B. Tech. 1ST YEAR

Information Technology and Computer Science and Engineering

(Applicable from the academic session 2024-2025)

Government College of Engineering & Ceramic Technology
(An Autonomous Institution under MAKUT)
73, A.C Banerjee Lane
Kolkata-700010

1st SEMESTER							
Mandatory Induction Program- 3 Weeks duration							
SL. NO.	**TYPE OF COURSE**	**COURSE CODE**	**COURSE TITLE**	**HOURS PER WEEK**			**Credit**
				Lecture	**Tutorial**	**Practical**	
THEORY							
01	Basic Science course	BS(CS/IT) 101	Mathematics – I	3	0	0	3
02	Basic Science course	BS(CS/IT) 102	Physics	3	0	0	3
03	Engineering Science Course	ES(CS/IT) 101	Basic Electrical Engineering	3	0	0	3
04	Humanities & Social Sciences	HS(CS/IT) 101	English	2	0	0	2
SESSIONAL/PRACTICAL							
01	Basic Science course	BSL(CS/IT) 103	Physics Laboratory	0	0	2	1
02	Engineering Science Course	ESL(CS/IT) 102	Basic Electrical Engineering Laboratory	0	0	2	1
03	Engineering Science Course	ESL(CS/IT) 103	Engineering Graphics & Design	1	0	2	2
04	Humanities & Social Sciences	HSL(CS/IT) 102	English Communication Lab.	0	0	2	1
TOTAL				**12**	**0**	**8**	**16**

Course Code: BS(CS/IT)101	**Year: 1ST YEAR (CSE & IT)**
Course Title: MATHEMATICS I	**Semester: 1ST SEMESTER**
Lecture per week: 3 hours	**Credit: 3**
Pre- Requisites: 10+2 KNOWLEDGE	

Module No.	Description of Topic	Lectures Hours
1	***Calculus (Integration):*** 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.	8
2	***Calculus (Differentiation):*** Rolle's Theorem, Mean value theorems, Taylor's and Maclaurin's theorems with remainders; Indeterminate forms and L'Hospital's rule; Maxima and minima.	6
3	***Matrices:*** Matrices, Vectors: addition and scalar multiplication, matrix multiplication; Linear systems ofequations, linear Independence, rank of a matrix, determinants, Cramer's Rule, inverse of a matrix, Gauss elimination and Gauss-Jordan elimination.	7
4	***Vector Spaces:*** Vector Space, linear dependence of vectors, Basis, Dimension; Linear transformations (maps), Range and Kernel of a linear map, Rank and Nullity, Inverse of a linear transformation, Rank-Nullity theorem,composition of linear maps, Matrix associated with a linear map.	9
5	***Vector Spaces (Continued):*** Eigenvalues, Eigenvectors, Symmetric, Skew-symmetric, and Orthogonal Matrices, Eigenbases. Diagonalization; Inner product spaces, Gram-Schmidt orthogonalization.	10

Course Outcomes:

The students will be able to:

CO 1: apply the concept and techniques of differential and integral calculus to determine curvature and evaluation of different types of improper integrals.

CO 2: understand the domain of applications of mean value theorems to engineering problems.

CO 3: learn different types of matrices, concept of rank, methods of matrix inversion and their applications.

CO 4: understand linear spaces, its basis and dimension with corresponding applications in the field of computer science.

CO 5:leam and apply the concept of eigen values, eigen vectors, diagonalisation of matrices and orthogonalization in inner product spaces for understanding physical and engineering problems

Learning Resources:

1. Erwin Kreyszig, Advanced Engineering Mathematics, John Wiley & Sons.
2. Michael Greenberg, Advanced Engineering Mathematics, Pearson.
3. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers.
4. Kanti B. Dutta, Mathematical Methods of Science and Engineering, Cenage Learning.
5. Veerarajan T., Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi.
6. S.K. Mapa, Higher Algebra: Abstract and Linear, Sarat Book House Pvt.Ltd.
7. Hoffman and Kunze: Linear algebra, PHI.

Course Code: BS(CS/IT) 102	**Year: 1ST YEAR (CSE & IT)**
Course Title: PHYSICS THEORY	**Semester: 1ST SEMESTER**
Lecture per week: 3 hours	**Credit: 3**
Pre- Requisites: 10+2 KNOWLEDGE	

Module I: Classical Mechanics [10 Lectures]

Use of vectors in particle mechanics, Unit vectors in spherical and cylindrical polar coordinates, Conservative vector fields and their potential functions - gravitational and electrostatic examples, Gradient, Divergence and Curl. Gauss' Divergence Theorem and Stokes Theorem.

Simple Harmonic Motion (SHM), Differential Equation of SHM, Damped vibration, Critical Damping, Forced Vibration, Resonance, Amplitude and Velocity Resonance, Sharpness of Resonance and Quality Factor, Lissajous Figure.

Module 2: Electricity and Magnetism [8 Lectures]

Overview of Coulomb's law, Gauss's law, dielectric polarization, Displacement vector, permeability and dielectric constant, polar and non-polar dielectrics, applications of dielectrics. Electric current and the continuity equation. Overview of Biot-Savart law and Ampere's Circuital law. Magnetisation, permeability and susceptibility, Classification of magnetic materials, Ferromagnetism, magnetic domains and hysteresis, Electromagnetic Induction – Faraday's Law and Lenz's Law, Displacement Current and Maxwell's Equations.

Module 3: Wave Optics [8 Lectures]

Interference of light waves, Young's experiment, Interference in thin film, Newton's rings. Diffraction of light waves, Fraunhoffer diffraction due to single slit, and plane diffraction grating, X-Ray Diffraction and Bragg's Law, Polarization of light waves, Polarization by reflection, Brewster's law.

Module 4: Modern Physics and Quantum Mechanics [10 Lectures]

Black body radiation, Photoelectric Effect, Compton effect, De Broglie Waves, Particle diffraction and Davisson-Germer experiment, Uncertainty principle and applications, Schrödinger equation, energy levels and wave functions, Particle in a box (1- D), Potential Barrier and tunneling, Formation of Energy Bands in a solid, Valence Band and Conduction Band, Concept of Metals, Insulators and Semiconductors.

