



## Guidelines For the Preparation of Exhibits and Models

All children are naturally motivated to learn and are capable of learning. The knowledge acquired by them is the outcome of their activity. Children learn through interaction with people and the environment around them. They construct knowledge by connecting new ideas to their existing ideas.

To stimulate creativity, inventiveness and the attitude toward innovation in science and mathematics, NCERT emphasizes on activities, experiments, technological modules, etc. It also encourages the implementation of various activities through a massive expansion of channels such as the organisation of science, mathematics and environment exhibition at the national level for school students, with feeder exhibitions at school/block/tehsil/district/region/State levels.

The National Council of Educational Research and Training (NCERT), New Delhi organises National Science, Mathematics and Environment Exhibition for Children every year to popularise science, mathematics and environmental education amongst children, teachers and the public in general.

In the year 2022, the advisory committee which advised about the science exhibition, in the light of NEP 2020, approved the name of this National Science Exhibition as Rashtriya Bal Vaigyanik Pradarshani (RBVP).

This exhibition is a culmination of various exhibitions organised in the previous year by the States, UTs and

other organisations at the district, zonal, regional and finally at the state level. Selected entries from all States and Union Territories, the Kendriya Vidyalaya Sangathan, the Navodaya Vidyalaya Samiti, the Department of Atomic Energy Central Schools, Central Board of Secondary Education affiliated Public (independent) Schools, Central Tibetan Schools Administration, Demonstration Multipurpose Schools of Regional Institutes of Education and National Education Society for Tribal Student participate in this national-level exhibition. Like in the past several years, such exhibitions are to be organised from the district to state level during 2024- 25 too. These would form the first phase of preparation for the RBVP to be organised in November 2025. The objectives of the exhibitions are:

- to provide a forum for children to pursue their natural curiosity, creativity, innovation and inventiveness;
- to make children feel that science and mathematics are all around us and we can gain knowledge as well as solve many problems by relating the learning process to the physical and social environment;
- to emphasize the development of science and mathematics as a major instrument for achieving goals of self-reliance, socio-economic and socio-ecological development of the nation and the world;
- to analyse how science and

mathematics has developed and are affected by many diverse individuals, cultures, societies and environments;

- to appreciate the role of science and mathematics in meeting the challenges of life such as climate change, opening new avenues in the areas of agriculture, fertilizer, food processing, biotechnology, green energy, disaster management, information and communication technology, astronomy, transport, games and sports etc.
- to create awareness about environmental issues and concerns and inspire children to devise innovative ideas towards their prevention and mitigation. Children are naturally inquisitive and innovative in response to a variety of problems confronting the society and the world. If today's children get engaged in tackling problems, solving issues, and creating new ideas, we can make our children better prepared for tomorrow's challenges. There is a need to continuously innovate to meet the challenges before us. The rising aspirations of the human community for the desire for more comfort and security have put tremendous pressure on the limited resources of the world leading to unequal access and unsustainable use of resources.

According to United Nations 'Global Resources Outlook 2019', resource extraction has more than tripled since 1970 in the world, including a five-fold increase in the use of non-metallic minerals and a 45 per cent increase in fossil fuel use. Similarly, a very important resource, fresh water is also experiencing acute stress worldwide. According to United Nations World Water Development Report 2019, over 2 billion people live in countries experiencing high water stress, and about 4 billion people experience

severe water scarcity during at least one month of the year. Water has to be treated as a limited resource, with a far stronger focus on managing demand. Climate change and bio-energy demands are also expected to amplify the already complex relationship between world development and water demand. It is true that "Jal hi Jeevan Hai", therefore it is the responsibility of everyone to conserve and manage this very important resource. Keeping in view the importance of water and sanitation the Government of India is increasing the level of investment in this area.

We all are aware that the problems faced by the world today are not confined to a particular city, state or country. Rather, these are global problems and for solving these problems, all the countries of the world need to work in unison. To solve the problems of the world and to bring peace and prosperity to people and the planet, now and in the future, all the member states of the United Nations adopted 'The 2030 Agenda for Sustainable Development' which includes 17 different Sustainable Development Goals (SDGs) along with 169 associated targets. Sustainable development is defined as the development that meets the needs of the present without compromising the ability of future generations to meet their own needs. This means we cannot continue using the resources at the current level as this will not leave enough for future generations.

The flagship programmes of the Government of India such as the Mahatma Gandhi National Rural Employment Guarantee Act (MGNREGA), Pradhan Mantri Jan Dhan Yojana (PMJDY), Pradhan Mantri Jan Arogya Yojana (Ayushman Bharat), Skill Development, the Swachh Bharat Abhiyaan (Clean India Campaign), Pradhan Mantri Ujjwala Yojana, Beti Bachao Beti Padhao (Save the Girl Child, Educate the Girl Child) are some of the steps to achieve these sustainable goals.

