5.	ESC	Design Thinking	0	0	2	1
6.	HSMC	Communicative English	2	0	2	3
Total			26			20

Semester II						
S.No	**Course Type**	**Course Title**	**Hours per Week**			**Credits**
			L	**T**	**P**	
1.	BSC	Physics	3	1	2	5
2.	BSC	Mathematics-II	3	1	0	4
3.	ESC	Engineering Graphics and Design	1	0	4	3
4.	ESC	Basic Electrical Engineering	2	1	2	4
5.	PEC	Data Structure and Algorithms	3	0	4	5
6.	HSMC	Universal Human Values: Understanding Harmony and Ethical Human Conduct	2	1	0	3
Total			30			24

Detailed Syllabus

SEMESTER I

Chemistry

Credit: 5
Semester: I
Nature of the Course: Core Course

Course Content:

Module No.	Module Name	Chapter Topic
I	Atomic and Molecular Structure	Schrodinger equation. Particle in a box solutions and their applications for conjugated molecules and nanoparticles. Forms of the hydrogen atom wave functions and the plots of these functions to explore their spatial variations. Molecular orbitals of diatomic molecules and plots of the multicenter orbitals. Equations for atomic and molecular orbitals. Energy level diagrams of diatomic. Pi-molecular orbitals of butadiene and benzene and aromaticity. Crystal field theory and the energy level diagrams for transition metal ions and their magnetic properties. Band structure of solids and the role of doping on band structures.
II	Spectroscopic techniques and applications	Principles of spectroscopy and selection rules. Electronic spectroscopy. Fluorescence and its applications in medicine. Vibrational and rotational spectroscopy of diatomic molecules. Applications. Nuclear magnetic resonance and magnetic resonance imaging, surface characterization techniques. Diffraction and scattering.
III	Intermolecular forces and potential energy surfaces	Ionic, dipolar and van Der Waals interactions. Equations of state of real gases and critical phenomena. Potential energy surfaces of H3, H2F and HCN and trajectories on these surfaces.
IV	Use of free energy in chemical equilibria	Thermodynamic functions: energy, entropy and free energy. Estimations of entropy and free energies. Free energy and EMF. Cell potentials, the Nernst equation and applications. Acid base, oxidation reduction and solubility equilibria. Water chemistry. Corrosion. Use of free energy considerations in metallurgy through Ellingham diagrams.
V	Periodic properties	Effective nuclear charge, penetration of orbitals, variations of s, p, d and f orbital energies of atoms in the periodic table, electronic configurations, atomic and ionic sizes, ionization energies, electron affinity and electronegativity, polarizability, oxidation states, coordination numbers and geometries, hard soft acids and bases, molecular geometries.
VI	Stereochemistry	Representations of 3 dimensional structures, structural isomers and stereoisomers, configurations and symmetry and chirality, enantiomers, diastereomers, optical activity, absolute configurations and conformational analysis. Isomerism in transitional metal compounds.

VII	Organic reactions and synthesis of a drug molecule	Introduction to reactions involving substitution, addition, elimination, oxidation, reduction, cyclization and ring openings. Synthesis of a commonly used drug molecule.

Practical:

The following topics are to be covered:
Choice of 10-12 experiments from the following:

1. Determination of surface tension and viscosity.
2. Thin layer chromatography.
3. Ion exchange column for removal of hardness of water.
4. Determination of chloride content of water.
5. Colligative properties using freezing point depression.
6. Determination of the rate constant of a reaction.
7. Determination of cell constant and conductance of solutions.
8. Potentiometry - determination of redox potentials and EMFs.
9. Synthesis of a polymer/drug.
10. Saponification/acid value of an oil.
11. Chemical analysis of a salt.
12. Lattice structures and packing of spheres.
13. Models of potential energy surfaces.
14. Chemical oscillations- Iodine clock reaction.
15. Determination of the partition coefficient of a substance between two immiscible liquids.
16. Adsorption of acetic acid by charcoal.
17. Use of the capillary viscosimeters to the demonstrate of the isoelectric point as the pH of minimum viscosity for gelatin sols and/or coagulation of the white part of egg.