Course outcomes

After completion of the course, a student would be able to:

CO 1: Develop the basic concepts of Vector Analysis and Apply them for an understanding of Electromagnetism.

CO 2: Explain the basics of Simple Harmonic Motion and its differential equation and apply it for an understanding of Damped vibration and Resonance.

CO 3: Explain basics of electromagnetism including Biot-Savart law, Ampere's circuital law and the laws of electromagnetism.

CO 4: Apply the concepts of wave theory of light to for an understanding of interference, diffraction and polarization and apply them to study the basics of X-Ray diffraction.

CO 5: Recall the Old Quantum Theory and apply it for an understanding of the Uncertainty Principle of Quantum Mechanics.

CO 6: Analyze the Schrodinger Theory of Quantum Mechanics and apply it to different problems and for an understanding of the basic concepts of Semiconductor Physics.

References:

1. Speigel – Vector Analysis
2. Griffiths – Electromagnetic Theory

3. Fewkes and Yarwood – Classical Electricity and Magnetism
4. Jenkins and White – Optics
5. Ryder – Perspectives of Modern Physics
6. Eiseberg and Resnick – Modern Physics and Quantum Mechanics

Course Code: ES(CS/IT)101	**Year: 1ST YEAR (CSE & IT)**
Course Title: Basic Electrical Engineering	**Semester: 1ST SEMESTER**
Lecture per week: 3 hours	**Credit: 3**
Pre- Requisites: 10+2 KNOWLEDGE	

Module	Content	Hr
1	**DC Circuits** Electrical circuit elements (R, L and C), voltage and current sources, Kirchoff's current and voltage laws, analysis of simple circuits with DC excitation, Super position Theorem, Thevenin's and Norton's Theorems. Time-domain analysis of first-order RL and RC circuits.	**8**
2	**AC Circuits** Representation of sinusoidal waveforms, peak, average and RMS values, phasor representation, real power, reactive power, apparent power, power factor. Analysis of single-phase ac circuits consisting of R, L, C, RL, RC, RLC combinations (series and parallel), Resonance, Q factor, Selectivity Three phase system, voltage and current relations in star and delta connections, three phase power calculations.	**8**
3	**Transformers** Basic construction, equivalent circuit, phasor diagram, loss and efficiency, regulation. Auto-transformer and applications.	**5**
4	**Electrical Machines** Induction Motor: Generation of rotating magnetic fields, Construction and working of a three-phase induction motor, Significance of torque-slip characteristic. Loss components and efficiency, starting and speed control of induction motor, Single-phase induction motor Special Motors: Introduction to BLDC Motor, Stepper motor, Permanent Magnet DC (PMDC) Motor, Servo motor, Synchronous motor (Qualitative analysis only)	**10**
5	**Electrical Installations** General layout of power system network: Generation, Transmission and Distribution Components of Low Tension Switchgear: Switch Fuse Unit (SFU), MCB, RCCB, ELCB, MCCB, Types of Wires and Cables, Earthing. Types of Batteries, Important Characteristics for Batteries. Elementary calculations for energy consumption.	**5**

Course Outcomes (COs)

After completion of this course, the students will be able to	
CO1	**explain** the overall electrical power system, its different parameters, components, protective elements and power converters
CO2	**solve** problems of DC and AC circuits using different methods and network theorems
CO3	**analyze** the operation of electric machines and transformer and circuits using equivalent circuits, phasor diagrams etc.
CO4	**derive** different characteristics and expressions of electric machines and transformer
CO5	**evaluate** performance of electrical machines and transformer

Text Book and Reference Book

1. D. P. Kothari and I. J. Nagrath, “Basic Electrical Engineering”, McGraw Hill
2. A. Chakrabarti, S. Nath, C. K. Chanda, “Basic Electrical Engineering”, McGraw Hill
3. D. C. Kulshreshtha, “Basic Electrical Engineering”, McGraw Hill
4. L. S. Bobrow, “Fundamentals of Electrical Engineering”, Oxford University Press
5. E. Hughes, “Electrical and Electronics Technology”, Pearson
6. V. D. Toro, “Electrical Engineering Fundamentals”, Prentice Hall India
7. P. V. Prasad, S. Sivanagaraju, K. R. Varmah, C. Abraham, “Basic Electrical Engineering”, Cengage Learning India Pvt. Ltd

Course Code: HS(CS/IT) 101	**Year: 1ST YEAR (CSE & IT)**
Course Title: English	**Semester: 1ST SEMESTER**
Theory per week: 2 hours	**Credit: 2**
Pre- Requisites: 10+2 KNOWLEDGE	

1 Vocubulary building and new words concept:

1.1 Concept of Word formation
1.2 Collection of five new words everyday (from Oxford Dictionary & English Newspapers)
1.3 Synonyms & Antonyms
1.4 Masculine & Feminine
1.5 Singular & Plural

2 Basic Writing Skill - Written English

2.1) Sentence construction
2.2) Use of Phrases, idioms and clauses in sentences
2.3) Importance of proper punctuation
2.4) Techniques for writing precisely
2.5) Paragraph writing

3 Avoiding mistakes & errors in English

3.1) Subject - Verb agreement
3.2) Noun - Pronoun agreement
3.3) Misplaced Modifiers
3.4) Articles
3.5) Prepositions

4 Practice of Writing English - Form

4.1) Precis writing
4.2) Essay writing
4.3) Letter writing
4.4) Comprehension
4.5) English Translation - Bengali to English & vice versa

5 Communication Skill - incorporation presentation skill & negotiation skill

5.1) Listening comprehension
5.2) Spoken English
5.3) Comprehension, intonation, accent, stress and rhythm
5.4) Conversation and dialogues
5.5) Manoeuvering sentences - replacing words
5.6) Interview - personal interview / Group Discussion
5.7)Public speaking

Course Code: BSL(CS/IT) 103	**Year: 1ST YEAR (CSE & IT)**
Course Title: Physics Laboratory	**Semester: 1ST SEMESTER**
Practical per week: 2 hours	**Credit: 1**
Pre- Requisites: 10+2 KNOWLEDGE	

- Preliminary Experiments

1. To determine the Young's Modulus of the material of a beam, by the method of flexures.
2. To determine the resistance per unit length of the bridge wire and hence to determine the unknown resistance of a coil using Carey Foster's Bridge.
3. Study of Charging and Discharging of a Capacitor in a R-C Circuit.
4. To verify the Stokes Law and hence to determine the coefficient of viscosity of a highly viscous liquid.
5. Determination of the Moment of inertia of a body about an axis passing through its CG and perpendicular to its length.
6. Determination of Modulus of rigidity of the material of a wire by dynamical method.

