Telangana University

Syllabus of

Bachelor of Science (B.Sc) Mathematics – I year

Mathematics: Paper – I 120 hrs (4 hrs/week)

DIFFERENTIAL EQUATIONS & SOLID GEOMETRY

DIFFERENTIAL EQUATIONS

UNIT - I: (25 hours)

Differential equations of first order and first degree

Linear differential equations; Differential equations reducible to linear form; Exact differential equations; Integrating factors; Change of variables; Simultaneous differential equations; Orthogonal trajectories. Differential equations of the first order but not of the first degree: Equations solvable for p; Equations solvable for y; Equations solvable for x; Equations that do not contain x (or y); Equations of the first degree in x and y - Clairaut's equation.

UNIT - II: (35 hours)

Higher order linear differential equations

Solution of homogeneous linear differential equations of order n with constant coefficients. Solution of the non-homogeneous linear differential equations with constant coefficients by means of polynomial operators. Method of undetermined coefficients; Method of variation of parameters; Linear differential equations with non-constant coefficients; The Cauchy-Euler equation System of linear differential equations: Solution of a system of linear equations with constant coefficients; An equivalent triangular system. Degenerate Case: p1(D) p4(D)-p2(D) p3(D) = 0. Prescribed Text book: Scope and treatment as in Differential Equations and Their Applications by Zafar Ahsan, published by Prentice-Hall of India Pvt. Ltd. New Delhi-Second edition: Sections: - 2.5 to 2.9, 3.1, 3.2, 4.2, 5.2 to 5.7, 7.3, 7.4. Reference Book: Rai Singhania, "Ordinary and Partial Differential Equations" , S.Chand & Company,New Delhi

SOLID GEOMETRY

UNIT - III: (35 hours)

The Plane

Equation of plane in terms of its intercepts on the axis, Equations of the plane through the given points, Length of the perpendicular from a given point to a given plane, Bisectors of angles between two planes, Combined equation of two planes, Orthogonal projection on a plane**The Line:** Equations of a line, Angle between a line and a plane, The condition that a given line may lie in a given plane, The condition that two given lines are coplanar, Number of arbitrary constants in the equations of a straight line. Sets of conditions which determine a line, The shortest distance between two lines. The length and equations of the line of shortest distance between two straight lines, Length of the perpendicular from a given point to a given line, Intersection of three planes, Triangular Prism.

The Sphere:

Definition and equation of the sphere, Equation of the sphere through four given points, Plane sections of a sphere. Intersection of two spheres; Equation of a circle. Sphere through a given circle; Intersection of a sphere and a line. Power of a point; Tangent plane. Plane of contact. Polar plane, Pole of a plane, Conjugate points, Conjugate planes; Angle of intersection of two spheres. Conditions

for two spheres to be orthogonal; Radical plane. Coaxial system of spheres; Simplified from of the equation of two spheres.

UNIT - IV: (25 hours)

Cones, Cylinders and conicoids:

Definitions of a cone, vertex, guiding curve, generators. Equation of the cone with a given vertex and guiding curve. Enveloping cone of a sphere. Equations of cones with vertex at origin are homogenous. Condition that the general equation of the second degree should represent a cone. Condition that a cone may have three mutually perpendicular generators Intersection of a line and a quadric cone. Tangent lines and tangent plane at a point. Condition that a plane may touch a cone. Reciprocal cones. Intersection of two cones with a common vertex. Right circular cone. Equation of the right circular cone with a given vertex, axis and semi-vertical angle. Definition of a cylinder. Equation to the cylinder whose generators intersect a given conic and are parallel to a given line, Enveloping cylinder of a sphere. The right circular cylinder. Equation of the right circular cylinder with a given axis and radius. The general equation of the second degree and the various surfaces represented by it; Shapes of some surfaces. Nature of Ellipsoid. Nature of Hyperboloid of one sheet. Prescribed Text book: Scope as in Analytical Solid Geometry by Shanti Narayan and P.K. Mittal, Published by S. Chand & Company Ltd. Seventeenth edition: Sections:-2.4, 2.7, 2.9, 3.1 to 3.8, 6.1 to 6.9, 7.1 to 7.8, 8.1, 8.2, 8.6

Reference Book:

P.K. Jain and Khaleel Ahmed, "A Text Book of Analytical Geometry of Three Dimensions", Wiley Eastern Ltd., 1999.