Suggested Books [Latest edition]:

1. Chemistry – I with Lab Manual, Khanna Book Publishing.
2. Engineering Chemistry, by Manisha Agrawal.
3. University chemistry, by B. H. Mahan.
4. Chemistry: Principles and Applications, by M. J. Sienko and R. A. Plane.
5. Fundamentals of Molecular Spectroscopy, by C. N. Banwell.
6. Engineering Chemistry (NPTEL Web-book), by B. L. Tembe, Kamaluddin and M. S. Krishnan.
7. Physical Chemistry, by P. W. Atkins.
8. A Textbook of Engineering Chemistry, Shashi Chawla.
9. Organic Chemistry: Structure and Function by K. P. C. Volhardt and N. E. Schore, 5th Edition http://bcs.whfreeman.com/vollhardtschore5e/default.asp

Mathematics-I

Credit: 4
Semester: I
Nature of the Course: Core Course

Course Content:

Module No.	Module Name	Chapter Topic
I	Introduction Basic Calculus	Curvature, evolutes and involutes; Evaluation of definite and improper integrals; Beta and Gamma Functions and their properties; Applications of definite integrals to evaluate surface areas and volumes of revolutions.
II	Single-variable Calculus (Differentiation)	Rolle's Theorem, Mean value theorems and applications; Extreme values of functions; Linear approximation; Indeterminate forms and L' Hospital's rule.
III	Sequences and series	Limits of sequence of numbers, Calculation of limits, Infinite series; Tests for convergence; Power series, Taylor and Maclaurin series; Taylor theorem, convergence of Taylor series, error estimates.
IV	Multivariable Calculus (Differentiation):	Limit, continuity and partial derivatives, directional derivatives, gradient, total derivative; Tangent plane and normal line; Maxima, minima and saddle points; Method of Lagrange multipliers.
V	Multivariable Calculus (Integration)	Multiple Integration: Double integrals (Cartesian), change of order of integration in double integrals, Change of variables (Cartesian to polar), Applications: areas and volumes, Center of mass and Gravity (constant and variable densities); Triple integrals (Cartesian), orthogonal curvilinear coordinates, Simple applications involving cubes, sphere and rectangular parallelepipeds; Scalar line integrals, vector line integrals, scalar surface integrals, vector surface integrals, Gradient, curl and divergence, Theorems of Green, Gauss and Stokes.

Suggested Books [Latest edition]:

1. Mathematics-I (Calculus & Linear Algebra), Khanna Book Publishing Co.
2. Reena Garg, Engineering Mathematics, Khanna Book Publishing Company, 2022.
3. Reena Garg, Advanced Engineering Mathematics, Khanna Book Publishing Company, 2021.
4. G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9th Edition, Pearson, Reprint, 2002.
5. Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
6. Ramana B.V., Higher Engineering Mathematics, Tata McGraw Hill New Delhi, 11th Reprint, 2010.
7. Veerarajan T., Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi, 2008.
8. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2008.
9. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 36th Edition, 2010.

Programming for Problem Solving

Credit: 4
Semester: I
Nature of the Course: Core Course

Course Content:

Module No.	Module Name	Chapter Topic
I	Introduction to Programming	Introduction to components of a computer system (disks,memory, processor, where a program is stored and executed, operating system, compilers etc.)Idea of Algorithm: steps to solve logical and numerical problems. Representation of Algorithm: Flowchart / Pseudocode with examples. From algorithms to programs; source code, variables (with data types) variables and memory locations, Syntax and Logical Errors in compilation, object and executable code.
II	Concept of Operator	Arithmetic expressions and precedence
III	Concept of Loop	Conditional Branching and Loops. Writing and evaluation of conditionals and consequent branching. Iteration and loops.
IV	Concept of Array	Arrays, Arrays (1-D, 2-D), Character arrays and Strings
V	Concept of Sorting	Basic Algorithms, Searching, Basic Sorting Algorithms (Bubble, Insertion and Selection), Finding roots of equations, notion of order of complexity through example programs (no formal definition required)
VI	Concept of Function	Function, Functions (including using built in libraries), Parameter passing in functions, call by value, Passing arrays to functions: idea of call by reference,
VII	Concept of Recursion	Recursion, Recursion as a different way of solving problems. Example programs, such as Finding Factorial, Fibonacci series, Ackerman function etc. Quick sort or Merge sort.
VIII	Concept of Structure	Structures, Defining structures and Array of Structures
IX	Concept of Pointer	Pointers, Idea of pointers, Defining pointers, Use of Pointers in self-referential structures, notion of linked list (no implementation)
X	Concept of File Handling	File handling (only if time is available, otherwise should be done as part of the lab).

