



## **Department of Basic Science & Humanities**

### **Detailed syllabus: Theory**

**Batch 2022-23**

**2<sup>nd</sup> Semester**

## Course Name: Physics

## Course Code: BSC101

### *Detailed Contents*

- **Classical Mechanics and Oscillations (9L):** Constraints- Holonomic and Non-Holonomic Constraints, Generalized Coordinates and Momentum, Degrees of Freedom, Lagrange's equation of motion, application of Lagrang's equation, Cyclic coordinate; Potential energy function  $F = -\text{grad } V$ , Equipotential surfaces and meaning of gradient. Conservative and non-conservative forces. Curl of a force field, Conservation laws of energy & momentum; Concept of Central forces, Kepler's law; Non-inertial frames of reference, Rotating coordinate system, Centripetal and Coriolis accelerations.

Harmonic oscillator; Damped harmonic motion – over-damped, critically damped and lightly damped oscillators; Examples of mechanical and electrical simple harmonic oscillators, energy decay in a damped harmonic oscillator, Forced oscillations and resonance, quality factor, power absorbed by oscillator.

- **Optics (6L):** Huygens' principle, superposition of waves and interference of light by wavefront splitting and amplitude splitting; Young's double slit experiment, Newton's rings, Fraunhofer diffraction from a single slit and a circular aperture, Rayleigh criterion for limit of resolution and its application to vision; Diffraction gratings and their resolving power.

Spontaneous and Stimulated emission, Einstein's theory of A and B coefficients; amplification of light by population inversion, different types of lasers: gas lasers, solid-state lasers, dye lasers; Properties of laser beams: mono-chromaticity, coherence, directionality and brightness, applications of lasers.

- **Introduction to Electromagnetic Theory (6L):** Concept of Bound charges due to electric polarization in dielectric medium, Electric displacement current; Introduction to Maxwell's equations of Electromagnetic fields, Continuity equation for current densities, Modifying equation for the curl of magnetic field to satisfy continuity equation. Maxwell's equation in vacuum and non-conducting medium, Energy in an electromagnetic field, Flow of energy and Poynting vector with examples, The wave equation, Plane electromagnetic waves in vacuum and their transverse nature and polarization, Relation between electric and magnetic fields of an electromagnetic wave, Energy carried by electromagnetic waves.

- **Electronic Materials and Semiconductors (6L):** Free electron theory of metals, Fermi level, density of states in 1, 2 and 3 dimensions, Bloch's theorem for particles in a periodic potential, Kronig-Penney model and origin of energy bands, Metals, semiconductors, and insulators. Intrinsic and extrinsic semiconductors, Dependence of Fermi level on carrier-concentration and temperature (equilibrium carrier statistics), Carrier generation and recombination, Carrier transport: diffusion and drift, p – n junction.

- **Introduction to Quantum Mechanics for Engineers (10L):** Introduction to Quantum Mechanics, Wave nature of particles, Time-dependent and time-independent Schrödinger equation for wavefunction, Born interpretation, Probability current density, Expectation values, Free-particle wavefunction and wave-packets, Uncertainty principle and de-Broglie hypothesis, Concept of Operator.

Applications of Schrödinger equation: One-dimensional problems - particle in one dimensional potential box, step potential, concept of tunnel effect, qualitative summary of linear harmonic oscillator; Three-dimensional problems - particle in three dimensional potential box, hydrogen atom problem, Occupation probability & examples, nuclear alpha decay.

- **Statistical Mechanics (3L):** Statistical Distributions functions (Three different kinds- Maxwell Boltzmann, Fermi-Dirac, Bose Einstein), Comparison of these three statistical distribution functions, Mention the form of the functions and graphical explanations of them, Concept of Fermions and Bosons, Mention the importance of statistical mechanics in perspective of thermodynamics, Concept of thermodynamical probability, Concept of Microstates and Macrostates.

**Suggested Text Books:**

1. Theory and problems of Theoretical Mechanics by Murray R. Spiegel SI (Metric) edition
2. Advanced Acoustics – Dr. D. P. Raychaudhuri, The new book stall, Revised Ninth Edition, 2009
3. A textbook on Optics, B. Ghosh and K. G. Majumder, Sreedhar Publishers, fifth edition.
4. Introduction to Electrodynamics by David J. Griffiths 3rd Edition
5. Introduction to Solid State Physics (January 2019) by Charles Kittel (Published by Wiley)
6. Concepts of Modern Physics (Sixth Edition) by Arthur Beiser (Published by McGraw-Hill)

**Course Name: Chemistry**  
**Course Code: BSC102**

*Detailed Contents*

- **Atomic and molecular structure (12 L):** 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 multicentre orbitals. Equations for atomic and molecular orbitals. Energy level diagrams of diatomics. Pi-molecular orbitals of butadiene and benzene and aromaticity. **Chemistry of Materials**, 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.
- **Spectroscopic techniques and applications (8 L):** 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 characterisation techniques. Diffraction and scattering.
- **Intermolecular forces and potential energy surfaces (4 L):** Ionic, dipolar and van Der Waals interactions. Equations of state of real gases and critical phenomena. Potential energy surfaces of H<sub>3</sub>, H<sub>2</sub>F and HCN and trajectories on these surfaces.
- **Chemical kinetics and reaction equilibrium:** **Concept of preequilibrium, equilibrium and related quantities. Concept of preequilibrium, equilibrium and related quantities Reaction laws: rate and order; molecularity; zero, first and second order kinetics. Pseudounimolecular reaction, Arrhenius equation. Mechanism and theories of reaction rates (Transition state theory, Collision theory). Catalysis: Homogeneous catalysis (Definition, example, mechanism, kinetics).**
- **Use of free energy in chemical equilibria (6 L):** 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.
- **Periodic properties (4 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

- **Stereochemistry (4 L):** 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
- **Organic reactions and synthesis of a drug molecule (4 L):** Introduction to reactions involving substitution, addition, elimination, oxidation, reduction, cyclization and ring openings. Synthesis of a commonly used drug molecule.

**Suggested Text Books:**

1. Engineering Chemistry by Jain and Jain, Dhanpat Rai Publishing Co.17th edition
2. Chemistry by Prasanta Rath and Subhendu Chakraborty
3. Physical Chemistry by P. W. Atkins
4. Fundamentals of Molecular Spectroscopy by C. N. Banwell
5. Physical Chemistry, P.C. Rakshit, Sarat Book distributors, Calcutta, 7th ed
6. University Chemistry by B. H. Mahan
7. A Textbook of Nanoscience and Nanotechnology Author: T. Pradeep. Publisher: McGraw Hill Education, ISBN: 9781259007323
8. The Chemistry of Nanomaterials, Prof. C.N.R. Rao, Publisher-Wiley- VCH

**Course Name: Mathematics – II**  
**Course Code: BSC104**

***Detailed Contents***

- **Multivariate Calculus (Integration) (10 L):** Multiple Integration: Double Integrals (Cartesian), Change of Order of Integration in Double Integrals, Change of Variables (Cartesian to Polar), Applications: areas and volumes, Centre of Mass and Gravity (constant and variable densities); Triple Integrals (Cartesian), Orthogonal Curvilinear Coordinates, Simple applications involving cubes, sphere and rectangular parallelepiped; Scalar Line Integrals, Vector Line Integrals, Scalar Surface Integrals, Vector Surface Integrals, Theorems of Green, Gauss and Stokes.
- **ODE (14 L):** Exact equations, Rules for finding Integrating Factors, 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.

Second Order Linear Differential Equations with constant coefficients, D-operator Method, Method of Variation of Parameters, Cauchy-Euler Equation; Power series Solutions; Frobenius method, Legendre equation, Legendre Polynomials, Rodrigue's Formula, Bessel equation, Bessel Functions of the First kind and their properties, Orthogonality conditions.

- **Vector Space (12 L):** Vector Space, Vector Subspace, Linear Independence and 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.

Inner Product Space, Gram-Schmidt Orthogonalization.

- **Basics of Statistics & Probability (8 L):** Classical & Axiomatic Definition of Probability, Addition Rule for two & three events (statement only), Concept of Conditional Probability, Multiplication Rule of Probability, Bayes' Theorem (statement only), Independent Events.

Measures of Central tendency: Moments, Skewness and Kurtosis, Correlation and Regression – Rank correlation.

### **Suggested Text Books:**

1. G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9th Edition, Pearson, Reprint, 2002.
2. Erwin kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
3. W. E. Boyce and R. C. DiPrima, Elementary Differential Equations and Boundary Value Problems, 9th Edition., Wiley India, 2009.
4. S. L. Ross, Differential Equations, 3rd Edition., Wiley India, 1984.
5. E. A. Coddington, An Introduction to Ordinary Differential Equations, Prentice Hall India, 1995.
6. E. L. Ince, Ordinary Differential Equations, Dover Publications, 1958.
7. N.P. Bali and Manish Goyal, A Text Book of Engineering Mathematics, Laxmi Publications, Reprint, 2008.
8. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 36th Edition, 2010.
9. P. G. Hoel, S. C. Port and C. J. Stone, Introduction to Probability Theory, Universal Book Stall, 2003(Reprint).
10. S. Ross, A First Course in Probability, 6th Ed., Pearson Education India, 2002.
11. W. Feller, An Introduction to Probability Theory and its Applications, Vol. 1, 3rd Ed., Wiley, 1968.
12. D. Poole, Linear Algebra: A Modern Introduction, 2nd Edition, Brooks/Cole, 2005
13. V. Krishnamurthy, V.P. Mainra and J.L. Arora, An Introduction to Linear Algebra, Affiliated, East–West Press, Reprint 2005.
14. B.Basu Mallik & Krishanu Deyasi, Engineering Mathematics-1B, Cengage Learning, First Edition, 2020.
15. B.Basu Mallik & Krishanu Deyasi, Engineering Mathematics-2B, Cengage Learning, First Edition, 2020.

