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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 and Demonstration Multipurpose Schools of Regional Institutes of Education 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 2023-24 too. These would form the first phase of preparation for the RBVP to be organised in November 2024. 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 — 2023–24 has been chosen as 'Science and Technology for Society'. The theme and s u b - t h e m e s identified for RBVP 2023- 24 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 f o r s t u d e n t s a n d 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 —2023–24 has been chosen as 'Science and Technology for Society'.** 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–2023-24 and RBVP–2024, is 'SCIENCE AND TECHNOLOGY FOR SOCIETY ',
and it intends to cover sub-themes like-

1. Health
2. LiFE (Lifestyle for Environment)
3. Agriculture
4. Communication and Transport
5. Computational Thinking

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

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

1. Health

'Health is a state of complete physical mental, and social well-being, rather than merely the absence of disease or infirmity' this definition was put forth by the World Health Organization (WHO) in 1948. A person can be called healthy only if his body is disease-free, as well as have no mental stress enjoys good interpersonal relationships with society and not just an absence of disease. For the individual, there is a certain level of health that everyone can desire to achieve. Health is the foundation that supports every aspect of your life. It allows you to pursue your goals and enjoy experiences that over time life has to offer. Healthy people lead a more successful and productive life. Healthy individuals are key to achieving productivity and economic prosperity.

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 thier surroundings clean and building strong and positive interpersonal connections within thier society, which are all important aspects of leading a healthy life.

Health is broadly affected by genetic disorders, infections and lifestyle but multi-factorial causes are more prevalent in the case of many diseases. In the case of genetic disorders, deficiencies or defects are inherited from parents and the best examples are haemophilia and color blindness. However, diseases like cancer and diabetes mellitus are also known to have a genetic basis, and these are non-infectious. Further, many diseases last for a short period of time and are called acute diseases like the common cold but many

Other ailments last for longer duration and even for as much as a lifetime time like, tuberculosis. They are chronic diseases. Cancer is one of the most dreaded chronic diseases of human beings and is a major cause of death all over the globe.

Infectious agents comprise a wide group of organisms called pathogens. They are viruses, bacteria, fungi, protozoan multi-cellular worms, insects, etc. The diseases caused by these organisms include influenza, dengue fever, AIDS, typhoid, cholera, malaria, ringworms, filariasis, etc. The pathogens live under different environmental conditions and have great potential to adapt to the environment within the host. In many instances, the body is able to defend itself from most of these infectious agents through the immune system.

Our health is adversely affected due to many environmental hazards that lead to several kinds of infection in the body. With the increasing population, demand for food, water, home, transport, energy, etc. is increasing causing tremendous pressure on our natural resources and thereby contributing to pollution of air, water and soil. The lifestyle including the food and water we take, the tendency for junk/ fast food, rest and exercise, habits and drugs and alcohol abuse is another challenge to our health. The increasing level of obesity and early detection of hyperglycemia and hypertension is a great cause of worry from a health point of view.

Continuous efforts of scientists, technologists, doctors and naturalists have brought many new ways of safety and security to our lives. Major inventions in bio-medical diagnostics, new vaccines and antibiotics, surgical methods and genetic engineering have given relief to mankind. These efforts are responsible for raising the standard of personal health and hygiene and providing both preventive and curative facilities to the community.

In Sustainable Developmental Goals, Goal 3 "Good Health and Well Being" established by the United Nations in 2015 is made "to ensure healthy lives and promote well-being for all at all ages.". "India is doing well in achieving SDG Goal 3 by working on path-breaking initiatives like the National Health Mission (NHM), Ayushman Bharat Health Insurance Scheme, National Digital Health Mission and much more.