Practical:

1. Familiarization with programming environment
2. Simple computational problems using arithmetic expressions
3. Problems involving if-then-else structures
4. Iterative problems e.g., sum of series
5. 1D Array manipulation
6. Matrix problems, String operations
7. Simple functions
8. Programming for solving Numerical methods problems
9. Recursive functions
10. Pointers and structures
11. File operations

Suggested Books [Latest edition]:

1. AICTE's Prescribed Textbook: Programming for Problem Solving, Khanna Book Publishing Co.
2. Byron Gottfried, Schaum's Outline of Programming with C, McGraw-Hill.
3. E. Balaguruswamy, Programming in ANSI C, Tata McGraw-Hill.
4. Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language, Prentice Hall of India.

Workshop

Credit: 3
Semester: I
Nature of the Course: Core Course

Course Content:

Module No.	Topic
I	Lathe machine operations, Shaping machine operations, Milling machine operations
II	Fitting operations & power tools.
III	Electrical & Electronics.
IV	Carpentry.
V	Welding (arc welding & gas welding), brazing.

Practical:

1. Machine shop
2. Fitting shop
3. Carpentry
4. Electrical & Electronics
5. Welding shop (Arc welding + Gas welding)

Suggested Books [Latest edition]:

1. Workshop / Manufacturing Practices (with Lab Manual), Khanna Book Publishing Co.
2. Hajra Choudhury S.K., Hajra Choudhury A.K. and Nirjhar Roy S.K., "Elements of Workshop Technology", Vol. I 2008 and Vol. II 2010, Media promoters and publishers private limited, Mumbai.
3. Kalpakjian S. And Steven S. Schmid, "Manufacturing Engineering and Technology", 4th edition, Pearson Education India Edition, 2002.
4. Gowri P. Hariharan and A. Suresh Babu," Manufacturing Technology – I" Pearson Education, 2008.
5. Roy A. Lindberg, "Processes and Materials of Manufacture", 4th edition, Prentice Hall India, 1998.
6. Rao P.N., "Manufacturing Technology", Vol. I and Vol. II, Tata McGraw Hill House, 2017.

Design Thinking

Credit: 1
Semester: I
Nature of the Course: Core Course

Course Content:

Module No.	Module Name	Chapter Topic
I	An Insight to Learning	Understanding the Learning Process, Kolb's Learning Styles, Assessing and Interpreting
II	Remembering Memory	Understanding the Memory process, Problems in retention, Memory enhancement techniques
III	Emotions: Experience & Expression	Understanding Emotions: Experience & Expression, Assessing Empathy, Application with Peers
IV	Basics of Design Thinking	Definition of Design Thinking, Need for Design Thinking, Objective of Design Thinking, Concepts & Brainstorming, Stages of Design Thinking Process (explain with examples) – Empathize, Define, Ideate, Prototype, Test
V	Being Ingenious & Fixing Problem	Understanding Creative thinking process, Understanding Problem Solving, Testing Creative Problem Solving
VI	Process of Product Design	Process of Engineering Product Design, Design Thinking Approach, Stages of Product Design, Examples of best product designs and functions, Assignment – Engineering Product Design
VII	Prototyping & Testing	What is Prototype? Why Prototype? Rapid Prototype Development process, Testing, Sample Example, Test Group Marketing
VIII	Celebrating the Difference	Understanding Individual differences & Uniqueness, Group Discussion and Activities to encourage the understanding, acceptance and appreciation of Individual differences
IX	Design Thinking & Customer Centricity	Practical Examples of Customer Challenges, Use of Design Thinking to Enhance Customer Experience, Parameters of Product experience, Alignment of Customer Expectations with Product Design
X	Feedback, Re-Design & Re-Create	Feedback loop, Focus on User Experience, Address "ergonomic challenges, User focused design, rapid prototyping & testing, final product, Final Presentation – "Solving Practical Engineering Problem through Innovative Product Design & Creative Solution".

Suggested Books [Latest edition]:
E Balaguruswamy (2022), Developing Thinking Skills (The way to Success), Khanna Book Publishing Company.

