1ST YEAR 2ND TERM

Sl. No.	Course No.	Course Title	Theory		Sessional		Total Credit
			Contact Hours	Credit	Contact Hours	Credit	
01	Ch 1213	Chemistry II	3	3.00	-	-	3.00
02	EE 1213	Electrical Circuits and Electronics	4	4.00	-	-	4.00
03	EE 1214	Sessional on EE 1213	-	-	3/2	0.75	0.75
04	Hum 1213	Technical English	3	3.00	-	-	3.00
05	Hum 1214	Sessional on Hum 1213	-	-	3/2	0.75	0.75
06	Math 1213	Differential Equation and Co-ordinate Geometry	3	3.00	-	-	3.00
07	ESE 1205	Thermodynamics for Energy Engineering	4	4.00	-	-	4.00
08	ESE 1206	Sessional on ESE 1205	-	-	3/2	0.75	0.75
09	ESE 1200	Engineering Drawing II	-	-	3	1.50	1.50

No. of Theory Courses: 5 Total Contact hours: T17 + S7.5 = 24.5 hrs

No. of Sessional Courses: 4 Total Credit:20.75

Ch 1213 Chemistry II

Credit: 3.0 Contact hour: 3 hrs/week

Chemical Kinetics: Order and molecularity of reaction, rate equations, for zero, first, second and third order reaction. Theories of reaction rates. reaction in solutions, kinetic model for non-elementary reactions.

Photochemistry: Photon, law of photo chemistry, absorption law and mechanism of photochemical reaction, fluorescence, phosphorescence and chemiluminescence.

Organic chemistry: Hybridization of orbitals, electrophiles, nucleophiles and free radicles, isomerism, geometrical and optical isomers, polymerization, introduction to biochemical engineering and concept of biological catalysis, nature of microorganisms, their requirements and classification, industrially important microorganisms. Kinetics of enzyme catalyzed reactions. Batch fermentation: yield coefficients for biomass and product formation, rates of reaction, growth, limiting substrate concentrations.

Corrosion: Introduction to corrosion, chemical corrosion, electrochemical corrosion of metals, corrosion rates, types of corrosion with properties and phenomenon, Factor affecting corrosion, corrosion in contact to soil, prevention of corrosion.

Adsorption and Catalysis: Adsorption, types of adsorption, Adsorption isotherms; Fruendlich, Langmuir, and BET isotherms, Catalysis.

Spectroscopy: Basic concept of Spectroscopy, Electronic, vibrational and rotational spectroscopy.

EE 1213 Electrical Circuits and Electronics

Credit: 4.00 Contact hour: 4 hrs/week

Electrical Circuits

Introduction: Voltage, current, power, energy, independent and dependent sources, resistance. Basic laws: Ohm's law, Kirchhoff's current and voltage laws, Joule's law. Simple resistive circuits: Series and parallel circuits, voltage and current division, Wye-Delta transformation.

Techniques of circuit analysis: Nodal and mesh analysis. Network theorems: Source transformation, Thevenin's and superposition theorems with applications in circuits having independent and dependent sources, Maximum power transfer.

Energy storage elements: Inductors and capacitors, series & parallel combination of inductors and capacitors.

Alternating Current circuits: Instantaneous, average and R.M.S values, complex impedance and phasor algebra. Real, reactive and apparent power, power factor. Series and parallel RL, RC and RLC circuits. Series and parallel resonance, energy analysis at resonance.

Electronics

Semiconductors: Intrinsic Semiconductors: Crystal and energy band diagram, conduction in semiconductors, Electron and hole concentration. Extrinsic semiconductors: n-type doping, p-type doping, and compensation doping. Drift and diffusion current, Mobility and Conductivity. The potential barrier; work function; contact potential.

Semiconductor diode characteristics: Qualitative and Quantitative theory of the p-n junction as a diode; Ideal pn junction, pn junction band diagram, current components in p-n diode; Volt-ampere characteristics; Reverse breakdown; Avalanche and Zener breakdown; Zener diode, Special-Purpose Diodes: Schottky diode, Current regulator diode.

Introduction to Logic and Digital Circuits: Logic operations, Basic gates; OR, AND, NOT, NAND, NOR, X-OR; Flip-Flops; Shift registers; Counter; Binary and BCD code, Comparators.

EE 1214 **Sessional on EE 1213**

Credit: 0.75 **Contact hour: 3/2 hrs/week**

Experiments based on the theory of EE 1213.

Hum 1213 **Technical English**

Credit: 3.00 **Contact hour: 3 hrs/week**

Vocabulary and Structure: Better reading skills, better writing skills, better speaking skills, word formation; roots, prefixes, suffixes, phrases and idioms; synonyms and antonyms; simple structures, complex and compound structure; Clauses, Identification and analysis of clauses, Notional language, Grammatical problems.

