Curriculum for Science and Technology at Secondary Level

RATIONALE

In the present times, the laws and principles of science find application, not only in our daily life but also in every walk of life. As a result Science and Technology have become an integral part of human life and culture. Scientific knowledge which is growing day by day is a powerful tool for solving our problems. This knowledge also contributes towards the national productivity. However, a word of caution misuse of scientific knowledge, indiscriminate use of natural resources leading to depletion of natural resources and environmental pollution can lead to dire consequences. The proper and sensible use of science and technology can achieve the twin goals of 'development' and 'improvement' is of utmost importance. In the light of this, it is becoming increasingly necessary for all to be aware of the basics of science and technology, as also its application in the interest of human welfare. Contribution of Indian scientists in this regard has also been highlighted in this text book.

OBJECTIVES

The basic objectives of the course on science at the secondary stage are to:

- enable the learner to explain the science behind natural phenomena;
- familiarize learners with various facets of science and the role it plays in human welfare;
- develop scientific attitude so that reasoning wins over blind faith and opinions;
- enable the learner to formulate simple hypothesis, verify them and apply in his/her daily life activities;
- cultivate the interest of the learners in science and technology and encourage them to pursue it as a career.

COURSE STRUCTURE

The present curriculum contains 7 modules. All modules are compulsory for all learners. Each module has been divided into units or lessons. The number of lessons, suggested study time and marks allocated for each is as follows:

Name of the Modules	No. of Lessons	Study Hours	Mark Allotted for Modules
Module 1: Measurement in Science	1	04	04
Module 2: Matter in our Surroundings	7	54	22
Module 3: Moving Things	3	24	07
Module 4: Energy	7	52	15
Module 5: The Living World	7	47	15
Module 6: Natural Resources	3	26	10
Module 7: Humans and Environment	4	33	12
Total	**32**	**240**	**85**

Module 1 Measurement in Science

Time: 4 Hours **Marks: 04**

Approach

As measurement is one of the important activities of day to day life, the beginning of this module aims at highlighting the correct way of expressing the units and the methods of measuring physical quantities and the need of accurate measurement in science and technology.

Unit 1.1 Measurement in Science & Technology

(Time allocation: 4 hours)

Need for measurement, precision and accuracy ; units of measurements: SI units, derived units, multiples and submultiples, correct way of expressing units, measurement of length, mass and time, least count and range of some common measuring devices (General discussion), meter scale, measuring tape, measuring cylinder, pan balance, stop watch, quartz clock.

Module 2 Matter in Our Surroundings

Time: 54 Hours **Marks: 22**

Approach

The module is designed to bring out the structure of matter by way of describing an atom and how atoms combine to form different substances. it also highlights that the structure of matter is responsible for its properties.

Unit 2.1 Matter in Our Surroundings

(Time allocation: 9 hours)

- What is matter
- Particulate nature of matter
- States of matter-Solid, Liquid and Gas. Inter conversion of states
- Effect of factors like pressure and temperature on states of matter
- Elements, compounds and mixture
- Homogeneous and Heterogeneous mixtures
- Solutions and concentration of solutions (percentage)
- Suspensions (brief)
- Separation of mixtures /purification

Unit 2.2 Atoms and Molecules

(Time allocation: 8 hours)

- Laws of Chemical Combination- Law of Conservation of mass and Law of Constant Proportions
- Dalton Atomic Theory
- Atoms and molecules, elements and symbols (representation of molecule by using a formula)
- Atomic and molecular masses
- Mole concept
- Avogrado number
- Molar Mass

Unit 2.3 Chemical Reaction and Equations

(Time allocation: 8 hours)

- Writing Chemical Equation
- Balancing of Chemical Equation
- Significance of balanced chemical equation in terms of mass, mole and volume.