Communicative English

Credit: 3
Semester: I
Nature of the Course: Core Course

Course Content:

Module No.	Module Name	Chapter Topic
I	Vocabulary Building	The concept of Word Formation, Root words from foreign languages and their use in English, Acquaintance with prefixes and suffixes from foreign languages in English to form Derivatives, Synonyms, antonyms, and standard abbreviations.
II	Basic Writing Skills	Sentence Structures, Use of phrases and clauses in sentences, Importance of proper punctuation, Creating coherence, Organizing principles of paragraphs in documents, Techniques for writing precisely
III	Identifying Common Errors in Writing	Subject-verb agreement, Noun-pronoun agreement, Misplaced modifiers, Articles, Prepositions, Redundancies, Clichés
IV	Nature and Style of sensible Writing	Describing, Defining, Classifying, Providing examples or evidence, Writing introduction and conclusion
V	Writing Practices	Comprehension, Précis Writing, Essay Writing

Practical:
The following topics are to be covered:

1. Listening Comprehension
2. Pronunciation, Intonation, Stress and Rhythm
3. Common Everyday Situations: Conversations and Dialogues
4. Communication at Workplace
5. Interviews
6. Formal Presentations

Suggested Books [Latest edition]:

1. English (with Lab Manual), Khanna Book Publishing Co.
2. Effective Communication Skills. Kul Bhushan Kumar, Khanna Book Publishing, 2022.
3. Practical English Usage. Michael Swan. OUP. 1995.
4. Remedial English Grammar. F.T. Wood. Macmillan.2007
5. On Writing Well. William Zinsser. Harper Resource Book. 2001
6. Study Writing. Liz Hamp-Lyons and Ben Heasly. Cambridge University Press. 2006.
7. Communication Skills. Sanjay Kumar and PushpLata. Oxford University Press. 2011.
8. Exercises in Spoken English. Parts. I-III. CIEFL, Hyderabad. Oxford University Press.

SEMESTER II

Physics

Credit: 5
Semester: II
Nature of the Course: Core Course

Course Content:

Module No.	Module Name	Chapter Topic
I	Introduction to Electromagnetic Theory	Electrostatics in vacuum, Electrostatics in a linear dielectric medium, Magneto statics, Magneto statics in a linear magnetic medium, Faraday's law, Displacement current, Magnetic field due to time-dependent electric field and Maxwell's equations, Electromagnetic waves
II	Introduction to Mechanics	Newtonian Mechanics and Coordinate Transformations, Conservative Forces and Central Force Motion, Non-Inertial Reference Frames and Rotational Dynamics, Oscillations and Damping, Planar Rigid Body Dynamics, Three-Dimensional Rigid Body Motion
III	Quantum Mechanics for Engineers	Wave nature of particles and the Schrodinger equation, Mathematical Preliminaries for quantum mechanics, Applying the Schrodinger equation, Introduction to molecular bonding, Introduction to solids,
IV	Oscillations, waves and optics	Simple harmonic motion, damped and forced simple harmonic oscillator, Non-dispersive transverse and longitudinal waves in one dimension and introduction to dispersion, The propagation of light and geometric optics, Wave optics, Lasers,

Practical:
The following topics are to be covered:

1. Experiments on electromagnetic induction and electromagnetic braking;
2. LC circuit and LCR circuit;
3. Resonance phenomena in LCR circuits;
4. Magnetic field from Helmholtz coil;
5. Measurement of Lorentz force in a vacuum tube.
6. Coupled oscillators;
7. Experiments on an air-track;
8. Experiment on moment of inertia measurement,
9. Experiments with gyroscope;
10. Resonance phenomena in mechanical oscillators.
11. Frank-Hertz experiment; photoelectric effect experiment; recording hydrogen atom spectrum.
12. Diffraction and interference experiments (from ordinary light or laser pointers); measurement of speed of light on a table top using modulation; minimum deviation from a prism.

