JAYOTI VIDYAPEETH WOMEN'S UNIVERSITY, JAIPUR

SYLLABUS

BACHELOR OF SCIENCE   B.SC.(PCM)

YEAR – 2017

DURATION – 3 YEARS (6 SEMESTERS)

SYLLABUS FOR:
I –II SEMESTERS

FACULTY OF EDUCATION & METHODOLOGY

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Book Details (I SEMESTER)

Sr. No.	Subject Name	Text Book	Author	Publisher
1.	DIFFERENTIAL CALCULUS AND ANALYTICAL GEOMETRY	Differential Calculus	Gokhroo and saini	Bansal Jaipur Publishing. House
2.	DIFFERENTIAL CALCULUS AND ANALYTICAL GEOMETRY	Calculus and Analytical Geometry	Robert Ellis &Denny Gulick	S.Chand
3.	NUMBER THEORY, THEORY OF EQUATIONS MATRICES	Algebra	Swapan kumar sarkar.	S.Chand
4.	Mechanics	Fundamentals of Physics	David Halliday, Robert Resnick and Jearl Walker,	6th Edition, John Wiley and Sons Inc.
5.	Mechanics	Mechanics	S.L. Kakni, C. Hemrajani	Anshan Limited
6.	Elastisity and Waves	University Physics	Harris Benson	John Wiley and Sons Inc.
7.	Inorganic Chemistry	Concise Inorganic Chemistry	J D Lee	John Wiley & Sons
8.	Inorganic Chemistry	University Chemistry	Bruce Mahan	Benjamin/Cummings Pub.
9.	Organic Chemistary	Organic Chemistry Vol. I & II	I L Finar	Pearson Education Ltd.

Program Summary
B.Sc. (PCM)
(I- II Semesters)

Program Summary

NATURE OF COURSE (I SEMESTER)	NO. OF CREDITS
Core Mathematics	13
Core Physics	17.5
Core chemistry	17.2
English Language	2
Hindi Language	2
University Compulsory Course	2
Total Credit	53.7

Program Summary

NATURE OF COURSE (II SEMESTER)	NO. OF CREDITS
Core Mathematics	12
Core Physics	16.2
Core chemistry	15.4
Computer	8
University Compulsory Course	2
Total Credit	**53.6**

Program Structure – I Year

I year consists of I, II Semester

1st Year Motive: This year Students will go to know about basic subjects of B.Sc. such as

DIFFERENTIAL CALCULUS, NUMBER THEORY, Mechanics, ELASTICITY AND WAVES, Inorganic Chemistry, Organic Chemistry etc.

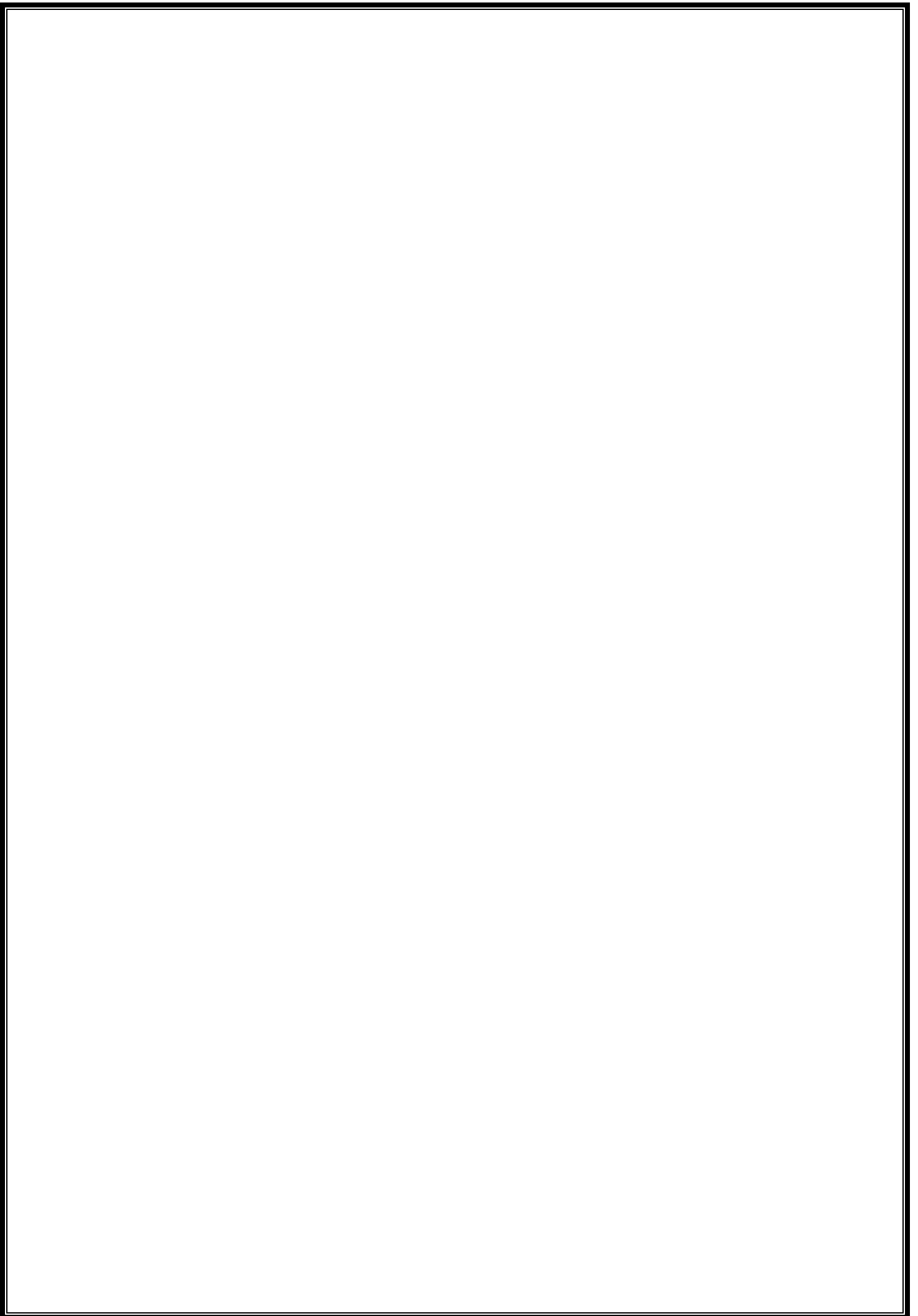| I SEMESTER					
Nature of Course	**Course Name**	**C**	**T**	**P1**	**P2**
Core Mathematics	DIFFERENTIAL CALCULUS AND ANALYTICAL GEOMETRY I- **Continuity and Differentiation-I**	2	2	0	0
Core Mathematics	DIFFERENTIAL CALCULUS AND ANALYTICAL GEOMETRY II- **Differentiation-II**	2.5	2.5	0	0
Core Mathematics	DIFFERENTIAL CALCULUS AND ANALYTICAL GEOMETRY III-: **Analytical Geometry – I**	2.5	2.5	0	0
Core Mathematics	NUMBER THEORY, THEORY OF EQUATIONS, MATRICES I- **Theory of Numbers**	2	2	0	0
Core Mathematics	NUMBER THEORY, THEORY OF EQUATIONS, MATRICES II- **Theory of Equations**	2	2	0	0
Core Mathematics	NUMBER THEORY, THEORY OF EQUATIONS, MATRICES III- **Matrices – I**	2	2	0	0
Core Physics	MechanicsI- **Particle Dynamics**	3.3	2.5	0.8	0
Core Physics	MechanicsII- **Conservation Laws and Collisions**	3.3	2.5	0.8	0
Core Physics	MechanicsIII- **Gravitation and Central Force**	2.9	2.5	0.4	0
Core Physics	ELASTICITY AND WAVES I- **Elasticity**	2.5	2.5	0	0
Core Physics	ELASTICITY AND WAVES II- **Waves**	3	3	0	0
Core Physics	ELASTICITY AND WAVES III- **Work and Energy**	2.5	2.5	0	0
Core chemistry	Inorganic Chemistry I- **Atomic Structure**	3.1	2.5	0.6	0
Core chemistry	Inorganic Chemistry II- **Periodic Properties and s and p-Block Elements**	3.1	2.5	0.6	0
Core chemistry	Inorganic Chemistry III- **Chemical**	2.8	2	0.8	0

