UNIT I | SOLID STATE

**Introduction:** Classification of solids based on differences in binding forces: ionic, molecular, covalent, metallic solids (definition with example).

Crystalline and amorphous solids (elementary idea with examples)

Two dimensional and three dimensional lattices

Unit Cell – cubic unit cell

[Primitive, body centered and face centered]

Number of atoms per unit cell in a cubic cell

Schottky defect and Frenkel defect.

UNIT II | SOLUTION

**Types of Solutions:** Solution of solids in liquids, solubility of gases in liquids, solid solutions.

Colligative properties: relative lowering of vapour pressure – Raoult’s Law; Elevation of Boiling Point; Depression of Freezing Point; Osmotic Pressure. Reverse Osmosis (qualitative idea)

Determination of molar masses using colligative properties.

UNIT III | ELECTRO CHEMISTRY

**Oxidation** – reduction reaction:

Concept of red – ox reaction

Oxidation number and balancing of simple red – ox reactions by oxidation number method.

Red – ox titration:-

 Oxalic Acid – KMnO₄

KMnO₄ – Fe²⁺

K₂Cr₂O₇ – Fe²⁺

**Conductance in electrolytic solutions:**

Specific and molar conductivity (definition with example)

Electrolysis – Laws of Electrolysis

Electrolytic Cell
Galvanic Cell (Voltaic Cell)
Half – cell reaction, cell reaction, emf of a cell, standard electrode potential
Dry cell (dry cell battery)
Primary dry cell battery
Common dry cell battery
Alkaline battery
Mercury battery
Lithium battery
Secondary dry cell battery
Lead storage battery (lead accumulator)
Nickel – cadmium ("ni – cad") battery
(precaution in disposal)
(Only electrodes, cell reactions and emf of cells)
Fuel cell.

**CORROSION:** Introduction
Cause of corrosion
Factors influencing corrosion
Various methods of corrosion control

<table>
<thead>
<tr>
<th>UNIT IV</th>
<th>CHEMICAL KINETICS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rate of a reaction (average and instantaneous):</td>
<td></td>
</tr>
</tbody>
</table>
Factors influencing rate of a reaction: concentration, temperature, catalyst.
Order and molecularity of a reaction.
Rate law of first order, second order and zero order reaction.
Definition of half life of a reaction.
Concept of activation energy of a reaction

<table>
<thead>
<tr>
<th>UNIT V</th>
<th>SURFACE CHEMISTRY</th>
</tr>
</thead>
<tbody>
<tr>
<td>ADSORPTION: Physiosorption and chemisorption; factors affecting adsorption of gases on solid catalysis: homogeneous and heterogeneous</td>
<td></td>
</tr>
<tr>
<td>COLLOIDAL STATE: Distinction between true solutions, colloids and suspensions; lyophobic and lyophilic colloids.</td>
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</tr>
<tr>
<td>PROPERTIES OF COLLOIDS: Tyndal effect, Brownian Movement, electrophoresis, coagulation</td>
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<tr>
<td>EMULSION: Type of emulsion</td>
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</table>

<table>
<thead>
<tr>
<th>UNIT VI</th>
<th>EXTRACTION OF METALS</th>
</tr>
</thead>
<tbody>
<tr>
<td>General principles and methods of extraction</td>
<td></td>
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<tr>
<td>Ores and minerals</td>
<td></td>
</tr>
</tbody>
</table>
Concentration: Froth floatation
Calcination, roasting
Flux and slag
Electrolytic reduction, carbon reduction
Self reduction
Occurrence and principles of extraction of aluminium, copper and iron (no technical details)
Distinction and uses of cast iron, wrought iron and steel.
ALLOYS: Purpose of making alloys
Composition and uses of Bronze, Brass, Bell Metal, Duralumin, Stainless Steel.

UNIT VII | $S$ – BLOCK & $P$ – BLOCK ELEMENTS

S – Block Elements (alkali and alkaline earth metals)

GROUP 1 AND GROUP 2 ELEMENTS

General introduction

Elements of groups 1 & 2

Electronic configuration

Trends in variation in ionization enthalpy, atomic and ionic radii.

Trends in chemical reactivity with oxygen and halogens.

$P$ – BLOCK ELEMENTS

General introduction

Anomalous behavior of first period elements compared to heavier elements of each group – to highlight differences in oxidation states and composition of compounds.

GROUP 13 ELEMENTS

Elements of Group 13, Valence Shell electronic configuration, possible oxidation states, natural occurrence comparative chemical properties of boron and aluminium - reaction with acids and alkalis.

