Course Structure and Syllabus

of

FIRST YEAR

BACHELOR OF TECHNOLOGY

(COMMON TO ALL BRANCHES)

(From the Session 2026-27)

INDIRA GANDHI INSTITUTE OF TECHNOLOGY, SARANG

(An Autonomous Institute of Government of Odisha)

Dhenkanal, Odisha- 759146

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INDIRA GANDHI INSTITUTE OF TECHNOLOGY, SARANG

Course Structure for 1st Year B.Tech programme (Common to all Branches)

(Effective from 2026-27 Academic Year)

First Semester				Second Semester			
Theory				**Theory**			
Course Code	**Course Name**	**L-T-P (Periods/ Week)**	**Credits**	**Course Code**	**Course Name**	**L-T-P (Periods/ Week)**	**Credits**
BS101	Mathematics-I	3-0-0	3	BS102	Mathematics-II	3-0-0	3
BS103/ BS104	Physics / Chemistry	3-0-0	3	BS104/ BS103	Chemistry / Physics	3-0-0	3
ES103/ ES104	Programming for Problem Solving / Engineering Mechanics	3-0-0	3	ES104/ ES103	Engineering Mechanics / Programming for Problem Solving	3-0-0	3
ES101/ ES102	Basic Electrical Engineering / Basic Electronics Engineering	3-0-0	2	ES102/ ES101	Basic Electronics Engineering / Basic Electrical Engineering	3-0-0	2
ES105/ ES106	Basic Civil Engineering / Basic Mechanical Engineering	3-0-0	2	ES106/ ES105	Basic Mechanical Engineering / Basic Civil Engineering	3-0-0	2
HSM101/ HSM102	Universal Human Values / English for Technical Writing	2-0-0	2	HSM101/ HSM102	English for Technical Writing / Universal Human Values	2-0-0	2
Total (Theory)		**17**	**15**	**Total (Theory)**		**17**	**15**
Practical/ Sessional				**Practical/ Sessional**			
BSLC101/ BSLC102	Physics Lab/ Chemistry Lab	0-0-3	1.5	BSLC102/ BSLC101	Chemistry Lab/ Physics Lab	0-0-3	1.5
ESLC103/ ESLC104	Programming for Problem solving Lab/ Workshop and Digital Manufacturing Lab	0-0-3	1.5	ESLC104/ ESLC103	Workshop and Digital Manufacturing Lab/ Programming for Problem solving Lab	0-0-3	1.5
ESLC101/ ESLC102	Basic Electrical Engg. Lab/ Basic Electronics Engg. Lab	0-0-3	1.5	ESLC102/ ESLC101	Basic Electronics Engg. Lab / Basic Electrical Engg. Lab	0-0-3	1.5
HSMLC101 / ESLC105	Communicative English & Report Writing Lab/ Engineering Graphics & Design Lab	0-0-3	1.5	ESLC105/ HSMLC101	Engineering Graphics & Design Lab/ Communicative English & Report Writing Lab	0-0-3	1.5
MNC101	Induction Programme	14 Days	0	MC101	Sports/Yoga/NCC/NSS	0-0-2	1
MC101	Sports/Yoga/NCC/NSS	0-0-2	1	MNC101	Induction Programme	7 Days	0
Total (Practical/ Sessional)		14	7	Total (Practical/ Sessional)		14	7
TOTAL		31	22	**TOTAL**		31	22
TOTAL SEMESTER CREDITS: 22				TOTAL SEMESTER CREDITS: 22			
TOTAL CUMULATIVE CREDITS: 22				TOTAL CUMULATIVE CREDITS: 44			

INDIRA GANDHI INSTITUTE OF TECHNOLOGY, SARANG

Course Structure for 1st Year B.Tech programme (Common to all Branches)
(Effective from 2026-27 Academic Year)

BS101	Mathematics-I	3-0-0	Credit 3

Course Objective: This Course introduces Calculus and Linear Algebra concepts for student will be able to solve the many engineering problem.

Module-1
Calculus: Evaluation of definite and improper integrals, Beta and Gamma functions and their properties.

Module-2
Calculus: Rolle's Theorem, Mean value theorems, Taylor's and Maclaurin's theorem with remainders, Indeterminate forms and L'Hospital rules, Maxima and minima.

Module-3
Matrices: Matrices, vector addition and scalar multiplication, matrix multiplication, linear system of equations, linear independence, rank of a matrix, determinants, Cramer's rule, inverse of a matrix, Gauss elimination.

Module-4
Vector Spaces: Vector spaces, linear dependence of vectors, basis, dimension, Linear transformation(maps), range and kernel of a linear map, rank and nullity.

Module-5
Vector Spaces: Eigen values, Eigen vectors, symmetric and skew-symmetric and orthogonal matrices, Eigen bases and Diagonalization.

Module-6
Vector Calculus: Limit continuity and partial derivatives, directional derivatives, Gradient, curl, divergence. Multiple integration: Line, double and triple integrals (Cartesian and polar), Applications: Areas and volumes by (double integration) center of mass and Gravity (constant and variable densities).Theorems of Green's, Gauss and Stokes.

Textbooks:

1. B.V.,Higher Engineering Mathematics, Tata McGraw Hill New Delhi,11th reprint,2010. Chapter6(6.6),11(11.1,11.2),2(2.4-2.9), 4(4.1,4.2), 13(13.1-13.6), 15(15.1-15.4),16(16.1-16.7)
2. Erwin Kreyszig, Advanced Engineering Mathematics, 8th Edition, Jhon wiley & Sons,2006. Chapter 6(6.8),7(7.1-7.5)

References:

1. G.B. Thomas and R.L Finney, Calculus and Analytic geometry,9th Edition, Pearson

Course Outcomes

The course outcomes for Calculus & Linear Algebra in Engineering focus on equipping students to model and solve complex engineering problems using matrices and multiple integrals.

CO1: To apply differential and integral calculus to improper integrals. Apart from some other applications they will have a basic understanding of Beta and Gamma functions.
CO2: The fallout's of Rolle's theorem that is fundamental to application of analysis to Engineering problems.
CO3: Solve system of linear equation for application like circuit analysis and finding Eigen values and Eigen vectors.
CO4: To understand linear equation and vector space.
CO5: Compute gradient, divergence and curl for understanding vector fields.
CO6: Evaluate double and triple integrals to find areas, volumes, center of mass and other physical properties.