	Bonding I				
Core chemistry	Organic Chemistry I- **Stereochemistry of Organic Compounds**	2.8	2	0.8	0
Core chemistry	Organic Chemistry II - **Aliphatic Hydrocarbons**	2.8	2	0.8	0
Core chemistry	Organic Chemistry III - **Aromatic Hydrocarbons**	2.6	2	0.6	0
English Language	Hindi	2	2	0	0
Hindi Language	English	2	2	0	0
University Compulsory Course	**Curriculum Training & Exposure**	1	0	1	0
University Compulsory Course	Community Development Activities	1	0	1	0
	Total Credit	51.7+2=53.7			

Note:

- **C represents number of credit per course**
- **T represents number of theory credit per course**
- **P1 represents number of practical and practice per course**
- **P2 represents number of seminar, paper presentation, Group discussion, Minor project , Major Project , Dissertation and Industrial visit per course**

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NATURE OF COURSE (I SEMESTER)	NO. OF CREDITS
Core Mathematics	13
Core Physics	17.5
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II SEMESTER					
Nature of Course	**Course Name**	**C**	**T**	**P1**	**P2**
Core Mathematics	PARTIAL DIFFERENTIATIONS I- **Partial Derivatives – I**	2	2	0	0
Core Mathematics	PARTIAL DIFFERENTIATIONS II- **Partial Derivatives - II**	2	2	0	0
Core Mathematics	PARTIAL DIFFERENTIATIONS III- **Curves and Surfaces**	2	2	0	0
Core Mathematics	Real Analysis I- **Real Numbers**	2	2	0	0
Core Mathematics	Real Analysis II- **Sequences**	2	2	0	0
Core Mathematics	Real Analysis III-**: Infinite Series**	2	2	0	0
Core Physics	HEAT AND THERMODYNAMICS I- **Kinetic Theory of Gases**	2.9	2.5	0.4	0
Core Physics	HEAT AND THERMODYNAMICS II- **Heat and First Law of Thermodynamics**	2.4	2	0.4	0
Core Physics	HEAT AND THERMODYNAMICS III- **Entropy and Second Law of Thermodynamics**	2.9	2.5	0.4	0
Core Physics	ELECTRICITY AND ELECTROMAGNETISM I- **Electrostatics & Electric Currents**	2.5	2.5	0	0
Core Physics	ELECTRICITY AND ELECTROMAGNETISM II- **Electric Fields in Matter**	2.4	2	0.4	0
Core Physics	ELECTRICITY AND ELECTROMAGNETISM III- **Magnetostatics**	3.1	2.5	0.6	0
Core chemistry	Physical Chemistry I- **Gaseous and Solid State**	2.6	2	0.6	0
Core chemistry	Physical Chemistry II- **Liquids and Colloids**	2.6	2	0.6	0
Core chemistry	Physical Chemistry III- **Acids and bases**	2.6	2	0.6	0
Core chemistry	Inorganic Chemistry I- **Molecular Orbital theory, boranes and Xenon compounds**	2.6	2	0.6	0
Core chemistry	Inorganic Chemistry II- **Coordination Compounds**	2.8	2	0.8	0
Core chemistry	Inorganic Chemistry III- **d-block and f-block elements**	2.2	2	0.2	0
Computer	Fundamentals of Computers I- **Basics of computer System and Number System**	2.6	2	0.6	0
Computer	Fundamentals of Computers II-**Boolean Algebra**	2	2	0	0
Computer	Fundamentals of Computers III- **Software and MS office**	3.4	2	1.4	0