Uses of some important compounds of boron and aluminium: boric acid, boron trifluoride, diborane, alumina, alums, anhydrous aluminium chloride
GROUP 14 ELEMENTS
Elements of group 14
Valence Shell electronic configuration
Oxidation states
Natural occurrence
Carbon: catenation property; allotropic forms – physical properties and uses. Uses of silicon and carborundum.

GROUP 15 ELEMENTS
Elements of group 15, valence shell electronic configuration, possible oxidation status with examples of respective compounds; natural occurrence; allotropy of phosphorous.
Comparative chemical reactivity of nitrogen and phosphorous with respect to reaction with oxygens & halogens
Important compounds of nitrogen and phosphorous; Nitrous acid & nitric acid; phosphine, phosphorous pentoxide, phosphorous pentachloride, phosphorous acid and phosphoric acid (preparation and uses only)

GROUP 16 ELEMENTS
Elements of group 16, valence shell electronic configuration, possible oxidation status with examples of respective compounds, natural occurrence (chalcogens) (allotropy of Sulphur)
Preparation, physical properties and reaction of ozone (oxidation reaction with mercury, lead sulphide, lead sulphide and acidified KI)
Important compounds of Sulphur : Hydrogen Sulphide – use in analysis of basic radicals.
Sulfur dioxide and sulfur trioxide [preparation and uses]
Sulfur dioxide shows both oxidizing and reducing properties – explanation with examples.

GROUP 17 ELEMENTS
Elements of Group 17, valence shell electronic configuration, possible oxidation status with examples of compounds; natural occurrence (halogens)
Preparation of halogens (only preparative reaction) and comparative reactions of halogens: oxidizing property, reaction with water and alkali.
Hydrohalic acid : preparation and reactions; detection of halides.
Bleaching powder – preparation and uses

GROUP 18 ELEMENTS
Elements of group 18
General electronic configuration, chemical inertness, occurrence, important uses.

UNIT VIII
Compounds of xenon : xenon fluorides – preparation and structure only.


**d- BLOCK ELEMENTS:** General introduction and electronic configuration, occurrence and characteristic of transition metals, general trends in properties of the first row transition metals – ionization enthalpy, oxidation states, ionic radii, colour, catalytic property, magnetic property, alloy formation.

Preparation and properties of $\text{K}_2\text{Cr}_2\text{O}_7$ and $\text{KMnO}_4$.

## UNIT IX | COORDINATION COMPOUNDS

**Coordination compounds:** introduction with examples ligands, coordination number, shapes

Bonding: Werner’s Theory and Simple Isomerism

A few important coordination complex (formula, structure, colour):

- Brown ring compound, sodium nitroprusside, tetraamine copper (II) sulphate.
- A few examples of coordination compounds, important in biological system: haemoglobin, chlorophyll, Vitamin B$_{12}$ (nature and function).

## UNIT X | HALOALKANES AND HALOARENES

**HALOALKANES:** Introduction

Preparation: Preparation from alcohols by reaction with $\text{PX}_3$ ($\alpha = \text{Cl, Br}$), Iodine and red phosphorous thionyl chloride.

Haloform reaction – preparation of chloroform and iodoform [preparative methods not required]

Physical properties

Chemical properties – hydrolysis and dehydrohalogeneration

Reaction of methyl iodide with Mg – corriignard reagent

Uses of chloroform and iodoform

**FREONS:**

Introduction, examples, uses and environmental hazards.

DDT and its environmental hazards.

**HALOARENES:**

Introduction

Preparation of chlorobenzene and bromobenzene

Substitution reaction (directive influence of chlorine): Nitration of chlorobenzene

## UNIT XI | ALCOHOLS, PHENOLS AND ETHERS

**ALCOHOLS:**

- Aliphatic alcohol and aromatic alcohol (benzyl alcohol)

Introduction

Primary, secondary and tertiary alcohols (examples)

Method of preparation (primary alcohol only): Hydrolysis of alkyl halides

Hydrolysis of esters

Reduction of esters
Preparation of methanol from water gas and synthesis gas.
Preparation of ethanol by fermentation and hydration of ethene.
Preparation of rectified spirit, absolute alcohol, spectroscopic alcohol, “super dry” alcohol.
Identification of methanol and ethanol.

Physical properties:
Chemical properties: oxidation; reaction with Na, PCl₅, SOCl₂, esterification reaction, uses of methanol and ethanol.

PHENOLS:

Introduction
Preparation (phenol) from aniline (laboratory process) by cumene process (industrial process)

CHEMICAL PROPERTIES:
Identification and uses of phenol.

