



First Semester (Common to All Branches)					
Theory					
Sl. No	Category	Subject Code	Subject Name	L-T-P	Credit
1	BSC	19FY1BS01T/ 19FY1BS02T	Physics Chemistry	3-0-0	3
2	BSC	19FY1BS03T	Mathematics-I	3-0-0	3
3	ESC	19FY1ES01T/ 19FY1ES02T	Basic Electrical Engineering/ Basic Electronics Engineering	2-0-0	2
4	ESC	19FY1ES03T/ 19FY1ES04T	Basic Mechanical Engineering/ Basic Civil Engineering	2-0-0	2
5	HSMC	19FY1HS01T	English	2-0-0	1
6	MC	19FY1MC01T	Induction Training (21 Days)		0
<b>Total Credit (Theory)</b>					<b>11</b>
Practical					
1	BSC	19FY1BS01L/ 19FY1BS02L	Physics Lab/ Chemistry Lab	0-0-2	1
2	ESC	19FY1ES01L/ 19FY1ES02L	Basic Electrical Engineering Lab / Basic Electronics Engineering Lab	0-0-2	1
3	ESC	19FY1ES03L/ 19FY1ES04L	Basic Mechanical Engineering Lab/ Basic Civil Engineering Lab	0-0-2	1
4	ESC	19FY1ES05L/ 19FY1ES06L	Engineering Graphics & Design / Workshop or Manufacturing	0-0-2	1
5	HSMC	19FY1HS01L	English Language Lab	0-0-2	2
<b>Total Credit (Practical)</b>					<b>6</b>
<b>Total Semester Credit</b>					<b>17</b>

19FY1BS01T	Physics (3-0-0)	3 Credits
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**Course Objective:**

1. Understand and apply the knowledge to analyze the fundamental physics behind their courses in higher semester.
2. Do project works based on theoretical as well as experimental research.
3. Use the knowledge of Physics for Industrial development.
4. Generate fundamental knowledge needed for the future technological advances that will continue to drive the economic engines of the society.
5. Create an exciting intellectual adventure that inspires young mass and expands the frontiers of their knowledge about Nature.

**Module I:**

[8 Hrs]

**Oscillation & Waves:**

Simple Harmonic Oscillation: velocity of motion, acceleration, time period, frequency, phase; damped harmonic oscillation: Wave equation of damped vibration, logarithmic decrement, quality factor, relaxation time; Forced oscillation, resonance, velocity resonance and amplitude resonance, coupled oscillation, Normal coordinates and normal frequencies, In-phase and out-of-Phase Oscillation, Concept of wave and wave equation, reflection and transmission of longitudinal waves at boundaries (Concepts).

**Module II:**

[10 Hrs]

**OPTICS:**

Concept of interference, two sources interference pattern, Bi-prism, Fringe width, uses of biprism, Newton's ring; measurement of wavelength and refractive index. Diffraction: Huygen's principle, Fresnel's Diffraction and Fraunhofer's diffraction, Half period zone, Zone plate, construction, principle, multiple foci, comparison of zone plate with convex lens, Fraunhofer's diffraction of Single slit, intensity distribution.

**Module III:**

**LASER and Fiber Optics:**

[6 Hrs]

Atomic excitation and energy states, Interaction of external energy with atomic energy states, Absorption, spontaneous emission and stimulated emission, Population inversion, Pumping mechanism, optical pumping, Electrical Pumping, Components of laser system, active medium, population inversion (All concepts only, not details), Ruby laser, Helium-Neon laser, Semiconductor laser (basic concepts, and Engineering application only, mechanism not required), Structure of optical fibre, Principle of propagation and numerical aperture (concept only, derivation not required), Acceptance angle, classification of optical fibre (Single mode and Multi mode, SIN and GRIN), FOCL (Fiber Optic Communication Link)

**Solid State Physics**

[4 Hrs]

Crystalline and Amorphous solid, unit cell, lattice parameter, Miller Indices, Reciprocal Lattice (Only concept), Bragg's law, Concept of fermions and Bosons and their distribution Functions, Band theory of Solids (Qualitative), Classification of materials: metals, semiconductor and insulator in terms of band theory.

**Module IV:**

**[8 Hrs]**

**Electromagnetism:**

(Student will be familiarized with some basic used in vector calculus prior to Development of Maxwell's electromagnetic wave equations. No proof of theorems and laws included in this unit **expected- statement and interpretation should sufficient**). Introduction; Scalar and vector fields, Gradient of Scalar Field, divergence and curl of Vector Field, Gauss divergence theorem, Stokes theorem (Only statements, no proof), Gauss's law of electrostatics in free space and in a medium (Only statements), Faraday's law of electromagnetic induction (Only statements), Displacement current, Ampere's circuital law, Maxwell's equation in Differential and Integral form, Electromagnetic wave equation in E and B, Electromagnetic Energy, Poynting theorem and Poynting vector (no derivation).