Suggested Books [Latest edition]:

1. Physics (Introduction to Electromagnetic Theory) with Lab Manual, Khanna Book Publishing Company.
2. Bhattacharya & Nag, Engineering Physics
3. David Griffiths, Introduction to Electrodynamics
4. Halliday and Resnick, Physics
5. W. Saslow, Electricity, magnetism and light
6. Malik, Singh, Engineering Physics, Tata McGraw Hill
7. Physics (Oscillations, Waves & Optics) with Lab Manual, Khanna Book Publishing.
8. Bhattacharya & Nag, Engineering Physics
9. Ian G. Main, Oscillations and waves in physics
10. H.J. Pain, The physics of vibrations and waves

Mathematics-II

Credit: 4
Semester: II
Nature of the Course: Core Course

Course Content:

Module No.	Module Name	Chapter Topic
I	Matrices	Linear Systems of Equations; Linear Independence; Rank of a Matrix; Determinant, Inverse of a matrix, rank-nullity theorem; System of linear equations; Symmetric, skew-symmetric and orthogonal matrices; Determinants; Eigenvalues and eigenvectors; Orthogonal transformation; Diagonalization of matrices; Cayley-Hamilton Theorem.
II	First order ordinary differential equations	Exact, linear and Bernoulli's equations. Equations not of first degree: equations solvable for p, equations solvable for y, equations solvable for x and Clairaut's type.
III	Ordinary differential equations of higher orders	Second order linear differential equations with variable coefficients: Euler-Cauchy equations, solution by variation of parameters; Power series solutions: Legendre's equations and Legendre polynomials, Frobenius method, Bessel's equation and Bessel's functions of the first kind and their properties.
IV	Complex Variable – Differentiation	Differentiation, Cauchy-Riemann equations, analytic functions, harmonic functions, finding harmonic conjugate; elementary analytic functions (exponential, trigonometric, logarithm) and their properties; Conformal mappings, Mobius transformations and their properties.
V	Complex Variable – Integration	Contour integrals, Cauchy-Goursat theorem (without proof), Cauchy Integral formula (without proof), Liouville's theorem and Maximum-Modulus theorem (without proof); Taylor's series, zeros of analytic functions, singularities, Laurent's series; Residues, Cauchy Residue theorem (without proof), Evaluation of definite integral involving sine and cosine, Evaluation of certain improper integrals using the Bromwich contour.

Suggested Readings [Latest edition]:

1. Mathematics-II (Calculus, Ordinary Differential Equations and Complex Variable), Khanna Book Publishing Co.
2. Reena Garg, Engineering Mathematics, Khanna Book Publishing Company, 2022.
3. Reena Garg, Advanced Engineering Mathematics, Khanna Book Publishing Company, 2021.
4. Erwin Kreyszig, Advanced Engineering Mathematics, 10th Edition, John Wiley & Sons, 2006.
5. Veerarajan T., Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi, 2008.
6. W. E. Boyce and R. C. DiPrima, Elementary Differential Equations and Boundary Value Problems, 9th Edition, Wiley India, 2009.
7. D. Poole, Linear Algebra: A Modern Introduction, 2nd Edition, Brooks/Cole, 2005.

8. S. L. Ross, Differential Equations, 3rd Edition, Wiley India, 1984.
9. E. A. Coddington, An Introduction to Ordinary Differential Equations, Prentice Hall India, 1995.
10. E. L. Ince, Ordinary Differential Equations, Dover Publications, 1958.

Engineering Graphics & Design

Credit: 3
Semester: II
Nature of the Course: Core Course

Course Content:

Module No.	Module Name	Chapter Topic
I	Introduction to Engineering Drawing	Principles of Engineering Graphics and their significance, usage of Drawing instruments, lettering, Conic sections including the Rectangular Hyperbola (General method only); Cycloid, Epicycloid, Hypocycloid and Involute; Scales – Plain, Diagonal and Vernier Scales;
II	Orthographic Projections	Principles of Orthographic Projections-Conventions - Projections of Points and lines inclined to both planes; Projections of planes inclined Planes - Auxiliary Planes;
III	Projections of Regular Solids	Covering those inclined to both the Planes- Auxiliary Views; Draw simple annotation, dimensioning and scale. Floor plans that include: windows, doors, and fixtures such as WC, bath, sink, shower, etc.
IV	Sections and Sectional Views of Right Angular Solids	Prism, Cylinder, Pyramid, Cone – Auxiliary Views; Development of surfaces of Right Regular Solids - Prism, Pyramid, Cylinder and Cone; Draw the sectional orthographic views of geometrical solids, objects from industry and dwellings (foundation to slab only).
V	Isometric Projections	Principles of Isometric projection – Isometric Scale, Isometric Views, Conventions; Isometric Views of lines, Planes, Simple and compound Solids; Conversion of Isometric Views to Orthographic Views and Vice-versa, Conventions;
VI	Overview of Computer Graphics	Listing the computer technologies that impact on graphical communication, Demonstrating knowledge of the theory of CAD software [such as: The Menu System, Toolbars (Standard, Object Properties, Draw, Modify and Dimension), Drawing Area (Background, Crosshairs, Coordinate System), Dialog boxes and windows, Shortcut menus (Button Bars), The Command Line (where applicable), The Status Bar, Different methods of zoom as used in CAD, Select and erase objects.; Isometric Views of lines, Planes, Simple and compound Solids];
VII	Customisation & CAD Drawing	Consisting of set up of the drawing page and the printer, including scale settings, setting up of Modules and drawing limits; ISO and ANSI standards for coordinate dimensioning and tolerancing; Orthographic constraints, Snap to objects manually and automatically; Producing drawings by using various coordinate input entry methods to draw straight lines, Applying various ways of drawing circles;
VIII	Annotations, layering & other functions	Covering applying dimensions to objects, applying annotations to drawings; Setting up and use of Layers, layers to create drawings, Create, edit and use customized layers; Changing line lengths through modifying existing lines (extend/lengthen); Printing documents to paper using the print command; orthographic