ETHERS:

ALIPHATIC ETHER AND AROMATIC ETHER (ANISOLE)

Introduction
Preparation of diethyl ether from ethanol (no experimental details)
Williamson Synthesis.
Preparation of anisole from phenol
Physical properties
Chemical properties: inflammability of diethyl ether (precaution to be taken)
Reaction with HI
Reaction of diethyl ether with aerial oxygen in the presence of light.
Preparation of peroxide – free diethyl ether
Uses of diethyl ether

UNIT XII ALDEHYDES, KETONES AND CARBOXYLIC ACIDS AND THEIR DERIVATIVES

ALDEHYDES:
Aliphatic aldehydes and aromatic aldehyde (benzaldehyde)

KETONES
Aliphatic ketones and aromatic ketone (acetophenone)
Introduction
Preparation
From:

- Alcohols
- Carboxylic acid
- Acid chlorides (Rosenmund reduction – aldehydes)
- Gatterman – Koch and Gatterman aldehyde
- Synthesis (benzaldehyde)
- Friedel – craft acylation reaction (acetophenone)

**Physical properties**

**Chemical properties**

**Oxidation reaction** (including reaction of aldehydes with Fehling’s and Tollens’ Reagents)

**Reduction reactions**

- Reduction with $H_2$ / Catalyst
- $Na–Hg, H_2O$; lithium aluminium hydride, sodium borohydride; Clemmensen reduction

**Addition reaction**: with HCN and $NaHSO_3$

**Hemiacetal and acetal formation**

**Reaction with hydroxylamine, hydrazine, phenylhydrazine, 2,4–dinitrophenylhydrazine (Brady’s Reagent), Semicarbazide**

**Aldol reaction**

**Cannizzaro and crossed cannizzaro reaction**

**Benzoin condensation**

**Perkin reaction**

**Distinction between aldehydes and ketones**

**Identification of acetaldehyde and acetone formation – uses.**

**CARBOXYLIC ACIDS:**

- Aliphatic carboxylic acids and aromatic carboxylic acid (benzoic acid)

**Introduction**

**Preparation**

- By the oxidation of alcohols and aldehydes, oxidation of toluene (benzoic acid).
- By the hydrolysis of alkyl and aryl cyanides
- By using Grignard reagent B
- By the hydrolysis of esters.

**Physical properties**

**Chemical properties**

- Acidic properties – reaction with alkali and $NaHCO_3$. 
Reaction with \( \text{PCl}_3, \text{PCl}_5 \) and \( \text{SoCl}_2 \)

Esterification reaction

Hunsdiecker reaction

Hell – Volhard – Zelinsky reaction

Identification of formic acid and acetic acid.

Uses of Acetic Acid

**DERIVATIVES OF CARBOXYLIC ACIDS:**

Acetyl chloride, acetic anhydride, Acetamide ethyl acetate – preparation and uses

**UNIT XIII | ORGANIC COMPOUNDS CONTAINING NITROGEN**

**AMINES:**

Introduction

Classification – primary, secondary and tertiary amines (examples with structures)

Preparation of primary amines by

- reduction of nitro compounds.
- Gabriel’s phthalimide synthesis.
- Hofmann degradation reaction

**ANILINE**

Preparation from nitrobenzene

Physical properties

Chemical properties

- Basic nature
- Isocyanide (carbylamine) reaction
- Diaz reaction.

**BENZENEDIAZONIUM SALTS:**

Preparation

Reactions involving replacement of diazo group by H, OH, Halogen, CN, NO\(_2\)

Coupling reaction

Reduction

**CYANIDES AND ISOCYANIDES:** preparation

**NITRO COMPOUNDS:**

Introduction

Preparation of nitroethane

Nitrobenzene and 1,3-di-nitrobenzene

Reduction of nitrobenzene under different conditions.

**UNIT XIV | BIOMOLECULES**

**CARBOHYDRATES:**
Introduction
Classification (aldose and ketose)

Monosaccharides
- Glucose and fructose structure (no elucidation) with D/L nomenclature
- Oxidation and reduction reactions
- Osazone formation
- Identification

OLIGOSACCHARIDES:
- Sucrose structure (no elucidation)
- Non reducing sugar, hydrolysis
- Identification

Polysaccharides:
- Starch, Monomer units, Hydrolysis
- Identification

PROTEINS:
Introduction
- Elementary idea of α - amino acids (examples: glycine, alanine, cysteine, serine, methionine, aspartic acid) zwitterionic structure, isoelectric point.
- Peptide bond, polypeptides
- Primary structure of proteins
- Identification