**Module V:**

**[10 Hrs]**

**Quantum Physics:**

Elementary concepts of quantum physics formulation to deal with physical systems. Need for Quantum physics- historical overviews (For concept), Einstein equation, de-Broglie Hypothesis of matter waves, Compton Scattering, Pair production (no derivation), Uncertainty Principle, Application of Uncertainty Principle, Non-existence of electrons in the Nucleus, Ground state energy of a harmonic oscillator. Basic features of Quantum Mechanics: Transition from deterministic to Probabilistic, Wave function, probability density, Normalization of wave function (Simple problem), observables and operators, expectation values (Simple problem), Schrodinger equation-Time dependent and time independent equation.

**Course Outcome:**

1. Memorize the Definitions, statements of physics.
2. Understand and explain different laws of physics governing our physical world.
3. Analyze the theoretical concepts mathematically as well as graphically.
4. Apply and interpret the knowledge to experimental application.

**Text Book:**

1. Malik and Singh, Engineering Physics, (Mc Graw Hill).
2. Chattopadhyay, & Rakshit, Practical of physics,
3. C L. Arora, Practical Physics.

**Reference Books:**

1. Optics - A. K. Ghatak
2. Introduction to Electrodynamics - David J. Griffiths, PHI Publication
3. Concepts of Modern Physics - Arthur Beiser.
4. Physics-I for engineering degree students - B.B. Swain and P.K.Jena.
5. Principle of Physics Vol. I & Vol. II by Md. M. Khan; S. Panigrahi (Cambridge Univ. Press).
6. Physics for Scientists and Engineers, Serway and Jewett,

**Digital Learning Resources**

Course Name	Foundation Engineering
Course Link	<a href="https://nptel.ac.in/courses/105/105/105105176/">https://nptel.ac.in/courses/105/105/105105176/</a>
Course Instructor	Prof. Koushik Deb, Department of Civil Engineering, IIT Kharagpur

NIST Autonomous

19FY1BS02T	Chemistry (3-0-0)	3 Credits
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**Course Objective:**

1. To understand the basics of quantum mechanical concepts and spectroscopy.
2. To predict the bulk properties and processes using thermodynamic considerations.
3. To understand the fundamental concepts on fuels and corrosion chemistry.
4. To know the Basic concepts of electro-chemistry

**Module I:**

[10 Hrs]

**Quantum Chemistry and Spectroscopy:** Introductory concepts of wave-mechanical model for atom, Electromagnetic radiation, dual nature of matter, Uncertainty principle. Operators in quantum mechanics, Postulates of quantum mechanics, Schrodinger Wave Equation, Particle in a box model (1D), Energy levels.

**Spectroscopy:** Introductory idea on rotational and vibrational Spectroscopy: Principle and applications to diatomic molecules. Beer's-Lambert Law: Principles and applications of UV-Visible Molecular Absorption Spectroscopy; Chromophores, Auxochrome, applications on quantitative analysis. Effect of conjugation on chromophores, solvent effect, Absorption by aromatic systems.

**Module II:**

[8 Hrs]

**The phase rule:** Introduction to free energy and Clausius Clapeyron equation. Statement of Gibb's phase rule(derivation not required) and explanation of the terms involved, Phase diagram of one component system - water and sulfur system, Condensed phase rule, Eutectic system, Phase diagram of two component system -Bi-Cd, and Fe-C system.

**Module III:**

[8 Hrs]

**Fuels:** Classification of fuels, calorific value. (Determination by Dulong's formula), G.C.V. and N.C.V., Solid fuels: Analysis of coal. Liquid fuels: Classification of petroleum, Refining of petroleum, Cracking (Mechanism not required), Knocking in IC engines, cetane and octane numbers. unleaded petrol, synthetic petrol, power alcohol. Gaseous Fuel: Producer gas, Water gas, LPG, CNG. Combustion calculation.

**Module IV:**

[8 Hrs]

**Electrochemistry:** Electrochemical cells, Electrode potentials, Reference electrode (Hydrogen, Calomel), EMF, Relation between EMF and Thermodynamic parameter, Nernst's Equation and it's applications: EMF, pH measurement (using Hydrogen and calomel electrode), Solubility product. Concentration cell, Lead storage cell, H<sub>2</sub>-O<sub>2</sub> Fuel cell.

**Module V:**

[6 Hrs]

**Corrosion:** Chemical and Electrochemical corrosion, galvanic series, Types of corrosion: Galvanic corrosion, Differential aeration corrosion (Pitting, Crevice water line corrosion), Stress corrosion (caustic embrittlement in boilers), Factors affecting corrosion, Corrosion control: metal coatings (Galvanizing and Tinning) Corrosion inhibitors, cathodic protection

**Course Outcome:**

1. Understand the basics of quantum mechanical concepts and spectroscopy.
2. Understand and analyze phase transition and know the conditions of different stable and metastable phase equilibria for both single and binary system.
3. Analyze the quantitative aspects of different kinds of fuel and their combustion and know the properties of different natural and synthetic fuels.
4. To know the basic principles electrochemistry and mechanism of corrosion

**Text Books:**

1. Wiley Engineering Chemistry, Willey publication
2. Jain and Jain, Engineering Chemistry, Dhanpat Rai Publication.

**Reference Books**

1. Banwell, Fundamentals of Molecular Spectroscopy, Tata McGraw Hill Education.
2. A.N. Acharya and B. Samantaray, Textbook on Applied Chemistry, Pearson
3. A. K. Chandra , Introductory to Quantum Chemistry, 4th Ed., Mcgraw Hill.
4. Puri, Sharma & Pathania, Principles of Physical Chemistry, Vishal Publishing Co.
5. B. L. Tembe, Kamaludddin and M. S. Krishan , Engineering Chemistry (NPTEL web-book).
6. Payal B. Joshi and Shashank Deep, Engineering Chemistry, Oxford University Press.