University compulsory course	**Curriculum Training & Exposure**	1	0		1		0
University compulsory course	**Community Development Activities**	1	0		1		0
	Total Credit		51.6+2=53.6				

Note:

- **C represents number of credit per course**
- **T represents number of theory credit per course**
- **P1 represents number of practical and practice per course**
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Total Credit	**53.6**

I SEMESTER

DIFFERENTIAL CALCULUS AND ANALYTICAL GEOMETRY

Unit I: Continuity and Differentiation – I (2-0-0)
Theory (2 Credits)

Limits, one-sided limits, Infinite limits and limits at infinity, Continuous functions, Discontinuous functions, Continuity theorems, Uniform continuity.

Differentiation, Linear approximation theorem, Higher derivatives, Leibnitz's theorem.

Monotone functions, Maxima and Minima, Concavity, Convexity and Points of inflection.

Practice (2 Credits)

Practice is based on limits,functions and maxima and minima.

Unit II: Differentiation – II (2.5-0-0)
Theory (2.5 Credits)

Polar coordinates, angle between the radius vector and the tangent at a point on a curve, angle of intersection between two curves.

Differentiability theorems, Rolle's theorem, Lagrange's Mean Value theorem, Cauchy's Mean Value Theorem, Taylor's theorem, Maclaurin's theorem, Generalised Mean Value theorem, Taylor's Infinite series and power series expansions, Maclaurin's infinite series, Indeterminate forms.

Practice (1 Credit)

Practice is based on polar coordinates and series

Unit III: Analytical Geometry – I (2.5-0-0)
Theory (2.5 Credits)

Cartesian coordinates in three dimensional spaces, Relation between Cartesian coordinates and position vector, Distance formula (Cartesian and Vector form), Direction cosines, Direction ratios, Projection on a Straight line, angle between two lines, Area of Triangle, Volume of a tetrahedron. Straight line, equations and straight lines (Cartesian and Vector form.

Practice (1 Credit)

Practice is bsed on distance formula,area and volume.

References :
1.   Calculus by Anton, Addison-Wiley.
2.   Calculus with Analytical Geometry by S K Stein, McGraw Hill.
3.   Calculus and Analytical Geometry, Thomas and Finney, S.Chand and Co. Ltd.

Textbook:
1.   Differential Calculas by Gokhroo and saini
2.   Calculus and Analytical Geometry by S.Chand

NUMBER THEORY, THEORY OF EQUATIONS, MATRICES

Unit I: Theory of Numbers (2-0-0)
Theory (2 Credits)
Division Algorithm – Prime and Composite Numbers – proving the existence and uniqueness of GCD and the Euclidean Algorithm – fundamental theorem of Arithmetic - the least common multiple – congruences – linear congruences – Wilson's theorem – Simultaneous congruences – Theorem of Euler – Fermat and Lagrange.
Practice (1 Credit)
Practice is based on algorithm and congruences.

Unit II : Theory of Equations (2-0-0)
Theory (2 Credits)
Relation between roots and coefficients, Symmetric functions, Transformations, Reciprocal equations, Descarte's rule of signs, Multiple roots, Solving cubic

equations by Cardon's method, Solving quartic equations by Descarte's method and Ferrari's method.

Unit III: Matrices – I(2-0-0)
Theory (2 Credits)
Matrices of order mXn, Algebra of matrices, Symmetric and Skew Symmetric, Hermitian and Skew Hermitian matrices and their standard properties, Determinants Adjoint of a square matrix, Singular and non-singular matrices, Rank of a matrix, Elementary row / column operations, Invariance of rank under elementary operations, Inverse of a non-singular matrix by elementary operations.

References :
1. Elementary Number Theory by David M. Burton.
2. Algebra by Natarajan, Manicavachagon Pillay and Ganapathy, S. Vishwanath Pvt. Ltd.
3. Theory of Equations by Uspensky, McGraw Hill Book Co. Ltd.

Textbook:
1. Algebra by Swapn kumar sarkar.
2. Theory of Numbers by John E. Cloury

MECHANICS

Unit I : Particle Dynamics (2.5-0.8-0)
Review of the following:
Theory (2.5Credits)
Vectors – the language of Physics, Vector addition, subtraction, resolution, vector and scalar products. Particle kinematics, equations of motion under constant acceleration

λ under free fall,

Motion in a plane: Motion in a plane with constant acceleration , projectile motion, tangential and radial acceleration in circular motion, relative velocity and acceleration.

Particle dynamics (review), Newton's First, Second and Third Law of Motion, Newton's I Law as a basic kinematical law defining a frame of reference, Newton's II Law as a basic dynamical law of mechanics and Newton's III law as an interaction law, Frames of reference, inertial and non inertial, pseudo forces, Force laws, weight and mass, static procedure for measuring forces, Application of Newton's law, importance of free body diagrams representing forces on the body and frictional forces. Discussion of importance of friction in daily life.