- Experiments directly connected with the Syllabus

1. To determine the Planck's constant by measuring the Stopping Potential for different wavelengths of incident light incident using a vacuum photo tube.
2. To verify the Bohr's theory of atomic orbitals by Franck-Hertz experiment.
3. To verify the Stefan's law of black body radiation using diode EZ-81.
4. To determine the Band gap of a semiconductor sample, by measuring its resistivity at different temperatures by Four-Point Probe method.
5. To determine the Radius of curvature of a Plano-convex lens, using Newton's Rings.
6. To determine the Dielectric Constant of an insulator using an Amplifier, Oscillator , CRO.
7. To measure the variation in the magnetic field along the axis of a Helmholtz coil.

A student has to complete at least 8 experiments in a single semester.

Course Code: ESL(CS/IT) 102	**Year: 1ST YEAR (CSE & IT)**
Course Title: Basic Electrical Engineering Lab	**Semester: 1ST SEMESTER**
Practical per week: 2 hours	**Credit: 1**
Pre- Requisites: 10+2 KNOWLEDGE	

Introduction to basic safety precautions and mentioning of the Do's and Don'ts during handling of electrical instruments and machines. Noting down list of experiments to be performed, and instruction for writing the laboratory reports by the students. Group formation. Students are to be informed about the modalities of evaluation.

List of Experiments

1) Introduction and uses of following instruments: (a) Voltmeter (b) Ammeter (c) Multimeter (d) Energy meter (e) Oscilloscope. Demonstration of real life resistors, capacitors with color code, inductors and autotransformer.
2 Demonstration of cut-out sections of machines: DC machine, Induction machine, Synchronous machine and single phase induction machine.
3 Calibration of ammeter and Wattmeter.
4 Determination of steady state and transient response of R-L, R-C and R-L-C circuit to a step change in voltage.
5 Determination of steady state response of R-L and R-C and R-L-C circuit and calculation of impedance and power factor.
6 Determination of resonance frequency and quality factor of series and parallel R-L-C circuit.
7 (a) Open circuit and short circuit test of a single-phase transformer (b) Load test of the transformer and determination of efficiency and regulation
8 Demonstration of three phase transformer connections. Voltage and current relationship, phase shifts between the primary and secondary side.
9 Measurement of power in a three phase unbalanced circuit by two wattmeter method.
10 Determination of Torque –Speed characteristics of separately excited DC motor.
11 Determination of Torque speed characteristics and observation of direction reversal by change of phase sequence of connection of Induction motor.
12 Demonstration of components of LT switchgear.
13 Verification of Thevenin's Theorem
14 Verification of Norton's Theorem
15 Verification of Superposition Theorem
16 Starting, reversing and speed control of DC shunt motor

Course Code: ESL(CS/IT) 103	**Year: 1ST YEAR CSE/IT**
Course Title: ENGINEERING GRAPHICS & DESIGN	**Semester: 1stSEMESTER**
Lecture per week: 1 Hours Practical per week: 2 Hours	**Credit:2**
Prerequisites: 10+2 KNOWLEDGE	

Module	Content	Hours	Remarks.
1	**Introduction to Engineering Drawing and AutoCAD** Principles of Engineering Graphics and their significance; Drawing instruments and their uses; Different types of lines and their uses; Dimensioning; Drawing standards and codes; Scales: concept of R.F, plain and diagonal scales. Demonstrating knowledge of the theory of CAD software; Drawing area; Command line; Status bar, Select and erase objects; Setting up of the drawing page and the printer, including scale settings; Setting up of units and drawing limits; Orthographic constraints, Snap to objects manually and automatically; Various ways of drawing circles.	3L+6P	Manual drawing sheet + AutoCAD sheet
2	**Geometrical Constructions and Curves used in Engineering Practice** Construction of polygons, conic sections including the rectangular hyperbola, cycloid and involute.	2L+4P	Manual drawing sheet
3	**Orthographic Projections of Points, Lines, Planes** Principles of orthographic projections, conventions; Projections of points; Projections of lines inclined to both reference planes; Projections of planes like circle, polygons etc.	2L+4P	Manual drawing sheet
4	**Projections of Regular Solids** Projections of regular solids like cone, pyramids, prisms etc.	1L+2P	AutoCAD sheet
5	**Sections of Right Regular Solids and Development of Surfaces** Section of solids like cylinder, prism, pyramid, cone etc. Development of surfaces of right regular solids: cylinder, prism, pyramid and cone.	2L+4P	Manual drawing sheet
6	**Isometric Projections** Principles of isometric projection, isometric scale, isometric views, conventions; Isometric views of planes, simple and compound solids; Conversion of isometric views to orthographic views and vice-versa.	2L+4P	Manual drawing sheet + AutoCAD sheet

Course outcomes	
After completion of the course, a student would be able to:	
CO 1	**apply** basics of Engineering Graphics standards for interpreting Engineering Drawing
CO 2	**create** Engineering Graphics of real life objects or machine components
CO 3	**explain** plan and elevation of different solid objects
CO 4	**develop** solid model with Computer Aided Design (CAD) software
CO 5	**construct** working drawings for sections of solids and development of surface

Learning Resources:	
1.	Bhatt N.D., Panchal V.M. & Ingle P.R., (2014), Engineering Drawing, Charotar Publishing House
2.	AutoCAD Software User Manuals

Following is the list of drawing instruments that required for making engineering drawings on paper with perfection.