Telangana University

Syllabus of

Bachelor of Science (B.Sc) Physics - I year

Mechanics and Waves and Oscillations 120 hrs (4 hrs/week)

Unit – I 30 hrs

1. Vector Analysis (10) Scalar and vector fields, gradient of a scalar field and its physical significance. Divergence and curl of a vector field and related problems. Vector integration, line, surface and volume integrals. Stokes, Gauss and Green's theorems- simple applications. 2. Mechanics of Particles (10) Laws of motion, motion of variable mass system, motion of a rocket, multi-stage rocket, conservation of energy and momentum. Collisions in two and three dimensions, concept of impact parameter, scattering cross-section, Rutherford scattering. 3. Mechanics of rigid bodies (10) Definition of Rigid body, rotational kinematic relations, equation of motion for a rotating body, angular momentum and inertial tensor. Euler's equation, precession of a top, Gyroscope, precession of the equinoxes

Unit – II 30 hrs

4. Mechanics of continuous media (8) Elastic constants of isotropic solids and their relation, Poisson's ratio and expression for Poisson's ratio in terms of y, n, k. Classification of beams, types of bending, point load, distributed load, shearing force and bending moment, sign conventions, simple supported beam carrying a concentrated load at mid span, cantilever with an end load 5. Central forces (12) Central forces – definition and examples, conservative nature of central forces, conservative force as a negative gradient of potential energy, equation of motion under a central force, gravitational potential and gravitational field, motion under inverse square law, derivation of Kepler's laws, Coriolis force and its expressions. 6. Special theory of relativity (10) Galilean relativity, absolute frames, Michelson-Morley experiment, Postulates of special theory of relativity. Lorentz transformation, time dilation, length contraction, addition of velocities, mass-energy relation. Concept of four vector formalism.

Unit – III 30 hrs

7. Fundamentals of vibrations (12) Simple harmonic oscillator, and solution of the differential equation– Physical characteristics of SHM, compound pendulum, measurement of ‘g', torsion pendulum, - measurements of rigidity modulus. Combination of two mutually perpendicular simple harmonic vibrations of same frequency and different frequencies, Lissajous figures 8. Damped and forced oscillations (12)

Damped harmonic oscillator, solution of the differential equation of damped oscillator. Energy considerations, comparison with undamped harmonic oscillator, logarithmic decrement, relaxation time, quality factor, differential equation of forced oscillator and its solution, amplitude resonance, velocity resonance 9. Complex vibrations (6) Fourier theorem and evaluation of the Fourier coefficients, analysis of periodic wave functions-square wave, triangular wave, saw-tooth wave

Unit – IV 30 hrs

10. Vibrations of bars (12) Longitudinal vibrations in bars- wave equation and its general solution. Special cases (i) bar fixed at both ends ii) bar fixed at the mid point iii) bar free at both ends iv) bar fixed at one end. Transverse vibrations in a bar- wave equation and its general solution. Boundary conditions, clamped free bar, free-free bar, bar supported at both ends, Tuning fork. 11. Vibrating Strings (12) Transverse wave propagation along a stretched string, general solution of wave equation and its significance, modes of vibration of stretched string clamped at both ends, overtones, energy transport, transverse impedance 12. Ultrasonics (6) Ultrasonics, properties of ultrasonic waves, production of ultrasonics by piezoelectric and magnetostriction methods, detection of ultrasonics, determination of wavelength of ultrasonic waves. Velocity of ultrasonics in liquids by Sear's method. Applications of ultrasonic waves.

Note: Problems should be solved at the end of every chapter of all units.

Text books

1. Berkeley Physics Course. Vol.1, Mechanics by C. Kittel, W. Knight, M.A. Ruderman - Tata-McGraw hill Company Edition 2008. 2. Fundamentals of Physics. Halliday, Resnick and Walker Wiley India Edition 2007. 3. Waves and Oscillations. S. Badami, V. Balasubramanian and K. Rama Reddy Orient Longman. 4. First Year Physics - Telugu Academy. 5. Mechanics of Particles, Waves and Oscillations. Anwar Kamal, New Age International. 6. College Physics-I. T. Bhimasankaram and G. Prasad. Himalaya Publishing House. 7. Introduction to Physics for Scientists and Engineers. F.J. Ruche. McGraw Hill. 8. Waves and Oscillations. N. Subramaniyam and Brijlal Vikas Publishing House Private Limited.