		projection techniques; Drawing sectional views of composite right regular geometric solids and project the true shape of the sectioned surface; Drawing annotation, Computeraided design (CAD) software modeling of parts and assemblies. Parametric and non-parametric solid, surface, and wireframe models. Part editing and two-dimensional documentation of models. Planar projection theory, including sketching of perspective, isometric, multiview, auxiliary, and section views. Spatial visualization exercises. Dimensioning guidelines, tolerancing techniques; dimensioning and scale multi views of dwelling;
IX	Demonstration of a simple team design project that illustrates	Geometry and topology of engineered components: creation of engineering models and their presentation in standard 2D blueprint form and as 3D wire-frame and shaded solids; meshed topologies for engineering analysis and tool-path generation for component manufacture; geometric dimensioning and tolerancing; Use of solid-modeling software for creating associative models at the component and assembly levels; floor plans that include: windows, doors, and fixtures such as WC, bath, sink, shower, etc. Applying colour coding according to building drawing practice; Drawing sectional elevation showing foundation to ceiling; Introduction to Building Information Modelling (BIM).

Suggested Books [Latest edition]:

1. AICTE's Prescribed Textbook: Engineering Graphics & Design Khanna Book Publishing.
2. Jain, Maheshwari, Gautam (2021), Engineering Graphics & Design, Khanna Book Publishing.
3. Bhatt N.D., Panchal V.M. & Ingle P.R., (2014), Engineering Drawing, Charotar Publishing.
4. Shah, M.B. & Rana B.C. (2008), Engineering Drawing and Computer Graphics, Pearson.
5. Agrawal B. & Agrawal C. M. (2012), Engineering Graphics, TMH Publication.
6. Narayana, K.L. & P Kannaiah (2008), Text book on Engineering Drawing, Scitech Publishers.
7. (Corresponding set of) CAD Software Theory and User Manuals.

Basic Electrical Engineering

Credit: 4
Semester: I
Nature of the Course: Core Course

Course Content:

Module No.	Module Name	Chapter Topic
I	Introduction	D. C. Circuits covering, Ohm's Law and Kirchhoff's Laws, Network theorems- Thevenin's , Norton's Superposition and Maximum power transfer theorem; Analysis of series, parallel and series-parallel circuits excited by independent voltage sources; Power and energy; Electromagnetism covering, Faradays Laws, Lenz's Law, Fleming's Rules, Statically and dynamically induced EMF; Concepts of self-inductance, mutual inductance and coefficient of coupling; Energy stored in magnetic fields;
II	AC Circuits: Single-Phase and Three-Phase Analysis	Single Phase A.C. Circuits covering, Generation of sinusoidal voltage- definition of average value, root mean square value, form factor and peak factor of sinusoidal voltage and current and phasor representation of alternating quantities; Analysis with phase diagrams of R, L, C, RL, RC and RLC circuits; Real power, reactive power, apparent power and power factor, series, parallel and series-parallel circuits; Three Phase A.C. Circuits covering, Necessity and Advantages of three phase systems, Generation of three phase power, definition of Phase sequence, balanced supply and balanced load; Relationship between line and phase values of balanced star and delta connections; Power in balanced three phase circuits, measurement of power by two wattmeter method;
III	Transformers and Synchronous Generators	Transformers covering, Principle of operation and construction of single phase transformers (core and shell types). EMF equation, phasor diagram, equivalent circuit diagram losses, efficiency and voltage regulation and open circuit test and short circuit test; Synchronous Generators covering, Principle of operation; Types and constructional features; EMF equation;
IV	DC Machines: Generators and Motors	DC Machines covering, working principle of DC machine as a generator and a motor; Types and constructional features; EMF equation of generator, relation between EMF induced and terminal voltage enumerating the brush drop and drop due to armature reaction; DC motor working principle; Back EMF and its significance, torque equation and speed control; Types of D.C. motors, characteristics and applications; Necessity of a starter for DC motor;
V	Three-Phase Induction Motors	Three Phase Induction Motors covering; Concept of rotating magnetic field; Principle of operation, types and constructional features; Slip and its significance; Applications of squirrel cage and slip ring motors; Necessity of a starter, star-delta starter.
VI	Sources of Electrical Power	Sources of Electrical Power covering, Introduction to Wind, Solar, Fuel cell, Tidal, Geo thermal, Hydroelectric, Thermal-steam, diesel, gas, nuclear power plants; Concept of cogeneration, and distributed generation;