Practicals:
1. To determine Young's modulus by bending of beam.**(0.2 Practical)**
2. To determine the height of object using sextent. **(0.2 Practical)**
3. Study of the rate of flow of water through a capillary tube under different pressure heads. **(0.2 Practical)**
4. To study the relation between force and extension produced in a stretched spring. **(0.2 Practical)**

Unit II : Conservation Laws and Collisions(2.5-0.8-0)

Theory (2.5Credits)
Conservation Laws: Introduction, conservative forces, potential energy, complete solution for one, two and three dimensional systems, non-conservative forces, conservation of energy, conservation of energy to be seen as a spreading out and appearing in different forms, mass and energy.

Conservation of Linear Momentum: Centre of mass, motion of the center of mass, linear momentum of a particle, linear momentum of a system of particles, conservation of linear momentum, some applications of momentum principle, systems of variable mass – Rocket equation.

Collisions: Definition and types of collisions. Impulse and momentum, conservation of momentum during collisions, collision in one and two dimensions.

Illustration with examples of collisions during accidents and collisions at atomic and sub-atomic level.

Practicals:
1. To study the relation between length and time period of a simple pendulum. **(0.2 Practical)**
2. Using compound pendulum study the variation of time period withamplitude in large angle oscillation. **(0.2 Practical)**
3. Using Compound pendulum study the damping. **(0.2 Practical)**
4. Study of the dependence of the period of oscillation of a spring-mass system on mass. **(0.2 Practical)**

Unit III : Gravitation and Central Force(2.5-0.4-0)
Theory (2.5 Credits)
Gravitation : Historical Introduction, Newton's law of Universal Gravitation, Universal Gravitation constant 'G', inertial and gravitational mass, variation in acceleration due to gravity with altitude and depth, motion of planets and satellites, gravitational field and potential, gravitational potential energy, potential energy for many particle systems, calculations of field and potential for (a) a spherical shell, (b) a sphere, energy consideration in the motion of planets and satellites.
Central Force: Kepler's laws of planetary motion, the inverse square law, Rutherford's problem, derivation of Kepler's Law from Universal law of Gravitation.

Practicals:
1.   Study of the acceleration of a body subjected to different unbalanced forces. **(0.2 Practical)**
2.   Study of accelerations of different masses under a constant unbalanced force. **(0.2 Practical)**

Recommended Text Books:
1. Fundamentals of Physics, 6th Edition, David Halliday, Robert Resnick and Jearl Walker, John Wiley and Sons Inc.
2. **University Physics, Revised Edition, Harris Benson, John Wiley and Sons, Inc.**

ELASTICITY AND WAVES

Unit I : Elasticity (2.5-0-0)
Theory (2.5Credits)
Hooke's law, Modulii of elasticity, Relation between elastic constants. Poisson's ratio – limiting values. Elastic potential Energy, bending moment.Theory of the cantilever. Torsion – calculation of couple per unit twist. The torsional pendulum. Static torsions, Searle's double bar experiment.

Oscillations : Simple Harmonic Motion (SHM), the restoring force along with its kinematical model, force law, SHM equation and idea of phase and phase difference, energy considerations in simple harmonic motion.Superposition of the SHMs, Lissajous figures, Equation for damped vibrations, forced vibrations. Analysis of complex waves. Fourier Series, Application to square wave, triangular wave.

Unit-II: Waves(3-0-0)

Theory (3 Credits)

Waves in elastic media: Review of Mechanical waves, types of waves, travelling waves, the superposition principle, wave speed, power and intensity in wave motion, expression for transverse waves in a stretched string, interference of waves, standing waves, resonance, simulation and demonstrations using ripple tank.
Sound Waves: Audible, ultrasonic and infrasonic waves, propagation and speed of longitudinal waves, travelling longitudinal waves, standing longitudinal waves, vibrating systems and source of sound, beats and Doppler effect, wave equation for sound pressure, sound power and measuring unit (decibel).
Model of sound being a pressure wave caused by longitudinally oscillating particles must be developed.

Unit-III: Work and Energy(2.5-0-0)
Theory (2.5Credits)
Work and Energy: Work done by a constant force and by a variable force – one and two dimensional cases. Kinetic energy and work-energy theorem, Significance of the work-energy theorem, power.The importance of language in Physics to be highlighted by differentiating the meaning of 'work', 'power', 'energy' as defined in Physics and in daily life.

Rotational Kinematics

Rotational variables, angular velocity, angular acceleration. Rotation with constant angular acceleration, Linear and angular variables, kinetic energy of rotation, rotational inertia, calculation of rotational inertia – of a rod, sphere and cylinder, torque, Newton's laws of rotation, work, power and work – kinetic energy theorem.

Recommended Text Books :

1. Fundamentals of Physics, 6th Edition, David Halliday, Robert Resnick and Jay Walker, John Wiley and Sons, Inc.
2. University Physics, Revised Edition, Harris Benson, John Wiley and Sons Inc.
3. Physics of Vibration and Waves, H J Pain

Inorganic Chemistry

Unit I: Atomic Structure (2.5-0.6-0)

Theory (2.5 credit)

Black-body radiation- Planck's radiation law, photoelectric effect, heat capacity of solids, Compton effect. Bohr's model of hydrogen atom and its limitations. de Broglie hypothesis and Heisenberg uncertainty principle Schrodinger wave equation and its importance, physical interpretation of the wave function, postulates of quantum mechanics, particle in one dimensional box. Radial wave functions, angular wave functions. Quantum numbers, atomic orbitals and shapes of s, p, d orbitals , Multi-electron atoms , Aufbau and Pauli exclusion principles and Hund's multiplicity rule, effective nuclear charge. Slaters' rule , Energy level diagram for multi –electron atoms.

