# Contents

# PI

- Impulse

- Friction

- Types of Friction

- Angle of Friction

- Methods of Reducing Friction

HYSI	ICS		- Centripetal and Centrifugal F		- Stress-Strain Curve
- Pi - Ti - M	its and Measurement 1-7 hysical Quantities types of Physical Quantities Measurement of a Physical Quantities Units Tractical Units		<ul> <li>Applications of Centripetal at Centrifugal Forces</li> <li>Centre of Mass</li> <li>Moment of Inertia</li> <li>Definitions Related to Mome Inertia</li> <li>Angular Momentum</li> </ul>		<ul> <li>Modulus of Elasticity</li> <li>Fluid</li> <li>Fluid Density</li> <li>Fluid Pressure</li> <li>Pascal's Law</li> <li>Buoyancy</li> <li>Law of Floatation</li> </ul>
- M - E	Dimensions  Measurement Equipments  Meror in Measurement  Classification of Errors	4.	Work, Energy and Power  - Work  - Types of Work  - Work Done as a Consequence	<b>22-27</b> e of Force	<ul><li>Archimedes' Principle</li><li>Flow of Fluid</li><li>Equation of Continuity</li><li>Bernoulli's Theorem</li></ul>
- R - B - A - Fi - G - P - C	ntroduction Lest and Motion Lest and Motion Lasic Terms Related to Motion Locceleration Loceleration Locelera	5.	<ul> <li>Conservative and Non-Conservative</li> <li>Forces</li> <li>Energy</li> <li>Kinetic Energy</li> <li>Potential Energy</li> <li>Sources of Energy</li> <li>Law of Conservation of Energy</li> <li>Power</li> </ul> Gravitation		<ul> <li>Viscosity</li> <li>Coefficient of Viscosity</li> <li>Stokes Law</li> <li>Terminal Velocity</li> <li>Surface Tension</li> <li>Factors Affecting Surface Tension</li> <li>Applications of Surface Tension</li> <li>Surface Energy</li> <li>Angle of Contact</li> <li>Capillarity</li> </ul>
Vo Mo - For - To - In - N	angular Displacement and Angular relocity  Tree and Newton's Laws of tion  14-21  Orce  Types of Forces  Inertia  Jewton's Laws of Motion  Jewton's First Law of Motion  Jewton's First Law of Motion  Jewton's Momentum		<ul> <li>Gravitation</li> <li>Newton's Law of Gravitation</li> <li>Centre of Gravity</li> <li>Acceleration Due to Gravity of Factors Affecting Acceleration Gravity</li> <li>Mass and Weight</li> <li>Planets</li> <li>Kepler's Laws of Planetary M</li> <li>Satellite</li> </ul>	n due to	- Capillarity  7. Oscillation, Wave and Sound 43-52 - Periodic Motion - Oscillatory Motion - Simple Harmonic Motion (SHM) - Simple Pendulum - Damped Harmonic Motion - Resonant Oscillations - Wave - Definitions Related to Waves
– N	lewton's Second Law of Motion	6	Properties of Matter	33-42	- Sound