NUCLEIC ACID:
- DNA & RNA
- Nucleotides and nucleosides

UNIT XV | POLYMERS

- Natural and synthetic polymers
- Homopolymer and copolymer
- Polymerization reaction: addition and condensation polymerization
- Thermoplastics and thermosetting plastics (definition with examples)
- Preparation (no technical details) and uses of polyethylene, Teflon, Bakelite, Nylon, Terylene (synthetic fibres)
- Hazards of using plastic materials
- Biodegradable polymers

UNIT XVI | CHEMISTRY IN EVERY DAY LIFE

CHEMICALS IN MEDICINES:
Analgesics, antipyretics, tranquillisers, antimicrobials, antifungals, antifertility drugs, anti viral drugs, antacids, antihistamines, antimalarials, antiseptics, disinfectants (examples only)

Side effects of aspirin and paracetamol

CHEMICALS:
In food preservatives, artificial sweetening agents

CLEANSING AGENTS:
Soaps and detergents – their chemical composition and cleansing action.

UNIT WISE DISTRIBUTION OF MARKS AND PERIODS

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<th>MARKS</th>
<th>NO. OF PERIOD</th>
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<td>Total</td>
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PRACTICALS (72 periods)

CHEMISTRY PRACTICAL LAB

Practical (72 Pds)

LIST OF EXPERIMENTS:

EXPERIMENT 1

1.1 To prepare starch sol (hydrophilic sol)

1.2 To prepare hydrated ferric oxide sol (hydrophobic sol)
EXPERIMENT 2
2.1 To prepare potash alum
2.2 To prepare ferrous ammonium sulfate (Mohr’s Salt)
2.3 To prepare acetalilide
2.4 To prepare 1-phenylazo-2-naphthol dye (2-naphtholamine dye)

EXPERIMENT 3
To identify one of the following functional groups present in a solid organic sample:
- Aromatic primary amino (azodye test)
- Phenolic - OH (Fech test)
- Carboxylic acid group (NaHCO₃ test)
- Addehydie and Ketonic groups (Brady’s Reagent and Tollen’s Reagent test)

EXPERIMENT 4
4.1 To prepare methyl orange indicator solution
4.2 To prepare BDS indicator solution
4.3 To prepare Fehling’s Solution A and Fehling’s Solution B
4.4 To prepare 0.1 M Mohr’s Salt Solution in 0.5 – 1 M H₂SO₄

EXPERIMENT 5
To identify carbohydrates, fats and proteins given as pure samples.

EXPERIMENT 6
General acquaintance with chemical balance – sartorius / bunge / electronic (preferably electronic)
6.1 To prepare ~ 0.1 N standard sodium carbonate solution
6.2 To determine the strength of unknown ~ 0.1N HCL/H₂SO₄ (in normality, molarity and g/l) by titration with the standard ~ 0.1N Na₂CO₃ solution.
6.3 To prepare standard 0.1 N oxalic acid solution
6.4 To determine the strength of unknown 0.1N NaOH solution (in normality, morality and g/l) by titration with the standard ~ 0.1N oxalic acid solution.
6.5 To determine the strength of unknown ~ 0.1 N KMnO₄ solution (in normality, molarity and g/l) by titration with the standard ~ 0.1 N oxalic acid solution.
6.6 To determine the amount of iron in g/l present in the unknown ~ 0.1N Mohr’s Salt Solution by titration with the standardised 0.1N KMnO₄ solution.

6.7 To prepare standard ~ 0.1N K₂Cr₂O₇ solution.

6.8 To determine the amount of iron in g/l in the unknown ~ 0.1N Mohr’s Salt Solution by the standard ~ 0.1N K₂Cr₂O₇ solution.

**MARKS DISTRIBUTION**

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<th>DESCRIPTION</th>
<th>MARKS</th>
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<tr>
<td>01</td>
<td>One Expt. From Expt. 1 (any one) or Expt. 2 (any one)</td>
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<td>[Both the expts will be set and the candidate will choose one by lottery].</td>
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<tr>
<td>02</td>
<td>One Expt from Expt. 3 or Expt.4 (any one) or Expt.5</td>
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<td>[All three Expts. will be set and the candidate will chose one by lottery].</td>
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<tr>
<td>03</td>
<td>Expt. 6 (any one)</td>
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<tr>
<td>04</td>
<td>Viva Voce</td>
<td>3</td>
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<tr>
<td>05</td>
<td>Laboratory Note Book</td>
<td>4</td>
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<td><strong>TOTAL MARKS</strong></td>
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## Physics (PHYS)