Type of Reactions

- Combination
- Decomposition
- Displacement/ double displacement
- Oxidation and reduction (Redox Reaction), (Corrosion and Rancidity)

Unit 2.4 Atomic Structure

(Time allocation:11 hours)

- Charged particles in matter
- Structure of an atom

- Thomson model-drawbacks
- Rutherford Model- drawbacks
- Bohr Model (elementary idea)
- Neutrons

Distribution of Electrons in Various Shells

- Concept of valency
- Atomic number and mass number
- Concept of isotopes and isobars
- Average/fractional atomic mass

Unit 2.5 Periodic Classification of Elements

(Time allocation: 5 hours)

- Early efforts at classifying elements
- Mendeleev's Periodic Table - limitation
- Modern Periodic table
- Periodicity of properties- atomic size and metallic character

Unit 2.6 Chemical Bonding

(Time allocation: 7 hours)

- Noble gas configuration as stable configuration
- Combination of elements through transfer of electrons-ionic bonds
- Some common properties of ionic substances
- Combination of elements through sharing of electrons-covalent bonds
- Single, double and triple bonds, depiction through Lewis –dot formulae
- Some common properties of covalent substances

Unit 2.7 Acids, Bases and Salts

(Time allocation: 6 hours)

- Understanding Acids and Bases (Arrhenius)
- pH and its importance in every day life.
- Salts as product of reactions between acids and bases.
- Commonly used salts – washing soda, baking soda, Plaster of Paris, bleaching powder.

Module 3 Moving Things

Time: 24 Hours **Marks: 07**

Approach

In this dynamic world everything is in motion with respect to one another. But all these motions are not alike. To understand the motion of the objects this unit will describe the terms distance, displacement, speed, velocity, acceleration etc. It will also describe the cause of motion in terms of force, momentum, pressure, upthrust etc. This unit will also describe the gravitational force, gravitational acceleration and other related phenomenon like weightlessness.

Unit 3.1 Motion and its Description

(Time allocation: 8 hours)

The concept of motion, examples of different types of motion- translational, rotational and oscillatory. Uniform and non-uniform motion (in one dimension only). Distance and displacement; speed, average speed, velocity and acceleration. Graphical representation of motion - distance-time and speed-time graphs. Equations of motion and their uses. Uniform circular motion (qualitative idea only)

Unit 3.2 Force and Motion

(Time allocation: 10 hours)

Force and motion. First law of motion,inertia. Concept of momentum. Second law of motion. Conservation of momentum. Third law of motion - action and reaction. Friction, Advantages and disadvantages of friction. Thrust and pressure.

Unit 3.3 Gravitation

(Time allocation: 6 hours)

Force of gravitation. Gravitational law; acceleration due to gravity; mass and weight. Motion of an object under gravity in one dimension. Free fall and weightlessness. Buoyancy and Archimedes principle

Module 4 Energy

Time: 52 Hours **Marks: 15**

Approach

The module intends to highlight the various types of energy, their sources, properties and applications in our daily life. The means and ways of meeting the challenge of energy crisis will also be discussed in this module.

Unit 4.1 Sources of Energy

(Time allocation: 4 hours)

Conventional and non-conventional sources of energy. Sun is the main source of energy. Fossil fuels, water, wind, nuclear, biomass (petro crops), energy from sea, geothermal energy and nuclear energy (fission and fusion). Energy crisis – approaches mitigation and of energy conservation.

Unit 4.2 Work and Energy

(Time allocation: 8 hours)

Work done by a force; relation between work and energy; unit of energy; various types of energy-mechanical (kinetic and potential); thermal, light, sound, electrical, chemical and nuclear, power and its unit; transformation and conservation of energy with examples.

Unit 4.3 Thermal Energy

(Time allocation: 6 hours)

Thermal energy and temperature. Thermal expansion of solids, liquids and gases; change of state and latent heat; specific heat (qualitative idea). Measurement of temperature.

Unit 4.4 Light Energy

(Time allocation: 10 hours)

Reflection of light - image formation by a plane and a spherical mirror; mirror formula (no derivation); applications of mirrors. Refraction of light, formation of image by a lens (qualitative idea only), lens formula (no derivation); magnification of image and power of lens. Use of lenses in correcting defects of vision(near and far). Dispersion of light through glass prism and spectrum of white light. Scattering of light - applications in daily life.