- Matter

- Properties of Solids

- Hooke's Law

- Solid

- Speed of Sound

– Human Ear

- SONAR

- Characteristics of Sound

- Properties of Sound Wave

8. Heat, Temperature and Thermodynamics

- Heat

<ul> <li>Heat and States of Matter</li> <li>Temperature</li> <li>Thermometers</li> <li>Thermal Expansion</li> <li>Importance of Thermal Expansion in Solids</li> <li>Specific Heat</li> <li>Humidity</li> <li>Latent Heat</li> <li>Principle of Colorimetry</li> <li>Change in State</li> </ul>	<ul> <li>Lenses</li> <li>Power and Magnification for a Lens</li> <li>Prism</li> <li>Angle of Deviation</li> <li>Dispersion of Light</li> <li>Colour of Objects</li> <li>Scattering of Light</li> <li>Tyndall Effect</li> <li>Human Eye</li> <li>Optical Instruments</li> <li>Interference and Diffraction of Light</li> </ul>	<ul> <li>Earth's Magnetism</li> <li>Magnetic Substances</li> <li>Electromagnets</li> <li>Electromagnetic Induction</li> <li>Eddy Current</li> <li>Direct Current and Alternating Current</li> <li>Electric Motor</li> <li>Commercial Electric Motor</li> <li>AC Generator or Dynamo</li> <li>DC Generator or Dynamo</li> <li>Transformer</li> </ul>
<ul> <li>Transmission of Heat</li> <li>Black Body</li> <li>Kirchhoff's Law</li> <li>Stefan's Law</li> <li>Wien's Displacement Law</li> <li>Thermodynamics</li> <li>Thermal Equilibrium</li> <li>Zeroth Law of Thermodynamics</li> <li>First Law of Thermodynamics</li> <li>Second Law of Thermodynamics</li> <li>Heat Engine</li> <li>Refrigerator or Heat Pump</li> <li>Kinetic Theory of Gases</li> </ul>	- Polarisation of Light  10. Electric Current and its Effects 78-87  - Electricity - Electric Charge - Electric Field - Electric Flux - Gauss's Theorem - Electric Potential - Electric Dipole and Capacitor - Electric Current - Ohm's Law - Electrical Resistance	12. Modern Physics (Atomic and Nuclear Physics) 95-103  - Electron Emission - Photoelectric Effect - Einstein's Photoelectric Equation - de-Brogile Wavelength - de Brogile Wave of an Electron - X-rays - Atom - Atomic Models - Nucleus - Einstein's Mass-Energy Relation
9. Optics  - Light  - Wave Nature of Light  - Sources of Light  - Properties of Light  - Reflection of Light  - Image  - Mirrors  - Plane Mirror  - Spherical Mirrors	<ul> <li>Heating Effect of Electric Current</li> <li>Household Electrical Circuit</li> <li>Chemical Effect of Electric Current</li> <li>Faraday's Laws of Electrolysis</li> <li>Electroplating</li> <li>Electric Cell</li> <li>Magnetic Effects of Electric Current</li> <li>Rules Related to Direction of Magnetic Field</li> <li>Magnetism</li> <li>Magnet</li> <li>Magnet</li> </ul>	<ul> <li>Radioactivity</li> <li>Types of Radioactive Decay</li> <li>Nuclear Fission</li> <li>Nuclear Reactor</li> <li>Nuclear Fusion</li> </ul> 13. Semiconductor Electronics and Communication System 104-109 <ul> <li>Electronics</li> <li>P-n Junction Diode</li> <li>Transistor</li> </ul>

- Refraction of Light

- Total Internal Reflection

- Refractive Index

53-62

Types of MagnetProperties of Magnet

- Magnetic Field

- INTEGRATED CIRCUITS (ICs)
- Logic Gates
- Communication System
- Message Signals
- Modulation
- LASER
- MASER
- RADAR

#### 14. Our Universe

110-114

- Universe
- Composition of Universe
- Galaxy
- Stars
- Solar System

### **CHEMISTRY**

# 1. Physical and Chemical Changes of Substances and their Separation

- Changes
- 115-123
- Physical Change
- Chemical Change
- Matter
- Classification of Matter
- Interconversion of States of Matter
- Chemical Composition of Matter
- Solution
- Colloidal Solution
- Emulsions
- Separation of Components of the Mixture

#### 2. Atomic Structure

- 124-130
- Introduction
- Dalton's Atomic Theory
- Atoms and Molecules
- Subatomic Particles of an Atom and their Properties
- Types of Atomic Species

- Rutherford's Atomic Model
- Bohr's Model
- Structural Features of an Atom
- Electronic Configuration
- Filling of Electrons in the Orbitals of an Atoms

### 3. Classification of Elements 131-137

- Introduction
- Need for Classification of Elements
- Earlier Attempts of Classification of Elements
- Development of Periodic Table
- Modern Periodic Table
- Periodic Properties

# 4. Chemical Bonding, Reactions and Equations 138-146

- Chemical Bonding
- Valency and Related Terms
- Types of Chemical Bond
- Chemical Formula
- Types of Chemical Formula
- Chemical Equation
- Chemical Reactions
- Types of Chemical Reactions
- Effect of Oxidation Reactions in Daily
- Electrolysis
- Catalyst and Catalysis
- Applications of Catalysts in Industrial Processes