Science and Mathematics act as powerful tools for investigating and understanding nature and the world. They also play a crucial role in solving problems confronting society and act as a major instrument for achieving goals of self-reliance and socioeconomic development sustainably. To recognize and encourage these powerful tools so that the problems confronting society can be overcome and a better sustainable future can be built through science and technology-led solutions, **the theme for the Rajya Stariya Bal Vaigyanik Pradarshani — 2024-25 has been chosen as ‘Science and Technology for Sustainable Future’.** **The theme and sub-themes identified for RBVP 2024- 25 are directly or indirectly focused on achieving the sustainable development goals enunciated by the United Nations.** In this context, it is envisaged that children and teachers would try to analyse all aspects of the role of science and technology in the sustainable development of the world. This will enable students and teachers to generate scientific and mathematical ideas and prepare models/exhibits for addressing various problems. Scientific ideas in this context may be regarding innovative ways of doing things, creating simple technologies/tools that meet new requirements; enabling the participation of the lower pyramid of the population in the development process through science and technology, creating an enabling innovation ecosystem in the country for enhancement of science, technology and mathematics. **However, there are instances when children and their teachers think of some ideas that are new and may be applicable in the future. Often such ideas may not be possible to be presented in the form of a model/exhibit. Organizers of exhibitions at all levels may provide opportunities for students and teacher to present such ideas in the form of presentations and discussions.**

Children and teachers should identify where and how new processes, research, and developments in science, technology and mathematics can bring a better future for the world.

Development of the creative domain of a learner through the teaching- learning process of science is an area which needs to be addressed to make the experience of learning stimulating and exciting. For this, it is necessary to involve students in the acquisition of science topics in creative ways that may aid in their overall growth as learners. With this in view, **the theme for the Rajya Stariya Bal Vaigyanik Pradarshani —2024-25 has been chosen as ‘Science and Technology for Sustainable Future’.** One cannot fathom life in the present day without science and technology; it is an essential component of day-to-day existence. Science and technology play a wide range of important roles in contemporary society. It expands beyond research and development to play a crucial role in our work, communication, education, health, and other areas. The basis of all scientific discoveries is thought about natural phenomena and what causes them; science is a structured pursuit of knowledge that is motivated by curiosity. On the other hand, the practical use of scientific knowledge to produce useful systems and processes is known as technology. Together, science and technology help us better understand our surroundings and enable us to make more educated decisions based on facts and data. One cannot express enough gratitude for the scientific research and technologies that led to the discovery of the COVID- 19 vaccine and other life- saving medications; it was only made possible by advanced medical imaging techniques and other scientific discoveries in this field that we have improved diagnosis, treatment, and patient care. Science and technology play a crucial role in shaping the development of various areas of our

society. It has helped us improve healthcare. Technology has paved the way for digitalization, the internet, and social media. It has also revolutionized communication and connectivity. As a result, sharing scientific knowledge is now simple and open to all. Science also helps to address environmental issues and promote sustainable development. Modern civilization, including every area of our life from healthcare to economics, nation-building, environmental preservation, communication, and automation, is changing as a result of science and technology. It is intended that students and teachers will attempt to analyse all facets of science and technology's function in society from this perspective. This will make it possible for teachers and students to come up with solutions and create models and exhibitions for diverse issues. However, there are instances when children and their teachers think of some ideas that are new and may be applicable in future. Often such ideas may not be possible to be presented in the form of a model/ exhibit. Organizers of exhibitions at all levels may provide opportunities for students and teachers to present such ideas in the form of presentations and discussions. The theme for RSBVP- 2024-25 and RBVP-2025, is 'SCIENCE AND TECHNOLOGY FOR SUSTAINABLE FUTURE', and it intends to cover sub-themes like-

1. Food, Health and Hygiene
2. Transport and Communication
3. Natural Farming
4. Disaster Management
5. Mathematical Modeling and Computational Thinking
6. Waste Management
7. Resource Management

(Sub-themes listed above are suggestive. Students may choose any other sub-themes and develop exhibits involving Science and Technology for Sustainable Future).

About Science and Technology for Sustainable Future we can discuss as follows:

Sustainable development means '**the development that meets the needs of the present without compromising the ability of future generations to meet their own needs**'. The goal of sustainable development involves enhancing the development that minimizes environmental issues. Development in the economy or overall development of a country comes at a price of damage to the environment. For the sake of fulfilling the needs of the present generation is causing day by day damage to the environment by exploiting forest resources-deforestation, polluting air and water, land degradation leading to soil erosion. These damages can fulfill the needs of today's generation but the needs of future generations will be compromised leading to environmental crisis.

Environmental crises occur when it fails to perform its essential function for sustenance. In the recent past decade there has been a rapid increase in several natural and anthropogenic activities that resulted in environmental crises such as global warming, climate change, population explosion, rising economic activities, rapid industrialization, deforestation, urbanization and excessive use of insecticides, pesticides and chemical fertilizers.

All these changes lead to adverse effects on the environment as well as individual health. So, there is an urgent need for integration of innovations in science and technology as it has emerged as an ultimate solution to combat environmental stress, poverty and malnutrition leading to a sustainable future.

For nation wise promotion of sustainable development, the United Nations (UN) has launched the 2030 Agenda for **Sustainable Development Goals (SDGs)**. This is a global level agenda that aims to promote actions and policies that will end poverty and develop a sustainable future in the next 15 years. There are 17 goals and 169 specific targets to be achieved by 2030



which aims for ending poverty and hunger, promotion of good health, quality education, affordable and clean water and energy resources leading to increment in the global economy along with industrial innovation and infrastructure. For achieving the sustainable goals, the actions and its regulation should be done at each level such as - civil society, government commercial business, which requires equal contribution from the people.