**Course Name: Programming for problem solving**  
**Course Code: ESC103**

***Detailed Contents***

- **Introduction to C Programming:** Operators, Expressions, Program structures, Header files, Fundamental examples
- **Conditional Branching and Loops:** Writing and evaluation of conditionals and consequent branching, If, else , if-elseif statements, Switch-case, Iteration and loops (2 lectures)
- **Arrays:** Arrays (1-D, 2-D), Character arrays and Strings
- **Basic Algorithms:** Notion of order of complexity through example programs, Searching, Basic Sorting Algorithms (Bubble, Insertion).
- **Function:** Functions (including using built in libraries), Parameter passing in functions, call by value, Passing arrays to functions: Call by reference, Return by reference
- **Recursion:** Recursion, as a different way of solving problems. Example programs, such as Finding Factorial, Fibonacci series, Ackerman function etc., Tail recursion concept
- **Structure and union:** Structures, Defining structures and Array of Structures, Union concept
- **Pointers:** Idea of pointers, Defining pointers, Use of Pointers in self-referential structures, Basic of linked list creation, Linked list insert and delete operation
- **File handling:** Create , open, close files, Opening modes, File copy using command line argument

**Suggested Text Books:**

1. Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language, Prentice Hall of India
  2. Byron Gottfried, Schaum's Outline of Programming with C, McGraw-Hill
  3. E. Balaguruswamy, Programming in ANSI C, Tata McGraw-Hill
- Suggested Reference Books
4. Reema Thareja, Computer Fundamentals and programming in C, Oxford University Press
  5. Yashavant Kanetkar, Let Us C, BPB Publications



**Course Name: English**  
**Course Code: HSMC101**

***Detailed Contents***

- **Fundamentals of Grammar & Vocabulary Building:** The concept of Word Formation; Root words from foreign languages; Acquaintance with prefixes and suffixes; Synonyms, antonyms, and standard abbreviations, structure and collocation of words, Phonetics, Diphthongs
- **Finding Common Errors in English:** Subject-Verb Agreement; Noun-Pronoun Agreement; Misplaced Modifiers, Articles, Prepositions, Conjunctions, Modals, Determiners, Redundancies, Clichés, Idioms and Phrasal Verbs, Transformation of sentences.
- **Introduction to Technical Communication:** Basics of Technical Communication, barriers to communication, Active Listening, Conversations and Dialogues, Feedback, Effective Speaking: Pronunciation, Intonation, Stress and Rhythm, Communication at Workplace: Interview skills including Cover Letter & CV formation, Reading Comprehension
- **Effective Writing Skills:** Structuring Sentences for Effective Writing, Art of Condensation, Importance of proper punctuation, Nature and Style of sensible Writing: Describing, Defining, Classifying, Providing examples or evidence, writing introduction and conclusion, creating coherence: Arranging paragraphs & Sentences in logical order.
- **Writing Practices:** Précis Writing; Essay Writing
- **Formal Presentation:** Introduction, Planning, Outlining and Structuring, Nuances of Delivery, Visual Aids in Presentations, Application of MS PowerPoint and slide presentation.

**Suggested Text Books:**

1. Practical English Usage-Michael Swan, OUP, 1995.
2. Remedial English Grammar-F.T. Wood, Macmillan, 2007.
3. On Writing Well. William Zinsser- Harper Resource Book, 2001.
4. Study Writing. Liz Hamp-Lyons and Ben Heasley- Cambridge University Press, 2006.
5. Communication Skills. Sanjay Kumar and PushpLata- Oxford University Press, 2011.
6. Exercises in Spoken English Parts. I-III- CIEFL, Hyderabad, Oxford University Press

## Course Name: Engineering Mechanics (Dynamics)

### Course Code: ESC202B

#### *Detailed Contents*

- **Review of particle dynamics:** Rectilinear motion; Plane curvilinear motion (rectangular, path, and polar coordinates). 3-D curvilinear motion; Relative and constrained motion; Newton's 2nd law (rectangular, path, and polar coordinates). Work-kinetic energy, power, potential energy. Impulse-momentum (linear, angular); Impact (Direct and oblique).
- **Introduction to Kinetics of Rigid Bodies:** Basic terms, general principles in dynamics; Types of motion, Instantaneous centre of rotation in plane motion and simple problems; D'Alembert's principle and its applications in plane motion and connected bodies; Work energy principle and its application in plane motion of connected bodies; Kinetics of rigid body rotation.
- **Kinematics of rigid bodies:** Motion of a rigid body; Rigid bodies as coordinate systems; Angular velocity of a rigid body; Distinction between two and three dimensional rotational motion; Motion relative to a rotating rigid body: Five term acceleration formula.
- **Mechanical Vibrations:** Basic terminology, free and forced vibrations, resonance and its effects; Degree of freedom; Derivation for frequency and amplitude of free vibrations without damping and single degree of freedom system, simple problems, types of pendulum, use of simple, compound and torsion pendulums.
- **General Motion:** General planar motions. General 3-D motions. Free precession, Gyroscopes.
- **Torsional Motion:** Torsion of circular shafts, derivation of torsion equation, stress and deformation in circular and hollow shafts.

### **Suggested Text Books:**

1. B B Ghosh, Satyajit Chakrabarti, Samir Ghosh “Engineering Mechanics” S Chand Publisher.
2. J. L. Meriam and L. G. Kraige, “Engineering Mechanics: Dynamics”, Wiley, 2011.
3. F. P. Beer and E. R. Johnston (2011), Vector Mechanics for Engineers, Vol II, – Dynamics, 9th Ed, Tata McGraw Hill.
4. R. C. Hibbler (2006), Engineering Mechanics: Principles of Statics and Dynamics, Pearson Press
5. S. Timoshenko, D.H. Young, J.V. Rao, SukumarPati, Engineering Mechanics (In SI Units) (SIE).
6. M. F. Beatty, “Principles of Engineering Mechanics”, Springer Science & Business Media, 1986.
7. Manoj K. Harbola, “Engineering Mechanics”, Cengage Learning India Pvt. Ltd, 2018
8. D.S. Bedi& M.P. Poonia, “Engineering Mechanics”, Khanna Publishing House, 2019
9. R.K. Bansal, “Engineering Mechanics”, Laxmi Publications
10. Hibler and Gupta (2010), Engineering Mechanics (Statics, Dynamics) by Pearson Education
11. Andy Ruina and RudraPratap (2011), Introduction to Statics and Dynamics, Oxford University Press.

**Course Name: Essential Studies for Professionals – II**  
**Course Code: HSMC202**

***Detailed Contents***

- **Laws of Society:** History of Constitution, Preamble, Fundamental Rights, Directive Principle of State Policy and Fundamental Duties
- **Our Ancient Past:** Indus Valley Civilization, Vedic Civilization, 16 Mahajanapadas, Mauryan Dynasty.
- **Know Our Country:** Physiographic Division of India- Geological history of India, Northern Mountain, Mineral Resources of India.
- **Financial Planning and Market Laws:** Basic Concept of Economics, National Income, Unemployment and Poverty
- **Module 5: India and World:** Monthly Current Affairs Magazine
- **Module 6: Universal Human Values:** Understanding Value Education, Method to fulfil the Basic Human Aspiration, Continuous happiness and Prosperity- the Basic Human Aspiration

**Suggested Text Books:**

1. Indian Constitution- M. Laxmikant
2. Indian Economy-Ramesh Singh
3. India's Ancient Past- R.S. Sharma
4. Geography of India- Majid Hussain
5. Current Affairs Magazine of IEM-UEM

**Course Name: Skill Development for Professionals – II**  
**Course Code: HSMC282**

*Detailed Contents*

- **Quantitative Aptitude:**

1)**Average**- Concept on average, different missing numbers in average estimation, shortcuts & their application.

2)**Mixture & Allegation** – Proportion & mixtures in percentages, populations & liquids, shortcuts & their application.

3)**Time & Work**- Basic concept, Chain rule, formulae & their application. Pipes & cistern.

4)**Time and distance** - Basic concept, Different problems & their shortcut tricks. Time & Speed & Tides- concept of speed, time & Distance, relative speed, Upstream & Downstream, formulae & their application.

- **Logical Reasoning:**

1)**Cube**- Dice, Miscellaneous Problems

2)**Data Sufficiency**-

a)Problems on Blood Relation, ages, Numbers

b)Logical Test Based on Data Sufficiency

3)**Non Verbal Reasoning**-

a)Image Formation

b)Water –Images

c)Mirror Image

d)Image completion

e)Paper Cutting And Folding

- **Objective English-2**

1)**Clauses:** Definition, Examples, Rules & Application, Types of Sentences (Simple +Complex +Compound) Examples, Rules & Application, Voice- Concept, Types, Examples, Rules & Application, Narration Change- Rules (Direct & Indirect Speech)

2)**Vocabulary:** Synonyms, Antonyms with examples, One word Substitution, Idioms & Phrases

3)**Spotting Errors:**

4)**Reading Comprehension:** ( Level II )

- **Data Interpretation level-II**

Newspaper reading: The Hindu & Economic Times

**Suggested Text Books:**

1. Fast Track Arithmetic- Rajesh Verma
2. 2.Verbal & non-verbal reasoning- R.S Agarwal
3. 3.Quantitative Aptitude- R.S Agarwal

**Course Name: Electronics- Fundamental & Principles**  
**Course Code: IVC201**

***Detailed Contents***

- **Semiconductors (5 L):** Semiconductor fundamentals: Introduction, Crystalline Materials and Semiconducting materials, Basis of Classification: Metals, Insulators and Semiconductors, Intrinsic Semiconductor, Extrinsic Semiconductors, Electrical Conduction Phenomenon.
- **Diode fundamentals (5L):** Introduction, Formation of the p-n Junction, Energy Band Diagram, Models of the p-n Junction, I-V Characteristics of a p-n Junction Diode, Breakdown Diode, Special Types of p-n junction Semiconductor Diodes, Diode as a Rectifier, Half Wave and Full Wave Rectifiers with and without Filters.
- **Bipolar Junction Transistor and Field Effect Transistor (10L):** Construction of BJT and FET, Operation, Amplifying Action, Common Base, Common Emitter and Common Collector Configurations, Operating Point, Characteristics of Junction FET, Depletion and Enhancement type Metal Oxide Semiconductor (MOS) FETs
- **Operational Amplifiers and Applications (5L):** Introduction to Op-Amp, Differential Amplifier Configurations, CMRR, PSRR, Slew Rate; Block Diagram, Pin Configuration of 741 OpAmp, Characteristics of Ideal OpAmp, Concept of Virtual Ground.

**Suggested Text Books:**

1. "Basic Electronics", by Debashsi De and Kamakhya Prasad Ghatak, Pearson Publication.
2. "Microelectronics Circuits Theory and Application" by Adel S.Sedra and Kenneth C.Smith, 6th Edition, Oxford International Student Edition.
3. "Electronics: Fundamental and application" by D. Chattopadhyay and P. C. Rakshit.
4. Salivahanan: "Electronics Devices & Circuits", Tata McGraw-Hill Education, 3rd Edition 2012.

**Course Name: Design Thinking & Innovation- Intermediate**  
**Course Code: IVC202**

***Detailed Contents***

- **Product Innovation (4 L):** Definition and Examples of Innovations, Levels of Innovations, Importance of Product Innovations (Uber, Ola, Netflix), Design thinking principles that redefine business.
- **SCAMPER Technique (4 L):** Introduction to Scamper Technique, Application of Substitute and Combine Technique for Design, Application of Adapt and Put to Other Use for Design, Application of Elimination and Rearrange/Reuse for Design.
- **Introduction to IPR and Patent Filing (4 L):** Introduction to Intellectual Property Rights, Various Type of IPR, Importance of Patent Filing, Patent Filing in India.