Practical:

1. To verify KCL and KVL
2. To verify Thevenin's , Norton's, Superposition Theorem, Maximum power transfer theorem
3. To study the V-I characteristics of an incandescent lamp (Fluorescent lamp, Tungsten & Carbon Filament lamp).
4. Calibration of Ammeter & Voltmeter
5. To perform Open circuit and Short circuit test on a single phase transformer.
6. To measure three phase power by using two wattmeter method.
7. Study of series RLC circuit
8. Calibration of Energy meter
9. Starting & Reversing Speed Control of Dc shunt motor
10. To measure different quantities of Y and Delta connected three-phase network

Suggested Books [Latest edition]:

1. AICTE's Prescribed Textbook: Basic Electrical Engineering, Khanna Book Publishing.
2. Ritu Sahdev (2022), Basic Electrical Engineering, Khanna Book Publishing.
3. Nagrath I.J. and D. P. Kothari (2001), Basic Electrical Engineering, Tata McGraw Hill.
4. Hayt and Kimberly, Engineering Circuit Analysis, Tata McGraw Hill.
5. Kulshreshtha D.C. (2009), Basic Electrical Engineering, Tata McGraw Hill.
6. Rajendra Prasad (2009), Fundamentals of Electrical Engineering, Prentice Hall, India Hughes, E. 2005)
7. Mittel & Mittal, Basic Electrical Engineering, Tata McGraw Hill.

Data Structure and Algorithms

Credit: 5
Semester: II
Nature of the Course: Elective Course

Course Content:

Module No.	Module Name	Chapter Topic
I	Introduction and basic terminology	Notion of data structures and algorithms, $l$og n, n, 2^n understanding growth of these functions, and applications (binary search and extensions to similar problems) Worst-case, average case time/space complexity and their relative merits. Asymptotic Notation: $O(\ ), \Omega(\ )$
II	Abstract Data-types, Arrays, Linked Lists, Stacks, Queues Dictionary ADT, Trees, Binary Trees	Abstract data-type (ADTs): arrays and linked list ADTs. Stacks, Queues: ADTs and implementations using arrays, linked lists. Doubly linked lists: ADT and implementation Dictionary ADT: implementation using array, linked lists, binary search. Tree ADT and Examples Implementation of trees and basic traversal Algorithms Binary trees and in order traversal
III	Priority Queues and Heaps	Priority Queue ADT, Definition of heaps, Implementation of Priority Queues using heaps and running time analysis Implementation of heaps using arrays. Heap-sort
IV	Binary Search Trees, AVL Trees, 2-4 trees	Binary Search Trees: definition and some basic algorithms. Implementation of Dictionary ADTs using Binary Search trees and running time analysis, AVL trees: height balance condition, rotations, and implementation of dictionary ADT 2-4 Trees: Multi-way search trees, implementation of dictionary ADT, Informal discussion of extension to B-trees.
V	Hash tables, tries	Map ADT, Hash Tables and implementation of Map using Hash Tables Design of hash functions Collision resolution schemes: chaining, open addressing schemes like linear probing, quadratic probing, double hashing. Applications of Hashing: finding duplicates, set intersection, etc. Tries: implementation of Map ADT using tries. Compressed tries and suffix tries.
VI	Sorting, Selection	Bubble sort, insertion sort, selection sort, Merge sort and divide and conquer paradigm Quick sort: average and worst case analysis, randomized quicksort (intuitive explanation), Selection based on partitioning ideas used in Quick Sort.
VII	Graphs, representations and traversal algorithms, applications of BFS, DFS	Graph ADTs and applications Adjacency list and adjacency matrix representations and relative merits Basic graph, definitions: paths, cycles, trees, spanning trees, connected components, Euler's formula. Depth First Search Traversal algorithm for directed graphs: classification of edges into forward, back and cross edges. Applications to cycle finding, topological sort in directed acyclic graphs, finding connected components. Running time analysis. Breadth first search algorithm: implementation using queues, shortest path tree property. Running time analysis