Sustainable development is not only limited to environmental and climatic aspects, but it also demands the sustainability for rapid increase in food demands that is agricultural sustainability, awareness and maintenance of health by consuming super food food like millets , natural farming, good sanitation practices and hygiene in an individual, advancements and innovation in transport and communication systems which are environment friendly, good waste management practices to prevent contamination of soil , planned management of resources which are available in the environment like water, sunlight , wind and fossil fuels. It also includes prior prediction of natural disasters and its management as it requires mathematical modeling and computational thinking which can help in understanding of the complex economic, social, and environmental phenomena underlying sustainable development.

According to **"Sustainable Development Goals-National Indicator Framework Progress Report 2024"** documented by the Ministry of Statistics and Program Implementation the government has launched various welfare and reformation programs over the past ten years such as National Nutrition Mission (NNM), Pradhan Mantri Jan Dhan Yojana, Make in India, National Mission for a Green India, Pradhan Mantri Swasthya Suraksha Yojana, National Mission for Sustainable

Agriculture and driving significant advancements motto, **"Leaving No One Behind,"** remains persistent, aligning with our national ethos of **'Sabka Saath, Sabka Vikas, Sabka Vishwas, Sabka Prayas'**.

### The Department of Science and Technology

objectives to promote science and technology development in various fields which include materials, devices and processes. It launches and funds the Programme which supports activities aimed at developing technologies both in the advanced/emerging sectors/areas, and innovation of a useful technology/product. It promotes advanced waste , Biomedical device and technology development programs.

In order to prevent environmental crises and to make the process of sustainable development more feasible and operational, it is important to :

- Integrate science and technology at global level and develop awareness by education in science, geography, economics and at society level.
- Developed countries need a reformation of their production and consumption patterns, including by limiting the use of fossil fuels and plastics, and to encourage public and private investments that align with the SDG's.
- Environmental resources such as rain forest, oceans, lands must be safeguarded as crucial sources of ecosystem services and natural resources. Citizens must work in a planned and coordinated manner for conservation, restoration and sustainable utilization of natural resources.
- Decreasing the extraction of resources so that it can be replenished timely.
- The waste generated should remain within the absorption capacity of the environment.

The sustainable development can be attained by smaller actions in our day to day life such as :

- Restricting anthropologic activities such as by minimizing all kinds of pollution-air, water, land etc.
- Sustenance in agricultural practices such as use of bio-manure, bio-pesticides, bio-insecticides which are devoid of harmful chemicals.
- Crop rotation system and by using techniques such as drip irrigation systems that can efficiently minimize the water usage in agriculture.
- For renewable resources of energy, the rate of consumption should not be more than the rate of generation of renewable substitutes. Solar panels and the windmills can be efficiently used to generate electrical energy. These alternatives can prevent the exploitation of fossil fuels and are also helpful for saving the environment from pollution.
- Improvement in human capacity through better education and healthcare systems.
- Providing safe, clean drinking water and nutritious meal responsible use of information technology to plan smart infrastructure.

Therefore, the expenditure of resources should be done in a planned manner without compromising the needs for future generation and to sustain all the resources given by nature.

The integration of science and technology requires a more innovative and ambitious response in order to bring a change at an enormous level to achieve our 2030 goals and a sustainable future. To achieve this objective, NCERT organizes the National Science Exhibition every year i.e., Rashtriya Stariya Bal Vaigyanik Pradarshini (RSBVP- 2024-25) to reflect the essence of the National Education Policy 2020 and is being organized every year in collaboration with the state/UT on a rotation basis. The theme of RSBVP-2024-25 is 'Science and Technology for a Sustainable Future' in order to promote sustainable development through innovations in science among school students. RSBVP aims to create awareness and innovation in science for sustainable

development among younger minds. It provides an opportunity to the school students/ learners/ researchers to pursue their natural creativity and innovation, reflecting their scientific temperament. This sub theme will develop an understanding amongst the school children towards the need for integration of science and technology for a sustainable future.

The students exhibit their innovative ideas in the form of presentations and working models which help the students to apply scientific knowledge to achieve a sustainable future by providing scientific solutions. It encourages the children to visualize the sustainable future of the nation and helps them become sensitive and responsible citizens along with the development of science and technology as a major instrument for achieving goals of self-reliance and socio-ecological development.

By such programs, students interact with participating children, teachers, parents, and exhibition organizers and they together give their valuable contribution to develop a sustainable future for the nation.

A few exemplar ideas pertaining to the sub-themes listed in the context of the theme development of exhibits are given below.

### **1. Food, Health, Hygiene**

The demand on nutritious food is increasing day by day due to the alarming rise in population. To satisfy the food requirements of the population, there is a need to look into what innovations can be undertaken for addressing this issue. We have a wide variety of food sources belonging to the categories of plants, animals, fungi, etc. The need for a balanced diet with all required nutrients including vitamins and minerals is very important for us for a healthy life and free from diseases. To meet the food requirements of an alarming population is very difficult, which needs revolutions in agriculture with innovations to increase the food productivity by improving upon farming, poultry, pisciculture etc. We need to address the issue of malnutrition and diseases due to malnutrition/ nutrient deficiency as they

contribute much towards the overall human resource management and wellness of the population. The problem of using canned foods, packed food, fast food etc. are major threat to humans as it leads to number of health issues such as obesity, diabetes etc. The use of food preservatives to store food for longer time has a long-lasting effect on human health. Many food items also have certain food adulterants that deplete the food quality. Maintaining the food safety and food quality is essential for having healthy humans. The food style of a region is determined by its geographical locality and the culture. Since India is a diverse country, we can see a wide variety of food habits and food style. The use of millets has been in practice for many areas in the world especially the tribal areas. There are efforts to improve the cultivation of millets which are rich source of vitamins and nutrients. We also need to look into the possibility of using technology for improving the food productivity and quality. Sustainable Development Goal 2 aims to achieve "zero hunger". It emphasises on "End hunger, achieve food security and improved nutrition and promote sustainable agriculture".