BS102	Mathematics-II	3-0-0	Credit 3

Course Objectives: To deal with fundamentals of probability and differential equations that is required to solve and analyze engineering problems.

Module-1

Basic Probability: Probability spaces, conditional probability, independence, Bayes' rule, discrete random variables, probability distributions, infinite sequences of Bernoulli trials, Expectation of Discrete random variables, Moments, Variance of sum, Correlation coefficient, Chebyshev's inequality.

Module-2

Continuous Probability Distributions: Continuous random variables and their properties, distribution function and densities, normal, exceptional and gamma distribution

Module-3

Bivariate distributions and their properties, distribution sums and quotients, conditional densities

Module-4

First Order Ordinary Differential Equations: Exact, Linear and Bernoulli's equation, Euler's equations, Equations solvable for p, equations solvable for y, equations solvable for x and Clairaut's equation.

Module-5

Ordinary Differential Equations of Second order: Second order differential equations with constant coefficients and variable coefficients, method of variation of parameters, Cauchy-Euler equation, Power series solution, Legendre polynomials, Bessel function of the first kind and their properties

Textbook

1. B. V. Ramana, Higher Engineering Mathematics, Tata McGraw Hill New Delhi, 11th print, 2010. Ch-8(8.7-8.12), 9(9.1-9.3, 9.6,9.7), 10(10.1,10.2), 11(11.3-11.5), 26(26.3-26.5), 27(27.1-27.9, 27.12, 27.13), 30.9, 31.1

References

1. Erwin Kreyszig, Advanced Engineering mathematics, John Wiley & Sons, 2006.
2. B. S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 2000.
3. P. V. O'Neil, Advanced Engineering mathematics, Thomson Publisher, India Edition.
4. E. A. Coddington, An Introduction to Ordinary Differential Equations, Prentice Hall India, 1995

Course Outcomes

The objective of this course is to familiarize the prospective engineers with different techniques in Probability, Calculus ODE. It aims to develop the ability to solve higher order and first degree linear differential equation arising in various branch of engineering and related mathematical models. Also equip the students to deal with advanced level of mathematics and applications that would be essential for their disciplines.

CO1: To know the application of probability in real life problems.
CO2: The effective mathematical tools for the solutions of differential equations that model physical processes.
CO3: Apply differential equation in real life engineering problems
CO4: Applications of modelling in differential equation.

BS103	Physics	3-0-0	Credit 3

Course Outcome: At the end of this course students will be able to
CO1: Understand and explain the principles of basic Physics involving different scientific phenomena both in the classical and quantum domain.
CO2: Demonstrate the basic principles and experimental methods of Physics.
CO3: Exploring the engineering applications and apply quantum mechanics to engineering Phenomena.
CO4: Analyze the basic Physics principles for possible applications in engineering problems.
CO5: Demonstrate knowledge and scientific understanding to identify research problems, design experiments, use appropriate methodologies, analyse and interpret data.
Course Objective: To enrich the fundamental knowledge in Physics and its applications relevant to various streams of Engineering and Technology.

Module-I **(10 Classes)**
Vector Calculus: Gradient of scalar field, divergence and curl of vector fields, Gauss divergence theorem and Stoke's theorem (Statement and physical significance only).
Force and Potential energy function: Forces in nature, Force from the potential energy function, conservative and non-conservative forces.
Oscillation & Waves: Simple Harmonic Oscillation, Damped oscillation, Forced oscillation, Resonance. Heavy, critical and light damping, energy decay in a damped harmonic oscillator, quality factor, steady state motion of forced damped harmonic oscillator.

Module-II **(11 Classes)**
Wave and Optics: Concept of Waves and Wave equation, Interference in thin films, Newton's ring. Fresnel and Fraunhoffer diffraction, zone plate, Fraunhoffer diffraction through single slit, plane diffraction grating, resolving power of grating. Polarization, polarization by reflection, Brewster's law.
Electromagnetism: Gauss Law of electrostatics, electric displacement, magnetic monopole, magnetic induction, Ampere's circuital law, displacement current, Faradays' law of electromagnetic induction (only statements, no derivation), non conservative electric field and continuity equation for current density.
Maxwell's electromagnetic equations in differential and integral form, electric field and magnetic field in terms of scalar and vector potential, Electromagnetic wave equation in vacuum, Poynting vector and its application.

Module-III **(11 Classes)**
Quantum Statistics: Statistical distribution, Maxwell-Boltzmann, Fermi-Dirac and Bose- Einstein distribution functions, density of states (Only statement and formulae, no derivation).
Quantum Mechanics: Needs for Quantum physics- Elementary ideas on blackbody radiation, photoelectric effect, Compton effect, pair production (No derivations). Wave particle duality- Matter waves, de-Broglie hypothesis, Davisson-Germer experiment. Heisenberg's uncertainty principle and its applications: absence of electron in nucleus and ground state energy of Hydrogen atom.
Wave function: Wave function and its characteristics, Born interpretation, probability density, normalization, operators, Eigen value, Eigen function, Expectation value, boundary conditions, stationary states, superposition, Schrodinger's equations (Time dependent and time independent).
Applications: Free particle, potential step, particle in one dimensional potential box, quantum theory of free electrons in metals.

Module- IV **(10 Classes)**
Optoelectronic Devices: LASER, spontaneous and stimulated emission, Principle and working of LASER, Population inversion and pumping, Different types of LASER: Ruby LASER, Helium- Neon LASER, semiconductor LASER, Applications of LASER.
Fibre Optics: Introduction, structure and types of optical fibre, step and graded index fibres, total internal reflection, Acceptance angle, Acceptance cone, Numerical aperature, Applications of optical fibre.

Text Books:

1. Principles of Engineering Physics (Vol-I, II), Md. N. Khan, S. Panigrahi, Cambridge Univ. Press.
2. Engineering Physics, D. R. Joshi, Tata Mc Graw Hill.
3. Engineering Physics, D.K. Bhattacharya and P. Tandon, Oxford University Press.
4. Concepts of Physics, A. Beiser, Mc Graw Hill.

BS104	Chemistry	3-0-0	Credit 3

Module–I: **(9Hours)**

PERIODIC PROPERTIES : Periodic Properties, Effective Nuclear Charge, Penetration of Orbitals, Variations of s, p, d and f Orbital Energies of Atoms in the Periodic Table, Electronic Configurations, Atomic and Ionic Sizes, Ionization Energies, Electron Affinity and Electronegativity, Polarizability, Oxidation States.