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Course Instructor	Prof. Koushik Deb, Department of Civil Engineering, IIT Kharagpur

19FY1BS03T	Mathematics-I (3-0-0)	3 Credits
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**Objectives:**

1. To familiarize the prospective engineers with techniques in Linear algebra, application of calculus, convergent and divergent of sequence and series and use of Fourier series.
2. To equip the students with standard concepts and tools at an intermediate to advanced level that will serve them well towards tackling more advanced level of mathematics and applications that they would find useful in their disciplines.

**Module-I: [8 Hrs]**

**Linear Algebra**

Basic concept of Matrix and its operation, Rank of Matrix, Inverse of matrices (by Gauss-Jordan Method). Solution of system of linear equations (by Gauss Elimination and Gauss -Jordan). Basic concept of Vector Spaces.

**Module-II: [8 Hrs]**

**Linear Algebra**

Eigen values and Eigen vectors of a Matrix with their properties. Symmetric, skew-symmetric and Orthogonal matrices. Complex matrices; Hermitian, skew Hermitian and Unitary matrices. Similar matrices, Diagonalization of Matrices.

**Module-III: [8 Hrs]**

**Beta & Gamma Function and Vector Calculus**

Beta & Gamma function. Scalar Field, Vector Field, Vector differential Operator, Gradient, divergent, Laplacian and Curl and properties, Directional derivatives.

**Module-IV: [8 Hrs]**

**Application of Differential Calculus**

Maximum, minimum and saddle points of one variable functions. Rolle's mean value, Lagrange mean value and Cauchy mean value theorems and its use Taylor's and Maclaurin Theorem. Power series for exponential, trigonometric and logarithm functions, curvature.

**Module-V: [10 Hrs]**

**Fourier Series and transform**

Fourier series, Fourier transform, Periodic function, Even and Odd function, Fourier series for arbitrary period. Half range series (Cosine series and sine series).

**Course Outcomes:**

On completion of this course, students are able to:

1. Apply the knowledge of matrix algebra for solving system of linear equations and compute the inverse of matrices.
2. To develop the essential tool of matrices to compute Eigen values and Eigen vectors required for matrix Diagonalization process.
3. Apply the knowledge of calculus, Gamma & Beta functions for analyzing engineering problems.
4. Obtain a power series of convergent functions with basic knowledge of convergent sequence and series.

5. Apply the knowledge of periodic function, Fourier series, cosine & sine series analyzing engineering problems.

**Text Books:**

1. Differential Calculus by Shanti Narayan and Mittal,
2. Advanced Engineering Mathematics by E. Kreyszig, Tenth Edition, Wiley.

**Reference Books:**

1. Higher Engineering Mathematics by B S Grewal, Khanna Publication
2. Higher Engineering Mathematics by B.V. Raman, Mc-Graw Hills Education
3. Text Book of Engineering Mathematics by Debashis Datta, NEW AGE International Publication.
4. Mathematical Methods of Science and Engineering, Cengage Publications.

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Course Instructor	Prof. Koushik Deb, Department of Civil Engineering, IIT Kharagpur

<b>19FY1ES01T</b>	<b>Basic Electrical Engineering (2-0-0)</b>	<b>2 Credits</b>
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**Course Objective:**

1. Understand the basics of the Electrical Engineering
2. Able to identify design and solve the engineering problems.
3. Acquire the knowledge and use the concepts in the practical field of Electrical Engineering , Research as well as in project

**Module I: [8 Hrs]**

**DC Circuits**

Circuit laws: Fundamentals of electrical circuit, Ohm's law, Kirchoff's laws, series and parallel connections, analysis of circuits using node voltage, mesh current, Superposition, Thevenin, Maximum power transfer theorem and Norton theorems to solve simple circuits with dc excitation, Star-Delta Conversion.

**DC transient analysis**

Analysis of DC transient circuits by consisting of RL & RC combinations, writing differential equations for circuits.

**Module II: [8 Hrs]**

**AC Circuits**

Single phase AC circuit: Single phase emf generation, representation of sinusoidal waveforms, average, effective, peak and rms values, j operator, impedance and admittance calculation, rectangular and polar representation of phasors.

**Power in AC Circuit**

Real power, reactive power, apparent power, power factor, analysis of single-phase ac circuits consisting of R, L, C, RL, RC, RLC combinations (series and parallel).

**Module III: [8 Hrs]**

**Three Phase Circuits**

Three phase circuit: Three phase emf generation, delta-star and star-delta conversions, and voltage and current relations in star and delta connections.