Practical-

1. Stoichiometry of neutralization reactions of Sulphuric, Hydrochloric and Nitric acids with Sodium Hydroxide.
2. Estimation of Sodium Carbonate and Sodium Bicarbonate in a mixture.
3. Estimation of Ammonia in Ammonium Salt by Back Titration.
4. Estimation of Ferrous ions using Potassium Permanganate

Unit II: Periodic Properties and s and p-Block Elements (2.5-0.6-0)

Theory (2.5 credit)

Atomic radius, Covalent, ionic and Vander waal radii, Atomic and ionic radii, ionization energy, electron affinity and electronegativity, trends in periodic table and applications in predicting and explaining the chemical behavior, Electronegativity – Variation in a group and a period, Relationship between Electronegativity, Ionisation Energy and Electron Affinity. Pauling Scale of Electronegativity Comparative study of s-Block Elements, diagonal relationships, alkyls and aryls –salient features of hydrides, Action of Liquid Ammonia , Properties of solutions of alkali metals in Liquid Ammonia, Anomalous properties of Lithium and Beryllium, hydrides, oxides, oxyacids and

halides of groups 13-16. tetrasulphur tetranitride, basic properties of halogens, interhalogens and polyhalides

- **Practical-**
  5 Estimation of Oxalic acid using Potassium Permanganate
  6. Estimation of Ferrous ions Using Potassium Dichromate with Internal & External Indicators.
  7 Standardisation of Sodium Thiosulphate using Potassium Dichromate and estimation of Iodine

Unit III: Chemical Bonding I(2-0.8-0)

Theory(2 credit)

Ionic Solids – Ionic structures, radius ratio effect and coordination number, limitation of radius ratio rule, lattice defects, semiconductors, lattice energy and Born-Haber cycle, solvation energy and solubility of ionic solids, polarizing power and polarisability of ions, Fajan's rule, band theories. Weak interactions – Hydrogen bonding, van der Waals forces. Covalent Bond – Valence bond theory and its limitations, directional characteristics of covalent bond, various types of hybridization and shapes of simple inorganic molecules and ions. Valence shell electron pair repulsion (VSEPR) theory to NH_3, H_3O^+, SF_4, CIF_3

- **Practical-**
  1. Estimation of Copper in a Copper salt by Iodimetry
  2. Standardisation of EDTA solution using Zinc Sulphate and determination of Mg or Ca
  3. Standardization of EDTA and estimating the hardness of water.
  4. Determination of Alkali content of antacids.

Recommended Text Books:-
   1. University Chemistry : Bruce Mahan
   2. Concise Inorganic Chemistry : J D Lee
Reference Books:
   1. An Introduction to Inorganic Chemistry : Mackay and Mackay

Reference :
   1.   A Text Book of Quantitative Inorganic Analysis, A I Vogel

ORGANIC CHEMISTRY – I

Unit I: Stereochemistry of Organic Compounds (2-0.8-0)
Theory(2credit)

Optical Isomerism: elements of symmetry, molecular chirality, enantiomers, stereogenic centre, optical activity, properties of enantiomers, chiral and achiral molecules with two stereogenic centres, diastereomers, meso compounds, resolution of enantiomers, inversion, retention and racemization and asymmetric synthesis. Relative and absolute

configuration, sequence rules, D & L and R & S systems of nomenclature.

Geometric isomerism: Determination of configuration of geometric isomers. Cis – trans and E & Z system of nomenclature,

Conformational isomerism: Difference between configuration and conformation, axial and equatorial bonds, conformation of mono alkyl substituted cyclohexane derivatives.

Practical-1. Calibration of Thermometer using naphthalene / acetanilide / urea

2. Determination of melting point of Benzoic acid / cinnamic acid / m – dinitro benzene / p- dichlorobenzene

3. Determination of boiling point of aniline / nitrobenzene / chlorobenzene

4. Distillation of water – alcohol mixture using water condenser; Distillation of chlorobenzene – nitrobenzene mixture using air-condenser

Unit II: Aliphatic Hydrocarbons (2-0.8-0)
Theory(2 credit)

Alkanes:alkanes.Isomerism in alkanes and industrial source. Methods of formation , physical properties and chemical reactions of alkanes, Mechanism of free radical halogenation of alkanes : orientation, reactivity and selectivity.

Alkenes: Regioselectivity in alcohol dehydration.The Saytzeff rule, Hofmann elimination, physical properties and relative stabilities of alkenes. Chemical reactions of alkenes – mechanism of hydrogenation, electrophilic and free radical additions, Markownikoff's rule, hydroboration followed by oxidation, oxymercuration – reduction. Epoxidation, ozonolysis, hydration, hydroxylation and oxidation with $KMnO_4$. Polymerization of Alkenes. Substitution at the allylic and vinylic positions of alkenes. (alkylation of acetylene and by elimination reactions). Acidity of alkynes. Chemical reactions of alkynes: Mechanism of electrophilic and nucleophilic addition reactions.

Practical-. 1.- Crystallization: Benzoic acid from hot water, naphthalene from ethanol

      2 Sublimation of camphor / phthalic acid / succinic acid (Total no of 5)

      3. Preparation of Iodoform from ethanol / acetone(Total no 5)

      4. Preparation of *m*-dinitrobenzene from nitrobenzene by nitration (Total no of 5)

Unit III: Aromatic Hydrocarbons (2-0.6-0)
Theory(2credit)

Factors responsible for the characteristic reactions of Aromatic compounds. Nomenclature of benzene derivatives. Structure of benzene : molecular formula and Kekule structure. Stability and carbon-carbon bond lengths of benzene, resonance structure, MO picture. Aromaticity : The Huckel rule, aromatic ions.Aromatic electrophilic substitution ,echanism of nitration, halogenation, sulphonation, mercuration and Friedel-Crafts reaction. Energy profile diagrams. Activating and deactivating substituents, orientation and ortho/ para ratio. Side chain reactions of benzene derivatives. Birch reduction.Methods of formation and chemical reactions of alkylbenzenes, alkynylbenzenes and biphenyl.