Module–II: **(9 Hours)**

FREE ENERGY IN CHEMICAL EQUILIBRIA : Concepts of Entropy, Entropy in Physical and Chemical Changes, Free Energy Concepts, Gibbs Helmholtz Equation, Free Energy Change and Criterion of Spontaneity of Chemical Equation and Chemical Equilibrium, Van't Hoff Equation.

Module–III: **(9 Hours)**

SPECTROSCOPIC TECHNIQUES AND APPLICATIONS: Basic Terms and Principles of Spectroscopy Molecular Rotational (Microwave) Spectroscopy: Basic Principle and Application to Diatomic Molecules, Selection Rules. Molecular Vibrational (IR) Spectroscopy: Basic Principle, Types of Vibrations, Vibrational Frequency, Selection Rules. Electronic (UV-Visible) Spectroscopy: Laws of Absorption, Basis Principle, Types of Electronic Transitions, Chromophores and Auxochrome.

Module–IV: **(9 Hours)**

STEREOCHEMISTRY: Structural and Stereoisomer (Geometrical and Optical), Symmetry and Chirality, Enantiomers, Diastereomers, Optical Activity, Configurational and Conformational Analysis, Representations of Three Dimensional Structures (E, Z and R,S only).

Module–V: **(9 Hours)**

ORGANIC REACTIONS AND SYNTHESIS: Introduction to Reaction Intermediates {Carbocation, Carbanion, Free Radial (Formation, structure and stability)}, Reactions involving Substitution, Addition, Elimination (Examples and Mechanisms).

Essential Reading:

1. Engineering Chemistry: fundamental to Applications by Shikha Agarwal, Cambridge University Press, Second Edition, 2019.
2. Engineering Chemistry by B. Rama Devi, P. Aparna, and Prasanta Rath, Cengage Learning, First Edition, 2023. Supplementary Reading:
3. Atkins' Physical Chemistry by Peter Atkins, Julio de Paula, and James Keeler, Oxford University Press, Eleventh Edition, 2018.
4. Principles of Physical Chemistry by B. R. Puri, L. R. Sharma, and Madan S.Pathania,Vishal Publishing, Forty Eighth Edition, 2021.
5. Fundamentals of Molecular Spectroscopy by C.N. Banwell and E.M. MacCash, 5th Edition, McGraw-Hill Education, Fourth Edition, 2017.
6. Concise Inorganic Chemistry by J.D Lee, Oxford University Press; Fifth Edition, 2008.
7. Principles of Inorganic Chemistry by B.R. Puri, L.R. Sharma, and K.C. Kalia, Vishal Publishing, Fifty Fifth Edition, 2020.
8. Stereochemistry: Conformation and Mechanism by P.S. Kalsi, New Age International, Eighth Edition, 2015.
9. Organic Chemistry Concepts and Applications by Jagdamba Singh, Pragati Prakashan, Eighth Edition, 2015.
10. Organic Chemistry by R.T. Morrison and R.N. Boyd, Pearson Education, Seventh Edition, 2010.
11. Organic Chemistry: Structure and Function by P. Volhardt and N. Schore, WH Freeman; Eighth Edition, 2018.

Course Outcomes:

CO1: To demonstrate and realise the trend in various periodic properties associated with different elements present in different groups and periods of modern periodic table.

CO2: To acquire the knowledge of free energy concept for the thermodynamics associated with chemical reactions and equilibriums.

CO3: To analyse and implement the concepts of spectroscopic techniques for identification of various organic and inorganic compounds.

CO4: To evaluate and visualize the concept of configurations and conformations of various organic compounds

CO5: To assess the generation, reaction and identification of intermediates involved during organic reactions and their applications in different organic reaction mechanisms.

ES103	Programming For Problem Solving	3-0-0	Credit 3

Course Objectives:

1. To learn the fundamentals of computers.
2. To understand the various steps in program development.
3. To learn the syntax and semantics of C programming language.
4. To learn the usage of structured programming approach in solving problems.
5. To understated and formulate algorithm for programming script

b. To analyze the output based on the given input variables

Course Contents:

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

Module II: Arithmetic expressions and precedence.

Module III: Conditional Branching and Loops. Writing and evaluation of conditionals and consequent branching. Iteration and loops.

Module IV: Arrays, Arrays (1-D, 2-D), Character arrays and Strings

Module V: Basic Algorithms, Searching, Basic Sorting Algorithms (Bubble, Insertion and Sclcction), Finding roots of equations, notion of order of complexity through example programs (no formal definition required)

Module VI: Function, Functions (including using built in libraries), Parameter passing in functions, Cdll by value, Passing arrays to functions: idea of call by reference

Module VII: Recursion, Recursion as a different way of solving problems. Example programs, such as Finding Factorial, Fibonacci series, Ackerman function etc. Quick sort or Merge sort.

Module VIII: Structures, Defining strictures and Array of Structures

Module IX: Pointers, Idea of pointers, Defining pointers, Use of pointers in self-referential structures, notation of Link-Lists (no Implimentation)

Module X: File handling (only if time is available, otherwise should be done as part of the lab)

Text / Reference Books:

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

Alternative NPTEL/SWAYAM Course:

S. No.	NPTEL Course Name	Instructor	Host Institute
1	INTRODUCTION TO PROGRAMMING IN C	PROF. SATYADEV NANDAKUMAR	IIT KANPUR
2	PROBLEM SOLVING THROUGH PROGRAMMING IN C	PROF. ANUPAM BASU	lIT KHARAGPUR

Course Outcomes: The student will learn following through lectures:

CO1: To formulate simple algorithms for arithmetic and logical problems.
CO2: To translate the algorithms to programs (in C language).
CO3: To test and execute the programs and correct syntax and logical errors.
CO4: To implement conditional branching, iteration and recursion.
CO5: To decompose a problem into functions and synthesize a complete program using divide and conquer approach.
CO6: To use arrays, pointers and structures to formulate algorithms and programs.
CO7: To apply programming to solve matrix addition and multiplication problems and searching and sorting problems.
CO8: To apply programming to solve simple numerical method function, differentiation of function and simple integration

ES104	Engineering Mechanics	3-0-0	Credit 3

Module-I **(10 Hours)**

Concurrent forces on a plane: Composition, resolution and equilibrium of concurrent coplanar forces, method of moment. General case of forces on a plane: Composition and equilibrium of forces in a plane, plane trusses, method of joints and method of sections.