Sl. No.	Name of the instrument	Sl. No.	Name of the instrument
1	Drawing Board	8	Compass (Small and Large)
2	T-Scale	9	Divider (Small and Large)
3	Set-squares (45°–45° & 60°–90°)	10	French Curves
4	Protractor	11	Sharpener
5	Scales (Plain, Diagonal)	12	Eraser
6	Drawing paper (A1 Size)	13	Drawing pins & clips
7	Drawing pencil (H, HB, B)	14	Duster or handkerchief etc.

Course Code: HSL(CS/IT) 102	**Year: 1ST YEAR (CS &IT)**
Course Title: English Communication Laboratory	**Semester: 1ST SEMESTER**
Practical per week: 2 hours	**Credit: 1**
Pre- Requisites: 10+2 KNOWLEDGE	

1) LISTENING :Listening to pre-recorded short episodes, conversations, passages, stories, news bulletin, speeches by famous personalities - Listening for general and specific information

2) READING : Reading aloud - by students individually - reading rhymes - proverbs - passages on various topics of interest - Newspaper reading - Reading humorous passages - Anecdotes - Stories - tricky sounds (conditioners) - Reading manuals - Reading individual sentences with articulation, pronunciation, Tones, Punctuation, pauses etc... - Reading the titles of popular books, movies and poems.

3) SPEAKING: Self-introduction - introducing one self, one's family - one's friends and relatives, one's country etc.
Welcome Address, Vote of thanks.
Extempore speeches.
Short speech on simple topics on simpler themes for about one minute.
Role play - Group Discussion - Debate - Seminars - Machine Descriptions (depending upon branches) - Compering - Interviewing others by Asking Questions - Interview Techniques - Conversational Practice - Telephonic Conversation - Telephonic Interviews - How to establish conversation / dialogues - Entry Attempts/Admissions.

4) WRITING:
Writing Resume, preparing Curriculum Vitae.Converting newspaper headlines into sentences. Formation of Sentences - Using the table of Sentence-making and producing multiple sentences. Framing Questions for the responses given. Tips for better performance in interviews. Describing Objects.Describing Situations

5) PROFESSIONAL ETHICS & ORGANISATIONAL BEHAVIOUR:
Different kinds of Ethics - Ethics in different fields - Engineering Ethics - Senses of Engineering Ethics - Moral Values - Integrity & Loyalty - Work Ethics - Respect for others and authority - Empathy - Caring and Sharing - Honesty - Courage and Commitment - Valuing Time - Co-operation & Teamwork - Safety and Risk - Right Action - Professional ideals and virtues - Individual's Ambition - Conflict Resolution - Self-Confidence - Customs and Manners - General Behaviour - Etiquettes to be followed - Professional Responsibility - Accountability - Leadership Quality - Effective Communication skills.

6) PROJECT REPORT WRITING (Outline):Significant features of Project Report Writing- Organization - Presentation - Use of Impersonal Passives - Acknowledgements.

2nd SEMESTER							
SL. NO.	**TYPE OF COURSE**	**COURSE CODE**	**COURSE TITLE**	**HOURS PER WEEK**			**Credit**
				Lecture	**Tutorial**	**Practical**	
THEORY							
01	Basic Science course	BS(CS/IT) 204	Mathematics – II	3	0	0	3
02	Basic Science course	BS(CS/IT) 205	Chemistry	3	0	0	3
03	Engineering Science Course	ES(CS/IT) 204	Programming for Problem solving	3	0	0	3
04	Engineering Science Course	ES(CS/IT) 205	Analog and Digital Electronics	3	0	0	3
05	Humanities & Social Sciences including Management	HS(CS/IT) 203	Universal Human Values	2	0	0	2
SESSIONAL/PRACTICAL							
01	Basic Science course	BSL(CS/IT) 206	Chemistry Laboratory	0	0	3	1.5
02	Engineering Science Course	ESL(CS/IT) 206	Programming for Problem solving Laboratory	0	0	3	1.5
03	Engineering Science Course	ESL(CS/IT) 207	Workshop /Manufacturing Practices	1	0	2	2
04	Engineering Science Course	ESL(CS/IT) 208	Electronics Lab.	0	0	3	1.5
05	Humanities & Social Sciences including Management	HSL(CS/IT) 204	Design -Thinking Lab.	0	0	2	1
06	NSS						1
TOTAL				**15**	**0**	**13**	**22.5**

Course Code: BS(CS/IT) 204	**Year: 1ST YEAR (CSE & IT)**
Course Title: MATHEMATICS -II	**Semester: 2ND SEMESTER**
Lecture per week: 3 hours	**Credit: 3**
Pre- Requisites: Knowledge on BS(CS/IT) 101	

Module No.	**Description of Topic**	**Lectures Hours**
1	**Basic Probability:** Probability spaces, conditional probability, independence; Discrete random variables, Independent random variables, the Multinomial distribution, Poisson approximation to the Binomial distribution, infinite sequences of Bernoulli trials, sums of independent random variables; Expectation of Discrete Random Variables, Moments, Variance of a sum, Correlation coefficient, Chebyshev's Inequality.	11
2	**Continuous Probability Distributions:** Continuous random variables and their properties, Distribution functions and densities, Normal, Exponential and Gamma densities.	4
3	**Bivariate Distributions:** Bivariate distributions and their properties, distribution of sums and quotients, Conditionaldensities, Bayes' rule.	5
4	***Basic Statistics:*** Measures of Central tendency, Moments, Skewness and Kurtosis, Probability distributions:Binomial, Poisson and Normal and evaluation of statistical parameters for these threedistributions, Correlation and regression - Rank correlation.	8
5	***Applied Statistics:*** Curve fitting by the method of least squares- fitting of straight lines, second degree parabolas and more general curves. Test of significance: Large sample test for single proportion, difference of proportions, single mean, difference of means, and difference of standard deviations.	8
6	***Small samples:*** Test for single mean, difference of means and correlation coefficients, test for ratio of variances - Chi-square test for goodness of fit and independence of attributes.	4

Course Outcomes:

The students will be able to:

C01:l learn the ideas of probability and random variables, various discrete and continuous probability distributions with their properties and their applications in physical and engineering environment.