Three phase interconnections: Solution of the three phase circuits with balanced voltage and balanced load conditions, phasor diagram, measurement of power in three phase circuits.

**Module IV: [8 Hrs]**

**Magnetic Circuits**

Magnetic Circuits: MMF, flux, reluctance, inductance, review of Ampere Law, Biot Savart Law, magnetic field, B-H characteristics and hysteresis loss, series and parallel magnetic circuits.

**Module V: [6 Hrs]**

**Electrical Machines**

Transformers (Single Phase): Construction, operation, impedance reflection, phasor diagram, transformer on no-load & on load and performance testing.

DC machines: EMF Equation, torque equation, types of D.C. machine, methods of Excitation, speed control.

Induction Motors (Three Phase): Basic Principles, rotating magnetic field, torque-speed characteristics.

**Course Outcome:**

1. Analysis of Resistive Circuits and Solution of resistive circuits with independent sources.
2. Two Terminal Element Relationships for inductors and capacitors and analysis of the magnetic circuit.
3. Analysis of Single Phase & Three Phase AC Circuits, the representation of alternating quantities and determining the power in these circuits.
4. Analysis of construction, connection and testing of single-phase transformer.
5. Acquire knowledge about the constructional details and principle of operation of dc machines.
6. Acquire knowledge about the working of dc & AC machines as generators and motors.

**Text Books:**

1. Giorgio Rizzoni, “Principles and Applications of Electrical Engineering”, McGrawHill.
2. N. K. De, D. Sarkar, “Basic Electrical Engineering”, University Press.
3. Leonard S. Bobrow , “Foundations of Electrical Engineering”, Oxford University Press.

**Reference Books:**

1. Edward Hughes, “Electrical & Electronics Technology”, Pearson Education Limited.
2. D. C. Kulshreshtha, “Basic Electrical Engineering”, McGraw Hill, 2009.

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Course Instructor	Prof. Koushik Deb, Department of Civil Engineering, IIT Kharagpur

19FY1ES02T	Basic Electronics Engineering (2-0-0)	2 Credits
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**Course Objectives:**

1. Develop an understanding of the characteristics and operation of modern semiconductor devices and their applications.
2. Understand the basics of operational amplifier and its applications.
3. Acquire the knowledge of basic logic gates and analyze its application to different combinational logic circuits.

**Module I: [6 Hrs]**

Introduction to Semiconductors, Principle of operation of Junction Diodes, V-I characteristics of Junction Diode, Diode Current Equation, AC and DC Resistance of Diode, Equivalent circuit of Diode, Applications of Diode-Clipper and Rectifier circuits.

**Module II: [6 Hrs]**

Bipolar Junction Transistors (BJTs): Types and Basic Principle of Operation, Modes of Operation and Configurations, Common Emitter Characteristics, Requirement of Biasing, DC Biasing (Fixed bias and Voltage Divider), Load line Analysis, Basic characteristics of a voltage amplifier.

**Module III: [6 Hrs]**

Field Effect Transistors (FETs): JFET-types, Operations and their Characteristics; MOSFET-types, Operations and their Characteristics; Concept of transconductance  $g_m$  and channel resistance  $r_d$ , Current Equations in FETs.

**Module IV: [4 Hrs]**

Operational Amplifiers (OP-AMP): The Ideal OP-AMP, Common Mode Rejection ratio (CMRR), Inverting and Non-Inverting configurations as amplifiers.

**Module V: [5 Hrs]**

Digital Electronic Principles: Binary digits, Logic levels, Basic Logic Operations, Laws and Rules of Boolean algebra, Logic Gates - AND, OR, NOT, NAND, NOR, XOR and XNOR gate, De Morgan's theorem, Minterms and Maxterms, Standard forms of Boolean expressions, Universal properties of NAND and NOR gates, Function implementation using different Gates.

**Course Outcomes:**

1. Understand the basic characteristics of semiconductor materials, principle of operation of a p-n junction diode and its use in different circuit design.
2. Understand the construction, operation and characteristics of different types of transistors and learn to solve basic BJT DC circuits.
3. Analyze the basic operational amplifier circuits by understanding its characteristics and configuration details.  
Gain the knowledge of basic logic gates and its application in functional implementation using Boolean algebra.

**Text books:**

1. Electronic Devices Circuit Theory - by Robert L. Boylestad 11<sup>th</sup> Edition, Pearson Publication, 2014. (Modules 1, 2, 3 and 4)
2. Digital Design by M. Morris Mano, 5<sup>th</sup> Edition, Pearson Publication, 2016. (Module 5)

### Reference Books:

1. Adel S. Sedra and Kenneth C. Smith, Microelectronic circuits, 7<sup>th</sup> Edition, Oxford University Press
2. David A. Bell, Electronic Devices and Circuits by, 5<sup>th</sup> Edition, Oxford University Press
3. Thomas L. Floyd, Digital Fundamentals, 11<sup>th</sup> Edition, Pearson

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Course Instructor	Prof. Koushik Deb, Department of Civil Engineering, IIT Kharagpur

19FY1ES03T	Basic Mechanical Engineering(2-0-0)	2 Credits
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**Course Objective:**

1. To understand basic terminologies associated with thermodynamics
2. To understand basic working principle of power plant, IC engine, refrigerator, heat pump, and air compressor.
3. To study the measurement of the fluid characteristics.
4. To give complete knowledge about power transmission.
5. To accustom with various methods of mechanical measurement

**Module-I: [12 Hrs]**

Thermodynamics: Systems, Properties, Process, State, Cycle, Internal energy, Enthalpy, Zeroth Law, Properties of ideal gas., First law of Thermodynamics, and Second Law of Thermodynamics, Properties of pure substances. (Only introduction).