Comprehension and Composition: Paragraph writing technique, formal and informal report writing, commercial correspondence; Memo, Letter; Application writing; Tender writing; Free composition writing; Précis writing; Term paper and Thesis/project report writing technique.

Hum 1214 **Sessional on Hum 1213**

Credit: 0.75 **Contact hour: 3/2 hrs/week**

Practical learning based on Hum 1213.

Math 1213 **Differential Equation and Co-ordinate Geometry**

Credit: 3.00 **Contact hour: 3 hrs/week**

Differential Equations

First-order ODEs: Introduction, Definition of differential equation, Classification based on type, order and linearity; General solution, initial and boundary value problem; Solution methods for Fist-order differential equations: Separable differential equations, Linear differential equations; Solution using integrating factors; Exact differential equations; Homogeneous differential equations; Modeling using first-order equations: Electric circuits, Newton's law of cooling, Radioactive decay.

Second-order ODEs: Solutions of linear homogeneous equations with constant coefficients; Solution of linear non-homogeneous equations by various methods (general method, method of variation of parameters, and short method); Modeling using second-order equations: Free oscillation, Forced oscillations, RLC-circuits.

Laplace Analysis: Definition and existence condition of Laplace transform. Properties of Laplace transform; Transform of elementary functions; Inverse Laplace transform and its properties; Convolution; Solution of ordinary and Laplace transform.

Co-ordinate Geometry

Two-dimensional geometry: Review of Cartesian and Polar co-ordinate systems, Transformation of co-ordinates: translation and rotation; General Equation of second degree; Identification of conics with their properties.

Vector geometry: Study of Cartesian, Cylindrical polar and Spherical polar coordinate systems, their mutual conversion; Review of vector algebra, dot product, cross product; Distance between two points; Equation of line in three-dimensions using vectors, symmetrical form of a straight line, equation of plane using vectors; Angle between line and plane, shortest distance between two lines, perpendicular distance of a point from a plane, angle between two planes.

Reference Books:

1. Advanced Engineering Mathematics by Erwin Kreyszig
2. Advanced Modern Engineering Mathematics – by Glyn James
3.Thomas' Calculus – by George B. Thomas, Maurice D. Weir, Joel Hass, and Frank R. Giordano

ESE 1205 **Thermodynamics for Energy Engineering**

Credit: 4.0 **Contact hour: 4 hrs/week**

Introduction and Basics: Macroscopic and microscopic viewpoints of thermodynamics; Definition of thermodynamic terms; Thermodynamic system; Heat and work and their path dependence; Pure substance and phase, property and phase diagrams, p-V-T surface; Ideal gas, its equation of state, law of corresponding states.

Laws of thermodynamics: Zeroth law; First law and its mathematical forms, its application in closed and open system for different processes; Second law and its mathematical forms, heat engine and Carnot's principles, Clausius inequality, application of second law in closed and open systems.

Exergy Analysis: Definition and basic concepts of exergy, specific exergy; Exergy analysis of closed systems; Exergy analysis of open systems; Exergetic (second law) efficiency.

Thermodynamic Relations: Virial, Van Der Waals, Redlich-Kwong (RK), and Soave-Redlich-Kwong (SRK) equation of state; Exact differentials and their properties, Maxwell relations; Volume expansivety, isothermal compressibility, isentropic compressibility, velocity of sound, Joule-Thomson coefficient.

Thermodynamic Cycles Analysis: Carnot cycle; Rankine cycle, improving performance by superheat and reheat; Regenerative cycle; Air-standard Otto, Diesel cycle, Dual cycle, and Brayton cycle; Vapor compressional refrigeration cycle; Absorption refrigeration cycle.

Mixture of Gases and Vapors: Mixture of ideal gases, gravimetric and volumetric analysis; Dalton's law of partial pressure, volume and enthalpy of gaseous mixture; Isentropic process with gaseous mixtures; Adiabatic saturation process; Psychrometry: dry and wet bulb temperatures, specific humidity, relative humidity, dew point temperature, degree of saturation; Psychometric chart and its uses.

Reference Books:

1. Fundamentals of Engineering Thermodynamics – by Michael J. Moran, Howard N. Shapiro, Daisie D. Boettner, and Margaret B. Bailey
2. Thermodynamics an Engineering Approach – by Yunus A. Cengel and Michael A. Boles
3. Thermodynamics – by Gregory Nellis and Sanford Klein
4. Basic and Applied Thermodynamics – by P.K. Nag

ESE 1206 **Sessional on ESE 1205**

Credit: 0.75 **Contact hours: 3/2 hrs/week**

Experiments based on the theory of ESE 1205.

ESE 1200 **Engineering Drawing II**

Credit: 1.50 **Contact hour: 3 hrs/week**

Working Drawing of machine elements with sectional views, Sub-assembly and assembly drawing; Pipes and pipe fittings; Electrical circuit diagrams. These will be implemented using CAD Software.