Health is an overall state of body, mind and social wellbeing that implies to an individual and people. When people are healthy, they are more efficient at work. This increases productivity and bring economic prosperity. Health also increases 'longevity of the people and reduces infant and maternal mortality. Health is affected by diseases which may be genetically transmitted or contagious in nature. In case of genetic disorders, deficiencies/ defects are inherited from parents and the best examples are haemophilia and colour blindness, however, diseases like cancer and diabetes mellitus are also known to have genetic basis, which are non-infectious. Further, many diseases last for a short period of time called acute diseases like common cold but many other ailments last for longer duration and even as much as life time like tuberculosis, which are chronic diseases. Cancer is one of the most deadly chronic diseases of human beings which is a major cause of death all over the globe. Proper nutrition which includes a balanced diet is required for having a healthy

body long with proper exercise. The problem of obesity and life style diseases are a threat to the human health. Some of the other areas of concern pertaining to health includes the unavailability of pure water, usage of genetically modified food, depletion of soil quality, pollution, climatic change etc. The human health is also affected due to the increase in the usage of alcohol, smoking and drug abuse. The post COVID health issues are also adding to the problems on human health. Increasing level of obesity, early detection of hyperglycemia and hypertension is a great cause of worry from the health point of view. Continuous efforts of Scientists, Technologists, Doctors and Naturalist are finding many new ways of addressing the health issues. Major inventions in bio-medical diagnostics, new vaccines and antibiotics, surgical methods and genetic engineering have given relief to the mankind. These efforts are responsible for raising the standard of the personal health and hygiene and in providing both preventive and curative facilities to the community which include the mortality age that has gone up, infant and maternal mortality gone down and epidemics are much under control. Awareness towards meditation and traditional knowledge of herbal medicines has influenced community health. In Sustainable Development Goals, Goal- 3 focus on "Good health and Well Being" which is "to ensure healthy lives and promote well-being for all at all ages."

Personal hygiene and cleanliness play an important role in maintaining a healthy environment. Personal hygiene such as washing hands was an important aspect of personal hygiene which we have been practicing as a protocol during COVID 19. We must keep our surroundings clean by not allowing any water logging which result in breeding of mosquitoes and causing contagious diseases.

The main objectives of this sub- theme is to bring awareness among the children about the factors affecting our health and nutritional needs of the body; to explore new scientific, technological and bio-medical inventions in prevention and cure of diseases like Coronavirus; to explore various scientific and technological interventions for meeting nutritional requirement of human beings

and innovative ideas for better management of the crisis created during COVID-19 pandemic. In addition, a healthy person has a positive interpretation of life, and emotional state and is also capable of stress management. One should always take care of his/her health, prioritizing their health through balanced lifestyle choices, doing regular exercise, taking a balanced and nutritious diet avoiding the consumption of junk food and abusive substances like tobacco and alcohol, keeping their surroundings clean and building strong and positive interpersonal connections within their society, which are all important aspects of leading a healthy life.

The exhibits/models in this sub-theme may pertain to:

- Factors affecting the health and resulting ailments in the body;
- To study how cleanliness influences health;
- Foods that improve our immunity to fight against diseases;
- Improved methods and innovative ways of sanitation and appropriate technology for disposal of medical wastes, other biodegradable and nonbiodegradable wastes
- Innovative ideas for effective implementation of policies/ programmes/ schemes related to food, health and hygiene of Government of India
- Innovative ideas for effective implementation of policies/ programmes/ schemes such as Namami Gange and the National Clean Air programme
- Ways to raise awareness about disposing of garbage properly
- Mechanisms/ways to control the spread of Coronavirus, Lung infections, Dengue, Malaria, Chikungunya, and other tropical diseases.
- Demonstration and use of traditional methods of medication.
- Demonstration of known facts and findings, and health benefits of physical exercise and yoga.
- Demonstrate the importance of a

- balanced diet and the nutritional values of various food items.
- Ways to raise awareness and sensitize people about the role of social distancing and measures/ innovative techniques to overcome issues in its implementation.
- Demonstration of models/projects to show the effect of junk food items and adulterated food items on our body and its preventive measures.
- Demonstration of models/ projects to create awareness among children about appropriate rules of safety in hazardous situations to avoid accidents and injuries.
- Presenting medical assistance and facilities for all geographically and socially disadvantaged group.
- Development of knowledge –base and understanding of new scientific, and technological aids in biomedical areas.
- Presentation of known facts and research findings in different medical systems like Traditional, Modern, Homeopathy, Ayurveda, etc.
- Lifestyle and its relationship with health based on known facts and research.
- Common prophylactic measures available for different diseases and advantages of inoculation and vaccination; appropriate measures for family planning and welfare.
- Ideas for developing low –cost, immunity -boosting nutritious food.
- Low -cost medical diagnostic and therapeutic tools;
- Ways to raise awareness and promote mental health and well - being
- Innovative ideas to strengthen the prevention and treatment of substance abuse including harmful use of alcohol.
- Ways to reduce pollution that causes illness from air, water and soil contamination.
- Role of biotechnology to improve the nutritional value of crops.
- Models for sustainable agriculture and health