**Module-II: [7 Hrs]**

Application of Thermodynamics: Air compressors, Steam Power Plant, Refrigerators, Heat pump, I.C. Engines and heat exchangers (basics). (Brief description of different components of above mentioned systems and working principles with Schematic diagram only).

**Module-III: [8 Hrs]**

Introduction to Fluid Mechanics: Fluid properties, Pascal's law, Buoyancy and Archimedes principle, Bernoulli's theorem and its application, Hydraulic turbines and pumps.

**Module-IV: [8 Hrs]**

Engineering materials: Classification of engineering materials. Mechanical properties of Steel, Aluminium and Plastics; Production processes: Casting and forming (Drawing, Forging, Extrusion) (working principles with Schematic diagram only).

**Module-V: [8 Hrs]**

Power transmission devices: Belt, Rope, Gear drives. Coupling, clutch, brakes. (Basics, applications, advantages and limitations only); Mechanical Measurements: Temperature, pressure, velocity, flow, strain, force, torque measurements. (Working principle only).

**Course Outcome:**

1. Understand basics of thermodynamics, heat transfer, refrigeration and internal combustion engines, and components of a thermal power plant.
2. Solve the numeric related to Laws of thermodynamics and pure substances.
3. Understand basics and application of the fluid.
4. Identify engineering materials, their properties, manufacturing methods encountered in engineering practice.
5. Understand mechanism of power transfer through belt, rope, gear drives, coupling, clutch, brakes.
6. Understand functions and operations of the measurement devices.

**Reference Books:**

1. Pravin Kumar, Basic Mechanical Engineering, Pearson
2. Dr. Sadhu Singh, Basic Mechanical Engineering, S.Chand Publications

3. Basant Agrawal, Basic Mechanical Engineering, C M Agrawal, Willey
4. K. Mysamy, Jonathan Wicket, Basic Mechanical Engineering, Cenage publication
5. S T Murthy, Text book of Elements of Mechanical Engineering, Universities press
6. Basic and applied Thermodynamics by P. K. Nag, Tata McGraw Hill

**Digital Learning Resources**

Course Name	Basic Mechanical Engineering
Course Link	<a href="https://nptel.ac.in/downloads/112108148/">https://nptel.ac.in/downloads/112108148/</a>
Course Instructor	

NIST Autonomous

19FY1ES04T	<b>Basic Civil Engineering (2-0-0)</b>	<b>2 Credits</b>
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**Course Objective:**

1. To understand the properties of common building materials.
2. To learn functional planning of building
3. To Understand the concepts of stress and strain of structural members
4. To learn the various methods of surveying
5. To understand public water supply system

**Module-I:**

[8 Hrs]

Basics of Civil Engineering; Broad disciplines of Civil Engineering; Structural Engineering, Geotechnical Engineering, Water Resources Engineering, Transportation Engineering. Construction materials: Bricks: Qualities of a good brick, Classification of bricks. Types of cement and their uses, Various field and laboratory tests on cement, Ingredients of cement concrete, Grades of concrete, workability of concrete.

**Module-II:**

[6 Hrs]

Functional planning of building: General principles of site selection, site plan, principles of planning of buildings, open air spaces, floor area ratio, requirement of parts of buildings, lighting and ventilation, functional aspects various rooms, Building bye laws. orientation of building.

**Module-III**

[8 Hrs]

Structural mechanics: Stress, Strain, Hookes' Law, Stress-Strain diagram, Young's modulus , Bulk modulus, Shear modulus of rigidity, Poisson's ratio. Parallel forces in a plane- General case of parallel forces, Center of parallel forces in a plane

**Module-IV**

[8 Hrs]

Surveying: Linear measurement and chain survey: Use of chains and tapes for measurement of correct length of lines. Prismatic Compass; Bearing Systems and Conversions , Local Attraction.

**Module-V**

[6 Hrs]

Water resources engineering: Necessity and objectives of public water supply schemes; population growth and forecast –estimating the quantity of water required.