### 5. Elements and Compounds 147-159

- Metals
- Physical Properties of Metals
- Chemical Properties of Metals
- Reactivity Series of Metals
- Metallurgy
- Minerals, Ores and Gangue

#### - Non-Metals

- Physical Properties of Non-Metals
- Chemical Properties of Non-Metals
- Hydrogen
- Carbon (C)
- Nitrogen
- Phosphorus (P)
- Oxygen (O<sub>2</sub>)
- Sulphur (S)
- Halogens
- Noble Gases
- Metalloids

### **6.** Acid, Base and Salt 160-166

- Acids
- Classification of Acids
- Properties of Acids
- Bases
- Classification of Bases
- Properties of Bases
- The pH Scale
- Salts
- Types of Salts

### 7. Organic Chemistry 167-176

- Organic Compounds
- Classification of Organic Compounds
- Important Terms Related to Organic Compounds
- Isomerism
- Hydrocarbons
- Some Organic Compounds Containing Carbon, Hydrogen and Oxygen
- Nitro Compounds

# 8. Chemistry in Everyday

177-188

- Cleansing Agents
- Soaps
- Detergents

- Explosives
- Fire Extinguisher
- Fertilisers
- Pesticides
- Dyes
- Cement
- Polymers
- Plastics
- Rubber
- Oil and Fats
- Chemicals in Medicines
- Chemicals in Food
- Chemicals in Cosmetics
- Fuels
- Liquid Fuel
- Solid Fuel
- Hybrid Fuel
- Other Important Fuels

# 9. Environmental Chemistry

189-194

- Environmental Pollution
- Atmospheric Pollution
- Water Pollution
- Soil Pollution
- Strategy for Control of Pollution
- Electronic Waste

### **BIOLOGY**

### 1. Introduction to Biology and Diversity in Living World 195-203

- Introduction to Biology
- Living World
- Classification of Living Organisms
- Systems of Classification
- Kingdom-Monera
- Economic Importance of Bacteria
- Kingdom-Protista

- Kingdom-Fungi
- Economic Importance of Fungi
- Harmful Fungal Activities

# 2. Classification of Plant and Animal Kingdom 204-213

- Kingdom-Plantae
- Cryptogamae
- Thallophyta (Algae)
- Bryophytes
- Pteridophytes
- Phanerogamae
- Gymnosperms
- Angiosperms
- Kingdom-Animalia
- Phylum-Porifera
- Phylum-Coelenterata (Cnidaria)
- Phylum-Platyhelminthes (Flatworms)
- Phylum-Nermatoda (Thread or Roundworm)
- Phylum-Annelida (Segmented Worms)
- Phylum-Arthropoda (Animals with Jointed legs)
- Phylum-Mollusca (Soft Bodied Animals)
- Phylum-Echinodermata (Spiny-Skinned Animals)
- Phylum-Chordata (Vertebrata)
- Classification of Phylum-Chordata
- Viruses

### **3.** Cell: The Unit of Life 214-221

- The Cell
- Cell Theory
- Types of Cell
- Structural Organisation of a Cell

222-226

- Cell Cycle and Cell Division

### 4. Tissue

- Introduction

- Plant Tissues
- Meristematic Tissues
- Permanent or Mature Tissues
- Animal Tissue
- Some Specialised Tissues of Animals

# 5. Plant Morphology and Physiology

227-236

- Morphology of Plants
- Morphology of Roots
- Morphology of Stem
- Morphology of Leaves
- Morphology of Flower
- Nutrition in Plants
- Photosynthesis
- Respiration in Plants
- Transportation in Plants
- Excretion in Plants
- Plant Growth and Development
- Reproduction in Plants
- Types of Reproduction in Plants
- Sexual Reproduction in Flowering Plants
- Plant Diseases

# 6. Human Physiology 237-254

- Introduction
- Digestion in Humans
- Alimentary Canal
- Digestive Glands
- Respiration in Humans
- Respiratory Tract
- Mechanism of Breathing
- Disorders of Respiratory System
- Transportation in Humans
- Circulatory System
- Cardiovascular Diseases or Diseases of Transport System
- Excretion in Humans