Module-II **(6 Hours)**

Friction: Fundamentals and Problems involving friction, Ladder, Wedges. Principle of virtual work.

Module - III **(8Hours)**

Parallel forces on a plane: General case of parallel forces, center of parallel forces and center of gravity, Centroid of plane and composite figures, Theorems of Pappus and Guildins. Moment of inertia: Plane figure with respect to an axis in its plane and perpendicular to the plane, Polar moment of inertia, parallel axis theorem.

Module – IV **(8 Hours)**

Rectilinear translation: Kinematics, Principle of dynamics, D Alembert‟s Principle, Principle of work and energy for a particle and a rigid body, Conservation of energy, Principle of impulse and momentum for a particle and a rigid body, Conservation of momentum, System of rigid bodies, Impact, direct and central impact, coefficient of restitution.

Module – V **(8 Hours)**

Curvilinear translation: Kinematics, Equation of motion, Projectile, D Alembert‟s principle of curvilinear motion. Kinematics of rotation of rigid body.

Essential Reading:

1. Engineering Mechanics: S. Timoshenko, D.H. Young, J.V. Rao, Sukumar Pati,5th Edition,2017 McGraw Hill.

Supplementary Reading:

1. Engineering Mechanics, Static and Dynamics, J. L. Meriam and L.G.Kraige, 9th Edition,2021, John Wiley & Sons, Inc.
2. Fundamental of Engineering mechanics, S Rajesekharan & G ShankaraSubramanium,3rd Edition, 2017, S. Chand
3. Engineering mechanics: K. L. Kumar and Veenu Kumar, 4th Edition,2017, Tata MC Graw Hill.

Upon completion of the subject the students will be able to:

CO1: Ability to analyze objects in static equilibrium including the determination of reactions, forces and moments.

CO2: Enrich fundamental concept of friction and demonstrate the analytical skills to solve the problems involving friction.

CO3: Assimilating the knowledge for determination of centroid and second moment of area of sections and their engineering applications.

CO4: To analyze the work done by forces, the energy transferred from one object to other and apply principle of work and energy conservation for realistic (/Practical) engineering problems.

CO5: Identify the various parameters in projectile motion. Apply the principle of dynamics to analyze the curvilinear motion of rigid bodies.

ES101	Basic Electrical Engineering	3-0-0	Credit 3

Module-I **(6 Hours)**

D.C Networks: Kirchoff's laws, node voltage and mesh current methods, delta-star and star-delta conversions, superposition principle, Thevenin's and Norton's theorems, Maximum Power Transfer Theorem.

Module-II **(6 Hours)**

Single phase and three phase ac circuit: Average and effective values of sinusoids, solution of R, L, C series circuits, solution of series and parallel circuits, series -parallel resonance. Line and phase quantities, Delta and star connections, solution of the balanced three phase circuits, measurement of power in three phase circuits.

Module-III **(6 Hours)**

Magnet circuit & principle of electromechanical energy conversion: Review of fundamental laws of electromagnetic induction, Solution of simple magnetic circuits. DC machine: Construction, types, emf equation of generator, torque equation of motor, speed control of DC motors.

Module-IV **(6 Hours)**

AC MACHINES: Single Phase Transformer: Construction, emf equation, no load and load operation, voltage regulation and efficiency. Three Phase Induction Motor: Construction, principle of working, concept of slip, torque speed relation. Principle of operation of Three Phase alternator.

Module-V **(6 Hours)**

Introduction to Power System: General structure of electrical power systems, Concepts of Generation, Transmission and Distribution, Sources of Electrical Power

ESSENTIAL READING

1. G. Rizzoni, Principles and Applications of Electrical Engineering, TMH , 2017
2. Nagrath I.J. and D. P. Kothari, Basic Electrical Engineering, Tata McGraw Hill.

SUPPLEMENTARY READING

1. S. Parker Smith, "Problems in Electrical Engineering", Asia Publications, 10th Edition.
2. Edward Hughes (revised by Ian McKenzie Smith), "Electrical & Electronics Technology", Pearson Education Limited. Indian Reprint 2002, 10th Edition.

Course Outcomes:

Upon completion of the subject the students will demonstrate the ability to:

CO1: Implement principles of DC network, theorems and transients.
CO2: Analyze the concept of Single phase and three phase AC circuits.
CO3: Express the concept of magnetic circuit and DC machines.
CO4: Apply basic principles of AC machines and their working.
CO5: Demonstrate basic principles of power system

ES102	Basic Electronics Engineering	3-0-0	Credit 3

Course Objective

1. To impart the fundamentals of semiconductor devices and their applications to various circuits.
2. To impart the knowledge of fundamentals of digital electronics and Integrated Circuits (IC).
3. To impart the knowledge of electronic measuring instruments and fundamentals of communication systems.

Module I **7 Hours**

Semiconductor Physics: Properties of semiconductor, current flow in semiconductors, voltage-current characteristic of a p-n junction, Rectifiers.

Bipolar junction Transistor (BJT): Device structure, types and modes of operation, static characteristic, BJT as a switch, BJT as an amplifier, concept of biasing of BJT.

Module II **7 Hours**

JFET: Physical structure, operation and static characteristics. MOSFET: Physical structure, operation and characteristics of D- and E-type MOSFET. Integrated Circuits: Introduction to CMOS technology in VLSI, Introduction to Integrated circuits, Fabrication of monolithic IC, Integration of circuit components, Limitations of VLSI.

Module III **6 Hours**

Feedback Amplifiers: General feedback structure, properties of negative feedback, four basic types of feedback topologies (Block diagram only). Operational Amplifier (OP-AMP): Ideal OP-AMP, inverting configuration, non-inverting configuration, OP-AMP Applications (Adder, Subtractor only).

Module IV **5 Hours**

Digital Electronics Fundamentals-Number system (Decimal, Binary, Octal and Hexadecimal), conversion among number systems, signed-binary numbers, binary addition, subtraction, multiplication and division, logic gates, laws of Boolean Algebra, simplification of expressions.

Module V **5 Hours**

Electronic Instruments: Overview of CRO, DSO; principles of operation, waveform reconstruction, Comparison between CRO & DSO, applications of oscilloscope. Principles of Communication Systems: Fundamentals of AM & FM, (Waveforms and general expressions only).