**Course Outcomes:**

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

1. Compare the properties of building materials.
2. Planning and design of building
3. Understand the concepts of stress and strain of structural members
4. use of various surveying instruments and mapping
5. estimate the quantity of water required for a project

**Text Books:**

1. Basic Civil Engineering and Engg mechanics, S.Ramamurtham Dhanpatrai pub.
2. M.S. Palanichamy, Basic Civil Engineering, McGraw Hill

**Reference Books:**

1. S.S.Bhavikatti, Basic Civil Engineering, New age international
2. S. Gopi, Basic Civil Engineering, Pearson

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Course Instructor	Prof. Koushik Deb, Department of Civil Engineering, IIT Kharagpur

19FY1HS01T	English (1-0-0)	2 Credits
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**Course Objective:**

1. To learn communication technologies to communicate effectively by developing exceptional textual, visual and non-verbal communication abilities.
2. To draft effective formal written business messages in various formats and styles.
3. To learn the skills to effectively deliver formal oral presentations to a variety of audiences in multiple contexts.
4. To be acquainted with the soft skills and various selection procedures adopted by the recruiters.

**Module-I:**

[8 Hrs]

**Basics of Communication Skills**

Significance of communication, The process and factors of communication (the communication loop), Difference between General and Technical Communication, Verbal communication and its principles, Non-verbal communication, Paralinguistics, The importance of audience & purpose.

**Module-II:**

[10 Hrs]

**Basics of English Pronunciation & Soft Skills**

Introduction to English pronunciation with the IPA chart, Received Pronunciation, problems of Indian English, Professional presentations, Group Discussion, Interview etiquette, Leadership skills

**Module-III:**

[6 Hrs]

**Brush up Your Grammar & Vocabulary**

Parts of speech & Tense, Voice Change, Direct and Indirect Speech, Concord, Parallelism, Word formation- root words, synonyms, antonyms, homonyms & homophones, Common errors in English Grammar

**(N.B. – Instead of teaching, this unit should be taught by assigning activities to the students in the class)**

**Module-IV:**

[6 Hrs]

**Basics of Reading and Writing Skills**

Reading Skill: Types of reading, Sub-skills of reading: Skimming, Scanning, Reading comprehension, Writing Skill: Steps to writing, Describing, Defining, Classifying and Providing examples or evidence, Empathetic and Result Oriented Writing.

**Module-V:**

[10 Hrs]

**Professional Writing:**

Paragraph, Letter, Memos & Circulars, Reports, Proposals, e-mails & CV

**Course Outcome:**

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

1. Become adept in their use of the spoken word in interpersonal communication, small group interaction and public speaking.
2. Use an appropriate style and format to write letters (formal and informal), prepare result oriented reports, prepare CVs and draft business documents.

- Gather and prepare information and apply it to persuade or articulate one's own point of view clearly and efficiently.
- Evaluate the employability market, identify the organizations to get good placements and broaden career plans by developing all-round personality.

**Text Books:**

- Communication Skills by Sanjay Kumar and Pushp Lata, Oxford University Press
- Technical Communication, Principle and Practice by Meenakshi Raman & Sangeeta Sharma, Oxford University Press
- Effective Technical Communication, M Ashraf Rizvi, Tata Mc Graw - Hill.
- Business Communication, Meenakshi Raman & Prakash Singh, Oxford
- Communication for Management, Urmila Rai and S M Rai, HPH
- Business and Managerial Communication, Sengupta, PHI
- Business Communication for Managers, P. Mehra, Pearson
- Soft Skills K Alex, S Chand

**References Readings:**

- Manual of English Grammar and Composition. J.C. Nesfield Forgotten Books
- Practical English Usage. Michael Swan. OUP.
- Exercises in Spoken English. Parts. I-III. CIEFL, Hyderabad. Oxford University Press
- A Course in English phonetics by T.R.KANSAKAR , ORIENT LONGMEN Press.
- A Communicative Grammar of English ,Leech, Geoffrey & Jan Svartvik , Longman

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Course Instructor	Prof. Koushik Deb, Department of Civil Engineering, IIT Kharagpur

19FY1BS01L	Physics Lab (0-0-2)	1 Credit
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A student is expected to perform ten experiments form the list given below.

1. Determination of Young's modulus by Searle's method.
2. Determination of Young's modulus by bending of beams.
3. Determination of Rigidity modulus by static method.
4. Determination of surface tension by capillary rise method.
5. Determination of acceleration due to gravity by Bar pendulum.
6. Verification of laws of vibration of string using sonometer.
7. Determination of wave length of light by Newton's ring apparatus.
8. Determination of wavelength of laser source by diffraction rating method.
9. Determination of grating element of a diffraction grating.
10. Plotting of characteristic curve of a PN junction diode.
11. Plotting of characteristic curves of BJT.
12. Study of Hall Effect.
13. Study of RC circuit.
14. Determination of unknown resistance using Meter Bridge.
15. Energy gap determination by Four-Probe method.

