

### First Semester

First Semester					Second Semester				
No	subject	the hours		units	No	subject	the hours		units
		theoretical	Practical				Practical	Practical	
1	Thermodynamics I	2	2	3	1	Thermodynamics II	2	2	3
2	Modern Physics I	2	2	3	2	Modern Physics II	2	2	3
3	Analytical Mechanics I	2		2	3	Analytical Mechanics II	2		2
4	Mathematics III	2		2	4	Mathematics IV	2		2
5	Analog Electronics	2	2	3	5	Digital Electronics	2	2	3
6	Numerical Analysis	3		3	6	Physical Chemistry II	3		3
7	Physical Chemistry I	3		3	7	English	2		2
8	English	2		2	8				
Total		18	6	21	Total		15	6	18
Total hour at week		24			Total hour at week		21		
Total number of units for the first year= 21+18= 39									

#### ● Thermodynamics I

Basic concepts and definitions, The nature of thermodynamics, Thermodynamics system, surrounding, boundaries, Pressure and the continuum, The equation of state of ideal gas, Temperature and zeroth law, Thermometers, Heat and work, First law of thermodynamics, second law of thermodynamics and its applications, Entropy, Equations of state and general thermodynamics relation, Maxwell equations.

#### ● Modern Physics I

Relativity, The Principle of Relativity, Inertial System of coordinates, Galilean transformation, Einstein's special theory of Relativity, Lorentz transformation, Inverse Lorentz transformation,

Length contractions, Time dilation, Transformation of Velocity, Change of mass with Velocity, Mass energy equivalence, Atomic view of electricity, Electrical discharges, Thomson's measurements of  $q/m$ , Electron charge, Mass of the electron, Mass spectroscopy, The Atomic view of radiation, Waves or particles, Electricity and light, Electrodynamics, Thermal radiation, Emission and absorption of radiation, Black body radiation, Wien and Rayleigh-Jeans law's, Planck's law (emission quantized), Stefan – Boltzmann law and Wien displacement law, Photoelectric effect.

### ●Analytical Mechanics I

vector calculus and kinematics of a particle, Derivative of a vector, Position vector of a Particle, Velocity Vector, Acceleration Vector, Vector Integration, Relative Velocity, dynamics of a particle rectilinear motion, Newton's laws of motion, Newton's First Law. Inertial Reference Systems, Mass and Force. Newton's Second and Third Laws, Linear Momentum, Motion of a Particle, Rectilinear Motion, The Force as a Function of Position Only. The concepts of Kinetic and Potential Energy, dynamics of a particle general motion, The Work Principle, Conservation Force and Force Fields, Potential Energy Function, Condition for the Existence of a Potential Function. The Del Operator, moving reference system, central forces and celestial mechanics, dynamics of a system of particles.

### ●Mathematics III

The logarithm, exponential, inverse, trigonometric and hyperbolic functions (Transcendental Functions), With derivative, With integration, Techniques and applications of integrations, Integrations by parts, Integration of rational functions by partial functions, Trigonometric integrals, Numerical integrations, Conic sections and polar coordinates, Conic sections and quadratic equations, Classifying conic sections by eccentricity, Quadratic equations and rotations, Polar coordinates, Areas and lengths in polar coordinates, Conic section in polar coordinates, Examples and applications, Homework + Tutorial+ Quiz.

### ●Analog Electronics

Diodes and Applications, Introduction to semiconductors– intrinsic and extrinsic (p-type, n-type), Diode (pn-junction): construction, biasing (forward and reverse biasing), characteristic curve, Application of diodes: rectification (half wave and full wave, rectification), Voltage doubler, clipper and clamper, logic gates, Power supply, Other types of diodes: Zener diode, LED, Photo diode,. Amplification, Definition of amplification, Elements of amplification, Transistor: construction and circuits, Common emitter circuit.

Characteristic curves, hybrid parameters, load line analysis, biasing, Circuits and thermal stability, Voltage divider self-biased common emitter amplifier, Common collector circuit, Common base circuit, The transistor as a switch.

Enhancement type (E-MOSFET), Construction and creating the inversion layer, Amplifiers, Classes of amplifiers (class A, class B ,class AB ,class C), Calculations of power efficiency, Class B push-pull amplifier, Tuned amplifier, Concept of feedback(positive and negative, Configurations of negative feedback and the effect of each on the amplifier characteristics.

#### ●Numerical Analysis

Introduction to numerical analysis, Types of Errors, Round off Errors, Truncations Errors, Initial Errors, Solution of non –linear equations, Bisection method , False position method , Iteration method, Newton – Raphson method, Solution of Differential equations, Explicit Euler's Differential equation, Modified Euler's Differential equation, Runge – Kutta method, Numerical Integration, Rectangular method, Trapezium method , Simpson's method, Least squares and curve fitting, Interpolation Extrapolation and Forward differences, Backward differences, Inverse Interpolation.