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 biomedical inventions in the prevention and cure of diseases like Coronavirus; to explore various scientific and technological interventions for meeting the nutritional requirement of human beings and innovative ideas for better management of the crisis created during COVID-19 pandemic. 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 surgical masks, PPE kits, etc. and other biodegradable and non-biodegradable waste;
- Innovative ideas for effective implementation of policies/ programmes/schemes/seminars/workshops such as Swachh Bharat Abhiyan, National Leprosy Eradication Program, educational programmes in schools/colleges about health

- etc. that have a significant impact on health;
- Innovative ideas for effective implementation of policies/ programmes/ schemes such as Atmanirbhar Bharat (self-reliant India) for making India a bigger part of the global economy.
- 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 like disposing of them in the separation of dry and wet garbage beans to maintain cleanliness methods to improve rural sanitation; infectious and non-infectious diseases, relationship with causative factors and their sources.
- Mechanisms/ways to control the spread of Coronavirus, Lung infections, Dengue, Malaria, Chikungunya, and other tropical diseases.
- Innovative preventive measures to control diseases at different levels/ roles of various agencies (role of an individual to break the infection spread chain).
- 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 rural/urban areas and gender aspects.
- 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 good and bad 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 control measures at different levels/ roles of different agencies.
- Innovative ideas/ models for better health of domestic animals. Ideas for effectively implementing policies/ schemes/programmes such as the National Animal Disease Control Programme, Livestock Health and Disease Control Scheme.

2. LiFE (Lifestyle for Environment)

The changing environment and its impact on our lives was never as evident as it is now. Every aspect of our lives is getting affected by the dramatic changes in the environment. Overexploitation of natural resources by humans is the cause of depletion of non-renewable natural resources such as fossil fuels, minerals, etc. We are using natural resources in such a haphazard manner that even water which is a renewable resource is getting polluted and leading to water scarcity in many places across the world. It is even said that the next world war may be fought for water. The world is headed to rapid urbanization and reckless consumerism causing excessive waste generation, and polluting land, soil, air and water. Refrigerators, transportation and chemical industries are major contributors to air pollution and emissions of greenhouse gases and depletion of stratospheric ozone. Our unsustainable practices are not only responsible for endangering the future of our coming generations but impacting other life forms on the planet. Unsustainable agriculture contributes to deforestation, habitat destruction, soil degradation and ultimately loss of biodiversity.

We do not have enough space anymore to dispose of the mountains of waste that we generate each day. A huge chunk of the waste also gets dumped into the ocean leading to ocean pollution thereby causing severe threats to marine life and the ecosystem.

While resources are depleting, our consumption is increasing. Therefore, the gap between what is available and what we need is increasing. This gap has to be reduced if we want to sustain life on this planet. A sustainable lifestyle is no longer an option but a necessity to minimize the negative impacts on the environment and maintain a balance between human needs and the well-being of the planet. A sustainable lifestyle is a lifestyle for the environment and includes practices like, (i)reducing energy consumption by using energy-efficient appliances and lighting, minimizing the use of fossil fuels by choosing appropriate means of transport and switching to renewable energy sources like solar energy, (ii)Conserving water by being mindful about our water usage in daily activities, (iii) Minimizing waste by adapting the 3R (Reduce, Reuse and Recycle) of a sustainable lifestyle. We should reduce our consumption and use only according to our needs. We should reuse items as much as possible like using plastic containers and cardboard boxes to store, we can also donate our old clothes to needy ones instead of dumping them. And we should recycle items like newspapers, bottles, tin, glass, etc., which are used as raw materials for manufacturing other items. Recycling reduces the load of extracting more from our natural resources and at the same time, it reduces waste by not letting it go to the landfills.

Incorporating sustainable practices into our daily life requires commitment towards the environment. Making conscious choices that align with the well-being of both people and the planet is the need of the hour and essential for future generations. Such mass movement towards mindful and deliberate utilization is what is Lifestyle for the Environment (LiFE)

all about. Educating people about LiFE should also be the agenda for all concerned stakeholders to create a sustainable future for all.