**Text Books:**

1. Engineering Practical Physics, by S. Panigrahi and B. Mallick, (CENGAGE learning)

19FY1BS02L	Chemistry Lab (0-0-2)	1 Credit
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**Course Objective:**

1. To understand the water quality parameter
2. Quantitative analysis of some standard compound
3. Instrumental methods for quantitative analysis

**Experiments (for all branches):**

1. Determination molecular weight of polymer by viscosity method.
2. Determination of partition coefficients of iodine between Toluene and water.
3. Determination of rate constant of acid catalyzed hydrolysis reaction.
4. Determination of dissolved oxygen in a sample of water.
5. Determination of Viscosity of a supplied sample(s) by Ostwald's Viscometer.
6. Determination of Flash point of given oil by Pensky-Marten's flash point approach.
7. Determination of critical solution temperature of Phenol-Water system.
8. Determination of Calorific value of a fuel using Bomb calorimeter.
9. Determination of percentage of available chlorine in a sample of bleaching powder.
10. Acid-Base Titration using pH meter
11. Estimation of acid mixture using Conductance Bridge.
12. Determination of total hardness of water by EDTA method.
13. Determination of amount of sodium hydroxide and sodium carbonate in a mixture.
14. Kinetic study of ester hydrolysis.
15. Determination of surface tension of given sample using Stalagnometer

**Course Outcome:**

1. Analyze the water quality parameter including dissolved oxygen, Hardness, and chlorine content.
2. Analyze qualitatively different compounds using analytical equipments like, pH meter, Conductivity meter, Colorimeter etc.
3. Qualitative analysis of liquid sample through viscosity and surface tension measurement

**Text Books:**

1. Laboratory manual on Engineering Chemistry, S.K. Bhasin, Sudha Rani, Dhanpat Rai Publishing company.
2. Experiments in Applied Chemistry By Dr. Sunita Ratan, S.K. Kataria and sons.

19FY1ES01L	Basic Electrical Engineering Lab(0-0-2)	1 Credit
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**Course Objective:**

1. To enhance understanding of electrical engineering circuit analysis concepts including: Thevenin's theorem, Norton's theorem, Superposition Theorem
2. To get the knowledge of phasor representation, power and power factor measurement of electrical circuit
3. To know the concept of B-H Curve of the magnetic materials and to know the functionality of the transformer with their losses by conducting suitable tests on it.
4. To Apply knowledge of DC generators and motors in various applications and able to know the uses of starter

**List of Experiments:**

1. V-I Characteristics of Incandescent (Filament) Lamp
2. Voltage and Power measurement of a Fluorescent Lamp
3. Verification of DC Network Theorems (Superposition, Thevenin's & Norton's Theorem)
4. Calculation of current, voltage and power in series R-L-C circuit excited by single phase AC supply and calculation of power factor
5. Measurement of power and power factor in a three phase AC circuit by using Two-Wattmeter method
6. Connection and testing of a Single Phase Energy Meter
7. O.C & S.C Test on Single phase Transformer
8. Starting and Speed Control of a D.C. Shunt Motor
9. Study of B-H curve by using by using CRO
10. House Wiring

**Course Outcome:**

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

1. Determination of DC network analysis with the use of theorems and their applicability for the practical application.
2. Know the fundamentals magnetic field theory, able to apply the laws of magnetic field for the transformer and also determination of its losses by conducting suitable tests
3. Understand the concept of Phasor representation and Power factor measurement of AC circuit
4. Analyze the performance of D.C machines and it various practical applications.

19FY1ES02L	Basic Electronics Engineering Lab(0-0-2)	1 Credit
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**Course Objective:**

1. Understand the measurement techniques using basic measuring instruments.
2. Expose to characteristics and testing of various electronics components.
3. Assemble and test different circuits using diode and op-amps.
4. Verify the truth table of basic logic gates.

**Any ten Experiments out of 12 should be performed**

1. Study of digital multi-meters, CROs and function generators.
2. Familiarization and testing of different electronic components (Active & Passive).
3. Study of the V-I characteristics of P-N junction diode and calculation of DC & AC resistance.
4. Construction of half-wave rectifier with & without capacitive Filter and verify the output waveforms using CRO and calculation of efficiency and ripple factor.
5. Constructions of full wave rectifier circuits with & without capacitive Filter and verify the output waveforms using CRO and calculation of efficiency and ripple factor.
6. Design a Zener based voltage regulator to verify the load regulation.
7. Construction of positive and negative clipper circuits and study of their output waveforms by CRO.
8. Study of both input and output V-I characteristics of a Common Emitter configuration.
9. Study of output V-I characteristics of an n-channel JFET and define the pinch off voltage from it.
10. Design of inverting and non-inverting amplifiers using Op-Amp and compare the theoretical and practical gain values.
11. Truth table verification of logic gates.

Verification of universal properties of NAND and NOR gates.

**Course Outcome:**

1. Identify and test basic electronics components using test and measuring instruments.
2. Design, assemble and test of diode characteristics and its application in circuits.
3. Design and testing of op-amp based configurations.
4. Familiarization and testing of basic logic gates.

19FY1ES03L	Basic Mechanical Engineering Lab(0-0-2)	1 Credit
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**List of Experiments:**

1. Model study of Fire Tube Boilers and Water Tube Boilers.
2. Model study of Two stroke I.C. Engine.
3. Model study of Four stroke I.C. Engine.
4. Model study of Refrigerator
5. Model study of Water Turbines.
6. Model study of Water pumps.
7. Study of Gears and Gear trains.
8. Verification of Bernoulli's Theorem and its application to Venturimeter.
9. Calibration of Bourdon Tube Pressure gauge and measurement of pressure using manometers.
10. Model study of Automobile Parts.
11. Determination of velocity ratio of belt drive.