Reference Books:

1. Fundamentals of Physics by Alan Giambattista et al Tata-McGraw Hill Company Edition, 2008. 2. University Physics by Young and Freeman, Pearson Education, Edition 2005. 3. Sears and Zemansky's University Physics by Hugh D. Young, Roger A. Freedman Pearson Education Eleventh Edition. 4. An introduction to Mechanics by Daniel Kleppner & Robert Kolenkow. The McGraw Hill Companies. 5. Mechanics. Hans & Puri. TMH Publications.
6. Engineering Physics. R.K. Gaur & S.L. Gupta. Dhanpat Rai Publications.

Bachelor of Science (B.Sc) Physics – I Year

Mechanics and Waves and Oscillations

PRACTICALS

1. Study of a compound pendulum determination of ‘g' and ‘k'. 2. Study of damping of an oscillating disc in Air and Water logarithmic decrement. 3. Study of Oscillations under Bifilar suspension. 4. Study of oscillations of a mass under different combination of springs. 5. ‘Y' by uniform Bending (or) Non-uniform Bending. 6. Verification of Laws of a stretched string (Three Laws) - Sonometer 7. Moment of Inertia of a fly wheel. 8. Measurement of errors – Simple Pendulum. 9. Determination of frequency of a Bar - Melde's experiment. 10. ‘n' by torsion pendulum. 11. Observation of Lissajous figures from CRO. 12. Study of flow of liquids through capillaries. 13. Determination of Surface Tension of a liquid by different methods. 14. Study of Viscosity of a fluid by different methods. 15. Volume Resonator –determination of frequency of a tuning fork.

Note: Any twelve of the experiments are to be performed

Telangana University

Syllabus of

Bachelor of Science (B.Sc) Chemistry – I Year

Paper 1: UNIT – I (Inorganic Chemistry – I) 30 hrs (1h/w)

1. s-block elements:

General characteristics of groups I & II elements, diagonal relationship between Li & Mg, Be & Al. 3 h

2. p-block elements: 20 h

General characteristics of elements of groups 13, 14, 15, 16 and 17 Group – 13: Synthesis and structure of diborane and higher boranes (B_4H_{10} and B_5H_9), boron-nitrogen compounds ($B_3N_3H_6$and BN) Group – 14: Preparation and applications of silanes and silicones, graphitic compounds. Group – 15: Preparation and reactions of hydrazine, hydroxylamine, phosphazenes. Group – 16: Classifications of oxides based on (i) Chemical behaviour and (ii) Oxygen content. Group – 17: Inter halogen compounds and pseudo halogens

3. Organometallic Chemistry 7 h

Definition and classification of organometallic compounds, nomenclature, preparation, properties and applications of alkyls of 1, 2 and 13 group elements.

UNIT-II (Organic Chemistry-I) 30hrs (1h /w)

1. Structural theory in Organic Chemistry 10 h

Types of bond fission and organic reagents (Electrophilic, Nucleophilic, and free radical reagents including neutral molecules like H_2O, NH_3 & $AlCl_3$). Bond polarization : Factors influencing the polarization of covalent bonds, electro negativity – inductive effect. Application of inductive effect (a) Basicity of amines (b) Acidity of carboxylic acides (c) Stability of carbonium ions. Resonance or Mesomeric effect, application to (a) acidity of phenol, and (b) acidity of carboxylic acids. Hyper conjugation and its application to stability of carbonium ions, Free radicals and alkenes, carbanions, carbenes and nitrenes. Types of Organic reactions: Addition – electrophilic, nucleophilic and free radical. Substitution – electrophilic, nucleophilic and free radical. Elimination- Examples(mechanism not required).