Practical-
1. Preparation of *p*-bromoacetanilide from acetanilide by bromination
2. Preparation of 2,4,6-tribromo phenol from phenol / 2,4,6-tribromoaniline from aniline
3. Preparation of Acetanilide from aniline by acetylation

Recommended Text Books:
1. Organic Chemistry : Seyhand N Ege
2. Organic Chemistry : Morrison and Boyd

Reference Books:
1. Organic Chemistry : I L Finar
2. Organic Chemistry : Hendricson, Cram and Hammond
3. Organic Chemistry : Stanley H. Pine

References:
A Text Book of Qualitative organic Analysis, A I Vogel

II SEMESTER

PARTIAL DIFFERENTIATIONS

Unit I: Partial Derivatives – I(2-0-0)
Functions of two or more variables, Limits, Continuity, Partial derivatives, Differentiable functions, Linear approximation theorem.

Unit II: Partial Derivatives - II(2-0-0)
Homogeneous functions, Euler's Theorem, Chain Rule, Change of Variable, Directional Derivative, Partial Derivatives of higher order, Taylor's Theorem, Derivate of Implicit functions, Jacobians.

Unit III: Curves and Surfaces(2-0-0)
Quadratic Curves, surfaces, sphere, cylinder, cone, Ellipsoid, Hyperbloid, Parabloid, Ruled surfaces.

References:
1. Calculus by Anton,Wiley.
2. Calculus with Analytic Geometry by S K Stein, McGraw Hill.
3. First Course in Calculus by Serge Lang, Addison-Wiley.

Textbook:
1. Calculus, Vols. 1 and 2 by Lipman Bers, IBH.
2. Calculus and Analytical Geometry by Thomas and Finney, S.Chand and Co. Ltd.

Real Analysis

Unit I: Real Numbers(2-0-0)
The field axioms; Theorems about field properties, Order in R-Absolute value, Completeness, some important subsets of Intervals, Countable and Uncountable sets.

Unit II: Sequences(2-0-0)
Introduction, Convergent sequences, Divergent sequences, Oscillatory sequences, Bounded sequences, Some important limit theorems, Cauchy sequences, Monotonic sequences, Cluster points of a sequence, Limit superior and limit inferior of a sequence, Subsequences.

Unit III: Infinite Series(2-0-0)
Introduction, Sequence of partial sums of a series, Convergent series, Cauchy's general principle of Convergence for Series, A necessary condition for convergence, Series of positive terms, A fundamental result for series of positive terms, Geometric series, Comparison test, Cauchy's nth root test, D'Alembert's Ratio test, Raabe's test, Maclaurin's integral test.

References:
1. Real Analysis by J.M.Howie, Springer 2007.
2. Real Analysis by Malik, Wiley Eastern.
3. Mathematical Analysis by Malik and Savita Arora, New Age International Pvt. Ltd.
   Textbook:
1. Mathematical Analysis by Shanthinarayan, S. Chand and Co. Ltd.
2. Real Analysis by Rudin Walter

HEAT AND THERMODYNAMICS

Unit I : Kinetic Theory of Gases(2.5-0.4-0)
Theory (2.5Credits)
Introduction, Kinetic Theory of Gases, kinetic theory as particle model and usefulness of the model in explaining the regular structure of crystals (Review), an ideal gas – a macroscopic description, an ideal gas – a microscopic description, kinetic calculation of pressure, kinetic interpretation of temperature, ideal gas scale, intermolecular forces, specific heat of an ideal gas, law of equipartition of energy.Mean free path, Maxwell' distribution law, distribution of molecular speeds, van derWaal's equations of State, critical constants, application to liquefaction of gases.

Practicals:
1. Study of Newton's law of cooling**(0.2 Practical)**
2. Melde's experiment – determination of frequency. **(0.2 Practical)**

Unit II :   Heat and First Law of Thermodynamics(2-0.4-0)
Theory (2 Credits)

Thermal equilibrium, Zeroth law of thermodynamics, ideal gas temperature scale, heat as a form of energy, quantity of heat and specific heat, molar heat capacities of solids,the mechanicale quivalent of heat,heatandwork;   First law   of thermodynamics, Discussion on usefulness of First Law of Thermodynamics in Meteorology,   some special cases of the first law of thermodynamics – (i) adiabatic process, (ii) isothermal process, (iii) isochoric process, (iv) cyclic process, (v) free expansion.

Practicals;
1.   Study of variation of pressure and temperature of a gas at constant volume. **(0.2 Practical)**
2.   J by Joules Calorimeter.**(0.2 Practical)**

Unit III : Entropy and Second Law of Thermodynamics(2.5-0.4-0)
Theory (2.5 Credits)

Introduction, reversible and irreversible processes, the Carnot cycle, Carnot engine, Carnot theorem, absolute scale of temperature, second law of thermodynamics, efficiency of engines, the thermodynamic temperature scale, entropy in reversible and irreversible processes, entropy and the II law, entropy and disorder, consequences of II and III law of thermodynamics, Second law of thermodynamics as a probabilistic statement.Low temperature Physics – Porous Plug experiment, temperature of inversion, principle of regenerative cooling, liquefaction of air by Linde's method.

Practicals:
1. Lees and Charlton disc – Thermal conductivity of a bad conductor. **(0.2 Practical)**
2. Specific heat of a solid by the method of mixtures. **(0.2 Practical)**

Recommended Text Books:
1. Heat and Thermodynamics, Zeemansky, McGraw Hill.
2. Heat and Thermodynamics, N Subharamanyam, Brij lal

ELECTRICITY AND ELECTROMAGNETISM

Unit I : Electrostatics & Electric Currents(2.5-0-0)
Theory (2.5 Credits)

Vector Calculus : Scalar and Vector fields, Gradient of a Scalar, Divergence and Curl of a vector, Line, surface and volume integrals.