**Total no. of weeks for classes / Year:** 36

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<tr>
<th>Classes per week:</th>
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<th>Practical =2</th>
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<td>Total classes per year:</td>
<td>216</td>
<td>Th=144</td>
<td>Practical =72</td>
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<tr>
<td>Total marks:</td>
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<td>Th= 70</td>
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<tr>
<th>Sl. No.</th>
<th>TOPIC</th>
<th>PERIODS</th>
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<tbody>
<tr>
<td><strong>UNIT I</strong></td>
<td>ELECTROSTATICS</td>
<td>15</td>
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<tr>
<td></td>
<td>Electric charge; conservation of charge, Coulomb’s Law – force between two point charges; principle of superposition – force due to multiple charges.</td>
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<td></td>
<td>Electric field - electric field due to a point charge, electric field lines; electric dipole – field due to a dipole, torque on a dipole placed in uniform electric field.</td>
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<td>Electric flux – Gauss’ theorem and its applications to find field due to uniformly charge infinite plane sheet and uniformly charged thin spherical shell [field inside and outside].</td>
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<td>Electric potential, potential difference, relation between intensity of electric field and potential, potential due to a point charge, equipotential surface. Potential energy of two point charges.</td>
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<tr>
<td></td>
<td>Conductors and insulators, free charge and bound charge inside a conductor. Dielectrics and electric polarization. Capacitor and capacitance, combination of capacitors in series and in parallel. Parallel plate capacitor, energy stored in a capacitor, Van De Graff generator.</td>
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<tr>
<td><strong>UNIT II</strong></td>
<td>CURRENT ELECTRICITY</td>
<td>10</td>
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<td></td>
<td>Electric current, flow of electrons in a metallic conductor, drift velocity, and its relation with electric current, volume density of current; Ohm’s law, electrical resistance. V-I characteristics [linear and non-linear] electrical energy and power, units of power, electrical resistivity and conductivity.</td>
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<td>Carbon resistors, colour code for carbon resistors, series and parallel combination of resistors; temperature dependence of resistors. Potential difference and e.m.f. of cells, internal resistance of a cell, series and parallel combination of cells, secondary cell.</td>
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</tbody>
</table>
Kirchhoff’s laws and simple applications. Wheatstone bridge, metre bridge, potentiometer-principle and its applications to measure potential difference and for comparing emf of two cells, measurement of internal resistance of a cell. Household wiring, three pin plug point, miniature circuit breaker [MCB].

**UNIT III  MAGNETIC EFFECT OF CURRENT & MAGNETISM**

Concept of magnetic field, Oersted’s experiment. Biot Savart Law and its application to current carrying circular loop at the centre, magnetic moment due to a current carrying circular loop. Ampere’s circuitual law and its applications to infinitely long straight wire, straight and toroidal solenoids. Force on a moving charge in uniform magnetic and electric fields. Force on a current carrying conductor in a uniform magnetic field. Force between two parallel current carrying conductors (no deduction) – definition of ampere. Torque on a current carrying loop in uniform magnetic field; moving coil galvanometer and its conversion to ammeter and voltmeter.

Earth’s magnetic field and magnetic elements. Dia,para-and ferro-magnetic substances. Electro magnet and permanent magnet.

**UNIT IV  ELECTROMAGNETIC INDUCTION & ALTERNATING CURRENTS**

Electromagnetic induction; Faraday’s laws, induced e.m.f. and current; Lenz’s law; eddy currents, self and mutual inductance. Alternating current, peak and rms values of alternating current and voltage; reactance and impedance; series LCR circuit, resonance, power in AC circuits, Wattless Current. AC generator and transformers, its different types; power station-thermal and hydel; transmission and distribution of power, renewable energy (basic principle only).

**UNIT V  ELECTROMAGNETIC WAVES**

Need for displacement current; Electromagnetic waves and their characteristics; Transverse nature of electromagnetic waves. Electromagnetic spectrum.

**UNIT VI  OPTICS**

Reflection of light, spherical mirror, mirror formula, refraction of light, total internal reflection and its application, optical fibres. Refraction at spherical surfaces, lenses, thin lens formula, lens maker’s formula, combination of thin lenses in contact. Refraction and dispersion of light through a prism, dispersive power of prism.

Scattering of light – blue colour of the sky and reddish appearance of the sun at sun rise and sun set.

Optical instruments: Microscopes and astronomical telescopes [reflecting and refracting] and their magnifying powers (no deduction), human eye – image formation and accommodation, correction of eye defects using lenses.

Wave optics: wave front and Huygens’ principle. Young’s double slit experiment and expression for fringe width, coherent sources and sustained interference of light.