Unit 4.5 Electrical Energy

(Time allocation: 8 hours)

Electrical charges. Electrostatic potential and electric current. Ohm's law; resistances in series and parallel. Heating effect of electric current –its applications, commercial unit of electric energy and electric power.

Unit 4.6 Magnetic Effect of Electric Current

(Time allocation: 10 hours)

Magnets and magnetic field, field lines. Magnetic effect of electric current (qualitative idea only). Magnetic field due to a current carrying solenoid; electromagnet, electric bell. Force on a current carrying conductor placed in a magnetic field. Electromagnetic induction. Direct current and alternating current. Frequency of AC. Advantages of AC over DC. Basic concept of electric circuits(domestic). Hazards of electricity and safety measures.

Unit 4.7 Sound and Communication

(Time allocation: 6 hours)

Waves – nature and characteristics of waves, transverse and longitudinal, different types of waves – mechanical (Sound) and electromagnetic waves, propagation, characteristics of sound, reflection of sound (SONAR) Communications – basic mechanism, use of waves in communication, different devices used in communication, use of satellite in communication.

Module 5 The Living World

Time: 47 Hours **Marks: 15**

Approach

The variety of living organisms inhabiting the earth forms an integral component of the earth's environment. This

theme includes lessons on Origin and Diversity of life deals with the origin and evolution of life, concept of biodiversity. Classification of living organisms for convenient and systematic study. One lesson on life processes encompasses the recognition of the cell as the basic building block of organisms and others deal with physiological processes such as nutrition, circulation, respiration, excretion, control and coordination. it also includes basics of reproduction, patterns of inheritance, genetic material and techniques of its manipulation.

Unit 5.1 Classification of Living Organisms
(Time allocation: 5 hours)

Classification-five kingdoms (up to division for plants and up to phylum level for animals), up to classes for vertebrates, nomenclature: Linnaeus, genus, species (with examples). Concept of biodiversity, levels of biodiversity, patterns of diversity (global and Indian).

Unit 5.2 History of Life on Earth
(Time allocation: 6 hours)

- Prebiotic earth conditions, origin of life and its diversification
- Evolution: Darwin's contributions, (Darwin's theory), Neo-Darwinism, major events in the history of life (Geological eras and associated events), Human evolution.

Unit 5.3 Building Blocks of Life - Cell and Tissue
(Time allocation: 7hours)

- Cell as a basic unit of living organisms. Plant and animal cells
- Biomolecules - DNA, RNA& protein synthesis
- Cell structure: organelles and their functions
- Brief idea of cell division
- Cell to tissues- Plant and animal tissues and their functions.
- Brief idea of stem cell technology and its use.

Unit 5.4 Life Process I: Nutrition, Transportation, Respiration and Excretion
(Time allocation: 8 hours)

Necessity of energy for living, harnessing energy by photosynthesis, heterotrophy as a mode of nutrition , nutritional disorders of humans and concept of balanced diet, respiration- basic process- organs (lungs and gills), basics of circulation (transport) (both plants and animals) and excretion. Technological advances in medical diagnosis and treatment: ECG & Dialysis.

Unit 5.5 Life Processes II: Control and Coordination
(Time allocation: 8 hours)

- Nervous system (brain, spinal cord, neurons, nerves),
- Major endocrine glands and their secretions, functions, hormone deficiency disorders.
- Sense organs-vision, hearing and taste, eye as a camera.

Unit 5.6 Life Processes III: Reproduction
(Time allocation: 6 hours)

Reproduction in plants and animals, asexual and sexual reproduction, tissue culture and cloning, basic facts of human reproduction, Family planning, sexually transmitted diseases, HIV and AIDS.