**Suggested Text Books:**

1. Title: Creative Confidence, Authors: Tom Kelley, David Kelley
2. Title: Change by design, Author: Tim Brown



**Course Name: Economics, Finance and Entrepreneurship Skills –**  
**Intermediate**  
**Course Code: IVC203**

*Detailed Contents*

- **Finance (2 L):** Market Structure, Pricing, Monopoly, Money and Banking, Types of Finances, Financial Management
- **Refining the Business Model (2 L):** Refining the Business Model and Product/Service, Pivoting, Unit Economics, Types of Business Models, Analyze Competitors, New Customer Segments, PV Profile, Product Management
- **Business Planning (2 L):** Sales Plan, Business Plan, Sales Organization, People Plan, Basics of a Financial Plan, Forecasting Template, Advanced Revenue Stream, Procurement, Negotiation
- **Economics and Revenue (2 L):** Customer Lifecycle, Primary Revenue Source, Secondary Sources of Revenue, Funding Landscape, Funding Plan
- **Branding (1 L):** Building the team, Team Setup, Creating a Branding and Channel Strategy, Positioning Statement
- **Leveraging Technologies and Available Platforms (1 L):** Platforms for Marketing and Promotion, Platforms for Communication and Collaboration, Other Platforms, Tech Plan
- **Financial Metrics (1 L):** Metrics for Customer Acquisition & Retention, Financial Metrics Forecast Your Financial Plan to Increase Margin, Pitch Deck
- **Legal Matters (1 L):** Professional Help and Legal and Compliance Requirements, IP Protection, Difference between Different Types of IPs

**Suggested Text Books:**

1. Effectuation: Elements of Entrepreneurial Expertise (New Horizons in Entrepreneurship series - Saras D. Sarasvathy



## **Department of Basic Science & Humanities**

### **Detailed syllabus: Practical**

**Batch 2022-23**

**2<sup>nd</sup> Semester**

## **Chemistry (Laboratory) (BSC102)**

<b>Department:</b>	Basic Science and Humanities
<b>Program:</b>	B. Tech.
<b>Course Code:</b>	BSC102
<b>Title of Course:</b>	Chemistry (Laboratory)
<b>Year of Study:</b>	First Year
<b>Semester:</b>	Second
<b>Contact Hours:</b>	L-T-P: 0-0-3
<b>Credits:</b>	1.5
<b>Type of course:</b>	Laboratory
<b>Pre-requisites Courses:</b>	<ul style="list-style-type: none"><li>• Basic knowledge of Chemistry in Class- XI and XII level.</li><li>• Basic concepts of qualitative and quantitative analysis</li><li>• Basic knowledge of algebraic calculation and graph plot</li></ul>
<b>Course Outcome (CO):</b>	<p><b>CO1:</b> Estimate rate constants of reactions from concentration of reactants/products as a function of time</p> <p><b>CO2:</b> Measure molecular/system properties such as surface tension, viscosity, conductance of solutions, redox potentials, chloride content of water, etc.</p> <p><b>CO3:</b> Synthesize a small drug molecule and analyze a salt sample</p> <p><b>CO4:</b> Operate the instruments properly, record and interpret data and also, learn to work effectively in teams to accomplish the assigned responsibilities</p>

### **List of the Experiments**

**Choose any 12 experiments from the following list**

<b>Expt. No.</b>	<b>Experiment</b>
1	Determination of the concentration of strong acid by standardized NaOH solution.
2	Determination of the alkalinity present in water.
3	Determination of cell constant and conductance of solutions: Conductometric titration
4	Determination of the pH of sample solutions by digital pH meter: pH metric titration

5	Determination of surface tension
6	Determination of viscosity
7	Determination of chloride content of water
8	Determination of the partition coefficient of a substance between two immiscible liquids
9	Determination of the rate constant of a reaction
10	Thin layer chromatography
11	Potentiometry - determination of redox potentials and emfs
12	Colligative properties using freezing point depression
13	Ion exchange column for removal of hardness of water
14	Adsorption of acetic acid by charcoal
15	Saponification/acid value of an oil
16	Chemical analysis of a salt
17	Synthesis of a polymer/drug
18	Chemical oscillations- Iodine clock reaction
19	Lattice structures and packing of spheres
20	Use of the capillary viscosimeters to demonstrate the isoelectric point as the pH of minimum viscosity for gelatin sols and/or coagulation of the white part of egg
21	Determination of the hardness of water
22	Determination of dissolved oxygen present in a given water sample
23	Determination of the Chemical Oxygen Demand

<b>Physics Laboratory (BSC101)</b>	
<b>Department</b>	Basic Science and Humanities
<b>Program</b>	B. Tech.
<b>Course Code</b>	BSC-191
<b>Title of Course</b>	Physics Laboratory
<b>Year of Study</b>	First Year
<b>Semester</b>	Second
<b>Contact Hours</b>	L-T-P: 0-0-3
<b>Credits</b>	1.5
<b>Type of course</b>	Laboratory
<b>Pre-requisites Courses</b>	<ul style="list-style-type: none"> <li>• Basic knowledge about measurement techniques by vernier calipers and screw gauge</li> <li>• Basic concepts of 12<sup>th</sup> standard physics</li> <li>• Basic knowledge of algebraic calculation and graph plot.</li> </ul>
<b>Course Outcome</b>	<p><b>CO1:</b> Develop familiarity with range of experimental methods.</p> <p><b>CO2:</b> Design, perform, document and analyze experiments in physics.</p> <p><b>CO3:</b> Learn to work in a group.</p> <p><b>CO4:</b> Verify the theories learnt with the help of instruments and measurement techniques, learn the sources of error in the experiment and calculate the error percentage.</p>

### **List of the Experiments**

**Choose any 12 experiments from the following list**

<b>Expt. No.</b>	<b>Experiment</b>
1	Determination of Planck's constant by photoelectric emission process.
2	Determination the excitation potential of a given gas by Franck-Hertz experiment
3	Determination the band-gap of a semiconductor by measuring the resistivity at different Temperatures by four-probe method

4	Study the variation in current and voltage in a series and parallel LCR circuit and to find the resonant frequency of the circuit in each case.
5	Determination of the numerical aperture of a given optic fibre and hence to find its acceptance angle.
6	To determine the Young's Modulus of material of a bar by non uniform bending method
7	To determine the Modulus of rigidity of a material of a rod by static method
8	To determine the Modulus of rigidity of a material of a wire by dynamic method
9	To determine the wavelengths of a given light source by diffraction grating method
10	To determine the resistance per unit length of a given bridge wire and hence to determine the very low unknown resistance by using Carey Foster's bridge
11	To determine the radius of curvature of a Plano convex lens by formation of Newton's ring method

<b>Language Laboratory (HSMC191)</b>	
<b>Department:</b>	Basic Science and Humanities
<b>Program:</b>	B. Tech.
<b>Course Code:</b>	HSMC 191
<b>Title of Course:</b>	Language Laboratory
<b>Year of Study:</b>	First Year
<b>Semester:</b>	Second
<b>Contact Hours:</b>	L-T-P: 2-0-1
<b>Credits:</b>	3
<b>Type of course:</b>	Laboratory
<b>Pre-requisites Courses:</b>	<ul style="list-style-type: none"> <li>• Bridge Course English on IEM Learning</li> <li>• English &amp; Soft Skills on IEM Learning</li> </ul>
<b>Course Outcome (CO):</b>	<p><b>CO1:</b> To enable students acquire English and the skill of communication through hands on training and mock sessions so that they can perform well in the job market.</p> <p><b>CO2:</b> To facilitate students to understand the codes and conducts of Business communication.</p> <p><b>CO3:</b> To help students acquire proper body language, speaking nuances in order to become industry ready.</p> <p><b>CO4:</b> To enable students experience real-life interview situations through various simulation based lab experiments.</p>

### **List of the Experiments**

**Choose any 12 experiments from the following list**

<b>Expt. No.</b>	<b>Experiment</b>
1	Listening to audio clips and renowned personalities, listening to Speeches and evaluate them.
2	Watching English movies and writing the synopsis and review.
3	Reading fictional texts, Reading non/technical passage, graphics, diagrams etc.
4	Reading out their own piece of writing.
5	Story/Fiction writing.
6	Framing Dialogues & scripts.

7	Essay Writing through clustering.
9	Introducing one before interview board.
10	Face to face communication in work field.
11	Telephonic Conversation with mobile phone.
12	Proper Pronunciation and Voice modulation.
13	Proper word stress, intonation, pitch and accent.
14	Perfect enunciation of speech.
15	JAM/ Extempore practice (Just a Minute).
16	Debate.
17	Mock Interview.
18	Video CV making.
19	Individual and Group PPT presentation.
20	Group Discussion on Current topics for helping them internalize the basic principles.
21	Paper writing manual (APA/MLA Style Sheet).
22	Writing a paper on communication.



### **Workshop/ Manufacturing Practices (ESC 104)**

<b>Department:</b>	Basic Science and Humanities
<b>Program:</b>	B. Tech.
<b>Course Code:</b>	ESC 104
<b>Title of Course:</b>	Workshop/ Manufacturing Practices
<b>Year of Study:</b>	First Year
<b>Semester:</b>	Second
<b>Contact Hours:</b>	L-T-P: 1-0-4
<b>Credits:</b>	3
<b>Type of course:</b>	Laboratory
<b>Pre-requisites Courses:</b>	<ul style="list-style-type: none"> <li>• Knowledge in dimensions and units.</li> <li>• Usage of geometrical instruments and analytical ability.</li> </ul>
<b>Course Outcome (CO):</b>	<p><b>CO1:</b> Upon completion of this laboratory course, students will be able to fabricate components with their own hands.</p> <p><b>CO2:</b> They will also get practical knowledge of the dimensional accuracies and dimensional tolerances possible with different manufacturing processes.</p> <p><b>CO3:</b> By assembling different components, they will be able to produce small devices of their interest.</p> <p><b>CO4:</b> Exposure to some of the advanced and latest manufacturing techniques being employed in the industry.</p>

### **List of the Experiments**

**Choose any 12 experiments from the following list**

<b>Expt. No.</b>	<b>Experiment</b>
1	Fitting shop : Typical jobs that may be made in this practice module: To prepare a simple type fitting job
2	Fitting shop: Typical jobs that may be made in this practice module: To make a Gauge from MS plate.
3	Casting : Typical jobs that may be made in this practice module: One/ two green sand moulds to prepare, and a casting be demonstrated.
4	Welding shop: Typical jobs that may be made in this practice module: ARC WELDING (4 hours): To join two thick (approx 6mm) MS plates by manual metal arc welding.