Review of Coulomb's law – Electric field and potential – Field due to a monopole, dipole, torque on a dipole in uniform and non-uniform E fields, Flux of an electric field. Gauss's law, applications to deduce electric fields, P.E. of a system of two charges, of many charges.

Basic circuit analysis – Kirchhoff's laws. Voltage and Current divider Rules. Single loop and two loop circuits, Mesh analysis, RC circuits, Maximum power transfer theorem.

Unit II: Electric Fields in Matter(2-0.4-0)

Theory (2 Credits)

Electric Fields: Capacitance, parallel plate capacitor, calculation of capacity of a spherical and cylindrical capacitor, energy stored in a capacitor, capacitor with dielectric, atomic view of dielectrics, polarization, electric field due to a polarised material, Gauss's law in dielectrics, Dielectric constant, Energy density of an electrostatic field (with and without dielectric).Polarisability and susceptibility – Frequency dependence of polarisability, Clausius- Mossotti equation

Practicals:

1.To study charging of a condenser & hence determine time constant. **(0.2 Practical)**

2. To study Variation of surface tension with temperature using Jaeggor's method. **(0.2 Practical)**

· **Unit III : Magnetostatics(2.5-0.6-0)**
Theory (2.5Credits)

Review of Ampere's law, $\oint B$
near a long wire, Magnetic lines of induction, force
between two parallel conductors, definition of ampere, B

law, applications. for a solenoid, Biot-savart's The magnetic field, Lorentz force and definition of magnetic field, magnetic induction, magnetic force on a current element, circulating charges, Cyclotron resonance frequency, Cyclotron. Magnetisation, magnetisation current density, magnetic field intensity, magnetic susceptibility and permeability.

Practicals:
1. To study the magnetic field along the axis of a current carrying circular coil. **(0.2 Practical)**
2. To study electromagnetic induction and verify farady's law. **(0.2 Practical)**
3. Ampere's Law. **(0.2 Practical)**

Recommended Text Books:
1. Electricity and Magnetism, Fewkes and Yarwood.
2. Electricity and Magnetism : A N Matveev, Mir Publishers, Moscow.
Reference Books:
1. Fundamentals of Physics, 6th Edition, David Halliday, Robert Resnick and Jearl Walker, John Wiley, Inc.

Physical chemistry

Unit I: Gaseous and Solid State (2.0-0.6-0)
Theory(2 credit)
 Definition of space lattice, unit cell, Laws of crystallography – (i) Law of constancy of interfacial angles,(ii) Law of rationality of indices, (iii) Law of symmetry. Symmetry elements in crystals, X-ray diffraction, Bragg equation. Predicting crystal structure . Defects in solids , Dielectric properties. kinetic theory of gases,deviation from ideal behaviour, van der Waals equation. Critical Phenomena :continuity of states, the isotherms of van der Waals equation, Derive a relationship between critical constants and van der Waals constants, the law of corresponding states, reduced equation of state.Molecular Velocitie Root mean square, average and most probable velocities. Liquefaction of gases (based on Joule-Thomson effect).

Practical-1. To evolve a scheme of analysis of anions and cations based on solubility products and common ion effect.(Total no 5)

   a) classification of anions and cations.
   b) Quantitative inorganic analysis of mixtures containing four radicals.
2. Determination of density by specific gravity bottle and viscosity of the given liquid by Ostwald's viscometer

Unit II: Liquids and Colloids ((2-0.6-0)

Theory(2 credit)

Intermolecular forces, structure of liquids ,Structural differences between solids, liquids and gases.Liquid crystals: Difference between liquid crystal, solid and liquid. Classification, structure of nematic and cholestric phases. Thermography and seven segment cell. Definition of colloids, classification of colloids.Solids in liquids (sols) : Properties – kinetic, optical and electrical; stability of colloids, protective action, Hardy – Schulze law, gold number.Liquids in liquids (emulsions) : Types of emulsions, preparation. Emulsifier.Liquids in Solids (gels) : Classification, preparation and properties, inhibition, general applications of colloids.

Practical-1. Determination of density by specific gravity bottle and surface tension of the given liquid by stalagnometer.
2. Measurement of vapour pressure of pure liquids and solutions ,finding enthalpy of vapourisation of water

Unit III : Acids and bases(2-0.6-0)
Theory(2 credit)

concepts of acids and bases involving concentrations and effects of solvent medium. Arrhenius, Bronstead-Lowry and Lewis concepts of acids and bases.Hard and Soft Acids and Bases (HSAB) -Classification of acids and bases as hard and soft. Pearson's HSAB concept, acid-base strength and hardness and softness. Symbiosis, theoretical basis of hardness and softness, electronegativity and hardness and softness.Non-aqueous Solvents- Physical properties of a solvent, types of solvents and their general characteristics, reactions in non-aqueous solvents with reference to liquid NH_3 and liquid SO_2.Practical-5. Determination of refractive index of pure liquids and mixtures .6. Determination of concentration of a given substance by colorimetry.