2. Acyclic Hydrocarbons 8 h

Alkanes– IUPAC Nomenclature of Hydrocarbons. Methods of preparation: Hydrogenation of alkynes and alkenes, Wurtz reaction, Kolbe's electrolysis, Corey- House reaction. Chemical reactivity – inert nature, free radical substitution mechanism. Halogenation example- reactivity, selectivity and orientation. Alkenes – Preparation of alkenes (a) by dehydration of alcohols (b) by dehydrohalogenation of alkyl halides (c) by dehalogenation of 1,2 dihalides (brief mechanism), Saytzev's rule. Properties: Addition of hydrogen – heat of hydrogenation and stability of alkenes. Addition of halogen and its mechanism. Addition of HX, Markonikov's rule, addition of H_2O, HOX, H_2SO_4 with mechanism and addition of HBr in the presence of peroxide (anti – Markonikov's addition). Oxidation – hydroxylation by $KMnO_4$, OsO_4, peracids (via epoxidation) hydroboration, Dienes – Types of dienes, reactions of conjugated dines – 1,2 and 1,4 addition of HBr to 1,3 – butadiene and Diel's – Alder reaction. Alkynes – Preparation by dehydrohalogenation of dihalides, dehalogenation of tetrahalides, Properties; Acidity of acetylenic hydrogen (formation of Metal acedtylides). Preperation of higher acetylenes, Metal ammonia reductions Physical properties. Chemical reactivity – electrophilic addition of X_2, HX, H_2O (Tautomerism), Oxidation with $KMnO_4$, OsO_4, reduction and Polymerisation reaction of acetylene.

3. Alicyclic hydrocarbons (Cycloalkanes) 4 h

Nomenclature, Preparation by Freunds methods, heating dicarboxylic metal salts. Properties – reactivity of cyclopropane and cyclobutane by comparing with alkanes, Stability of cycloalkanes – Baeyer's strain theory, Sachse and Mohr predictions and Pitzer's strain theory. Conformational structures of cyclobutane, cyclopentane, cyclohexane.

4. Benzene and its reactivity 7 h

Concept of resonance, resonance energy. Heat of hydrogenation, heat of combustion of Benezene, mention of C-C bond lengths and orbital picture of Benzene. Concept of aromaticity – aromaticity (definition), Huckel's rule – application to Benzenoid (Benzene, Napthalene) and Non – Benzenoid compounds (cyclopropenyl cation, cyclopentadienyl anion and tropylium cation)

Reactions – General mechanism of electrophilic substitution, mechanism of nitration. Friedel Craft's alkylation and acylation. Orientation of aromatic substitution – Definition of ortho, para and meta directing groups. Ring activating and deactivating groups with examples (Electroni interpretation of various groups like NO_2 and Phenolic). Orientation of (i). Amino, methoxy and methyl groups (ii). Carboxy, nitro, nitrile, carbonyl and Sulfonic acid groups. (iii). Halogens (Explanation by taking minimum of one example from each type).

5. Polynuclear Hydrocarbons – 2 h

Structure of naphthalene and anthracene (Molecular Orbital diagram and resonance energy) Any two methods of preparation of naphthalene and reactivity. Reactivity towards electrophilic substitution. Nitration and sulfonation as examples.

Unit-III – (Physical Chemistry – I) 30h (1h/w)

I Gaseous state 6 h

Compression factors, deviation of real gases from ideal behavior. Van der Waal's equation of state. P-V Isotherms of real gases, Andrew's isotherms of carbon dioxide, continuity of state. Critical phenomena. The van der Waal's equation and the critical state. Relationship between critical constants and van der Waal's constants. The law of corresponding states and reduced equation of states. Joule Thomson effect. Liquefaction of gases: i) Linde's method and ii) Claude's method.

II Liquid state 2 h

Intermolecular forces, structure of liquids (qualitative description). Structural differences between solids, liquids and gases. Liquid crystals, the mesomorphic state. Classification of liquid crystals into Smectic and Nematic. Differences between liquid crystal and solid/liquid. Application of liquid crystals as LCD devices.

III Solid state10 h

Symmetry in crystals. Law of constancy of interfacial angles. The law of rationality of indices. The law of symmetry. Definition of lattice point, space lattice, unit cell. Bravis lattices and crystal systems. X-ray diffraction and crystal structure. Bragg's law. Determination of crystal structure by Bragg's method and the powder method. Indexing of planes and structure of NaCl and KCl crystals. Defects in crystals. Stoichiometric and non-stoichiometric defects. Band theory of semoconductors. Extrinsic and intrinsic semiconductors, n- and p-type semiconductors and their applications in photo electrochemical cells.