C02: understand the basic ideas of statistics with different characterisation of a univariate and bivariate data set.

C03: apply statistical tools for analysing data samples and drawing inference on a given data set.

Learning Resources:

1. Erwin Kreyszig, Advanced Engineering Mathematics, John Wiley & Sons
2. S. Ross, A First Course in Probability, Pearson Education India
3. W. Feller, An Introduction to Probability Theory and its Applications, Vol. 1, Wiley.
4. John E. Freund, Ronald E. Walpole, Mathematical Statistics, Prentice Hall.
5. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers.
6. N.G. Das, Statistical Methods (Combined Volume), Tata-McGraw Hill.

Course Code: BS(CS/IT) 205	**Year: 1ST YEAR (CSE/IT)**
Course Title: Chemistry	**Semester: 2ndSEMESTER**
Lecture per week: 3 hours Tutorial per week:	**Credit: 3**
Prerequisites: 10+2 KNOWLEDGE	

Unit-1: Chemical bonding in molecules(6 L)

MO theory, Structure, bonding and energy levels of bonding and shapes of many atom molecules, Chemistry of coordination compounds reactivity and stability: Determination of configuration of cis- and trans- isomers by chemical methods. Labile and inert complexes, substitution reaction on square planer complexes, trans effect (example and applications). Structure and bonding: VB description and its limitations. Elementary Crystal Field Theory: Splitting of d^{11} configurations in octahedral, square planar and tetrahedral fields, crystal field stabilization energy in weak and strong fields; pairing energy. JahnTeller distortion.

Unit-2: Spectroscopic techniques and applications (5 L)

Principles of spectroscopy and selection rules.Electronic spectroscopy.Fluorescence and its applications in medicine.Vibrational and rotational spectroscopy of diatomicmolecules.Applications.Nuclear magnetic resonance and magnetic resonance imaging,surface characterisation techniques.Diffiaction and scattering.d-d transitions; selection rules for electronic spectral transitions; spectrochemical series of ligands; charge transfer spectra (elementary idea).

Unit-3: Periodic properties (3 L)

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.

Unit-4: Chemical Thermodynamics (6 L)

Concept of Thermodynamic system: Definition with example of diathermal wall, adiabatic wall, isolated system, closed system, open system, extensive property, intensive property.
Introduction to first law of thermodynamics: different statements, mathematical form. Internal energy: Definition, Example, Characteristics, Physical significance, Mathematical expression for change in internal Energy, Expression for change in internal energy for ideal gas.
Enthalpy: Definition, Characteristics, Physical significance, Mathematical expression for change in Enthalpy, Expression for change in enthalpy for ideal gas.
Heat Capacity: Definition, Classification of Heat Capacity (Cp and CY): Definition and General expression of Cp - CY. Expression of Cp - CV for ideal gas. Reversible and Irreversible processes: Definition, Work done in Isothermal Reversible and Isothermal Irreversible process for Ideal gas,
Adiabatic changes: Work done in adiabatic process, Interrelation between thermodynamic parameters (P, Y and T), slope of P-Y curve in adiabatic and isothermal process. Application of first law of thermodynamics to chemical processes: exothermic, endothermic processes, law of Lavoisier and Laplace, Hess's law of constant heat summation, Kirchoff s law.
2 nd law of thermodynamics: Statement, Mathematical form of 2nd law of thermodynamics (Carnot cycle). Joule Thomson and throttling processes; Joule Thomson coefficient for Ideal gas, Concept of inversion temperature. Evaluation of entropy: characteristics and expression, entropy change in irreversible cyclic process, entropy change for irreversible isothermal expansion of an ideal gas, entropy change of a mixture of gases.
Work function and free energy: Definition, characteristics, physical significance, mathematical expression of AA and AG for ideal gas, Maxwell's Expression (only the derivation of 4 different forms), Gibbs Helmholtz equation. Condition of spontaneity and equilibrium reaction.

Unit-5:Surface and Colloid Chemistry(3L)

Adsorption, absorption and sorption, Physical and Chemisorption, Langmuir and Freaudlich isotherm, Multilayer adsorption, BET isotherm and its application to surface area measurement, Sols (reversible and irreversible), emulsion and emulsifier, micelle, gels, application of colloids, qualitative idea of electrokinetic phenomena, Zeta potential

Unit-6: Solid state Chemistry (3L)

Introduction to stoichiometric defects (Schottky&Frenkel) and non - stoichiometric defects (Metal excess and metal deficiency). Role of silicon and germanium in the field of semiconductor.

Unit-7: Stereochemistry(5L)

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

Unit-8: Organic reactions and synthesis of a drug molecule (5L)

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

Learning Resources:

1. P. C. Rakshit, Physical Chemistry, Sarat Book House (7th Edition).
2. S. Glasston, Text Book of Physical Chemistry, Macmillan India Limited.
3. S. Pahari, Physical Chemistry, New Central Book Agency.
4. S. Sarkar, Fuels and Combustion, Taylor & Francis (3rd Edition),
5. R. P. Sarkar, Inorganic Chemistry (Vol-1 & II)
6. L. Finar, Organic Chemistry, Addison Wesley Longman, Inc.
7. Physical Chemistry, Atkins, 6th Edition, Oxford Publishers.
8. Organic Chemistry, Mark Loudon, 4th Edition, Oxford Publishers.