#### ●Physical Chemistry I

Historical of Elements, Introduction, Discovery of elements, Periodic table, Some physical properties of element, Atomic and Molecular Structure, The Electron, The atomic theories of Thomson and Rutherford, The wave nature of light, The Bohr atom, One electron spectra, Many electron atoms, Quantum number, Theory of chemical bonding, Electron spin, The Pauli exclusion principle, Electronic structure, Relation of electronic structure to the chemistry of the elements, The beginning of bonding theory, Type of chemical bond, Primary bondic, Ionic bond, Covalent bond, Metallic bond, Secondary bonding, Hydrogen bonding, The nature of the bonding in chemical compounds, Bonding in photonuclear diatomic molecules, Heteronuclear bond and the ionic character of bond, Electro negativities, Direct valence, Pi and sigma bond, Hybridization, S,Pand d orbital, Octate rule, Break down of octate rule, The colligative properties,

### Second Semester

#### ●Thermodynamics II

Systems and Surroundings, State Variables and Thermodynamic Properties, Intensive and Extensive Variables , Homogeneous and Heterogeneous Systems, Phases, Reversible and Quasi-Static Processes, Quasi-Static Process Reversible Process, Adiabatic and Diathermal Walls, Thermal Contact and Thermal Equilibrium, Concept of Temperature and He, Concept of Temperature, Thermal Equilibrium, The Zeroth Law of Temperature, Scale of Temperature, Specification of Fixed Points, Factors for Changes in Fixed Points, The Temperature Scales, Specification of Interpolation, Definition of Temperature on Celsius Scale, Definition of Temperature on Fahrenheit, Thermodynamic Scale, Thermometric Properties, Types of Thermometer, Liquid-in-Glass Thermometers, Constant Volume Gas Thermometers, latinum

Resistance Thermometers, Thermo-Electric Thermometers, Concept of Heat, Heat Capacity, Specific Heat Capacity, Simple method of Mixtures, Inclusion of calorimeter in Method of Mixtures.

### ●Modern Physics II

The Atomic models of Rutherford and Bohr, Introduction, The Rutherford model of the atom, Spectrum of hydrogen gas, Bohr model of theory of atoms, Energy levels of hydrogen atom, Binding energy, Ionization Potentials of hydrogen atom, Many electron atoms, Quantum Numbers, Pauli Exclusion principle, Electron shells & chemical Activity, Structure of solids, Atomic bonding, Ionic bonding, Covalent bonding, Metallic bonding, Vander wall's bonding, Unit cell, Miller indices, Crystal structure, Lattice planes and direction, Atomic packing, X-rays, Discovery, Production of x-rays, The Nature of x-rays, X-rays diffraction, Mechanism of x-ray production, X-ray energy levels, X-ray spectra of the elements Atomic number, Compton scattering.

### ●Analytical Mechanics II

mechanics of rigid bodies. motion in a plan, center of mass of a rigid body, static equilibrium of a rigid body, calculation of the moment of inertia, the physical pendulum, a general theorem concerning angular momentum, laminar motion of a rigid body, body rolling down an inclined plane, motion of a rigid body under an impulsive force, collision of rigid bodies, general motion of a rigid body, angular momentum of a rigid body. products of inertia, principal axes of a rigid body, 2-2 rotational kinetic energy, moment of inertia of a rigid body about an arbitrary axis, the momental ellipsoid, the momental ellipsoid, euler's equation of motion of rigid body, free rotation of a rigid body under no forces, geometric description of the motion, free rotation of a rigid body with an axis of symmetry. analytical treatment, gyroscopic precession. motion of atop, use of matrices in rigid body, dynamics. inertia tensor, lagrange's equations, 1-3 generalized coordinates, generalized forces, lagrange's equations, some application of lagrange's equations, generalized momenta, ignorable coordinates, lagrange's equations for impulsive forces, hamilton's vibrational principle, the hamiltonian function, hamilton's equation, lagrange's equation of motion with constraints, theory of vibrations, potential energy and equilibrium. expansion of the potential – energy function in a power series, oscillation of a system with one degree of freedom, two coupled harmonic oscillators, normal coordinates, general theory of vibrating systems, vibration of a loaded string, vibration of a continuous system. the wave equation, sinusoidal waves, the special theory relativity, the michelson – morley experiment, einstein's postulates of special relativity, the lorentz transformation, consequences of the lorentz transformation, length contraction and time dilation, space – time, space travel and twin paradox, relativistic particle dynamics, the variation of mass with velocity, the mass – energy relation, the use of matrices and four – vectors in relativity.

- **Mathematics IV**

Infinite sequences and series, Infinite series, Integral ,comparison , ratio and root tests, Power series , Taylor and Maclaurin Series , Fourier series , Vectors and the geometry of the space , Three- dimensional space coordinates systems , Vectors, The dot and cross product, Lines and planes in space, Cylinders and quadratic surfaces, Applications and examples, Homework + Tutorial +Quiz, Partial derivatives, Functions of several variables, Limits and continuity, Partial derivatives, Chain rule, Directional derivatives and gradients vectors , Extreme values and saddle points, Lagrange multipliers, Taylor formula for two variables.

- **Digital Electronics**

Logic gates, Decision making elements, NOT, OR, AND, NOR, NAND, XOR, XNOR –Gates, Combinational logic circuit, Simple logic circuits, Universality of the NAND–gate, Universality of the NOR–gate, Numbering systems, Decimal numbers, Binary numbers, Binary addition, Binary subtraction (1's and 2's complements methods), Binary multiplication, Binary division, Octal numbering system, Hexadecimal numbering system, Conversion between the systems, Digital codes, Binary coded decimal code (BCD code), Boolean algebra, Laws of Boolean algebra, Rules of Boolean algebra, Arithmetic logic circuits, Logic gates: memory elements (flip–flops),Simplifying logic equations, Registers, Counters, Decoders and Encoders

- **Physical Chemistry II**

The matter, gas phase, liquid phase, Solid phase, Characterization of atomic structures, The structure of atoms and crystals, Metallic characteristics, Chemical behavior and the metallic bond, Arrangement of atoms in metals, Metals and insulators, Real crystals and imperfection, Ceramics and Alloys, Oxide, Nitride, Carbide, Some properties of ceramics, Simple alloys, Some methods of preparation, X–ray, X–ray generation, Moseley law and elements detection, Bragg law, Diffractometer, Deby–Schereer, Laue method, Defect in crystals, Point, line, and interfacial defect, Amorphous, Glass formation and silicate, Phase diagram and diffusion, Water, two component, The study state.