Text Books:

1. Electronics Fundamentals and Applications, D. Chattopadhyay and P.C. Rakshit, New Age International Publications. (Selected portions from chapters)
2. Electronic Devices & Circuit Theory, R.L. Boylestad and L. Nashelsky, Pearson Education.

Reference Books:

1. Integrated Electronics, Millman and Halkias, TMH Publications.
2. Microelectronics Circuits, A.S Sedra, K.C. Smith, Oxford University Press.
3. VLSI Design, Debaprasad Das, Oxford University Press.
4. Electrical & Electronics Measurement and Instrumentation, A.K. Sawhney, Dhanpat Rai & Co (Pvt.) Ltd.

Course Outcomes

After completion of the course, students should be able to

CO1. Understand the operation and application of semiconductor devices.
CO2. Analyze characteristics of FETs.
CO3. Apply the Feedback Amplifiers and Operational Amplifiers.
CO4. Remember the fundamentals of different Digital arithmetic operations and Integrated circuits.
CO5. Evaluate some important Electronic Instruments and Communication systems.

ES106	Basic Mechanical Engineering	3-0-0	Credit 3

MODULE-I **(11 classes)**

Thermodynamics: Systems, Properties, Process, State, Cycle, Internal energy, Enthalpy, Zeroth Law, First law ar Second Law of Thermodynamics, Basic Concept Entropy, Properties of ideal gas, Properties of pure substance Enthalpy, Specific volume, Internal energy and dryness fraction of steam, use of Steam tables.
Related numerical.

MODULE-2 **(8 classes)**

Application of Thermodynamics: Single stage air compressor, Steam Power Plant, I.C. Engines (Brief Description o working principles with Schematic diagrams only)
Elements of Fluid Mechanics and Heat Transfer
Properties used in Fluid Mechanics, Fluid Statics, Kinematics and Dynamics (Concepts only), Heat transfer ar Classifications (Concepts only)

MODULE-3 **(7 Classes)**

Introduction to Manufacturing: Classification of engineering materials, Material Properties, Manufacturir processes: Welding, Casting, Forming (Basics only)

MODULE-4 **(4 Classes)**

Basic Power transmission devices: Belt, Gear drives, clutch, brakes. (Working principle only) Introduction to Robotics: Robot anatomy, Joints and links and common robot configurations.

Essential Reading

1. Basic Mechanical Engineering by Pravin Kumar, Pearson
2. Basic Mechanical Engineering by A R Israni, P K Shah, BS Publications
3. Text book of Elements of Mechanical Engineering, S T Murthy, Universities press
4. Basic and applied Thermodynamics by P. K. Nag, Tata McGraw Hill

Supplementary reading

1. Basic Mechanical Engineering by D. Mishra, P. K. Parida, S. S. Sahoo, India Tech Publishing company
2. Elements of Mechanical Engineering by J K Kittur and G D Gokak, Willey
3. Basic Mechanical Engineering by Basant Agrawal, C M Agrawal, Willey
4. Engineering Thermodynamics by P. Chattopadhaya, Oxford University Press

Course Outcomes

CO1: Comprehending the Law of Thermodynamics
CO2: Being aware of how crucial thermodynamics is to IC engines, power plants, refrigerators, and Heat Pump
CO3: Being aware of fluid mechanics and heat transfer concepts
CO4: Recognizing the functions of Engineering materials
CO5: Have a fundamental understanding of welding, Casting, Forming and other manufacturing techniques.
CO6: Recognizing fundamental power transfer mechanisms and aware of the fundamental robotics system.

ES105	Basic Civil Engineering	3-0-0	Credit 3

Module I: Introduction to Civil Engineering and Building Construction (7 Hours)
Introduction to Civil Engineering: Branches and disciplines of Civil Engineering, Importance of Civil Engineering in national infrastructure development, Interdisciplinary nature of construction projects, Residential Buildings, NBC classification of buildings, Basic components and functional requirements of buildings, Site selection principles, Introduction to planning and design of buildings (functional and structural aspects). Foundations Types/classification of foundations, Definitions: bearing capacity of soil and related terms.

Module II: Building Materials and Their Properties (7 Hours)
Fundamental Properties of Construction Materials, Physical, mechanical, and durability properties, Common Construction Materials: Stone, brick, cement, aggregate, mortar, concrete, timber, steel, Non-ferrous metals, paint, plastic, glass, adhesive, tiles, composites, (Definitions, classifications, and applications).

Module III: Transportation Engineering (7 Hours)
Importance and modes of transportation, Highways, railways, airways, waterways, pipeline, and conveyor transport, Basic characteristics, advantages, and disadvantages, Indian Road Transport System, Classification and types of roads, Urban roads: classification and basic requirements, Road Components and Pavement Types, Basic components of a road, Comparison between rigid and flexible pavements.

Module IV: Water Resources and Environmental Engineering (7 Hours)
Sources of water and quantity estimation, Per capita demand and drinking water standards, Layout and necessity of a public water supply system, Conventional water treatment process, Screening, Sedimentation, Coagulation, Filtration, Disinfection (principles only).

Module V: Irrigation Engineering (7 Hours)
Irrigation Engineering, Importance and classification of irrigation projects, Types of irrigation systems and field water distribution, Multipurpose River valley projects, Dams: purposes and types, Layout of canal irrigation system and its components.

Essential Reading:
1. Basic Civil engineering, Gopi, S., Pearson Publication
2. Basic Civil Engineering, Bhavikatti, S. S., New Age.

Course Outcomes:
CO1: Able to understand the basics of civil engineering and fundamental aspects of building.
CO2: Able to get the brief overview of general aspect of building material.
CO3: Able to get brief idea about transportation modes and planning.
CO4: Able to get brief idea about drinking water standards and water treatment plant.
CO5: Able to get brief idea about irrigation network system.

HSM102	English for Technical Writing	3-0-0	Credit 3

Objectives:

1. To develop the communication skills of the students
2. To improve students' pronunciation in English
3. To enhance the ability to use targeted grammatical structures meaningfully and appropriately in oral and written production
4. To improve their general English knowledge that can assist them towards achieving their goal of effectively communicating in English
5. The student will acquire basic proficiency in English including reading and listening comprehension, writing and speaking skills
6. To initiate them to select literary texts and establish how these texts contribute to the afore-mentioned objectives.