Course Code: ES(CS/IT) 204	**Year: 1ST YEAR (CSE & IT)**
Course Title: Programming for Problem Solving	**Semester: 2ND SEMESTER**
Lecture per week: 3 hours	**Credit: 3**
Pre- Requisites: 10+2 KNOWLEDGE	

Detailed contents

Unit 1 Computer Fundamentals **(4 lectures)**
Introduction to components of a computer system (disks, memory, processor, where a program is stored and executed, operating system, compilers etc.) - **(1 lecture).**
Idea of Algorithm: steps to solve logical and numerical problems. Representation of Algorithm: Flowchart/Pseudocode with examples. **(1 lecture)**
From algorithms to programs; source code, variables (with data types) variables and memory locations, Syntax and Logical Errors in compilation, object and executable code- **(2 lectures)**

Unit 2:Arithmetic expressions and precedence **(2 lectures)**

Unit 3: Conditional Branching and Loops **(6 lectures)**
Writing and evaluation of conditionals and consequent branching **(3 lectures)**
Iteration and loops **(3 lectures)**

Unit 4 Arrays **(6 lectures)**
Arrays (1-D, 2-D), Character arrays and Strings ***Unit*** -/Basic Algorithms **(6 lectures)**
Searching, Basic Sorting Algorithms (Bubble, Insertion and Selection), Finding roots of equations, notion of order of complexity through example programs (no formal definition required)

Unit 5 Function **(5 lectures)**
Functions (including using built in libraries), Parameter passing in functions, call by value,
Passing arrays to functions: idea of call by reference ***Unit*** ^Recursion **(4 -5 lectures)**
Recursion, as a different way of solving problems. Example programs, such as Finding Factorial, Fibonacci series, Ackerman function etc. Quick sort or Merge sort.

Unit 6 Structure **(4 lectures)**
Structures, Defining structures and Array of Structures ***Unit*** ^Pointers **(2 lectures)**
Idea of pointers, Defining pointers, Use of Pointers in self-referential structures, notion of linked list (no implementation)

Unit 7 File handling (only if time is available, otherwise should be done as part of the lab)

Course Outcomes
The student will learn
1. To formulate simple algorithms for arithmetic and logical problems.
2. To translate the algorithms to programs (in C language).
3. To test and execute the programs and correct syntax and logical errors.

Suggested Text Books
1. Byron Gottfried, Schaum's Outline of Programming with C, McGraw-Hill
2. E. Balaguruswamy, Programming in ANSI C, Tata McGraw-Hill **Suggested Reference Books**
3. Brian W. Kemighan and Dennis M. Ritchie, The C Programming Language, Prentice Hall of India

Course Code: ES(CS/IT) 205	**Year: 1ST YEAR (CSE & IT)**
Course Title: Analog & Digital Electronics	**Semester: 2ND SEMESTER**
Lecture per week: 3 hours	**Credit: 3**
Pre- Requisites: Basic Electrical Engineering ES(CS/IT) 101	

Objective:
1) To study Analog Electronic devices
2) To study Boolean logic and logic gates
3) To compare digital and analog electronic circuits

Module	Content	Hrs
1.	Basic Electronic devices: PN junction diode, Application of diodes in rectification, Half wave Full wave rectifier and Factors determining rectifier performance , Transistor, Transistor characteristics for CE, CB and CC mode, current amplification factors and their relationship, Introduction to FET and MOSFET.	08
2.	Number system, Boolean algebra & logic gates: Binary numbers & Boolean algebra , Logic gates, Truth Tables and function minimization using algebraic method, Karnaugh map, , Signed binary number representation with 1's and 2's complement methods, Maxterm, Minterm, Representation in SOP and POS forms ; Realization of Boolean functions using NAND/NOR gates	10
3.	Combinational circuits: Adder and Subtractor circuits ; Encoder, Decoder, Comparator, Multiplexer, De-Multiplexer, Parity Generator and checker.	10
4.	Sequential Circuits: Flip-flops - SR, JK, Master slave JK, D and T. Register, counter	08

Course Outcome: After completion of this course the students will be able to –
CO1 Identify the difference between analog and digital electronic systems.
CO2 Compare the operation of semiconductor devices based on their characteristic curves.
CO3 Explain number base conversions and K-Map.
CO4 Construct various combinational logic circuits.
CO5 Design various sequential circuits.

Learning Resources:

1. Morries Mano, Digital Logic Design, PHI
2. Kharate, Digital Electronics, Oxford
3. Leach & Malvino, Digital Principles & Application,Mc Graw Hill
4. D chattopadhyay & P.C.Rakshit. Electronics (Fundamentals and Applications), New Age International Publishers
5. Malvino, Electronic Principle, McGraw Hill.
6. Millman & Halkias, Integrated Electronics, McGraw Hill
7. Boyelstad & Nashelsky, Electronic Devices & Circuit Theory,PHI
8. R.P.Jain, Modern Digital Electronics, McGraw Hill

Course Code: HS(CS/IT) 203	**Year: 1ST YEAR (CSE & IT)**
Course Title: Universal Human Values	**Semester: 2ND SEMESTER**
Lecture per week: 2 hours	**Credit: 2**
Pre- Requisites: 10+2 KNOWLEDGE	

Objective:

1. To help the students appreciate the essential complementarity between 'VALUES' and 'SKILLS' to ensure sustained happiness and prosperity which are the core aspirations of all human beings.
2. To facilitate the development of a Holistic perspective among students towards life as well as towards happiness and prosperity based on a correct understanding
3. To strengthen self reflection
4. To develop clarity of the harmony in human nature and existence.
5. To explore themselves

Module-1 **3 hours**

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, Happiness and Prosperity - Current Scenario. Method to Fulfil the Basic Human Aspirations

Module-2 **3 hours**

Hamony in the Human Being :

Jnderstanding 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

Module-3 **3 hours**

Harmony in the Family and Society :

Harmony in the Family - the Basic Unit of Human Interaction, '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

Module-4 **3 hours**

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

Module-5 **3 hours**

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

Course Outcome:

After completion of this course the students will be able to -

CO1 Evaluate the significance of value inputs in formal education and start applying them in their life and profession

CO2 Distinguish between values and skills, happiness and accumulation of physical facilities, the Self and the Body, Intention and Competence of an individual, etc.