- Skeletal System
- Disorders of Skeletal System
- Neural Co-ordination in Humans
- Nervous System
- Sensory Organs
- Human Endocrine System
- Reproduction in Humans
- Male Reproductive System
- Female Reproductive System

#### 7. Genetics and Evolution 255-261

- Genetics
- Rules of Inheritance
- Inheritance of one Gene
- Inheritance of Two Genes
- Sex Determination in Humans
- Gene and Gene Concept
- Genetic Code
- Evolution
- Theories of Evolution
- Lamarckism
- Darwinism
- Evidences for Evolution
- Mechanisms of Evolution
- Human Evolution

# 8. Nutrition, Human Health and Disease 262-273

- Nutrition
- Nutrients
- Organic Substances
- Inorganic Substances
- Health
- Disease
- Communicable Diseases
- Non-Communicable Diseases
- Genetics Diseases
- Other Diseases
- Immunity

- Immunisation (or Vaccination)
- Autoimmunity

### 9. Biotechnology

274-281

- Introduction
- Techniques of Biotechnology
- Recombinant DNA Technology (RDT)
- Stem Cells
- Applications of Biotechnology
- Transgenic Animals
- Some Common Genetically Modified Crops
- Reproduction and Embryology

## 10. Environment, Ecology and Biodiversity 282-290

- Environment
- Categorisation of Environment
- Ecology
- Ecosystem
- Food Chain
- Ecological Pyramids
- Ecological Succession
- Biodiversity
- Conservation of Biodiversity
- Different National and International Conventions on Wildlife

# 11. Economic Botany and Zoology

- 291-300
- Agriculture
- Agronomy
- Economic Importance of Plants
- State of Agriculture in India
- Agro forestry
- Plant Breeding
- Animal Husbandry
- Different Animals and their Keeping or Culturing Fields
- Animal Disease

### SCIENCE AND TECHNOLOGY

# 1. Development of Science and Technology in India 301-311

- Development of Science in Ancient, Medieval and Modern India
- Development during post independent
- Important Research Institutes in India
- Development of Science and Technologies in Five Years Plan
- Eminent Indian Scientists
- Science, Technology and Innovation Policy 2020
- Technology Vision 2035
- Science and Technology Awards of India

# 2. Space Technology and Indian Space Programme 312-329

- Indian Space Research Programme
- Department of Space
- ISRO
- Orbit
- Satellites
- Launch Vehicles Programmers
- Major Space Centres in India
- Future ISRO Missions

# 3. Nanotechnology and Its Applications 330-337

- Nanotechnology
- Nano Materials
- Evalution of Nanotechnology in India
- Major Nano technological Institutions in India

### 4. Nuclear Technology 338-347

- Nuclear Energy
- Radioactivity
- Nuclear Fission

_	Nuclear Fusion
_	Radioicotopes

- Development of Nuclear Energy in India
- Use of Nuclear Power

### 5. Defence Technology

348-362

363-369

- DRDO
- The Missile System
- Types of Missiles
- India's Missile Development Programme
- Indian Navy Ships
- Submarines
- Tank and Armoured Vehicles
- Unnamed Aerial Vehicles
- Aircrafts and Helicopters

# 6. Fundamentals of Laser Technology

- Laser Technology
- Major Components of Laser

- Types of Laser
- Applications of Laser
- Future Scope of Laser Technology
- Major Laser Research Institutions in India

## 7. Computer and Information Technology 370-388

- History of Computer
- Classification of Computer
- Generations of Computer
- Hardware
- Software
- Computer Network
- Internet
- Communication Technology
- Blockchain
- Cyber Security Mechanism in India

389-394

# 8. Robotics and Artificial Intelligence

- Robotics

#### - Automation

- Artificial Intelligence
- Advantages of Integration Artificial Intelligence into Robotics
- Robotics Institutions in India

# 9. Modern Advancements in Science and Technology 395-399

- Introduction
- Big Data Technology
- Narco-Analysis, Polygraph and Brain-Mapping
- Hydroponics
- Aeroponics
- Bio-Digester Tank-DRDO
- Hyperloop, Chatbot, HAPI Fork, Space Monkey
- India's First Arctic Research Station: Himadri

# Appendix 401-416 UPSC Mains PYQs 417-418