IV Solutions 6 h

Liquid-liquid - ideal solutions, Raoult's law. Ideally dilute solutions, Henry's law. Non-ideal solutions. Vapour pressure – composition and vapour pressure-temperature curves. Azeotropes-HCl-H_2O, ethanol-water systems and fractional distillation. Partially miscible liquids-phenol-water,

trimethylamine-water, nicotine-water systems. Effect of impurity on consulate temperature. Immiscible liquids and steam distillation.
Nernst distribution law. Calculation of the partition coefficient. Applications of distribution law.

V Colloids and surface chemistry 6 h

Definition of colloids. Solids in liquids(sols), preparation, purification,properties - kinetic,optical,electrical. Stability of colloids, Hardy-Schulze law, protective colloid. Liquids in liquids (emulsions) preparation, properties, uses. Liquids in solids (gels) preparation, uses. Adsorption: Physical adsoption, chemisorption. Freundlich, Langmuir adsorption isotherms. Applications of adsorption

UNIT – IV (General Chemistry-I) 30 h (1h / w)

1. Atomic Structure and elementary quantum mechanics 8 h

Blackbody radiation, Planck's radiation law, photoelectric effect, Compton effect, de Broglie's hypothesis, Heisenberg's uncertainty principle. Postulates of quantum mechanics. Schrodinger wave equation and a particle in a box, energy levels, wave functions and probability densities. Schrodinger wave equation for H-atom. Separation of variables, Radial and angular functions, hydrogen like wave functions, quantum numbers and their importance.

2. Chemical Bonding 8 h

Valence bond theory, hybridization, VB theory as applied to ClF_3, BrF_5, $Ni(CO)_4$, XeF_2. Dipole moment – orientation of dipoles in an electric field, dipole moment, induced dipole moment, dipole moment and structure of molecules. Molecular orbital theory – LCAO method, construction of M.O. diagrams for homo-nuclear and hetero-nuclear diatomic molecules (N2, O2, HCl, CO and NO). Comparision of VB and MO theories.

3. Stereochemistry of carbon compounds 10 h

Molecular representations- Wedge, Fischer, Newman and Saw-Horse formulae. Stereoisomerism, Stereoisomers: enantiomers, diastereomers- definition and examples.Conformational and configurational isomerism- definition. Conformational isomerism of ethane and n-butane. Enantiomers: Optical activity- wave nature of light, plane polarised light, interaction with molecules, optical rotation and specific rotation. Chiral molecules- definition and criteria- absence of plane, center, and Sn axis of symmetry- asymmetric and disymmetric molecules. Examples of asymmetric molecules (Glyceraldehyde, Lactic acid, Alanine) and disymmetric molecules (trans -1,2-dichloro cyclopropane). Chiral centers: definition- molecules with similar chiral carbon (Tartaric acid), definition of mesomers- molecules with dissimilar chiral carbons (2,3-dibromopentane). Number of enantiomers and mesomers- calculation. D,L and R,S configuration for asymmetric and disymmetric molecules. Cahn-Ingold-Prelog rules. Racemic mixture- racemisation and resolution techniques.

Diastereomers: definition- geometrical isomerism with reference to alkenes- cis, trans and E,Z-configuration.

4. General Principles of Inorganic qualitative analysis 4 h

Solubility product, common ion effect, characteristic reactions of anions, elimination of interfering anions, separation of cations into groups, group reagents, testing of cations

Bachelor of Science (B.Sc) Chemistry – I Year

Practicals paper – I Qualitative analysis & Inorganic preparations

LABORATORY COURSE- I : 90 hrs (3 h/w)
Practical Paper – I(Inorganic Chemistry)
Qualitative Analysis and Inorganic preparations:

Analysis of mixtures containing two anions (one simple and one interfering) and two cations (of different groups) from the following: Anions: Carbonate, sulfide, sulphate, chloride, bromide, iodide, acetate, nitrate, oxalate, tartrate, borate, phosphate, arsenate* and chromate*. Cations: Lead, copper, bismuth, cadmium, tin, antimony, iron, aluminum, zinc, manganese, nickel, cobalt, calcium, strontium, barium, potassium and ammonium. ***not to be given for examination.**

Preparations: Any three of the following inorganic preparations: 1) Ferrous ammonium sulphate 2) Tetrammine copper (II) sulphate 3) Potassium trisoxalato chromate 4) Potash alum $KAl(SO_4)_2.12H_2O$ 5) Hexammine cobalt (III) chloride.