- Models to demonstrate the impact of chemical residues from fertilizers, pesticides, hormones, and food dyes etc. on health.
- New medical diagnostic and therapeutic tools/ aids for physically handicapped persons for prevention from coronavirus
- Innovative and ecofriendly methods of Pollution control
- Innovative ideas for addressing alcoholism, smoking and drug abuse

## 2. Transport and communication

Over the past decade, we've seen remarkable progress in both transport and communication technologies to achieve sustainable goals via reducing the emission of flu gases. The continued advancements in areas like robotics, machine learning, and artificial intelligence are expected to further expand the role of automation across both the transportation and communications sectors in the coming years. This is helping to improve efficiency, safety, and accessibility in these critical infrastructure systems.

### Transport Advancements:

- Electric and hybrid vehicles have become more mainstream, with major automakers rolling out new EV models with longer ranges and faster charging times. This has helped reduce emissions and fossil fuel dependency in the transportation sector. Autonomous driving capabilities have steadily improved, with many production cars now offering advanced driver-assistance features like lane-keeping, adaptive cruise control, and automated parking. Some cities have also begun testing fully autonomous public transit shuttles.
- High-speed rail networks have expanded in many parts of the world, offering faster and more efficient intercity travel options. The development of these high-speed rail corridors is a key part of India's broader infrastructure modernization efforts. These projects are expected to have a transformative impact on urban mobility, regional economic integration, and sustainable transportation in the country.

The government has set an ambitious target of building 10,000 km of high-speed rail networks across the country by 2030 to improve intercity connectivity and reduce travel times.

- Commercial aviation has seen incremental improvements in fuel efficiency, flight times, and passenger amenities. Developing new supersonic jet designs could bring back faster-than-sound passenger travel in the coming years. The efficiency and safety of commercial flying have improved due to the increasing sophistication of flight management systems and autopilot. Unmanned aerial vehicles (UAVs), like drones, are also used for various tasks like cargo delivery and infrastructure inspections.
- Start-up of urban transportation has diversified, with the growth of bike-sharing, scooter-sharing, and ride-hailing services complementing traditional public transit options.
- Maritime shipping: The maritime sector is investigating self-navigating cargo ships and tankers, with prototypes already under development i.e., Automated container terminals, autonomous guided vehicles, and AI-powered port management systems.
- Logistics and Freight: With the advent of technology like self-driving trucks, autonomous delivery robots, AI-powered supply chain management, and route optimization, automation is completely changing the logistics and freight industries.

### Communication Advancements:

- 5G cellular networks have been deployed in many countries, offering significantly faster data speeds and lower latency for mobile devices and emerging IoT applications. Telecom providers are using AI and machine learning to automate network optimization, fault detection, and resource allocation, improving reliability and efficiency.
- Fiber-optic broadband infrastructure has continued to expand, providing homes and businesses with high-bandwidth internet access.

- Cloud computing, edge computing, and virtualisation technologies have transformed how information is processed and stored, enabling new business models and consumer services.
- The "Internet of Things" has grown rapidly, with more devices, sensors, and appliances becoming interconnected and providing real-time data like home/building management, industrial operations, and smart city infrastructure.
- Advancements in artificial intelligence, machine learning, and natural language processing have led to smarter virtual assistants, automated decision-making systems, and more personalized digital experiences.
- Network Management: Telecom providers are using AI and machine learning to automate network optimization, fault detection, and resource allocation, improving reliability and efficiency.
- Customer Service: Chatbots and virtual assistants powered by natural language processing are automating many customer service and support functions, providing 24/7 availability and faster response times.
- Content Creation: Automated content generation tools leveraging AI are being used to produce simple media like news articles, social media posts, and data visualizations at scale.
- Cybersecurity: Automated threat detection and response systems are helping organizations rapidly identify and mitigate cyber threats, complementing human security teams.

### 3. Natural Farming

Natural Farming is an agricultural method that seeks to work in harmony with nature rather than against it. It is a chemical-free farming system rooted in Indian tradition, enriched with modern ecological understanding. It integrates crops, trees, and livestock, emphasizing functional biodiversity. It emphasizes the use of natural resources and ecological processes to produce food for human consumption. This is also known as organic farming or regenerative agriculture as well.

Natural farming is also known as "Do-Nothing Farming," and it seeks to work in a simpler natural way and avoiding a rely on synthetic inputs and intensive agricultural practices. It emphasizes the involvement of natural practices and materials to cultivate crops and thus maintaining soil health as a priority. In today's scenario, the goal of adopting natural farming is to restore soil health, reduce input costs, and promote sustainable agriculture in society.

#### Key Principles of Natural Farming:

Natural farming demands minimal human intervention by avoiding plowing, tilling and other soil-disturbing practices. It also encourages the growth of microorganisms and earthworms to maintain soil fertility. Such practice avoids the use of chemical fertilizers, herbicides, pesticides and also genetically- modified organisms and crops. There is only use of natural fertilizers, e.g., green manure and compost.

Natural farming leads to promotion of biodiversity by growing a variety of more than one crop together, which synergistically improves soil health and does not catch pest problems. Crop rotation and intercropping maintain soil health and grants a resistance against plant diseases. This encourages a diverse ecosystem on the farm, including plants, animals, and microorganisms.