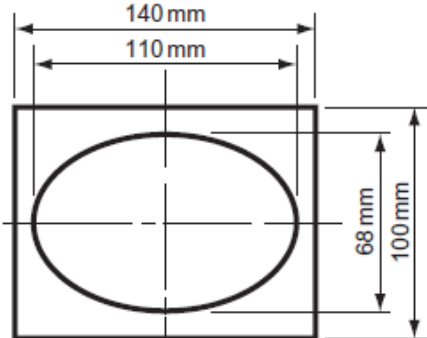
5	Welding shop: Typical jobs that may be made in this practice module: To join two thin mild steel plates or sheets by gas welding.
6	Smithy :Typical jobs that may be made in this practice module: Prepare a simple type job by upsetting process
7	Smithy: (Typical jobs that may be made in this practice module: Prepare a simple type job by drawing down process
8	Carpentry: Typical jobs that may be made in this practice module: To make wooden joints and/or a pattern or like.
9	Machine shop: Typical jobs that may be made in this practice module: To make a pin from a mild steel rod in a lathe.
10	Machine shop: Typical jobs that may be made in this practice module: To make rectangular and vee slot in a block of cast iron or mild steel in a shaping and / or milling machine.
11	Plastic moulding & Glass cutting: Typical jobs that may be made in this practice module: For plastic moulding, making at least one simple plastic component should be made.
12	Plastic moulding & Glass cutting : Typical jobs that may be made in this practice module: For glass cutting, three rectangular glass pieces may be cut to make a kaleidoscope using a black colour diamond cutter, or similar other components may be made.
13	Electrical & Electronics: Familiarization with LT switchgear elements, making its sketches and noting down its specification. Kitkat fuse, Glass cartridge fuse, Plastic fuse holders (optional), Iron clad isolators, MCB style isolators, Single phase MCB, Single-phase wire, wiring cable.
14	Electrical & Electronics: Demonstration of domestic wiring involving two MCB, two piano key switches, one incandescent lamp, one LED lamp and plug point.
15	Electrical & Electronics: Simple wiring exercise to be executed to understand the basic electrical circuit.
16	Electrical & Electronics: .Fabrication of a single-phase full wave rectifier with a step down transformer using four diodes and electrolytic capacitor and to find its volt-ampere characteristics to understand basic electronic circuit fabrication.
17	Electrical & Electronics: Simple soldering exercises to be executed to understand the basic process of soldering.

## **Engineering Graphics & Design (ESC 102)**

<b>Department:</b>	Basic Science and Humanities
<b>Program:</b>	B. Tech.
<b>Course Code:</b>	ESC 102
<b>Title of Course:</b>	Engineering Graphics & Design
<b>Year of Study:</b>	First Year
<b>Semester:</b>	Second
<b>Contact Hours:</b>	L-T-P: 1-0-4
<b>Credits:</b>	3
<b>Type of course:</b>	Laboratory
<b>Pre-requisites Courses:</b>	<b>Basic Knowledge of Geometry</b>
<b>Course Outcome (CO):</b>	<b>CO1:</b> Prepare students to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability. <b>CO2:</b> Prepare students to communicate effectively. <b>CO3:</b> Prepare students to use the techniques, skills, and modern engineering tools necessary for engineering practice. <b>CO4:</b> Helping students to increase their visualization power

## List of the Experiments

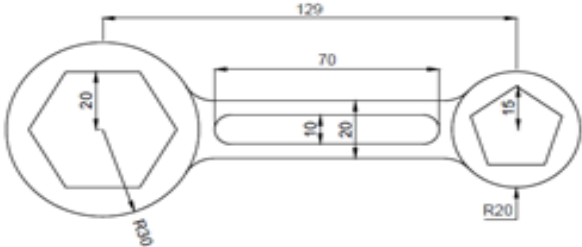
Choose any 12 experiments from the following list

Expt. No.	Experiment
1	<p><b>INTRODUCTION TO ENGINEERING DRAWING:</b> 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.</p> <p><b>Assignment:</b> Q1.</p> <p>a. Draw at least six types of lines are used in engineering drawing.</p> <p>b. Divide a straight line in 7 equal parts by (n-1) method.</p> <p>c. Divide a straight line in 10 equal parts by two set square method.</p> <p>Q2. Figure X shows the loud speaker grill of a car radio. The grill is rectangular with an elliptical hole. Draw the grill, full size, showing the construction of ellipse clearly.</p> <div style="text-align: center;"></div> <p>Q3. A fielder throws a ball high up in the air. It reaches a horizontal distance of 40 meter to the wicket keeper and a maximum height of 64 meter from the ground. The throwing height is 1.6 meter from the ground. Name the curve and draw the trajectory of the ball.</p> <p>Q4. Construct a conic, when the distance of any point P between the focus and the directrix is constant and equal to <math>\frac{3}{2}</math>. Name the curve. The focus is located 50 mm away from the directrix .</p>

2	<p><b>ORTHOGRAPHIC PROJECTIONS:</b> Principles of Orthographic Projections-Conventions -Projections of Points and lines inclined to both planes; Projections of planes inclined Planes -Auxiliary Planes.</p> <p><b>Assignment:</b></p> <p>Q5.Draw Front View and Top View of a a) Hollow cylinder (Ht=120mm, O.D. = 80 mm, ID= 50 mm) b) Right circular cone (Axis height = 80 mm, Base Dia = 50 mm) All are Standing vertically on the ground or horizontal plane</p>
3	<p><b>PROJECTIONS OF REGULAR SOLIDS:</b> Solids 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</p> <p><b>Assignment:</b></p> <p>Q6.Right regular pentagonal pyramid, base 40 mm and axis 65 mm long has its base in the V.P. One edge of t base is inclined at <math>30^0</math> to the H.P. and a corner contained by the edge is on the H.P. Draw its projections.</p> <p>Q7. A square prism (base 40 mm, height 65 mm) has its axis inclined at <math>45^0</math> to the ground and parallel to V.P. The edge of the base which is nearest to the ground level is 10 mm above the ground. Draw its, F.V, T.V. &amp; Left Hand Side View using 1<sup>st</sup> angle projection method.</p>
4	<p><b>SECTIONS AND SECTIONAL VIEWS OF RIGHT ANGULAR SOLIDS</b> 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)</p> <p><b>Assignment:</b></p> <p>Q8.A right circular cone, dia of base 60 mm and axis height 100 mm is standing vertically and is cut by a plane inclined at 45 degree to HP and perpendicular to VP so as to intersect the axis of the cone at a height of 65 mm from the base. Draw the FV, Sectional TV and True Shape of the Section.</p> <p>Q9.Draw the development of lateral surface of a truncated cylinder standing vertically on the base (dia of base = 50 cm and Axis Height = 70 cm.)The cutting plane is perpendicular to VP, inclined at 40degree to H.P. and intersecting the axis at a distance of 35 cm from the top end.</p>

5 **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;  
**Assignment:**  
 Q10. A regular hexagonal prism (each side of base 55 cm & axis length 110 cm) is lying horizontally with its axis parallel to V.P. Draw its Isometric Projection.

6 **OVERVIEW OF COMPUTER GRAPHICS**  
 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 (ButtonBars), 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  
**Assignment:**  
 Q.11 Draw neat sketch of following figures in Sketch book and using AutoCAD software create the same.



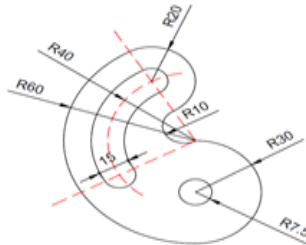
7

### CUSTOMISATION & CAD DRAWING

Set up of the drawing page and the printer, including scale settings, Setting up of units 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.

#### Assignment:

Q.12 Draw neat sketch of following figures in Sketch book and using AutoCAD software create the same.



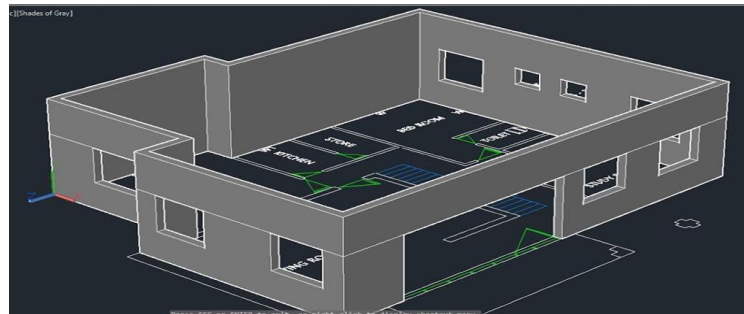
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### ANNOTATIONS, LAYERING & OTHER FUNCTIONS

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.

#### Assignment:

Q.13 Make AutoCAD plans of your house and 3d view of the same (Sample given)



<b>Basic electronics Engineering (ESC201)</b>	
<b>Department:</b>	Basic Science and Humanities
<b>Program:</b>	B. Tech.
<b>Course Code:</b>	IVC203
<b>Title of Course:</b>	Electronics- Fundamental & Principles
<b>Year of Study:</b>	First Year
<b>Semester:</b>	Second
<b>Contact Hours:</b>	L-T-P: 3-1-0
<b>Credits:</b>	4
<b>Type of course:</b>	Theory
<b>Total Lecture Hours:</b>	24
<b>Pre-requisites Courses:</b>	<b>Band Theory (Physics), Mathematics, Introduction of Basic Electrical Engineering</b>
<b>Course Outcome (CO):</b>	<p><b>CO1:</b> To be able to identify semiconductor materials, distinguish between types of semiconductor.</p> <p><b>CO2:</b> To be able to explain the junction properties and the phenomenon of rectification, I-V characteristics and identify operating points.</p> <p><b>CO3:</b> be able to draw and explain the I-V characteristics of BJTs and FETs.</p> <p><b>CO4:</b> To be able to understand the concept of operational amplifier.</p>

### List of the Experiments

**Choose any 12 experiments from the following list**

<b>Expt. No.</b>	<b>Experiment</b>
1	Familiarization with passive and active electronic components such as Resistors, Inductors, Capacitors, Diodes, Transistors (BJT) and electronic equipment like DC power supplies, multimeters etc.
2	Familiarisation with measuring and testing equipment like CRO, Signal generators etc.
3	Study of I-V characteristics of Junction diodes.
4	Study of I-V characteristics of Zener diodes.



5	Study of Half and Full wave rectifiers with Regulation and Ripple factors
6	Study of I-V input characteristics of BJTs in CE mode
7	Study of I-V output characteristics of BJTs in CE mode
8	Study of I-V Transfer characteristics of Field Effect Transistors.
9	Study of I-V Drain characteristics of Field Effect Transistors.
10	Study of OPAMP circuits: Inverting and Non-inverting amplifiers
11	Study of OPAMP circuits: Adder and Subtractor
12	Study of OPAMP circuits: Integrators and Differentiators.
13	Determination of Common-mode Rejection ratio, Bandwidth and Off-set null of OPAMPs.
14	Study of Logic Gates
15	Realization of Boolean functions using Logic Gates



## **Department of Basic Science & Humanities**

### **Detailed syllabus: Practical** **Batch 2022-23** **1<sup>st</sup> Semester**

## **Chemistry (Laboratory) (BSC102)**

<b>Department:</b>	Basic Science and Humanities
<b>Program:</b>	B. Tech.
<b>Course Code:</b>	BSC102
<b>Title of Course:</b>	Chemistry (Laboratory)
<b>Year of Study:</b>	First Year
<b>Semester:</b>	First
<b>Contact Hours:</b>	L-T-P: 0-0-3
<b>Credits:</b>	1.5
<b>Type of course:</b>	Laboratory
<b>Pre-requisites Courses:</b>	<ul style="list-style-type: none"><li>• Basic knowledge of Chemistry in Class- XI and XII level.</li><li>• Basic concepts of qualitative and quantitative analysis</li><li>• Basic knowledge of algebraic calculation and graph plot</li></ul>
<b>Course Outcome (CO):</b>	<p><b>CO1:</b> Estimate rate constants of reactions from concentration of reactants/products as a function of time</p> <p><b>CO2:</b> Measure molecular/system properties such as surface tension, viscosity, conductance of solutions, redox potentials, chloride content of water, etc.</p> <p><b>CO3:</b> Synthesize a small drug molecule and analyze a salt sample</p> <p><b>CO4:</b> Operate the instruments properly, record and interpret data and also, learn to work effectively in teams to accomplish the assigned responsibilities</p>