19FY1ES04L	Basic Civil Engineering Lab(0-0-2)	1 Credit
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**List of Experiments:**

1. Shape, size and compressive strength test of brick
2. Consistency Test of Cement
3. Setting time of cement
4. Workability test of concrete: Slump test
5. Line plan of a two BHK building in a plot.
6. Plan, section and elevation of a building.
7. Cube test of concrete (nominal mix)
8. Experiment on calculation of support Reactions of a simply supported beam.
9. Experiment on calculation of support Reactions of a overhanging beam.
10. Chain traversing through obstacles

19FY1ES05L	Engineering Graphics & Design (0-0-2)	1 Credit
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**Module- I:** **[6 Hrs]**  
 Importance of graphics in engineering applications - Use of drafting instruments. BIS conventions and specifications. Size, layout and folding of drawing sheets - Lettering and dimensioning; Construction of ellipse, parabola and hyperbola by eccentricity method - Construction of cycloid - construction of involutes of square and circle. Drawing of tangents and normal to the above curves.

**Module- II: Orthographic Projections** **[8 Hrs]**  
 Introduction, Definitions - Planes of projection, reference line and conventions employed, Projections of points in all the four quadrants, Projections of straight lines (located in First quadrant/first angle only), True and apparent lengths, True and apparent inclinations to reference planes 2 - Sheets

**Module- III:** **[8 Hrs]**  
**Orthographic Projections of Plane Surfaces (First Angle Projection Only)**

Introduction, Definitions-projections of plane surfaces-triangle, square, rectangle, rhombus, pentagon, hexagon and circle, planes in different positions by change of position method only 1-Sheet

**Module- IV:** **[10 Hrs]**  
**Projections of Solids (First Angle Projection Only)**

Introduction, Definitions - Projections of right regular tetrahedron, hexahedron (cube), prisms, pyramids, cylinders and cones in different positions. 2-Sheets

**Sections and Development of Lateral Surfaces of Solids**

Introduction, Section planes, Sections, Section views, Sectional views, Apparent shapes and True shapes of Sections of right regular prisms, pyramids, cylinders and cones resting with base on HP. 2 - Sheet

**Module- V: Isometric Projection (Using Isometric Scale Only)** **[8 Hrs]**

Introduction, Isometric scale, Isometric projection of simple plane figures, Isometric projection of tetrahedron, hexahedron(cube), right regular prisms, pyramids, cylinders, cones, spheres, cut spheres. 2-Sheets

**Text Books:**

1. Engineering Drawing - N.D. Bhatt & V.M. Panchal, Charotar Publishing House, Gujarat.
2. Computer Aided Engineering Drawing - S. Trymbaka Murthy, -I.K. International Publishing House Pvt. Ltd., New Delhi.
3. Engineering Drawing by N.S.Parthasarathy and Vela Murali Oxford University Press.
4. Engineering Graphics - K.R. Gopalakrishna, Subash Publishers Bangalore.
5. Fundamentals of Engineering Drawing with an Introduction to Interactive Computer Graphics for Design and Production-Luzadder Warren J., Duff John M., Eastern Economy Edition, Prentice-Hall of India Pvt. Ltd., New Delhi.

19FY1ES06L	Workshop (0-0-2)	1 Credit
Topic		Hour
<b>Safety: Workplace safety:</b> Safety rules for workplace organization. Survival techniques and evacuation procedure in case of hazard at workplace.		1
<b>Personal safety:</b> Personal protection equipment, safe workplace behaviour; First aid techniques: General first aid, resuscitation.		2
<b>Tooling:</b> Introduction to different tools used in engineering fabrication; Tool organization: Tool board, tool box.		3
<b>Fitting practice (Any one experiment):</b> 1. Preparing a male and female joint; 2. Making a hexagonal paper weight. (Material: MS);		6
<b>Joining practice:</b> Gas welding, electric arc welding, Gas brazing Prepare any two: 1. Lap joint 2. Butt joint 3. T-joint using appropriate joining technique		6
<b>Carpentry:</b> Engineering description of wood: composition, type, texture, grains. Any one experiment- Male female T-joint (or) Male female elbow joint.		3
<b>Plumbing practice:</b> Plumbing elements (Demonstration), Threading and assembly, Introduction to PVC fittings, quick joining (Demonstration), Leakage prevention with cementing components (Demonstration).		3
<b>Machining practice:</b> All experiments - Stepped cylindrical turning from a bar stock using 3-jaw chuck; Making rectangular and trapezoidal slots using shaping operation; Gear cutting using milling machine; Cutting rectangular slot using dremel;		12

19FY1HS01L	English Lab (0-0-4)	2 Credits
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**(This unit involves interactive practice sessions in Language Lab)**

1. Listening Comprehension
2. Pronunciation, Intonation
3. Stress and Rhythm practice
4. Common Everyday Situations: Conversations and Dialogues
5. Formal Presentations
6. Reading Comprehension
7. Report writing
8. Writing letters, e-mails,
9. Writing essay, CV
10. Statement of Purpose
11. Grammar activities
12. Empathetic Listening