Such agriculture practice with covering crops and mulching, protects the soil from erosion and retains moisture. The continuous plant cover enhances soil organic matter and beneficial microbial activity in the soil. Crop beneficial insects and birds participate in healthy crop yield.

The natural crop practices add-on water-saving techniques including mulching, drip irrigation and rainwater harvesting. This way it focuses on water retention and alleviating runoff water issues.

#### Common Practices in Natural Farming:

- Composting: To create nutrient-rich compost from organic matter. The compost is without involvement in any human-made chemical reaction.
- Crop rotation: Farming with more than one crop in succession to maintain soil health and friendly environment of microorganisms in soil.

- Livestock integration: This practice incorporates animals into the farming system for manure and pest control. This way such agriculture leads to sustainable practice.
- Intercropping: Growing diverse kinds of crops together, optimize land use and pull down the chances of pest and disease pressure.

#### **Initiatives of Organic Farming in India:**

- To promote organic farming in the country by making available organic inputs, such as bio fertilisers, bio pesticides as well as fruit and vegetable market waste compost and thereby generate better return for the crop produce.
- To increase agricultural productivity, by avoiding soil health and environmental safety.
- To reduce absolute dependence on chemical fertilizers and pesticides by increasing the availability and improving the quality of bio-fertilisers, bio-pesticides, and composts in the country.
- To convert organic waste into plant-nutrient resources.
- To prevent pollution and environmental degradation by proper conversion and utilisation of organic waste.
- To establish bio-fertilisers and bio-pesticides production units.
- To set up fruit and vegetable waste compost units throughout the country.

#### **Shortcomings of Organic Farming:**

- One of the key issues of organic farming is the lack of inadequate infrastructure and marketing of the product. Keeping in mind the human population, organic farming is shorter in supply.
- The products obtained through organic farming are less in the initial period as compared to that in chemical products. Hence, farmers find it difficult to accommodate large-scale production.
- Organic products have more flaws and a shorter shelf life than that of chemical products.
- Off-season crops are limited and have fewer options in organic farming.

#### **4. Disaster Management**

The main Objective of this sub-theme is to enhance community awareness, especially among children, regarding disaster preparedness. It promotes a Paradigm shift in Disaster Management i.e., the shift in thinking and focus from a relief-centric approach to a more proactive, holistic and integrated approach for management of disasters through improved disaster.

The model/ exhibits in this sub-theme may pertain to :

- Enhancing Information Dissemination and Public Address Systems during disasters is crucial to minimize confusion and chaos.
- Implementing mechanisms to create widespread awareness among the students about handling disaster situations is essential for effective disaster management .
- Extending logistic support and undertaking rescue and rehabilitation during calamities are critical aspects of effective disaster management it involves pre-positioning of resources such as food, water in disaster prone areas, transportation & distribution, temporary shelter & infrastructure, medical and health services.
- Improving devices for Effective Communication Between Emergency Services such as medical, police, military, and administrative bodies is crucial for enhancing coordination and response during emergencies. Enhancing communication devices can improve coordination, response efficiently, and ultimately the effectiveness of disaster management operation .
- Various measures & models for planning, preparedness, and coordination among different agencies are essential for Community Level Preparedness in the event of man-made disasters like gas leaks, nuclear accidents, bombing, explosions, and stampedes.
- Use of geostationary satellites plays a crucial role in providing real time information on meteorological processes, especially floods and storms.

They collect meteorological data through various sensors such as infrared and visible spectrometer which are essential for weather prediction.

- Technologies for forecasting and warning of cyclones, floods, and storms such as Numerical Weather Prediction (NWP) model help forecast the track, intensity and timing of cyclones, floods and storms with increasing accuracy.
- Innovative designs of flood alarms systems such as advanced sensors and Internet of Things (IoT) technology to monitor water levels in rivers, lakes, and flood prone areas in real-time. Machine learning algorithms and artificial intelligence (AI) Models to analyse weather forecast. Similarity by integrating this innovative design into flood forecasting systems, and cyclone warning networks can enhance ability to anticipate disaster.
- Use of ocean buoys, radars, and ship-based systems in detecting and managing cyclones and other maritime-related disasters.
- Present models for flood prevention such as raised platforms in flood prone areas to provide safe refuge during flood, river embankments, mangrove maintenance by preserve & restore mangrove forests and wetlands to absorb excess water during heavy rainfall, and other mitigation strategies can reduce vulnerability to flooding, protect lives and property and enhance overall resilience to natural disaster.
- Effective Drainage System management to emphasize the importance of clearing sewage before monsoon seasons to manage stormwater effectively.
- A case study: COVID-19 Pandemic demonstrated the critical need for flexible response strategies, effective risk communication, and coordinated international cooperation in managing health emergencies.

- The disaster management sub-theme aims to educate, demonstrate, and innovate various aspects crucial for mitigating the impact of disasters. By promoting awareness, preparedness, and the adoption of advanced technologies, it seeks to foster a proactive approach to disaster management, ensuring safer and more resilient communities.

## 5. Mathematical Modeling and computational thinking

### Mathematical Modeling

Mathematical modelling is an essential tool for understanding the world. It is the process of creating mathematical descriptions, or models, of real-world systems or phenomena. It is an attempt to study some part (or form) of the real-life problem in mathematical terms. *Conversion of physical situation into mathematics with some suitable conditions is known as mathematical modelling.* It is nothing but a technique and the pedagogy taken from fine arts and not from the basic sciences.