Suggested Books [Latest edition]:

1. “Expert Data Structures with C” by R.B. Patel, Khanna Book Publishing Company, New Delhi, 4th Edition.
2. “Data Structures and Algorithms in Java”, by Michael T. Goodrich and Roberto Tamassia, John Wiley & Sons; 3rd Edition.
3. “Data Structures and Algorithms in Python”, by Michael T. Goodrich and Robert, Tamassia, Wiley, 1st Edition.
4. “Taming Python by Programming”, Jeeva Jose, Khanna Book Publishing Company.
5. “Fundamentals of Data Structures”, Sartaj Saini, University Press.

Universal Human Values: Understanding Harmony and Ethical Human Conduct

Credit: 3
Semester: II
Nature of the Course: Core Course

Course Content:

Module No.	Module Name	Chapter Topic
I	Introduction to Value Education	Right Understanding, Relationship and Physical Facility (Holistic Development and the Role of Education), Understanding Value Education, Self-exploration as the Process for Value Education, Continuous Happiness and Prosperity – the Basic Human Aspirations, Practice Session PS2 Exploring Human Consciousness, Happiness and Prosperity – Current Scenario, Method to Fulfill the Basic Human Aspirations, Practice Session PS3 Exploring Natural Acceptance
II	Harmony in the Human Being	Understanding Human being as the Co-existence of the Self and the Body, Distinguishing between the Needs of the Self and the Body, The Body as an Instrument of the Self, Understanding Harmony in the Self, Harmony of the Self with the Body, Programme to ensure self-regulation and Health
III	Harmony in the Family and Society	Harmony in the Family – the Basic Unit of Human Interaction and 'Trust' – the Foundational Value in Relationship, 'Respect' – as the Right Evaluation, Other Feelings, Justice in Human-to-Human Relationship, Understanding Harmony in the Society, Vision for the Universal Human Order
IV	Harmony in the Nature/Existence	Understanding Harmony in the Nature, Interconnectedness, self-regulation and Mutual Fulfilment among the Four Orders of Nature, Realizing Existence as Co-existence at All Levels, The Holistic Perception of Harmony in Existence
V	Implications of the Holistic Understanding – a Look at Professional Ethics	Natural Acceptance of Human Values, Definitiveness of (Ethical) Human Conduct, A Basis for Humanistic Education, Humanistic Constitution and Universal Human Order, Competence in Professional Ethics, Holistic Technologies, Production Systems and Management Models-Typical Case Studies, Strategies for Transition towards Value-based Life and Profession

Suggested Books [Latest edition]:

1. The Textbook - A Foundation Course in Human Values and Professional Ethics, R R Gaur, R Asthana, G P Bagaria, 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93- 87034-47-1
2. The Teacher's Manual- Teachers' Manual for A Foundation Course in Human Values and Professional Ethics, RR Gaur, R Asthana, G P Bagaria, 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-53
3. Professional Ethics and Human Values, Premvir Kapoor, ISBN: 978-93-86173-652, Khanna Book Publishing Company, New Delhi, 2022.
4. JeevanVidya: EkParichaya, A Nagaraj, JeevanVidyaPrakashan, Amarkantak, 1999.
5. Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.
6. The Story of Stuff (Book).
7. The Story of My Experiments with Truth - by Mohandas Karamchand Gandhi

8. Small is Beautiful - E. F Schumacher.
9. Slow is Beautiful - Cecile Andrews
10. Economy of Permanence - J C Kumarappa