CO3 Analyze the value of harmonious relationship based on trust and respect in their life and family

CO4 Examine the role of a human being in ensuring harmony in society and nature.

CO5 Create awareness and safety for nature.

Learning Resources:

1. A.N. Tripathi, new age international publishers: 2003- Human values. Human Society in Ethics 2 polities- Bertrand Russell.
2. Small is beautiful – E.F. Schumacher philosophy of humanism: Corliss Layout. Foundation Course in value Education: Gour.R.R./sangal R.

Course Code: BS(CS/IT) 205	**Year: 1ST YEAR (CSE/IT)**
Course Title: Chemistry Lab	**Semester: 2ndSEMESTER**
Lecture per week: 3 hours	**Credit: 1.5**
Prerequisites: 10+2 KNOWLEDGE	

Objective
1. To develop laboratory practice and safety.
2. To develop laboratory skills and instrumentation.
3. To deepen the understanding of concepts.
4. To provide scientific skills and chemical knowledge.

Pre-Requisite -Class 12th standard knowledge in Practical Chemistry

Module	Content	Hours
1	Qualitative analysis of an inorganic sample salt.	6
2	Estimation of Fe(II) present in a solution permanganometrically	3
3	Estimation of Fe(II) present in a solution dichromatometrically.	3
4	Determination of hardness of water in ppm unit complexometrically.	6 (any two from Module 4-9)
5	Determination of surface tension of a given liquid.	
6	Determination of viscosity of a given liquid.	
7	Determination of rate constant of a reaction.	
8	Determination of cell constant and conductance of a solution.	
9	Potentiometry: determination of redox potential and emf.	

After completion of the course, a student would be able to
CO 1 analyze qualitative parameters (basic and acid radicals) of inorganic salts.handle stalagmometer and Ostwald's viscometer to determine surface tension and viscosity of liquid.
CO 2 estimate quantities of Fe (II) permanganetometrically and dichromatometrically.
CO 3 estimate hardness of water complexometrically.
CO 4 handle stalagmometer and Ostwald's viscometer to determine surface tension and viscosity of liquid.
CO 5 develop perception about safety standards to be maintained inside the laboratory.
CO 6 develop skill to work in a team.

Learning Resources:

1. Practical Chemistry, Prof Sachin Dutta, Bharati Book Stall
2. Practical Chemistry , R Mukhopadhyay & P Chatterjee, Books and Allied (p) Ltd.
3. Practical Chemistry, Pandey, Bajpai, Giri, S Chand Publication
4. Vogel's Qualitative Inorganic Analysis, G Svehla, B Shivasankar (7th Edition), Pearson
5. Vogel's Quantitative Chemical Analysis, J Mendham, R C Denney, J D Barnes, M Thomas, B Shivasankar (6th Edition), Pearson

Course Code: ESL(CS/IT) 206	**Year: 1ST YEAR (CSE & IT)**
Course Title: Programming for Problem Solving Laboratory	**Semester: 2ND SEMESTER**
Practical per week: 3 hours	**Credit: 1.5**
Pre- Requisites: 10+2 KNOWLEDGE	

The laboratory should be preceded or followed by a tutorial to explain the approach or algorithm to be implemented for the problem given.

Tutorial 1: Problem solving using computers:
Lab 1: Familiarization with programming environment

Tutorial 2: Variable types and type conversions:
Lab 2: Simple computational problems using arithmetic expressions

Tutorial 3: Branching and logical expressions:
Lab 3: Problems involving if-then-else structures

Tutorial 4: Loops, while and for loops:
Lab 4: Iterative problems e.g., sum of series

Tutorial 5: ID Arrays: searching, sorting:
Lab 5: ID Array manipulation

Tutorial 6: 2D arrays and Strings
Lab 6: Matrix problems, String operations

Tutorial 7: Functions, call by value:
Lab 7: Simple functions

Tutorial 8 &9: Numerical methods (Root finding, numerical differentiation, numerical integration):
Lab 8 and 9: Programming for solving Numerical methods problems

Tutorial 10: Recursion, structure of recursive calls
Lab 10: Recursive functions

Tutorial 11: Pointers, structures and dynamic memory allocation
Lab 11: Pointers and structures

Tutorial 12: File handling:
Lab 12: File operations

Laboratory Outcomes
1) To formulate the algorithms for simple problems C To translate given algorithms to a working and correct program
2) To be able to correct syntax errors as reported by the compilers
3) To be able to identify and correct logical errors encountered at run time
4) To be able to write iterative as well as recursive programs
5) To be able to represent data in arrays, strings and structures and manipulate them through a program
6) To be able to declare pointers of different types and use them in defining self-referential structures.
7) To be able to create, read and write to and from simple text files.

Course Code: ESL(CS/IT) 207	**Year: 1ST YEAR (CSE & IT)**
Course Title: WORKSHOP/ MANUFACTURING PRACTICES	**Semester: 2ND SEMESTER**
Theory 1 hr, practical 2 hrs	**Credit: 2**
Pre- Requisites: 10+2 KNOWLEDGE	

Module	Content	Hours
1	Introduction to different manufacturing methods like casting, forming, machining, joining. Visit to mechanical workshop and awareness on the safety rules to be followed in mechanical workshop.	1L+2P
2	Introduction to fitting operations; Study of different fitting tools: Bench vice, Hammer, Files, Punch, Callipers etc.; Making a job using bench working methods; Power tools.	2L+4P
3	Introduction to carpentry: Seasoning of wood; Familiarisation with different carpentry tools: rule, try square, marking gauge, hand saw, chisel, jack plane, trying plane, claw hammer, mallet, rasp file etc; Making of a wood joint	2L+4P
4	Glass cutting and making of a glass based product e.g. kaleidoscope.	1L+2P
5	Casting: Introduction to riser, core, shrinkages. Making of a die cast component.	1L+2P
6	Introduction to welding, brazing and soldering. Join metallic pieces using electric arc welding; Hands on practice on soldering/ brazing.	1L+2P
7	Introduction to machine shop: Lathe, Grinding machine, Drilling machine, Shaping machine. Preparation of a work piece through turning, knurling, taper turning operations in lathe. Flatten one surface of a metallic block using Shaping machine and polishing the same surface using grinding machine.	2L+4P
8	Introduction to smithy; Drawing, upsetting; Smithy tools: Anvil, swage block, hearth, hammer, tongs; Resize a component using smithy operations.	1L+2P
9	Introduction to advanced manufacturing methods. Making of a product/ part using polymer based 3D printing.	1L+2P