Module-I

Introduction to Communication:

Importance of Communication in English

The process of communication and factors that influence the process of communication:

Sender, receiver, channel, code, topic, message, context, feedback, 'noise'.

Principles of Communication.

Barriers to Communication & Communication Apprehension

Verbal (Spoken and Written) and non-verbal communication, Body language and its importance in communication.

Module-II The sounds of English

Vowels, diphthongs, consonants, consonant clusters, Problem sounds, The International Phonetic Alphabet (IPA); phonemic transcription, Syllabic division and word stress, Sentence rhythm and weak forms, Contrastive stress in sentences , Intonation: falling, rising and fall-rise tones, Varieties of Spoken English: Standard Indian, American and British, MTI and problem sounds

(Note: This unit should be taught in a simple, non-technical, application oriented manner, avoiding technical terms as far as possible.)

Module-III

Reading and Writing

Comparing reading and writing Reading: Sub -skills of reading. Reading for comprehension, Comprehending the text, Skimming, Scanning, Getting the meanings of unfamiliar words, Note making, Summarising. The following Texts are to be covered in the classroom: The Road Not Taken by Robert Frost, Hunger by Jayanta Mahapatra, Lead, Kindly Light by Saint John Henry Newman, On Freedom and Order by Jiddu Krishna Murti, The Magic of Team Work by Sam Pitroda.

Mechanics of Writing

Process of writing, Paragraph writing, Business and Official Letters (Good news, bad news, Neutral messages), Report and Proposal writing, Notice, Circular and Memo writing, Résumé (CV) Writing.

Module-IV

Functional Grammar

Time, Tense and Aspects, Articles, Use of Modal Verbs, Passive and Active Voice, Conditionals Reported Speech, Elimination of Common Errors.

Recommended Books:

1. Das, B.K. et al. An Introduction to Professional English and Soft Skills: Cambridge University.
2. Kumar, Sanjay & PuspLata. Communication Skill: Oxford University Press.
3. Conner, J.D.O. Better English Pronunciations: Cambridge University Press.
4. Leech, G.N. and Jan Svartik. A Communicative Grammar of English: OUP.

Reference Books:

1. Raman, Meenakshi. & Sangeeta Sharma .Technical Communication, Principle and Practice: Oxford University Press.
2. Chaturvedi & Chaturvedi. Business Communication- Concepts, Cases & Applications: Pearson.
3. Rai,Urmila. and S M Rai. Communication for Management: HPH.

HSM101	Universal Human Values	3-0-0	Credit 3

Objective:

1. To help students distinguish between values and skills, and understand the need, basic guidelines,
1. content and process of value education.
2. To sensitize the student towards issues in society and nature.
3. To Strengthen self-reflection to know what the students „really want to be" in their life and profession.
4. To understand harmony at all the levels of human living, applying the understanding of harmony in
5. existence in their profession and lead an ethical life.

Module 1- Foundations of Value Education

Right Understanding, Relationship and Physical Facility (Holistic Development and the Role of Education)
Understanding Value Education
Self-exploration as the Process for Value Education
Continuous Happiness and Prosperity - the Basic Human Aspirations
Happiness and Prosperity-Current Scenario
Method to Fulfil the Basic Human Aspirations

Module 2-Harmony in the Human Life, Relationships and Society

Understanding Human being as the Co-existence of the Self and the Body
Distinguishing between the Needs of the Self and the Body
Achieving Harmony: Integrating Self and the Body
Harmony in the Family and Society
'Trust'& 'Respect'–as Foundational Values in Relationship
Other Feelings, Justice in Human-to-Human Relationship
Understanding Harmony in the Society & Universal Human Order.

Module 3-Harmony in the Nature/Existence & Professional Ethics

Understanding Harmony in the Nature
Interconnectedness, self-regulation and Mutual Fulfilment among the Four Orders of Nature
Realizing Existence as Co-existence at All Levels
The Holistic Perception of Harmony in Existence
Natural Acceptance of Human Values
Humanistic Education, Humanistic Constitution and Universal Human Order
Competence in Professional Ethics – Ethical Decision Making &Transition towards Value-based Life and Profession.

Text Book:

1. R R Gaur, R Sangal, G P Bagaria, 2009, A Foundation Course in Human Values and Professional Ethics.

References Books:

1. A Nagraj, 1998, Jeevan Vidya Ek Parichay, Divya Path Sansthan, Amarkantak.
2. A N Tripathy, 2003, Human Values, New Age International Publishers.
3. B P Banerjee, 2005, Foundations of Ethics and Management, Excel Books

Course Outcome:

On completion of this course, the students will be able to:

CO1: Distinguish between values and skills; understand the need, basic guidelines, content and process of value education.

CO2: Distinguish between the Self and the Body; understand the meaning of Harmony in the Self the Coexistence of Self and Body.

CO3: Understand the value of harmonious relationship based on trust, respect and other naturally acceptable feelings.

CO4: Distinguish between ethical and unethical practices, and start working out the strategy to actualize a harmonious environment.

BSLC101	Physics Lab	3-0-0	Credit 3

A Student is expected to perform ten experiments from the list given below.

1. Determination of Young's modulus by Searle's methods.
2. Determination of Rigidity modulus by static methods.
3. Determination of surface tension by capillary rise method.
4. Determination of acceleration due to gravity by Bar / Kater's pendulum.
5. Determination of thermal conductivity by Lee's method.
6. Determination of wave length of light by Newton's ring apparatus.
7. Determination of grating element of a diffraction grating.
8. Determination of wave length of light by Biprism.
9. Plotting of characteristic curves of a PN junction diode.
10. Plotting of characteristic curves of BJT.
11. Verification of laws of verification of strings using sonometer.
12. Determination of wavelength of laser source by diffraction rating methods.
13. Study of Hall effect.
14. Study of RC circuit.
15. Study of a power source- output impedance.

Course Outcomes:

Upon completion of the subject the students will demonstrate the ability to:

CO1: Understand the nature of Acceleration due to gravity and to explain the procedure of calculation of acceleration due to gravity at any place using simple devices.

CO2: Demonstrate the properties of fluids and materials including the elastic properties and their possible measurements.

CO3: Demonstrate the characteristics behaviour of the electronic devices.

CO4: Understanding the rigidity concept of solid materials.