### **List of the Experiments**

**Choose any 12 experiments from the following list**

<b>Expt. No.</b>	<b>Experiment</b>
1	Determination of the concentration of strong acid by standardized NaOH solution.
2	Determination of the alkalinity present in water.
3	Determination of cell constant and conductance of solutions: Conductometric titration
4	Determination of the pH of sample solutions by digital pH meter: pH metric titration

5	Determination of surface tension
6	Determination of viscosity
7	Determination of chloride content of water
8	Determination of the partition coefficient of a substance between two immiscible liquids
9	Determination of the rate constant of a reaction
10	Thin layer chromatography
11	Potentiometry - determination of redox potentials and emfs
12	Colligative properties using freezing point depression
13	Ion exchange column for removal of hardness of water
14	Adsorption of acetic acid by charcoal
15	Saponification/acid value of an oil
16	Chemical analysis of a salt
17	Synthesis of a polymer/drug
18	Chemical oscillations- Iodine clock reaction
19	Lattice structures and packing of spheres
20	Use of the capillary viscosimeters to demonstrate the isoelectric point as the pH of minimum viscosity for gelatin sols and/or coagulation of the white part of egg
21	Determination of the hardness of water
22	Determination of dissolved oxygen present in a given water sample
23	Determination of the Chemical Oxygen Demand

### Physics Laboratory (BSC101)

<b>Department</b>	Basic Science and Humanities
<b>Program</b>	B. Tech.
<b>Course Code</b>	BSC-191
<b>Title of Course</b>	Physics Laboratory
<b>Year of Study</b>	First Year
<b>Semester</b>	First
<b>Contact Hours</b>	L-T-P: 0-0-3
<b>Credits</b>	1.5
<b>Type of course</b>	Laboratory
<b>Pre-requisites Courses</b>	<ul style="list-style-type: none"> <li>• Basic knowledge about measurement techniques by vernier calipers and screw gauge</li> <li>• Basic concepts of 12<sup>th</sup> standard physics</li> <li>• Basic knowledge of algebraic calculation and graph plot.</li> </ul>
<b>Course Outcome</b>	<p><b>CO1:</b> Develop familiarity with range of experimental methods.</p> <p><b>CO2:</b> Design, perform, document and analyze experiments in physics.</p> <p><b>CO3:</b> Learn to work in a group.</p> <p><b>CO4:</b> Verify the theories learnt with the help of instruments and measurement techniques, learn the sources of error in the experiment and calculate the error percentage.</p>

### List of the Experiments

**Choose any 12 experiments from the following list**

Expt. No.	Experiment
1	Determination of Planck's constant by photoelectric emission process.
2	Determination the excitation potential of a given gas by Franck-Hertz experiment
3	Determination the band-gap of a semiconductor by measuring the resistivity at different Temperatures by four-probe method

4	Study the variation in current and voltage in a series and parallel LCR circuit and to find the resonant frequency of the circuit in each case.
5	Determination of the numerical aperture of a given optic fibre and hence to find its acceptance angle.
6	To determine the Young's Modulus of material of a bar by non uniform bending method
7	To determine the Modulus of rigidity of a material of a rod by static method
8	To determine the Modulus of rigidity of a material of a wire by dynamic method
9	To determine the wavelengths of a given light source by diffraction grating method
10	To determine the resistance per unit length of a given bridge wire and hence to determine the very low unknown resistance by using Carey Foster's bridge
11	To determine the radius of curvature of a Plano convex lens by formation of Newton's ring method

### **Workshop/ Manufacturing Practices (ESC 104)**

<b>Department:</b>	Basic Science and Humanities
<b>Program:</b>	B. Tech.
<b>Course Code:</b>	ESC 104
<b>Title of Course:</b>	Workshop/ Manufacturing Practices
<b>Year of Study:</b>	First Year
<b>Semester:</b>	First
<b>Contact Hours:</b>	L-T-P: 1-0-4
<b>Credits:</b>	3
<b>Type of course:</b>	Laboratory
<b>Pre-requisites Courses:</b>	<ul style="list-style-type: none"> <li>• Knowledge in dimensions and units.</li> <li>• Usage of geometrical instruments and analytical ability.</li> </ul>
<b>Course Outcome (CO):</b>	<p><b>CO1:</b> Upon completion of this laboratory course, students will be able to fabricate components with their own hands.</p> <p><b>CO2:</b> They will also get practical knowledge of the dimensional accuracies and dimensional tolerances possible with different manufacturing processes.</p> <p><b>CO3:</b> By assembling different components, they will be able to produce small devices of their interest.</p> <p><b>CO4:</b> Exposure to some of the advanced and latest manufacturing techniques being employed in the industry.</p>

### **List of the Experiments**

**Choose any 12 experiments from the following list**

<b>Expt. No.</b>	<b>Experiment</b>
1	Fitting shop : Typical jobs that may be made in this practice module: To prepare a simple type fitting job
2	Fitting shop: Typical jobs that may be made in this practice module: To make a Gauge from MS plate.
3	Casting : Typical jobs that may be made in this practice module: One/ two green sand moulds to prepare, and a casting be demonstrated.
4	Welding shop: Typical jobs that may be made in this practice module: ARC WELDING (4 hours): To join two thick (approx 6mm) MS plates by manual metal arc welding.

5	Welding shop: Typical jobs that may be made in this practice module: To join two thin mild steel plates or sheets by gas welding.
6	Smithy :Typical jobs that may be made in this practice module: Prepare a simple type job by upsetting process
7	Smithy: (Typical jobs that may be made in this practice module: Prepare a simple type job by drawing down process
8	Carpentry: Typical jobs that may be made in this practice module: To make wooden joints and/or a pattern or like.
9	Machine shop: Typical jobs that may be made in this practice module: To make a pin from a mild steel rod in a lathe.
10	Machine shop: Typical jobs that may be made in this practice module: To make rectangular and vee slot in a block of cast iron or mild steel in a shaping and / or milling machine.
11	Plastic moulding & Glass cutting: Typical jobs that may be made in this practice module: For plastic moulding, making at least one simple plastic component should be made.
12	Plastic moulding & Glass cutting : Typical jobs that may be made in this practice module: For glass cutting, three rectangular glass pieces may be cut to make a kaleidoscope using a black colour diamond cutter, or similar other components may be made.
13	Electrical & Electronics: Familiarization with LT switchgear elements, making its sketches and noting down its specification. Kitkat fuse, Glass cartridge fuse, Plastic fuse holders (optional), Iron clad isolators, MCB style isolators, Single phase MCB, Single-phase wire, wiring cable.
14	Electrical & Electronics: Demonstration of domestic wiring involving two MCB, two piano key switches, one incandescent lamp, one LED lamp and plug point.
15	Electrical & Electronics: Simple wiring exercise to be executed to understand the basic electrical circuit.
16	Electrical & Electronics: .Fabrication of a single-phase full wave rectifier with a step down transformer using four diodes and electrolytic capacitor and to find its volt-ampere characteristics to understand basic electronic circuit fabrication.
17	Electrical & Electronics: Simple soldering exercises to be executed to understand the basic process of soldering.

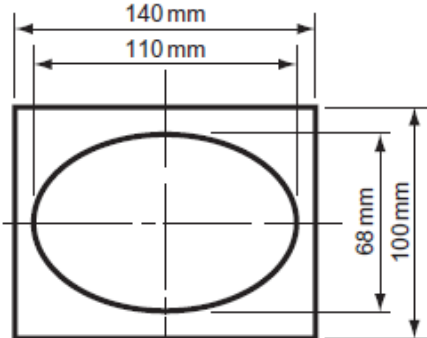


## **Engineering Graphics & Design (ESC 102)**

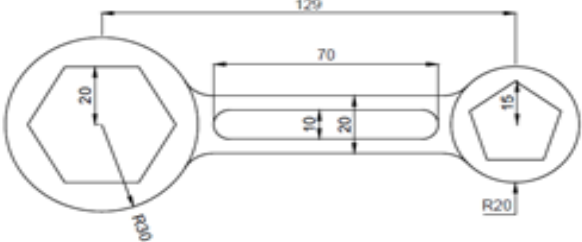
<b>Department:</b>	Basic Science and Humanities
<b>Program:</b>	B. Tech.
<b>Course Code:</b>	ESC 102
<b>Title of Course:</b>	Engineering Graphics & Design
<b>Year of Study:</b>	First Year
<b>Semester:</b>	First
<b>Contact Hours:</b>	L-T-P: 1-0-4
<b>Credits:</b>	3
<b>Type of course:</b>	Laboratory
<b>Pre-requisites Courses:</b>	<b>Basic Knowledge of Geometry</b>
<b>Course Outcome (CO):</b>	<b>CO1:</b> Prepare students to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability. <b>CO2:</b> Prepare students to communicate effectively. <b>CO3:</b> Prepare students to use the techniques, skills, and modern engineering tools necessary for engineering practice. <b>CO4:</b> Helping students to increase their visualization power

## List of the Experiments

Choose any 12 experiments from the following list

Expt. No.	Experiment
1	<p><b>INTRODUCTION TO ENGINEERING DRAWING:</b> 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.</p> <p><b>Assignment:</b> Q1.</p> <p>a. Draw at least six types of lines are used in engineering drawing.</p> <p>b. Divide a straight line in 7 equal parts by (n-1) method.</p> <p>c. Divide a straight line in 10 equal parts by two set square method.</p> <p>Q2. Figure X shows the loud speaker grill of a car radio. The grill is rectangular with an elliptical hole. Draw the grill, full size, showing the construction of ellipse clearly.</p> <div style="text-align: center;">  </div> <p>Q3. A fielder throws a ball high up in the air. It reaches a horizontal distance of 40 meter to the wicket keeper and a maximum height of 64 meter from the ground. The throwing height is 1.6 meter from the ground. Name the curve and draw the trajectory of the ball.</p> <p>Q4. Construct a conic, when the distance of any point P between the focus and the directrix is constant and equal to <math>\frac{3}{2}</math>. Name the curve. The focus is located 50 mm away from the directrix .</p>