Unit 5.7 Heredity (Time allocation: 7 hours)

Mendelian inheritance, chromosomes, genes- DNA replication, sex determination, blood groups, brief account of human genome, hereditary disorders, genetic engineering, genetic counseling.

Module 6 Natural Resources
Time: 26 Hours **Marks: 10**

Approach

They are important for our survival and well being. Basic resources required by society are discussed in this theme.

Unit 6.1 Air and Water
(Time allocation: 9 hours)

- Composition of air as mixture of various gases

- Air Pollution
- Sources of water
- Potable water
- Water pollution
- Conservation and harvesting of water.

Unit 6.2 Metals and Non-metals
(Time allocation: 7 hours)

- Physical properties of metals and non-metal
- Chemical properties of metals-reactions of metals with oxygen, water and with common acids and bases
- Reaction of non-metals with oxygen
- Reactivity series of metals
- Uses of metals and non-metals

Unit 6.3 Carbon and its Compounds
(Time allocation: 10 hours)

- Carbon:constituent of all living matter
- Allotropic forms of carbon
- Oxides of carbon (CO & CO_2)
- Catenation properties of carbon-(Chains, branches and rings).
- sources of hydrocarbons
- Saturated and unsaturated hydrocarbons
- Homologous series
- Some other common functional groups
- Nomenclature
- Useful compounds of carbon (Ethanol and Acetic acid)

Module 7: Humans and Environment

Time: 33 Hours **Marks: 12**

Approach

Healthy environment is an important asset. Modern humans have made enormous progress in industry and technology. At the same time the industrial and urban development has progressively degraded. The environment and adversely affected the health and well being.

Unit 7.1 Natural Environment
(Time allocation: 10 hours)

Ecosystem component - Abiotic, biotic, adaptation of organisms, ecosystem processes- energy flow, food webs, nutrients cycling (Nitrogen, Carbon), water cycle, Population interactions, population growth.

Ecosystem: Aquatic and terrestrial, Ecosystem services (food production, pollination, soil fertility, nutrient cycling, waste management), fuel, timber, fibre, medicines.

Unit 7.2 Human Impact on Environment
(Time allocation: 9 hours)

Regional: causes and consequences of air pollution, water pollution, noise pollution, deforestation: causes and consequences waste management.

Global: global warming, ozone depletion, acid rain, photochemical smog.

Natural disasters: causes and consequences and its management of Landslides, cloudbursts, earthquakes, floods, Tsunami, cyclone, fire and their management.

Unit 7.3 Food Production
(Time allocation: 6 hours)

Agriculture (practices, food crops, weed control and pest management, storage), fisheries, animal husbandry, live stock management, animal breeding.

Role of technology and biotechnology in food production.

Unit 7.4 Health and Hygiene
(Time allocation: 8 hours)

Communicable and non-communicable diseases, causes, mode of transmission, symptoms, prevention and control (influenza, tuberculosis, malaria, dengue, amoebiasis).

Health disorders caused by environmental pollution.

- Immunization, first Aid
- Diagnostic tools for detecting human disease and disorder-ray, MRI and Ultrasound

Feed back on Lessons

Lesson No.	Lesson Name	Content			Language		Illustrations		What You Have Learnt	
		Difficult	Interesting	Confusing	Simple	Complex	Useful	Not useful	Very helpful	Not helpful
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Complete and Post the feedback form today

Dear Learners,

You must have enjoyed going through your course books. It was our endeavor to make the study material relevant, interactive and interesting. Production of material is a two way process. Your feedback would help us improve the study material. Do take a few minutes of your time and fill-up the feedback form so that an interesting and useful study material can be made.

Thank you
Coordinators
(Science and Technology)

Feed back on Questions

Lesson No.	Lesson Name	Intext Questions		Terminal Questions		
		Useful	Not useful	Easy	Diff.	V. diff.
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Did you consult any other book to study Science and Technology? Yes/No

If Yes, give reason for consulting it

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Name : _____

Enrolment No: _____

Address : _____

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Subject : _____

Book No: _____

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