CO5: Analyzing the electrical and magnetic field measurements and their applications**.**

BSLC102	Chemistry Lab	3-0-0	Credit 3

Chemistry Laboratory (Any Ten Experiments):

1. Determination of the alkalinity in the given water sample.
2. Determination of the temporary and permanent hardness in the given water sample by complexometric titration using EDTA as standard solution.
3. Determination of amount of available chlorine in bleaching powder.
4. Standardization of potassium permanganate using sodium oxalate
5. Determination of amount of ferrous iron present in Mohr's salt.
6. Determination of the rate constant of a chemical reaction.
7. Estimation of calcium in Limestone
8. Determination of dissolved oxygen in water sample.
9. Determination of the partition coefficient of a chemical between two immiscible liquids.
10. Determination of the strength of given HCl solution by titrating it against NaOH solution using pH meter.
11. Conduct metric titration of strong acid and strong base.
12. Determination of viscosity of lubricating oil by Redwood viscometer.
13. Determination of flash point of a given oil by Pensky-Martens flash point apparatus.
14. To find out the concentration of a given potassium permanganate solution spectrophotometric method.
15. Synthesis of Aspirin/Paracetamol.

Essential Reading:

1. Practical Chemistry by D.N. Bajpai, O.P. Pandey and S. Giri, S. Chand Publishing, Revised Edition, 2010.
2. Practical Physical Chemistry by B. Vishwanathan and P.S. Raghavan, Viva Books, First Edition, 2012.

Course Outcomes:

CO1: To analyze the alkalinity and hardness value of the water sample.
CO2: To analyze the concentration of copper present in the solution.
CO3: To analyse kinetics of the reactions.
CO4: To gain hands-on experiences of pH meter, conductometer, and spectrophotometer.
CO5: To analyze viscosity and flash point of lubricating oils.

ESLC103	Programming for Problem Solving	3-0-0	Credit 3

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

S.No.	Experiment Name	Experiment Link(s)
	Simple computational problems using arithmetic expressions	http://ps-iiith.vlabs.ac.in/exp7/Introduction.html?do main-Computer%20Science&lab-Problem%20Solving%20Lab
	Iterative problems e.g., sum of series.	http://ps-iiith.vlabs.ac.in/exp4/Introduction.html?do main=Computer%20Science&lab=Proble m%20Solving%20Lab
	I D Array manipulation.	http://cse02-iiith.vlabs.ac.intexp4/index.html
	Matrix problems, String operations	http://ps-iiith.vlabs.ac.in/exp5troduction.html?do main-Computer%20Science&lab-Proble m%20Solving%20Lab
	Simple functions	http://cse02-iiith.vlabs.ac.in/exp2/index.html
	Programming for solving Numerical methods problems.	http://ps-iiith.vlabs.ac.in/exp1/Introduction.html?do main Computer%20Science & lab-Proble m%20Solving%201.ab
	Recursive functions.	http://ps-iiith.vlabs.ac.in/exp6/Introduction.html?do main-Computer%20Science&lab=Proble m%20Solving%20Lab

COURSE OUTCOMES: The student will learn following through Practicals:
CO1: To formulate the algorithms for simple problems.
CO2: To translate given algorithms to a working and correct program.
CO3: To be able to correct syntax errors as reported by the compilers.
CO4: To be able to identify and correct logical errors encountered at run time.
CO5: To be able to write iterative as well as recursive programs.
CO6: To be able to represent data in arrays, strings and structures and manipulate them through a program.
CO7: To be able to declare pointers of different types and use them in defining self-referential structures.
CO8: To be able to create, read and write to and from simple text files.

ESLC104	Workshop and Digital Manufacturing Lab	3-0-0	Credit 3

1. Preparation of job in fitting section/Study of lathe and turning operation
2. Preparation of job in black smith section/ Study of milling machine and milling operation.
3. Preparation of job in carpentry section/milling operation on CNC milling machine.
4. Study of CNC lathe machine and turning on CNC lathe.
5. Study of Robot (Pick and place and palletizing operation).
6. Study of additive manufacturing using 3D printer and product development.

1. **Carpentry Section:** Study of different Hand tools, measuring instruments and equipments used in Carpentry work. Safety precautions.
   Preparation of Job: Carpentry job involving different types of joint.
   Includes the operations: Measuring, Marking, Sawing, Planing, Chiseling, Mortesing, Tenoning, making Half-lap joint, Mortese & Tenon joint and Nail joint.
2. **Fitting Section:** Study of different Hand tools, measuring instruments and equipments used in Fitting work. Safety precautions. Study of Drilling Machine and Grinding Machine.
   Preparation of Job: Paper Wt. / Square or Rectangular joint (male-female joint) (any one)
   Includes the operations: Measuring, Marking, Filing, Sawing, Drilling, Tapping, Dieing and Punching.
3. **Black Smith Section:** Study of different Hand tools, equipments and Open-hearth furnace used in Blacksmith work. Different types of heat treatment processes. Safety precautions.
   Preparation of Job: Weeding hook/ Chisel (any one)
   Includes the operations: Measuring, Marking, Cutting, Upsetting, Drawing down, Bending, Fullering and Quenching.
4. **Turning/ Milling Section (Conventional & CNC)**
   A. Study of Lathe Machine, different parts of Lathe and different applications of Lathe. Study of different measuring & marking instruments.
   B. Study of Milling Machine, different parts and applications of Milling Machine. Study of different measuring & marking instruments.
   C. (i) Study of CNC Lathe Machine, different parts of CNC Lathe and its operation.
      (ii) Part programming for turning operations.
   D. (i) Study of CNC Milling Machine, different parts of CNC Milling Machine and its operation.
      (ii) Part programming for milling operations.

4. Robotics Lab:
   A. Study of Robot.
   B. Pick and place operation, demonstration and explanation of code.
   C. Palletizing operation, demonstration and explanation of code.

5. Additive Lab
Study of 3D Printer and demonstration of its operation.

Course Outcomes:
At the end of the course, the student will be able to:

CO1: Acquire knowledge of conventional & CNC (Lathe and Milling Machine). CNC code and part programming for Milling and Turning operations. Different types of hand tool, measuring instruments and machine tools used in Fitting, Carpentry & Smithy work.
CO2: Know about different types of operations and joints performed in different shops i.e. in Fitting and Carpentry.
CO3: Explore learning about forging temperature of different types of ferrous metals and different types of operation (e.g. upsetting, edging, flattening and bending etc.) carried out on hot metals to prepare jobs.
CO4: Acquire knowledge for the preparation of different types of jobs by using conventional/ CNC Lathe and Milling Machines (e.g. facing, step turning, knurling, drilling, boring, taper turning, thread cutting and different

methods of indexing for machining gears.
CO5: Acquire skills in using different precision measuring and marking instruments. Understand the importance of safety precaution in different shops.