2	<p><b>ORTHOGRAPHIC PROJECTIONS:</b> Principles of Orthographic Projections-Conventions -Projections of Points and lines inclined to both planes; Projections of planes inclined Planes -Auxiliary Planes.</p> <p><b>Assignment:</b></p> <p>Q5.Draw Front View and Top View of a a) Hollow cylinder (Ht=120mm, O.D. = 80 mm, ID= 50 mm) b) Right circular cone (Axis height = 80 mm, Base Dia = 50 mm) All are Standing vertically on the ground or horizontal plane</p>
3	<p><b>PROJECTIONS OF REGULAR SOLIDS:</b> Solids 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</p> <p><b>Assignment:</b></p> <p>Q6.Right regular pentagonal pyramid, base 40 mm and axis 65 mm long has its base in the V.P. One edge of t base is inclined at <math>30^0</math> to the H.P. and a corner contained by the edge is on the H.P. Draw its projections.</p> <p>Q7. A square prism (base 40 mm, height 65 mm) has its axis inclined at <math>45^0</math> to the ground and parallel to V.P. The edge of the base which is nearest to the ground level is 10 mm above the ground. Draw its, F.V, T.V. &amp; Left Hand Side View using 1<sup>st</sup> angle projection method.</p>
4	<p><b>SECTIONS AND SECTIONAL VIEWS OF RIGHT ANGULAR SOLIDS</b> 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)</p> <p><b>Assignment:</b></p> <p>Q8.A right circular cone, dia of base 60 mm and axis height 100 mm is standing vertically and is cut by a plane inclined at 45 degree to HP and perpendicular to VP so as to intersect the axis of the cone at a height of 65 mm from the base. Draw the FV, Sectional TV and True Shape of the Section.</p> <p>Q9.Draw the development of lateral surface of a truncated cylinder standing vertically on the base (dia of base = 50 cm and Axis Height = 70 cm.)The cutting plane is perpendicular to VP, inclined at 40degree to H.P. and intersecting the axis at a distance of 35 cm from the top end.</p>

5	<p><b>ISOMETRIC PROJECTIONS</b></p> <p>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;</p> <p><b>Assignment:</b></p> <p>Q10. A regular hexagonal prism (each side of base 55 cm &amp; axis length 110 cm) is lying horizontally with its axis parallel to V.P. Draw its Isometric Projection.</p>
6	<p><b>OVERVIEW OF COMPUTER GRAPHICS</b></p> <p>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 (ButtonBars), 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</p> <p><b>Assignment:</b></p> <p>Q.11 Draw neat sketch of following figures in Sketch book and using AutoCAD software create the same.</p> 

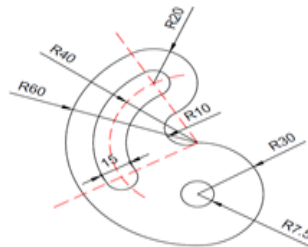
7

### CUSTOMISATION & CAD DRAWING

Set up of the drawing page and the printer, including scale settings, Setting up of units 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.

#### Assignment:

Q.12 Draw neat sketch of following figures in Sketch book and using AutoCAD software create the same.



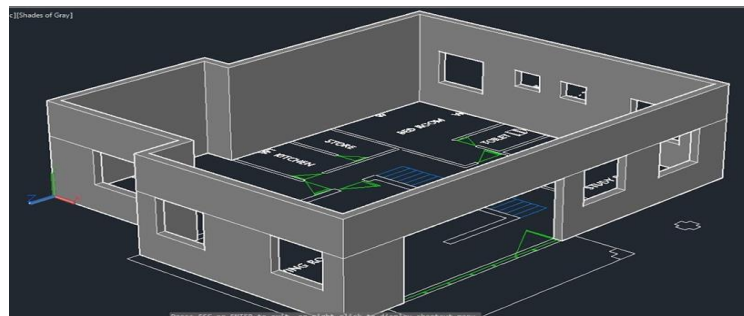
8

### ANNOTATIONS, LAYERING & OTHER FUNCTIONS

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.

#### Assignment:

Q.13 Make AutoCAD plans of your house and 3d view of the same (Sample given)



<b>Basic Electrical Engineering Lab (ESC191)</b>	
<b>Department:</b>	Basic Science and Humanities
<b>Program:</b>	B. Tech.
<b>Course Code:</b>	ESC191
<b>Title of Course:</b>	Basic Electrical Engineering Lab
<b>Year of Study:</b>	First Year
<b>Semester:</b>	First
<b>Contact Hours:</b>	L-T-P: 0-0-2
<b>Credits:</b>	1
<b>Type of course:</b>	Laboratory
<b>Pre-requisites Courses:</b>	<b>High school physics</b>
<b>Course Outcome (CO):</b>	<p><b>CO1:</b> To learn how we can connect the different elements (like resistance) series and parallel in breadboard.</p> <p><b>CO2:</b> To learn the practical verification of the network theorem with the theoretical results</p> <p><b>CO3:</b> Observe the speed variation of the DC motor by the resistance of the armature and field</p> <p><b>CO4:</b> To verify the open circuit and short circuit results and got the idea about the core loss and copper loss of the single phase transformer.</p>

### List of the Experiments

**Choose any 12 experiments from the following list**

Expt. No.	Name of the experiments
1	Design R-L-C series circuit set the input voltage 9V and resistance R=100Ω. Note down the voltage and current of the circuit. Determine the power factor and impedance of the circuit.
2	Design R-L-C parallel circuit set the input voltage 6V and resistance R=70Ω. Note down the voltage and current of the circuit. Determine the power factor and impedance of the circuit.
3	Verification of Thevenin's Theorem in breadboard
4	Verification of Norton's Theorem in breadboard
5	Verification of Superposition Theorem in breadboard
6	Verification of Maximum power Transfer Theorem in breadboard
7	The open circuit and short circuit tests on a 1kVA, 55/220 V, 50Hz, single phase

	<p>transformer. Perform open circuit and short circuit test.</p> <p>i) Determine the parameters of the equivalent circuit.</p> <p>ii) Draw the equivalent circuit refer to the LV side</p>
8	<p>a) In Speed control of DC shunt motor set the value of Armature current (<math>I_a</math>) 2.9A and field current (<math>I_f</math>) fixed. Draw the characteristics between armature voltage and speed of the motor.</p> <p>b) For the same experiment set the value of armature voltage (<math>V_a</math>) 100V and armature current (<math>I_a</math>) constant. Draw the characteristics between field current (<math>I_f</math>) and speed of the motor.</p>
9	<p>In no load characteristics of DC shunt generator driven at 400 RPM. Vary the voltage of Field current and also note down armature voltage at each step. Draw the no load characteristics of generator</p>
10	<p>a) In Speed control of DC shunt motor set the value of Armature current (<math>I_a</math>) 2.5A and field current (<math>I_f</math>) fixed. Draw the characteristics between armature voltage and speed of the motor.</p> <p>b) For the same experiment set the value of armature voltage (<math>V_a</math>) 120V and armature current (<math>I_a</math>) constant. Draw the characteristics between field current (<math>I_f</math>) and speed of the motor</p>
11	<p>Calibration of ammeter, voltmeter, wattmeter and draw the graphs.</p>
12	<p>Measurement of 3ph. power by two wattmeter method and calculate the power factor (use star connected load) and also measure the neutral current.</p>
13	<p>Demonstration of L.T. Switch gear... MCB, MCCB, ICDP, ICTP, CHANGE OVER SWITCH, LT BUS BAR, LT DISTRIBUTION BOX etc.</p>
14	<p>Starting and reversing of D.O.R. of D.C. shunt motor by using 3point starter.</p>



## **Department of Basic Science & Humanities**

### **Detailed syllabus: Theory**

**Batch 2022-23**

**1<sup>st</sup> Semester**



## Course Name: Physics

## Course Code: BSC101

### *Detailed Contents*

- **Classical Mechanics and Oscillations (9L):** Constraints- Holonomic and Non-Holonomic Constraints, Generalized Coordinates and Momentum, Degrees of Freedom, Lagrange's equation of motion, application of Lagrang's equation, Cyclic coordinate; Potential energy function  $F = -\text{grad } V$ , Equipotential surfaces and meaning of gradient. Conservative and non-conservative forces. Curl of a force field, Conservation laws of energy & momentum; Concept of Central forces, Kepler's law; Non-inertial frames of reference, Rotating coordinate system, Centripetal and Coriolis accelerations.

Harmonic oscillator; Damped harmonic motion – over-damped, critically damped and lightly damped oscillators; Examples of mechanical and electrical simple harmonic oscillators, energy decay in a damped harmonic oscillator, Forced oscillations and resonance, quality factor, power absorbed by oscillator.

- **Optics (6L):** Huygens' principle, superposition of waves and interference of light by wavefront splitting and amplitude splitting; Young's double slit experiment, Newton's rings, Fraunhofer diffraction from a single slit and a circular aperture, Rayleigh criterion for limit of resolution and its application to vision; Diffraction gratings and their resolving power.

Spontaneous and Stimulated emission, Einstein's theory of A and B coefficients; amplification of light by population inversion, different types of lasers: gas lasers, solid-state lasers, dye lasers; Properties of laser beams: mono-chromaticity, coherence, directionality and brightness, applications of lasers.

- **Introduction to Electromagnetic Theory (6L):** Concept of Bound charges due to electric polarization in dielectric medium, Electric displacement current; Introduction to Maxwell's equations of Electromagnetic fields, Continuity equation for current densities, Modifying equation for the curl of magnetic field to satisfy continuity equation. Maxwell's equation in vacuum and non-conducting medium, Energy in an electromagnetic field, Flow of energy and Poynting vector with examples, The wave equation, Plane electromagnetic waves in vacuum and their transverse nature and polarization, Relation between electric and magnetic fields of an electromagnetic wave, Energy carried by electromagnetic waves.

- **Electronic Materials and Semiconductors (6L):** Free electron theory of metals, Fermi level, density of states in 1, 2 and 3 dimensions, Bloch's theorem for particles in a periodic potential, Kronig-Penney model and origin of energy bands, Metals, semiconductors, and insulators. Intrinsic and extrinsic semiconductors, Dependence of Fermi level on carrier-concentration and temperature (equilibrium carrier statistics), Carrier generation and recombination, Carrier transport: diffusion and drift, p – n junction.

- **Introduction to Quantum Mechanics for Engineers (10L):** Introduction to Quantum Mechanics, Wave nature of particles, Time-dependent and time-independent Schrödinger equation for wavefunction, Born interpretation, Probability current density, Expectation values, Free-particle wavefunction and wave-packets, Uncertainty principle and de-Broglie hypothesis, Concept of Operator.

Applications of Schrödinger equation: One-dimensional problems - particle in one dimensional potential box, step potential, concept of tunnel effect, qualitative summary of linear harmonic oscillator; Three-dimensional problems - particle in three dimensional potential box, hydrogen atom problem, Occupation probability & examples, nuclear alpha decay.

- **Statistical Mechanics (3L):** Statistical Distributions functions (Three different kinds- Maxwell Boltzmann, Fermi-Dirac, Bose Einstein), Comparison of these three statistical distribution functions, Mention the form of the functions and graphical explanations of them, Concept of Fermions and Bosons, Mention the importance of statistical mechanics in perspective of thermodynamics, Concept of thermodynamical probability, Concept of Microstates and Macrostates.