Diffraction due to a single slit, width of central maxima (no deduction).
Polarization: plane polarized light, Brewster’s law, uses of plane polarized light and polaroids.

<table>
<thead>
<tr>
<th>UNIT VII</th>
<th>DUAL NATURE OF MATTER &amp; RADIATION</th>
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<tbody>
<tr>
<td></td>
<td>Dual nature of radiation, photoelectric effect, Einstein’s photoelectric equation, particle nature of light. Matter waves – wave nature of particles, de Broglie relation.</td>
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<tr>
<th>UNIT VIII</th>
<th>ATOMS &amp; NUCLEI</th>
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<tbody>
<tr>
<td></td>
<td>Bohr’s model, energy level, hydrogen spectrum. Continuous and characteristic x rays spectra. Composition and size of nucleus, atomic masses, isotopes, isobars, isotones. Radio activity – alpha, beta and gamma particles / rays and their properties; radioactive decay law. Mass energy relation, mass defect; binding energy per nucleon and its variation with mass number; nuclear fission and fusion.</td>
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<tr>
<th>UNIT IX</th>
<th>ELECTRONIC DEVICES</th>
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<tr>
<th>UNIT X</th>
<th>COMMUNICATION SYSTEM</th>
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<td>Elements of a communication system [block diagram only], band width of signal [audio, video and digital]; bandwidth of a transmission medium, transmission media. Noise, Signal to noise [S/N] ratio. Propagation of electromagnetic waves – ground, sky and space waves. Need for modulation – production and detection of amplitude modulated wave, satellite communication.</td>
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**UNIT WISE DISTRIBUTION OF PERIODS AND MARKS**

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<th>Periods</th>
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<tbody>
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<td>I</td>
<td>Electrostatics</td>
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<tr>
<td>II</td>
<td>Current Electricity</td>
<td>10</td>
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<tr>
<td>III</td>
<td>Magnetic effect of Current &amp; Magnetism</td>
<td>16</td>
<td>08</td>
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<tr>
<td>IV</td>
<td>Electromagnetic induction and Alternating Current</td>
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<td>V</td>
<td>Electromagnetic Waves</td>
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<td>12</td>
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<tr>
<td>-------</td>
<td>-----------------------------------------------</td>
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<td>------------------------------------------</td>
</tr>
<tr>
<td>I</td>
<td>Electrostatics</td>
<td>1 x 3</td>
<td>1 x 2</td>
</tr>
<tr>
<td>II</td>
<td>Current Electricity</td>
<td>1 x 4</td>
<td>1 x 1</td>
</tr>
<tr>
<td>III</td>
<td>Magnetic effect of current &amp; magnetism</td>
<td></td>
<td>3 x 1</td>
</tr>
<tr>
<td>IV</td>
<td>Electromagnetic induction and alternating current</td>
<td>1 x 1</td>
<td>1 x 1</td>
</tr>
<tr>
<td>V</td>
<td>Electromagnetic waves</td>
<td></td>
<td></td>
</tr>
<tr>
<td>VI</td>
<td>Optics</td>
<td>1 x 1</td>
<td>1 x 3</td>
</tr>
<tr>
<td>VII</td>
<td>Dual nature of radiation &amp; matter</td>
<td>1 x 1</td>
<td>1 x 1</td>
</tr>
<tr>
<td>VIII</td>
<td>Atoms &amp; Nuclei</td>
<td>1 x 2</td>
<td></td>
</tr>
<tr>
<td>IX</td>
<td>Electronic Devices</td>
<td>1 x 1</td>
<td>1 x 1</td>
</tr>
<tr>
<td>X</td>
<td>Communication System</td>
<td>1 x 2</td>
<td>1 x 1</td>
</tr>
<tr>
<td></td>
<td><strong>TOTAL NO. OF QUESTIONS</strong></td>
<td>15</td>
<td>10</td>
</tr>
</tbody>
</table>

**TOTAL NO. OF QUESTIONS**

- MCQ should have 4 options with only one correct answer.
- Alternative questions should be from the same unit.
- For short answer type question, marks [3] should be divided into smaller parts like 1+2 or 1+1+1
- For long answer type question, marks [5] should be divided into smaller parts like 1+4 or 2+3 or 1+1+3.