Recommended Text Books :

1. Sl.nos 1 to 6 of I Semester.
2. Principles of Physical Chemistry : Marron and Prutton
Reference Books:
3. Elements of Physical Chemistry : Samuel Glasstone and Lewis
4. Physical Chemistry : P W Atkins

References :
1. A Text Book of Quantitative Inorganic Analysis, A I Vogel
2. Practical Physical Chemistry, A Findlay

Inorganic chemistry

Unit I- Molecular Orbital theory, boranes and Xenon compounds(2-0.6-0)

Theory(2 credit)

Molecular orbital theory, basic ideas – criteria for forming M.O. from A.O., construction of M.O's by LCAO – H_2^+ ion, calculation of energy levels from wave functions, physical picture of bonding and antibonding ,Hybrid orbitals – sp, sp^2, sp^3; calculation of coefficients of A.O.s used in these hybrid orbitals. Introduction to valence bond model of H_2, comparison of M.O. and V.B. Models. homonuclear (He_2, N_2, O_2, F_2, C_2) and heteronuclear (CO and NO) diatomic molecules, bond Order and bond energy, percentage ionic character from dipole moment and electronegativity difference. Hydrides of boron-diborane and higher boranes, borazine, borohydrides, fullerenes, carbides, silicates (structural principle), - Chemistry of xenon: structure and bonding in xenon compounds.

Practical-

1. Iodination of Acetone by titration and Colorimetry.
2. Acid Hydrolysis of Ester.

Unit II : Coordination Compounds(2-0.8-0)
Theory(2 credit)

Werner's coordination theory and its experimental verification, nomenclature of coordination compounds, isomerism in coordination compounds, valence bond theory of transition metal complexes. Limitations of VBT. Elementary treatment of crystal field theory, splitting of d-orbitals in square planar, tetrahedral and octahedral complexes, factors affecting crystal field parameters, magnetic behavior and color of complexes using CFT, effective atomic number concept. Metal carbonyl, 18 electron rule, Preparation, structure and reactions of $Ni(CO)_4$, $Fe(CO)_5$ and $V(CO)_6$, nature of bonding in metal carbonyls.

Practical- 1. Reaction between Potassium Peroxydisulphate and Potassium Iodide.
2. Base Hydrolysis of an Ester by Titration and Conductometry
3. Iodine clock reaction
4. Solvolysis of Tertiary Butyl Chloride by Titrimetry, conductometry and pH metry

Unit-III- d-block and f-block elements(2-0.2-0)
Theory(2 credit)

d-block elements. Properties of the elements of the first transition series, their binary compounds and complexes illustrating relative stability of their oxidation states, coordination number and geometry. Chemistry of Elements of Second and Third Transition Series General characteristics, comparative treatment with their 3d-analogues in respect of ionic radii, oxidation states, magnetic behaviour, spectral properties and stereochemistry. Powder metallurgy extraction of tungsten. Position of lanthanaides and actinides in the periodic table, lanthanide contraction, spectral and magnetic properties of lanthanides, separation of lanthanides and actinides. extraction of Thorium, Uranium and Plutonium from burnt nuclear fuels

Practical- 1. Inversion of Cane Sugar

Recommended Text Books:-
1. University Chemistry : Bruce Mahan

2. Concise Inorganic Chemistry : J D Lee

Reference Books:

1. An Introduction to Inorganic Chemistry : Mackay and Mackay

Reference :

1. A Text Book of Quantitative Inorganic Analysis, A I Vogel

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Fundamentals of Computers

UNIT – I (Basics of computer System and Number System) (2-0.6-0)

Theory (2 Credits)

Introduction to Computer System and functions of its components, evaluation of Computers and their classification, hardware and software; Number System: Decimal, Binary, Octal and Hexadecimal and their inter conversions. Representation of integer and real numbers, characters and codes (BCD, ASCII and EBCDIC), error detecting and correcting codes (Parity, Gray and Hamming codes), binary and floating point arithmetic (addition and subtraction).

Practicals: (0.3 credit)

Sr. no.	Name of practical	Nature	Credit
1	Demonstration of different Hardware and software components of computers.	**Practical**	**0.1**
2	Description of assembly of computer system hardware	**Practical**	**0.1**
3	Description of the functionalities of different types of system software and application software.	**Practical**	**0.1**
4.	Practice of number systems and codes (BCD, ASCII and EBCDIC).	**Practice**	**0.3**

UNIT – II (Boolean Algebra) (2-0-0)

Theory (2 Credits)

Basic concepts of Boolean algebra and their electronic implementation through various logic gates, simplification of Boolean expressions (Boolean algebra and Karnaugh map method). Hard Devices and software device, CPU, Memory disks and its types.

UNIT – III (Software and MS office) (2-1.4-0)

Theory (2 Credits)

Network Basics and Internet, Concept of System software and application software, Office Automation (MS-Word, Excel and Power Point). Introduction to Data Bases, concept and architecture, Tables, Query and Report generation (MS- Access).

Practicals: (1.4 credit)

Sr. no.	Name of practical	Nature	Credit
	Word Processing:		
1	Document creation & formatting of that document,	**Practical**	0.1
2	Create a word document and grammar & spelling checking in that document,	**Practical**	0.1
3	Table creation in a word document and table handling handling,	**Practical**	0.1
4	Find & Replace function in Microsoft word,	**Practical**	0.1
5	Mail Merge, Macro functions in Microsoft word,	**Practical**	0.1
6	Document with multiple columns, Templates	**Practical**	0.1
	Spreadsheet:		
1	Creation of Workbook, entering data in multiple sheets, Cell referencing, charts,	**Practical**	0.2
2	Functions-Date & Time, Mathematical, Statistical, Look up and text.	**Practical**	0.2
	Presentation:		
1	Creation of Presentation and formatting, different views of presentation,	**Practical**	0.2
2	layouts and templates, Master slides, Animation, Transition.	**Practical**	0.2

Recommended text Books:

1. Computer Fundamentals, Architecture & Organization, B.RAM, New Age International, New Delhi, 2000
2. Fundamental of computer, V. Rajaraman, Prentice Hall India Pvt., Limited.

References:
1. Microsoft Office 2000 for Windows, S. Sagman, Berkeley Peachpit Press, 1999