**Suggested Text Books:**

1. Theory and problems of Theoretical Mechanics by Murray R. Spiegel SI (Metric) edition
2. Advanced Acoustics – Dr. D. P. Raychaudhuri, The new book stall, Revised Ninth Edition, 2009
3. A textbook on Optics, B. Ghosh and K. G. Majumder, Sreedhar Publishers, fifth edition.
4. Introduction to Electrodynamics by David J. Griffiths 3rd Edition
5. Introduction to Solid State Physics (January 2019) by Charles Kittel (Published by Wiley)
6. Concepts of Modern Physics (Sixth Edition) by Arthur Beiser (Published by McGraw-Hill)

**Course Name: Chemistry**  
**Course Code: BSC102**

***Detailed Contents***

- **Atomic and molecular structure (12 L):** 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 multicentre orbitals. Equations for atomic and molecular orbitals. Energy level diagrams of diatomics. Pi-molecular orbitals of butadiene and benzene and aromaticity. **Chemistry of Materials**, 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.
- **Spectroscopic techniques and applications (8 L):** 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 characterisation techniques. Diffraction and scattering.
- **Intermolecular forces and potential energy surfaces (4 L):** Ionic, dipolar and van Der Waals interactions. Equations of state of real gases and critical phenomena. Potential energy surfaces of H<sub>3</sub>, H<sub>2</sub>F and HCN and trajectories on these surfaces.
- **Chemical kinetics and reaction equilibrium:** **Concept of preequilibrium, equilibrium and related quantities. Concept of preequilibrium, equilibrium and related quantities Reaction laws: rate and order; molecularity; zero, first and second order kinetics. Pseudounimolecular reaction, Arrhenius equation. Mechanism and theories of reaction rates (Transition state theory, Collision theory). Catalysis: Homogeneous catalysis (Definition, example, mechanism, kinetics).**
- **Use of free energy in chemical equilibria (6 L):** 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.
- **Periodic properties (4 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

- **Stereochemistry (4 L):** 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
- **Organic reactions and synthesis of a drug molecule (4 L):** Introduction to reactions involving substitution, addition, elimination, oxidation, reduction, cyclization and ring openings. Synthesis of a commonly used drug molecule.

**Suggested Text Books:**

1. Engineering Chemistry by Jain and Jain, Dhanpat Rai Publishing Co.17th edition
2. Chemistry by Prasanta Rath and Subhendu Chakraborty
3. Physical Chemistry by P. W. Atkins
4. Fundamentals of Molecular Spectroscopy by C. N. Banwell
5. Physical Chemistry, P.C. Rakshit, Sarat Book distributors, Calcutta, 7th ed
6. University Chemistry by B. H. Mahan
7. A Textbook of Nanoscience and Nanotechnology Author: T. Pradeep. Publisher: McGraw Hill Education, ISBN: 9781259007323
8. The Chemistry of Nanomaterials, Prof. C.N.R. Rao, Publisher-Wiley- VCH

**Course Name: Mathematics – I**  
**Course Code: BSC103**

***Detailed Contents***

- **Calculus (Differentiation) (6 lectures):** Rolle's Theorem, Mean Value Theorems, Taylor's and Maclaurin's Theorems with Remainders; Taylor's Series, Series for Exponential, Trigonometric and Logarithm Functions, Indeterminate forms and L'Hospital's Rule; Maxima and Minima; Evolutes and Involutives.
- **Calculus (Integration) (6 lectures):** 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.
- **Multivariable Calculus (Differentiation) (11 lectures):** Limit, Continuity and Partial Derivatives; Homogeneous Functions, Eulers Theorem of second and third order (Statement only), Change of variables, Composite function, Derivative of implicit functions, Total Derivative, Jacobian, Maxima, Minima and Saddle points; Method of Lagrange multipliers; Gradient, Directional Derivatives, Tangent Plane and Normal Line, Curl and Divergence.
- **Matrix and Determinant (11 lectures):** Matrices, Addition and Scalar Multiplication, Matrix Multiplication, Symmetric and Skew-symmetric Matrices, Hermitian and Skew-Hermitian Matrices, Determinants, Cramer's Rule, Inverse of a Matrix, Orthogonal Matrices, Linear Systems of Equations, Gauss Elimination and Gauss-Jordan Methods, Rank of a Matrix. Eigenvalues, Eigenvectors, Eigen values of some special matrices, Similarity Matrix, Diagonalization.
- **Sequences and Series (11 lectures):** Monotonic and bounded sequence, Convergence and divergence of sequence, Algebra of sequences (Statement only). Series of positive terms - Notion of Convergence and Divergence, Convergence of infinite G.P. series and p-series (Statement only), Tests of Convergence [Statement only] – Comparison Test, Integral Test, D'Alembert's Ratio Test, Raabe's Test, Cauchy's Root Test. Alternating Series- Leibnitz's test [Statement only], Absolute and conditional convergence. Even function, Odd function. Periodic function, Euler's formula, Dirichlet's conditions. Half Range Sine and Cosine Series, Parseval's Theorem, Introduction to typical wave form like Periodic square wave, Saw-toothed wave, Triangular wave, Half wave rectifier, Full wave rectifier, Unit step function etc. and their corresponding Fourier series expansions.

**Suggested Text Books:**

1. G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9th Edition, Pearson, Reprint, 2002.
2. Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
3. Veerarajan T., Engineering Mathematics for First Year, Tata McGraw-Hill, New Delhi, 2008.
4. Ramana B.V., Higher Engineering Mathematics, Tata McGraw Hill New Delhi, 11th Reprint, 2010.
5. D. Poole, Linear Algebra: A Modern Introduction, 2nd Edition, Brooks/Cole, 2005.
6. N.P. Bali and Manish Goyal, A Text Book of Engineering Mathematics, Laxmi Publications, Reprint, 2008.
7. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 36th Edition, 2010.
8. V. Krishnamurthy, V.P. Mainra and J.L. Arora, An Introduction to Linear Algebra, Affiliated, East–West Press, Reprint 2005.
9. B.Basu Mallik & Krishanu Deyasi, Engineering Mathematics-1A, Cengage Learning, First Edition, 2020
10. B.Basu Mallik & Krishanu Deyasi, Engineering Mathematics-1B, Cengage Learning, First Edition, 2020

**Course Name: Basic Electrical Engineering**  
**Course Code: ESC101**

*Detailed Contents*

- **DC Circuits & Network Theorems:** Definition of electric circuit, network, linear circuit, non-linear circuit, bilateral circuit, unilateral circuit, Dependent source, Kirchhoff's law, Principle of superposition. Source equivalence and conversion, Thevenin's theorem, Norton Theorem, nodal analysis, mesh analysis, star-delta conversion. Maximum power transfer theorem with proof.
- **Electrostatics:** Coulomb's law, Electric Field Intensity, Electric field due to a group of charges, continuous charge distribution, Electric flux, Flux density, Electric potential, potential difference, Gauss's law, proof of Gauss's law, its applications to electric field and potential calculation, Capacitor, capacitance of parallel plate capacitor, spherical capacitor, isolated spheres, concentric conductors, parallel conductors. Energy stored in a capacitor.
- **Electromagnetism:** Biot-savart law, Ampere's circuital law, field calculation using Biot-savart & Ampere's circuital law. Magnetic circuits, Analogous quantities in magnetic and electric circuits, Faraday's law, Self and mutual inductance. Energy stored in a magnetic field, B-H curve, Hysteretic and Eddy current losses.
- **AC Circuit Analysis:** RMS Values, average value, phasor representation of alternating quantities. Concept of j-operator, Steady state AC circuit analysis for R, L, C, RL, RC & RLC series and parallel circuits. Series and parallel resonance condition. AC power calculations. Introduction to three phase systems, balanced. Star and delta connections. Measurement of three phase power.
- **DC Machines:** Construction, Basic concepts of winding (Lap and wave). DC generator: Principle of operation, EMF equation, characteristics (open circuit, load) DC motors: Principle of operation, Speed-torque Characteristics (shunt and series machine), starting (by 3 point starter), speed control (armature voltage and field control)
- **Single phase transformer:** Core and shell type construction, EMF equation, no load and on load operation, phasor diagram and equivalent circuit, losses of a transformer, open and short circuit tests, regulation and efficiency calculation.
- **3 phase induction motor:** Types, Construction, production of rotating field, principle of operation, equivalent circuit and phasor diagram, rating, torque-speed characteristics (qualitative only). Starter for squirrel cage and wound rotor induction motor. Brief introduction of speed control of 3 phase induction motor (voltage control, frequency control, resistance control).

**Suggested Text Books:**

1. Basic Electrical Engineering -Abhijit Chakrabarti, Sudipta Nath,Chandan Kumar Chanda
2. Basic Electrical Engineering (vol2)-B.L.Thereja
3. Basic Electrical engineering, D.P Kothari & I.J Nagrath, TMH, Second Edition
4. Hughes Electrical & Electronics Technology, 8/e, Hughes, Pearson Education



**Course Name: Biology for Engineers**  
**Course Code: BSC109**

***Detailed Contents***

- **Introduction (2 lectures):** Purpose: To convey that Biology is as important a scientific discipline as Mathematics, Physics and Chemistry, Bring out the fundamental differences between science and engineering by drawing comparison between eye and camera, Bird flying and aircraft. Mention the most exciting aspect of biology as an independent scientific discipline. Why we need to study biology?
- **Evolution of life: Origin of Life; Darwin's concepts of evolution**
- Discuss how biological observations of 18<sup>th</sup> Century that lead to major discoveries. Examples from Brownian motion and the origin of thermodynamics by referring to the original observation of Robert Brown and Julius Mayor. These examples will highlight the fundamental importance of observations in any scientific inquiry.
  
- **Classification (3 lectures):** Purpose: To convey that classification *per se* is not what biology is all about. The underlying criterion, such as morphological, biochemical or ecological be highlighted.
- Hierarchy of life forms at phenomenological level. A common thread weaves this hierarchy Classification. Discuss classification based on (a) cellularity- Unicellular or multicellular (b) ultrastructure- prokaryotes or eucaryotes. (c) energy and Carbon utilisation -Autotrophs, heterotrophs, lithotropes (d) Ammonia excretion – aminotelic, uricotelic, ureotelic (e) Habitata- aquatic or terrestrial (e) Molecular taxonomy- three major kingdoms of life. A given organism can come under different category based on classification. Model organisms for the study of biology come from different groups. E.coli, S.cerevisiae, D. Melanogaster, C. elegance, A. Thaliana, M. Musculus
  
- **Genetics (4 lectures):** Purpose: To convey that “Genetics is to biology what Newton’s laws are to Physical Sciences”, Mendel’s laws, Concept of segregation and independent assortment. Concept of allele. Gene mapping, Gene interaction, Epistasis. Meiosis and Mitosis be taught as a part of genetics. Emphasis to be give not to the mechanics of cell division nor the phases but how genetic material passes from parent to offspring. Concepts of recessiveness and dominance. Concept of mapping of phenotype to genes. Discuss about the single gene disorders in humans. Discuss the concept of complementation using human genetics. **Concepts in population biology.**
  
- **Biomolecules (4 lectures):** Purpose: To convey that all forms of life has the same building blocks and yet the manifestations are as diverse as one can imagine Molecules of life. In this context discuss monomeric units and polymeric structures. Discuss about sugars, starch and cellulose. Amino acids and proteins. Nucleotides and DNA/RNA. Two carbon units and lipids.