Course outcomes

After completion of the course, a student would be able to

- **CO 1** **explain** different manufacturing processes which are commonly employed in industry to fabricate components using different materials including advanced manufacturing methods.
- **CO 2** **construct** a defined job in different sections of mechanical workshop e.g., carpentry, fitting , welding, machine shop, casting shop floor, forging shop etc.
- **CO 3** **develop** different components to produce small devices using welding, brazing, soldering, glass cutting etc.
- **CO 4** **bulid** products using additive manufacturing process.

Learning Resources

1. 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.
2. Kalpakjian S. And Steven S. Schmid, "Manufacturing Engineering and Technology",4thedition, Pearson Education India Edition, 2002.
3. Gowri P. Hariharan and A. Suresh Babu," Manufacturing Technology – I" Pearson Education, 2008.
4. Roy A. Lindberg, "Processes and Materials of Manufacture", 4th edition, Prentice Hall India, 1998.
5. Rao P.N., "Manufacturing Technology", Vol. I and Vol. II, Tata McGraw Hill House,2017.

Course Code: ESL(CS/IT) 208	**Year: 1ST YEAR (CSE & IT)**
Course Title: Electronics Lab	**Semester: 2ND SEMESTER**
Practical 3 hrs	**Credit: 1.5**
Pre- Requisites: Basic Electrical Engineering Laboratory ESL(CS/IT)102	

Module	Content	Hrs
1.	I-V characteristics of semiconductor diode.	2
2.	Input and output characteristics of BJT in CE configuration	2
3.	Verification of truth table of different logic gates	2
4.	Design and implementation of half adder and full adder	2
5.	Design and implementation of parity generator and checker	2
6.	Construction of simple Decoder circuits and verification of truth table	2
7.	Construction of multiplexer circuits and verification of truth table.	2
8.	Realization of RS / JK / D flip flops using logic gates.	2

Course Outcome:
After completion of this course the students will be able to -

CO1 Measure static and dynamic resistance of P-N junction diode from the I-V characteristics.
CO2 Identify different regions of operation of BJT and JFET from the characteristics curves.
CO3 Construct logic circuits using minimum number of logic gates.
CO4 Implement adder, parity generator and checker, decoder and multiplexer circuits using basic logic gates.
CO5 Construct different types of sequential circuits using basic logic gates.

Learning Resources:
1 Laboratory Manuals.

Course Code: HSL(CS/IT) 204	**Year: 1ST YEAR (CSE & IT)**
Course Title: Design -Thinking Lab	**Semester: 2ND SEMESTER**
Practical 2 hrs	**Credit: 1**
Pre- Requisites: 10+2 KNOWLEDGE	

Introduction

This course is intended for students from any discipline who require an understanding of design thinking for brand, product, and service development. Students will learn a series of design thinking concepts, methods and techniques that are used to bring about innovation in business and in the social sector.

Pedagogical approach

The course will be a mix of lecture, case discussions, participative and immersive learning. It will be a predominantly student driven learning to acquire the requisite skills. Relevant case discussions drive the principles of arriving at an optimum solution through innovative approaches. A comprehensive group project will be a major outcome of the course.

Course objectives

*To expose the student with state of the art perspectives, ideas, concepts, and solutions related to the design and execution of projects using design thinking principles

*To prepare the mindset and discipline of systemic inspiration driven by a desire to identify new sources of ideas, and new models especially outside their regular working atmosphere

*To propose a concrete, feasible, viable and relevant innovation project/challenge.

Module 1 **13 hours**

What is Different About Design thinking? Design Thinking Skills Principles of Design Thinking, The Basis for Design Thinking, The Design Thinking Team, Design Thinking Workshops and Meetings - Exercises and case based discussions

Module 2 **13 hours**

Listening and Empathizing Techniques - observation - structured open ended approach - .

Design Thinking Frameworks, Ideation tools - brainstorming, innovation heuristics, behaviour models, overcoming cognitive fixedness - Exercises and case based discussions

Module 3 **14 hours**

Use of Diagrams and Maps in Design Thinking - Empathy map. Affinity diagram, mind map, journey map, combining ideas into complex innovation concepts.

Story telling - improvisation, scenario planning, development of scenarios, evaluation tools, frog design and prototyping - - Exercises and case-based discussions

Assess developer and user perspectives for bias - apply frameworks to strengthen communication - sustain a culture of innovation.

References:

Roger Martin, "The Design of Business: Why Design Thinking is the Next Competitive Ad vantage", Harvard Business Press , 2009.

Hasso Plattner, Christoph Meinel and Larry Leifer (eds), "Design Thinking: Understand - Improve- Apply", Springer, 2011
Idris Mootee, "Design Thinking for Strategic Innovation: What They Can't Teach You at Business or Design School", John Wiley & Sons 2013
Jeanne Liedtka , Andrew King, Kevin Bennett, “Book - Solving Problems with Design Thinking - Ten Stories of What Works” (Columbia Business School Publishing), 2013
Maurfcio Vianna, Ysmar Vianna, Isabel K. Adler, Brenda Lucena, Beatriz Russo, “Design thinking: Business Innovation” MJV Press, 2011
Burgelman, Christensen, and Wheelwright, “Strategic Management of Technology and Innovation”5th Edition, McGraw Hill Publications, 2017