**OPTION PATTERN**

<table>
<thead>
<tr>
<th>SL NO</th>
<th>QUESTION PATTERN</th>
<th>NO. OF OPTIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>01</td>
<td>Very short answer type questions</td>
<td>At least 5</td>
</tr>
<tr>
<td>02</td>
<td>Short answer type questions</td>
<td>At least 6</td>
</tr>
<tr>
<td>03</td>
<td>Long answer type questions</td>
<td>3</td>
</tr>
</tbody>
</table>
PRACTICALS (72 periods)

PHYSICS PRACTICAL LAB

Practical (72 Pds)

Every student has to perform at least 10 (Ten) experiments out of the list of following experiments and to carry out one project under the guidance of teacher.

LIST OF EXPERIMENTS
1) To measure resistance of a given wire using metre bridge and hence to find the specific resistance of its material.
2) To compare the emf of two given primary cells using potentiometer.
3) To verify the laws of series and parallel combination of resistance using post office box.
4) To determine resistance of a galvanometer by half deflection method and to find its figure of merit.
5) To convert the given galvanometer of known resistance and figure of merit into an ammeter and voltmeter of desired range and to verify the same.
6) To find the focal length of a convex lens by plotting 1/u against 1/v.
7) To determine refractive index of a glass slab using a travelling microscope.
8) To construct a full wave rectifier using pn junction diodes with capacitor filter and to draw load current – load voltage graph and hence to find percentage regulation using bread board.
9) To draw the I-V characteristics of a Zener Diodes in the reverse bias and to find the break down voltage.
10) To draw the output characteristics of a pnp/pnp transistor in the common – emitter configuration and to find the current gain.
11) To verify the truth table of NAND / NOR gate and to show that they are universal gate [using bread board].
12) To study the variation of resistance of a LDR with intensity of light from LED as a source [using bread board]
13) Use of solar cell as generator of energy.
14) To fabricate and test a circuit consisting of two lines, one with two bulbs and a fan and the other with a high current plug point using a MCB and feed by AC mains.

Students should be conversant with the use of multi-meter.

EVALUATION SCHEME FOR PRACTICAL EXAMINATION

<table>
<thead>
<tr>
<th></th>
<th>Description</th>
<th>Marks</th>
</tr>
</thead>
<tbody>
<tr>
<td>01</td>
<td>One experiment to be performed</td>
<td>15</td>
</tr>
<tr>
<td>02</td>
<td>Practical record</td>
<td>05</td>
</tr>
<tr>
<td>03</td>
<td>Project</td>
<td>05</td>
</tr>
<tr>
<td>04</td>
<td>Viva voce on experiment and project</td>
<td>05</td>
</tr>
<tr>
<td></td>
<td><strong>TOTAL</strong></td>
<td><strong>30</strong></td>
</tr>
</tbody>
</table>
# Course Content:

## Theory: (144 Pds)

### UNIT I

**Content [Name of the Topic]**

<table>
<thead>
<tr>
<th>Periods</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>20</td>
<td></td>
</tr>
</tbody>
</table>

#### ALGEBRA [Marks : 10]

- **1.1** Concept, notation, order, equality, types of matrices, zero matrix, transpose, symmetric and skew symmetric matrices, operations on matrices, invertible matrices [upto 3rd order]

- **1.2** Determinant of a square matrix [upto 3rd order], properties of determinant, minor, co-factor and application in calculating the area of triangle. Adjoint and inverse of a square matrix, Cramer’s rule [unique solution].

### UNIT II

**Differential Calculus [Marks:25]**

<table>
<thead>
<tr>
<th>Periods</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>44</td>
<td></td>
</tr>
</tbody>
</table>

- **2.1** Intuitive Idea of Limit and Continuity
  
  \[
  \lim \left( x^n - a^n \right) / (x-a), \quad \lim \left( \sin x \right) / x, \quad \lim \left( e^x - 1 \right) / x, \quad \lim \left( a^x - 1 \right) / x, \quad \lim \ln(1+x) / x
  \]
  
  \[
  x \to a \quad x \to 0 \quad x \to 0 \quad x \to 0 \quad x \to 0
  \]

  Testing of continuity problems

- **2.2** Definition – derivative of standard function, rules for differentiation, differentiation of parametric, logarithmic and implicit functions.