- **Enzymes (4 lectures):** Purpose: To convey that without catalysis life would not have existed on earth Enzymology: How to monitor enzyme catalysed reactions. How does an enzyme catalyse reactions? Enzyme classification. Mechanism of enzyme action. Discuss at least two examples. Enzyme kinetics and kinetic parameters. Why should we know these parameters to understand biology? RNA catalysis.
- **Information Transfer (4 lectures):** Purpose: The molecular basis of coding and decoding genetic information is universalMolecular basis of information transfer. DNA as a genetic material. Hierarchy of DNA structure- from single stranded to double helix to nucleosomes. Concept of genetic code. Universality and degeneracy of genetic code. Define gene in terms of complementation and recombination. **Genetic engineering/Cloning and its applications.**
- **Macromolecular analysis (5 lectures):** Purpose: How to analyse biological processes at the reductionist level Proteins- structure and function. Hierarch in protein structure. Primary secondary, tertiary and quaternary structure. Proteins as enzymes, transporters, receptors and structural elements.
- **Metabolism (4 lectures):** Purpose: The fundamental principles of energy transactions are the same in physical and biological world. Thermodynamics as applied to biological systems. Exothermic and endothermic versusendergonic and exergoinc reactions. Concept of  $K_{eq}$  and its relation to standard free energy. Spontaneity. ATP as an energy currency. This should include the breakdown of glucose to  $CO_2 + H_2O$  (Glycolysis and Krebs cycle) and synthesis of glucose from  $CO_2$  and  $H_2O$  (Photosynthesis). Energy yielding and energy consuming reactions. Concept of Energy Charge.
- **Microbiology (3 lectures):** Concept of single celled organisms. Concept of species and strains. Identification and classification of microorganisms. Microscopy. Ecological aspects of single celled organisms. Sterilization and media compositions. Growth kinetics.

#### **Suggested Text Books:**

1. Biology: A global approach: Campbell, N. A.; Reece, J. B.; Urry, Lisa; Cain, M, L.; Wasserman, S. A.; Minorsky, P. V.; Jackson, R. B. Pearson Education Ltd
2. Outlines of Biochemistry, Conn, E.E; Stumpf, P.K; Bruening, G; Doi, R.H. John Wiley and Sons
3. Principles of Biochemistry (V Edition), By Nelson, D. L.; and Cox, M. M.W.H. Freeman and Company
4. Molecular Genetics (Second edition), Stent, G. S.; and Calender, R. W.H. Freeman andcompany, Distributed by Satish Kumar Jain for CBS Publisher
5. Microbiology, Prescott, L.M J.P. Harley and C.A. Klein 1995. 2nd edition Wm, C.Brown Publishers.

**Course Name: Engineering Mechanics (Statics)**  
**Course Code: ESC202A**

*Detailed Contents*

- **Vectors and tensors:** Introduction to Vectors and tensors and their applications
- **Force & Equilibrium Systems:** Basic concepts, ; Rigid Body equilibrium (2-D & 3-D); System of Forces, Coplanar Concurrent Forces, Components in Space – Resultant-Moment of Forces and its Application; Couples and Resultant of Force System, Equilibrium of System of Forces, Concept of Free body diagrams, Equations of Equilibrium of Coplanar Systems, Lami's Theorem.
- **Friction:** Laws of Friction, Static and Dynamic Friction, friction on inclined surface and threaded screw.
- **Basic Structural Analysis:** Equilibrium in three dimensions; Method of Sections; Method of Joints; How to determine if a member is in tension or compression; Simple Trusses; Zero force members.
- **Properties of area - Centre of Gravity & Moment of Inertia:** Centre of Gravity and its implications; Centroid of simple figures from first principle, centroid of composite sections.  
Area moment of inertia of plane sections from first principles, principal axes, Theorems of moment of inertia, Moment of inertia of standard sections and composite sections; Concept of Mass moment inertia.
- **Basic Concept of Bending Moment:** Transverse loading on beams, Concept of shear force and bending moment, Different type of beams and loading, relationships between shear force and bending moment, shear force and bending moment diagrams of point loading on cantilevers and simply supported beams.
- **Virtual Work and Energy Method:** Virtual displacements, principle of virtual work for rigid bodies, degrees of freedom. Mechanical efficiency, energy equation for equilibrium. Applications of energy method for equilibrium.

**Suggested Text Books:**

1. B B Ghosh, Satyajit Chakrabarti, Samir Ghosh “Engineering Mechanics” S Chand Publisher.
2. J. L. Meriam, L. G. Kraige, J. N. Bolton “Engineering Mechanics: Statics”, Wiley, 2011.
3. F. P. Beer and E. R. Johnston, Vector Mechanics for Engineers, Vol I – Statics. 9th Ed, Tata McGraw Hill
4. R. C. Hibbler (2006), Engineering Mechanics: Principles of Statics and Dynamics, Pearson Press
5. S. Timoshenko, D.H. Young, J.V. Rao, SukumarPati, Engineering Mechanics (In SI Units) (SIE).
6. M. F. Beatty, “Principles of Engineering Mechanics”, Springer Science & Business Media, 1986.
7. Manoj K. Harbola, “Engineering Mechanics”, Cengage Learning India Pvt. Ltd, 2018
8. D.S. Bedi& M.P. Poonia, “Engineering Mechanics”, Khanna Publishing House, 2019
9. R.K. Bansal, “Engineering Mechanics”, Laxmi Publications
10. Irving H. Shames (2006), Engineering Mechanics, 4th Edition, Prentice Hall
11. Shanes and Rao (2006), Engineering Mechanics, Pearson Education,
12. Tayal A.K. (2010), Engineering Mechanics, Umesh Publications

**Course Name: Essential Studies for Professionals – I**  
**Course Code: HSMC102**

***Detailed Contents***

- **Quantitative Aptitude:** Quant foundation, Basic Multiplication, Division, Squaring numbers, Percentage, Ratio, Simple equation, Variation, Partnership, Profit & Loss
- **Logical Mental ability -1:** Coding and Decoding & Direction Sense, Series & Numbers, Blood Relations, Analogy

**Suggested Text Books:**

1. Fast Track Arithmetic- Rajesh Verma
2. Verbal & non-verbal reasoning- R.S Agarwal
3. Quantitative Aptitude- R.S Agarwal
4. Analytical Reasoning –Peeyush Bhardwaj

**Course Name: Skill Development for Professionals – I**  
**Course Code: HSMC182**

*Detailed Contents*

- **Objective English-1:** Introduction of Parts of speech, What is noun, Kinds of Noun, Rules & Application, Definition of Pronoun, Examples, Rules & Application, Definition of Verb, Kinds of Verb, Rules & Application, Definition of Tense, Different types of Tenses, Examples, Rules & Application, Definition of Adjective, Kinds of Adjective, Rules & Application, Definition of Adverb, Kinds of Adverb, Rules & Application, Definition of Preposition, Examples , Rules & Application, Definition of Interjection, Examples, Rules & Its Application, Definition of Conjunction, Examples, Rules & Application, Different types of Articles, Examples, Rules & Application English Grammar. Newspaper reading: The Hindu & Economic Times.
  
- **Module 2: Data Interpretation level-I**

**Suggested Text Books:**

1. Objective English- Arihant Publications
2. Data Interpretation - R.S Agarwal
3. Objective English Grammar- Kiran Publications

**Course Name: Programming for Problem Solving with Python**  
**Course Code: IVC101**

***Detailed Syllabus***

**1. Write about different components of Computer system and its functions with proper diagram.**

**2. Implementation of Various Python operators**

a) Write a program to enter number and display its hexadecimal and Octal equivalent

b) Write a program to calculate the area of a triangle using herons formula

**3. Write a program to convert degrees Fahrenheit to degrees Celsius.**

Design of different patterns, accessing lists and other structures using loops, implementation of different conditional statements.

i. Write a program to calculate the sum of tailor series.

ii. Write a program to display all the numbers from 1-100 that are not divisible by 2 as well as 3.

iii. Write a program to print the pattern given below.

```
*
* *
* * *
* * * *
* * *
* *
*
      *
```

**4. Function definition invocation, keyword argument implementation, Lambda Function.**

**Fundamental data structure programs**

1. Write a function to construct tower of Hanoi

2. Write a function to construct tower of Hanoi

3. Write a program to find out the greatest common divisor using lambda function

**5. Fundamental data structure programs**

1. Write a program to find a given key from n numbers.

2. Write a program to accept a comma separated sequence of words as input and print the unique word in sorted format.

## **6. Advanced operations in Data Structure**

1. Write a program that creates a dictionary of cubes of odd numbers in the range of 1-10.
2. Write a program that uses dictionary to return the name of employee of an organization when his project name is given.
3. Write a program that calculates fib(n) using dictionary.

## **7. Creation of Class and Objects in Python**

1. Write a program to deposit or withdraw money in a bank account.
2. Write a class that stores a string and all its status details such as number of uppercase characters, vowels, consonants, spaces etc.

## **8. Polymorphism and Inheritance concept**

Write a program that has classes such as student, course, and department. Enroll a student in particular department.

## **9. Creation of file different file accessing .xlsx and CSV file using Pandas.**

## **10. Implementation of mathematical computation using Numpy and Scipy.**



**Course Name: Design Thinking & Innovation- Basic**  
**Course Code: IVC102**

*Detailed Syllabus*

- **Introduction to Design Thinking (4 L):** Empathy: Empathy Building, Empathy Map & Evoking the 'right problem', Introduction to Human-Centered design, Customer Journey Mapping, Divergent Thinking and Convergent Thinking
- **Ideation, Prototyping and testing (4 L):** Creative process and creative principles, Steps to Enhance Design thinking, Bio mimicking- Design by Nature, Types of Prototyping.
- **Introduction to Research and Research Ethics (4 L):** Meaning, Objectives and Motivation in research, Types of research, Research approaches, Significance of research, Research methods versus methodology, Review paper writing, Literature Survey, Indexing of Journal, Citation and Journal Impact Factor.

**Suggested Text Books:**

1. Title: Creative Confidence, Authors: Tom Kelley, David Kelley
2. Title: Change by design, Author: Tim Brown

**Course Name: Economics, Finance and Entrepreneurship Skills -  
Foundation**

**Course Code: IVC103**

***Detailed Syllabus***

- **Self and Opportunity Discovery (3 L):** Finding Your Flow, Effectuation Principles, Importance of Team, Identify Problems worth Solving, Case Studies, Problem Interviews, Look for Solutions, Brainstorming, Back-of-the-Envelope Calculation.
- **Module 2: Customer and Solution (2 L):** Customers and Markets Identify Your Customer Segment and Niche, Segmentation and Targeting, Identify Your Customer Segment, Niche Marketing, Identify Jobs, Pains, and Gains and Early Adopters, Value Proposition Design
- **Module 3: Business Model and validation (4 L):** Basics of Business Model and Lean Approach, Risks and Assumptions, Competition Analysis, Blue Ocean Strategy, Solution Demo, Solution Interviews, Problem-Solution Fit, MVP, MVP Interviews, Product-Market Fit.
- **Module 4: Economics and Finance (3 L):** Basics of economics, micro-economics and macro-economics, Production, supply and demand (only basics), Break even analysis, Costs, Revenue, Revenue Streams, Profitability Checks, Basics of Finance, Bootstrapping, Sources and Uses of Funds, Positioning and Branding, Channels, Marketing, Sales Planning.

**Suggested Text Book:**

1. Effectuation: Elements of Entrepreneurial Expertise (New Horizons in Entrepreneurship series) - Saras D. Sarasvathy