These models are typically formulated based on observations and data, and they aim to represent the essential aspects, behaviors, or relationships within the system under study. The architects, artisans and craftsmen based many of their works of art on geometric principles. Mathematical modeling is widely used across various disciplines such as physics, engineering, biology, economics, and social sciences to understand complex systems, make predictions, optimize processes, and aid decision-making. It allows researchers and scientists to study phenomena that may be difficult or impractical to observe directly, providing insights that can inform theory and practical applications. Mathematical model is a simplified representation of a real problem, by its very nature, has built-in assumptions and approximations. Following steps are involved in Mathematical modeling process.



**Abstraction:** Simplifying the real-world system to focus on its essential features and relationships.

**Formulation:** Expressing the system using mathematical equations, functions, or algorithms.

**Validation:** Checking the model against real-world data to ensure it accurately represents the system's behavior.

**Simulation and Analysis:** Using the model to make predictions, simulate scenarios, or analyze the system's behavior under different conditions.

### Example 1.

Suppose a surveyor wants to measure the height of a tower. It is physically very difficult to measure the height using the measuring tape. So, the other option is to find out the factors that are useful to find the height. From her/his knowledge of trigonometry, her/he knows that if he has an angle of elevation and the distance of the foot of the tower to the point where her/he is standing, then he can calculate the height of the tower. So, her/his job is now simplified to find the angle of elevation to the top of the tower and the distance from the foot of the tower to the point where her/he is standing. Both of which are easily measurable. Thus, if she/he measures the angle of elevation as  $60^\circ$  and the distance as 600m, then the problem can be solved.

Here we have studied the real problem and found that the problem involves three parameters height, distance and angle of elevation. That means in this step we have studied the real-life problem and identified the parameters. Then procedure for Solution of the problem and finally Interpreting the mathematical solution to the real situation.

### Example 2.

**Scenario:** we want to understand how an investment grows over time with *compound interest*.

**Mathematical Model:**

Use the formula

$$A = P \left( 1 + \frac{r}{n} \right)^{nt}$$

where  $A$  is the amount of money accumulated,  $P$  is the principal amount (initial investment),  $r$  is the annual interest rate (as a decimal),  $n$  is the number of times that interest is compounded per year, and  $t$  is the number of years.

**Application:** Calculate the future value of investments under different interest rates and compounding frequencies, helping individuals make informed financial decisions.

This example demonstrate how mathematical modeling can be applied at the secondary level to solve practical problems in various fields, using fundamental mathematical concepts taught in mathematics classes.

### Examples 2.

**Linear Equations:** if we know the cost per unit and fixed costs, we can model total costs as  $C=mx+b$  where  $m$  is the cost per unit,  $x$  is the number of units, and  $b$  is the fixed cost.

### Computational thinking

Computational thinking is a problem-solving method that draws on concepts and techniques from computer science to address complex issues and systems. It involves breaking down problems into smaller, manageable parts, identifying patterns and relationships, developing algorithms to solve problems, and designing and implementing solutions effectively.

Computational thinking builds on the power and limits of computing processes, whether they are executed by a human or by a machine. It is give us the courage to solve problems and design systems that no one of us would be capable of tackling alone. It is a fundamental skill for everyone, not just for computer scientists. To reading, writing, and arithmetic, we should add computational thinking to every child's analytical ability. Computational thinking involves solving problems, designing systems, and understanding human behavior, by drawing on the concepts fundamental to computer science.

It is reformulating a seemingly difficult problem into one we know how to solve, perhaps by reduction, embedding, transformation, or simulation. Computational thinking is thinking recursively. It is parallel processing. It is interpreting code as data and data as code. It is type checking as the generalization of dimensional analysis. It is judging a program not just for correctness and efficiency but for aesthetics, and a system's design for simplicity and elegance.

Computational thinking is thinking in terms of prevention, protection, and recovery from worst-case scenarios through redundancy, damage containment, and error correction. It is calling gridlock deadlock and contracts interfaces. It is learning to avoid race conditions when synchronizing meetings with one another.

Computational thinking is not limited to computer science; it can be applied to various fields and everyday situations where complex problems need to be tackled systematically. It emphasizes logical reasoning, creativity, and the ability to think in ways that leverage computational tools and methods *components of computational thinking are* :

**Decomposition:** Breaking down a complex problem or system into smaller, more manageable parts or steps.

**Pattern Recognition:** Identifying similarities or common patterns among problems or data sets.

**Abstraction:** Focusing on the important details while ignoring irrelevant information to develop a general solution.

**Algorithm Design:** Developing a step-by-step procedure or set of rules to solve a problem or perform a task.

**Problem-Solving:** Applying computational techniques and strategies to find solutions efficiently.

#### **Example : Analyzing Geometric Shapes**

**Decomposition:** Break down the process of analyzing geometric shapes:

- Identify properties such as area, perimeter, angles, and side lengths.
- Classify shapes based on these properties (e.g., triangles by angles or sides).

**Pattern Recognition:** Recognize geometric patterns and relationships:

- Pythagorean theorem applies to right triangles.
- Similarity criteria for triangles (e.g., AAA, SAS) help in identifying similar shapes.

**Abstraction:** Focus on essential geometric principles:

- Ignore specific measurements to generalize geometric rules.
- Simplify calculations using formulas for area, perimeter, and volume.

**Algorithm Design:** Create a step-by-step procedure for geometric problem-solving:

Step 1: Identify the type of shape and gather necessary measurements.