- **2.3** Successive differentiation upto 2nd order problems
**UNIT III**

**INTEGRAL CALCULUS [MARKS:25]**

<table>
<thead>
<tr>
<th>2.4 Application of derivative:</th>
</tr>
</thead>
<tbody>
<tr>
<td>a) Maxima-Minima, simple problems [that illustrate basic principles and understanding of the subject as well as the real life situations].</td>
</tr>
<tr>
<td>b) Tangent Normal: Equation of tangent and normal for standard curves and its condition.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>UNIT IV <strong>DIFFERENTIAL EQUATION [MARKS:10]</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>4.1 Definition, order and degree of a differential equation – solution of differential equation of 1(^{st}) order by the method of separation of variables, solution of homogeneous differential equation of 1(^{st}) order and 1(^{st}) degree.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>UNIT V <strong>VECTOR [MARKS:10]</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>5.1 Vector and scalar, magnitude and direction of a vector, types of vector [equal, unit, zero, parallel and co-linear vectors], position vector of a point, negative of a vector, addition of vectors, multiplication of vectors by scalar, position vector of a point dividing a line segment in a given ratio. Scalar [dot] product of vectors, projection of a vector on a line, vector [cross] product of two vectors.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>UNIT VI <strong>PROJECT [MARKS:20] [ANY TWO]</strong></th>
</tr>
</thead>
</table>

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**MARKS DISTRIBUTION**

- INTEGRAL CALCULUS [MARKS:25]
- DIFFERENTIAL EQUATION [MARKS:10]
- VECTOR [MARKS:10]
- PROJECT [MARKS:20] [ANY TWO]
### 6.1 Determination of area bounded by a known curve [straight line, circle, parabola, ellipse] by definite integral [using graph paper].

### 6.2 Detail discussion on maxima and minima of a given function.

### 6.3 Discussion on origin and formation of differential equation and its solution.

### 6.4 History, development and application of matrix and matrix algebra.

#### MATH QUESTION PATTERN

##### CLASS XII

<table>
<thead>
<tr>
<th>CHAPTER</th>
<th>NO. OF QUESTION</th>
<th>MARKS ALLOTTED</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>ALGEBRA</strong></td>
<td>LA – 1 (Out of 2)</td>
<td>05</td>
</tr>
<tr>
<td>• Matrices</td>
<td>SA –</td>
<td>-</td>
</tr>
<tr>
<td>• Determinant</td>
<td>VSA – 1 (Out of 2)</td>
<td>02</td>
</tr>
<tr>
<td></td>
<td>MCQ – 3</td>
<td>03</td>
</tr>
<tr>
<td><strong>DIFFERENTIAL CALCULUS</strong></td>
<td>LA – 2 (Out of 4)</td>
<td>10</td>
</tr>
<tr>
<td>• Limit Continuing</td>
<td>SA – 2 (Out of 4)</td>
<td>08</td>
</tr>
<tr>
<td>• 1st Order derivative</td>
<td>VSA – 2 (Out of 4)</td>
<td>04</td>
</tr>
<tr>
<td>• 2nd Order derivative</td>
<td>MCQ – 3</td>
<td>03</td>
</tr>
<tr>
<td>• Maxima – minima</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Tangent Normal</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>INTEGRAL CALCULUS</strong></td>
<td>LA – 1 (Out of 3)</td>
<td>05</td>
</tr>
<tr>
<td>• Indefinite integral</td>
<td>SA – 3 (Out of 5)</td>
<td>12</td>
</tr>
<tr>
<td>• Definite integral</td>
<td>VSA – 2 (Out of 4)</td>
<td>04</td>
</tr>
<tr>
<td>• Area evaluation</td>
<td>MCQ – 4</td>
<td>04</td>
</tr>
<tr>
<td><strong>DIFFERENTIAL EQUATION</strong></td>
<td>LA –</td>
<td>-</td>
</tr>
<tr>
<td>• Order degree of differential equation</td>
<td>SA – 2 (Out of 4)</td>
<td>08</td>
</tr>
<tr>
<td>• Solution of 1st order differential equation by separation of variable.</td>
<td>VSA – 1 (Out of 2)</td>
<td>02</td>
</tr>
<tr>
<td>• Solution of homogeneous differential equation of 1st order and 1st degree</td>
<td>MCQ</td>
<td>-</td>
</tr>
<tr>
<td><strong>VECTOR</strong></td>
<td>LA –</td>
<td>-</td>
</tr>
<tr>
<td>• Magnitude, direction, different types of vector, position vector of a point etc.</td>
<td>SA – 2 (Out of 4)</td>
<td>08</td>
</tr>
<tr>
<td>• Scalar (dot) and vector (cross) product of two vectors.</td>
<td>VSA – 1 (Out of 2)</td>
<td>02</td>
</tr>
<tr>
<td></td>
<td>MCQ</td>
<td>-</td>
</tr>
</tbody>
</table>

MCQ – 10 X 1 = 10 (No. of alternatives)
VSA – 7 X 2 = 14 (Total 14 Questions)
SA – 9 x 4 = 36 (Total 17 Questions)
LA – 4 X 5 = 20 (Total 9 Questions)
80 Total 50 Questions