ESLC101	Basic Electrical Engineering Lab	3-0-0	Credit 3

List of Experiments

1. Preliminary: Preparation of symbol chart for various systems & components as per ISS, to study the constructional & operational features for Voltmeter, Ammeter, Wattmeter, Frequency meter, multi-meter and Rheostat, Study of safety rules.
2. Demonstration of cut-out sections of machines: dc machine (commutator-brush arrangement), induction machine (squirrel cage rotor), synchronous machine (field winging - slip ring arrangement) and single-phase induction machine.
3. Measurement of the armature & field resistance of D.C. Machine by volt-amp method.
4. Starting and speed control of a D.C. shunt motor
5. Study of BH Curve of ferromagnetic core.
6. Determination of open circuit characteristics (O.C.C) of D.C shunt generator when separately excited at different speeds and different excitation levels.
7. Calibration of a single-phase Energy Meter by direct loading.
8. Measurement of power & power factor of a single-phase circuit
9. Measurement of earth resistance and insulation resistance.
10. Verification of Thevenin and Norton's theorem
11. Study of House wiring

Course Outcomes

Upon completion of the subject the students will demonstrate the ability to:

CO1: Express the safety rules as per ISS and symbols of different electrical components and the use of various electrical instruments in the laboratory.

CO2: Demonstrate the working and operational characteristics of dc motor and dc generator.

CO3: Evaluate the voltage, current, power and power factor of choke coil and study BH curve of a ferromagnetic core.

CO4: Measure armature and field resistance of DC machines, earth resistance and insulation resistance and demonstrate the internal structure of different machines.

CO5: Analyze the connection and calibration of single phase energy meter

ESLC102	Basic Electronics Engineering Lab	3-0-0	Credit 3

Course Objective

1. To provide engineering skills for circuit design on breadboard with electronic components.
2. To impart the knowledge on digital fundamentals and digital circuit design.
3. To analyze various electronic circuits such as BJT, FET, OP-AMPs etc.

List Of Experiments

1. Familiarity with electronic components and devices (Testing of semiconductor diode, Transistor, IC Pins connection) Digital Multimeter should be used.
2. Study and use of CRO to view waveforms and measure its Amplitude and Frequency.
3. V-I Characteristics of a Semiconductor Diode.
4. V-I (Output) Characteristics of N-P-N/P-N-P Transistor in CE Configuration.
5. Measurement of pinch off voltage and plot transfer characteristics and drain characteristics of JFET.
6. Transfer characteristics and drain characteristics of MOSFET.
7. OP-AMP: Inverting and Non-Inverting Configuration. Record of Waveforms.
8. Verification of Truth table of Logic gates (AND, OR, NOT, NAND, NOR, EX-OR)
9. Half Wave and Full Wave Rectifier without Capacitor filter. Record of Waveforms, Measurement of Average and RMS value.
10. Implementation of digital circuit using Universal gates.

Reference Book:

1. Integrated Electronics, Millman and Halkias, TMH Publications.
2. Electronic Devices & Circuit Theory, R.L Boylestad and L. Nashelsky, Pearson Education.

Course Outcomes

After completion of the sessional student should be able to

CO1. Acquire basic knowledge on electronic devices and components.
CO2. Design different electronics circuits using semiconductor diodes.
CO3. Analyze and develop the characteristics of BJT and FET Circuits.
CO4. Implement Operational amplifier circuits.
CO5. Acquire knowledge on basic digital logic gates.

HSMLC101	Communicative English & Report Writing Lab	3-0-0	Credit 3

Course Objectives:

1. The laboratory experience for this course aims at acquainting the learners with their strength and weakness in expressing themselves, their interests and academic habits.
2. To improve their skills of LSRW (Listening, Speaking, Reading and Writing) through mutual conversation and activities related to these skills.
3. To promote the creative and imaginative faculty of the students through practice before the teacher-trainer.

Speaking: Ice-breaking and Introducing each other, Writing: Happiest and saddest moment of my life
Listening: Listening practice (ear-training): News clips, Movie clips, Presentation, Lecture or speech by a speaker Speaking: Debate
Reading: Reading comprehension, Writing: Creative writing (Short story: Hints to be given by the teacher)
Reading: Topics of General awareness, Common errors in English usage. Writing: Construction of different types of sentences
Speaking: Practice of vowel and consonant sounds (1 Hour), Writing: Practice of syllable division
Speaking: My experience in the college/ or any other topic as per the convenience of the student, Writing: Phonemic transcription practice.
Listening: Practice of phonetics through ISIL system and also with the help of a dictionary, Speaking: Role-play in groups
Speaking: Practice sessions on Stress and Intonation, Writing: Practice sessions on Grammar (Tense and voice change)
Speaking: Extempore, Writing: Framing sentences using phrasal verbs and idioms.

ESLC105	Engineering Graphics & Design Lab	3-0-0	Credit 3

With AutoCAD

1. Introduction to AutoCAD: Basic commands, Code provision of IS-696 regarding Lines, Lettering and Dimensioning.
2. Drawing of Scales (Plane Scales, Diagonal Scales, Vernier Scales and Scales of Chords).
3. Construction of simple geometrical figures and Engineering curves.
4. Orthographic Projections:
   a) Projection of a point situated in various quadrants.
   b) Projections of straight lines.
   c) Projection of plane figures.
   d) Projection of simple solids.
   e) Section of solid and Development of surfaces.
5. Isometric projection and perspective view.

Essential Reading:

1. N. D. Bhatt, Geometrical Drawing, Charotar Book Stall, 2002.

Supplementary Reading:

1. K. Venugopal, Engineering Drawing and Graphics + AutoCAD, New Age International (P) Limited. 4th Reprint: June, 2008.
2. K. L. Narayana and P. Kannaiah, Engineering Graphics, Tata McGraw Hill Publishing Co. Ltd.
3. J. D. Bethune, Engineering Graphics with AutoCAD, Pearson Education.