Step 2: Apply relevant formulas (e.g., area of a triangle, volume of a cylinder).

Step 3: Verify calculations by cross-checking with known geometric principles.

**Problem-Solving:** Address challenges in geometric problem-solving:

- Handle irregular shapes by breaking them into simpler components.
- Apply coordinate geometry to find distances or coordinates of points in the plane.

## **6. Waste Management**

### **Introduction**

Waste management involves the collection, transportation, processing, recycling, and disposal of waste materials. It is a crucial aspect of urban planning and environmental sustainability, addressing the challenges of waste generation and its impact on health, the environment, and resources.

### **Types of Waste**

1. **Municipal Solid Waste (MSW):** Everyday items discarded by the public, including household waste, packaging, and food scraps.
2. **Industrial Waste:** Byproducts of manufacturing and industrial processes.
3. **Hazardous Waste:** Waste with properties that make it dangerous or capable of having a harmful effect on human health or the environment, such as chemicals, batteries, and medical waste.

4. **E-Waste:** Discarded electronic appliances, including computers, TVs, and smartphones.
5. **Agricultural Waste:** Waste produced from agricultural activities, including crop residues and animal manure.

### Waste Management Strategies

1. **Source Reduction:** Minimizing waste generation by altering the design, manufacture, purchase, or use of products and materials.
2. **Recycling and Reuse:** Converting waste into reusable material. This includes the separation of waste materials and the reprocessing of used items.
3. **Composting:** Biological decomposition of organic materials, such as food and yard waste, into a nutrient-rich soil amendment.
4. **Landfilling:** Disposing of waste in a landfill, which is designed to isolate waste from the environment, particularly groundwater.
5. **Incineration:** Burning waste materials to reduce volume and, in some cases, generate energy.

### Challenges in Waste Management

1. **Increasing Waste Generation:** Rapid urbanization and consumerism are leading to higher volumes of waste.
2. **Resource Recovery:** Efficiently recovering resources from waste materials requires advanced technology and infrastructure.
3. **Environmental Impact:** Improper waste disposal can lead to soil, air, and water pollution.
4. **Public Awareness:** Encouraging the public to adopt sustainable waste management practices is challenging but essential.
5. **Policy and Regulation:** Effective waste management requires robust policies and regulations, which can be difficult to implement and enforce.

### Innovations in Waste Management

1. **Smart Waste Bins:** Equipped with sensors to monitor waste levels and optimize collection routes.
2. **Waste-to-Energy Technologies:** Converting non-recyclable waste materials into usable heat, electricity, or fuel.
3. **Biodegradable Materials:** Developing products that break down more easily in the environment.
4. **Advanced Recycling Technologies:** Improving the efficiency and range of materials that can be recycled.
5. **Circular Economy Models:** Designing products and systems to minimize waste and make the most of resources.

### Conclusion

Effective waste management is essential for sustainable development and environmental protection. It requires a comprehensive approach that includes reducing waste generation, improving recycling and reuse, and adopting innovative technologies. Public awareness and participation, along with robust policies and regulations, play a crucial role in achieving efficient and sustainable waste management systems.

### 7. Resource Management

Our planet's resources – water, land, minerals, energy, biodiversity, etc. – are the building blocks of our lives. They provide us with food, shelter, and everything we need to thrive. However, these resources are finite and the demands on them are growing rapidly. This is where resource management comes in.

Resource management is the practice of using and conserving resources wisely to ensure their availability for future generations. It is also about finding a balance between meeting our needs and safeguarding the well-being of our planet.

#### Why is Resource Management Important?

- **Sustainable Development:** Resource management is essential for achieving sustainable development – a future where our needs are met without compromising the ability of future generations to meet their own needs.

- **Environmental Protection:** By using resources efficiently and reducing waste, we can minimise our impact on the environment and protect ecosystems.
- **Economic Stability:** Efficient resource management can help stabilise economies by ensuring a steady supply of resources and reducing the costs of production. **Social Well-being:** Efficient resource management can ensure fair distribution of resources helping to reduce poverty and inequality.

### **Some Ideas for Science Exhibition on Resource Management**

#### **Water Conservation Techniques:**

- Models demonstrating rainwater harvesting systems.
- Exhibits on greywater recycling for household use.
- Interactive displays on the importance of reducing water wastage.

#### **Energy Efficiency:**

- Construct a model of a solar-powered house or car.
- Design a device that monitors energy consumption and provides feedback to users.
- Build a wind turbine or a model of a geothermal energy system.

#### **Waste Management and Recycling:**

- Design a composting system for organic waste.
- Create a model of a waste-to-energy plant.
- Develop a recycling program for your school or community.

#### **Sustainable Agriculture:**

- Models of sustainable farming practices such as crop rotation and organic farming.
- Build a model of a hydroponic or aquaponic system for growing food.
- Design a permaculture garden that mimics natural ecosystems.

#### **Forest Conservation:**

- Models demonstrating the impact of deforestation and the importance of reforestation.

- Exhibits on the role of forests in maintaining ecological balance.
- Projects highlighting sustainable forest management practices.

### **The Challenge and the Opportunity**

The challenges of resource management are significant, but they also present us with an opportunity to innovate and create a more sustainable future. By exploring new technologies, adopting sustainable practices, and raising awareness about resource conservation, we can build a world where everyone has access to the resources they need to live a healthy and fulfilling life.