Keeping this in view, students can come up with innovative strategies by applying their scientific knowledge. They can identify an issue and suggest innovative ways to solve the problem through a model/ project. Students maybe encouraged to choose an issue which is locally relevant. There is a wide range of projects which students may consider. Some areas in which students can develop their projects are listed below:

- Green or renewable energy from solar, wind, water, etc.
- Reducing air, water and soil pollution in rural and urban environments; agriculture, industries, manufacturing and transport sectors, etc.
- Reclamation of riverbanks and flood-affected areas for the rehabilitation of landless people
- Automatic weather-recording devices
- Devices or models to calculate the carbon footprint of an individual or a family.
- Innovative designs and technologies for solid waste management
- Eco-friendly home design featuring the use of energy-efficient appliances and renewable energy resources
- Model on the difference between urban and rural life in terms of sustainability and consumption of resources.
- Water harvesting and groundwater recharging
- Management of coastal areas Reducing carbon and ecological footprint
- Drainage systems
- Green buildings

- Sustainable, biodegradable and innovative ways of packaging
- Sustainable and eco-friendly cooling and heating systems in appliances, buildings, etc.
- Biodegradable and cost-effective products
- Restoration and conservation of biodiversity—terrestrial and aquatic (freshwater and marine)
- Human susceptibility to infectious diseases through malnutrition due to climate stress and ways to control them/ studies of the impact of global warming on human health (spread of epidemics like dengue, malaria, zika virus, SARS CoV-2, etc.)
- Innovative ideas to reduce waste in the extraction and processing of minerals
- Innovative designs to address human-animal conflict
- Social conflicts resulting from the environment and climate change and their resolution (if possible, using case studies)
- Innovative designs/ methods of wastewater recycling/ reclamation/using recycled water in industries/ homes
- Innovative technologies/designs of sanitation/hygiene-related issues
- Innovative designs for enhancing efficiencies of existing lighting systems/ automobiles/machines/ stoves/ *chulhas*
- Innovative devices for various purposes like measurement of pollutants, detecting forest fires, recording weather, diseases, etc.
- Conservation and management strategies for biodiversity
- Conservation and management strategies for forests, lakes, rivers, mangroves, wetlands, peatlands, etc.

- Technologies for forecasting and warning of cyclones, floods and storms
- Mathematical modelling to address the impact of environmental degradation and climate change on biodiversity
- Mathematical modelling to address the impact of the increase in population on the environment
- Mathematical modelling to address the spread of forest fire depending on the types of trees, weather and nature of the ground surface, etc.

3. Agriculture

The backbone of the Indian economy, agriculture is a practice that has been practiced for a thousand years and is deeply ingrained in Indian culture. In 2022–2023, agriculture and related sectors contributed about 18.3% to the GDP; it is the oldest and fastest-growing sector in India and supports about 151 million people. For Indians, agriculture is not simply a source of income but also a way of life. Approximately 60% of Indians are either directly or indirectly involved in agricultural pursuits. India is the second-largest producer of wheat, rice, sugarcane, vegetables, groundnuts, cotton, and fruit in the world because agriculture is the only sector that also produces raw ingredients for other industries. In addition, India is the biggest producer of spices, jute, and pulses in the world. The main reason other industries in India are thriving, including textile, food processing, and pharmaceutical manufacturing, is the simple accessibility to raw materials. Since the Indus Valley civilization in antiquity, India's ecology, varied climate, and topography have made a broad variety of crops possible to grow. Numerous other crops, including pulses and millets, are grown throughout India, including wheat and sugarcane in the northern plains, rice in the south, cotton and jute in the western Ganga delta, and many others. Indian soil is fertile and rich in nutrients, making it ideal for growing cash crops like spices, tea, and coffee that support the nation's export revenue.

We can argue that science and technology have created a symbiotic connection with agriculture, revolutionizing the way we produce food, manage resources, and maintain ecosystems. This is true when discussing the growth of agriculture in our country. The Green Revolution of the 1960s is the best example of how ground-breaking innovations have repeatedly changed the agriculture sector. Science continues to enable the development of new crops through the genetic engineering of commercial crops and the use of breeding techniques to improve a variety of staple crops. These techniques are also to thank for the increased resistance of various crops to pests and diseases as well as their improved nutritional values. Sustainable agriculture approaches have been influenced by scientific understanding of soil chemistry, microbiology, and ecology to maximize fertilizer utilization, lessen soil erosion, and preserve biodiversity. Technology in agriculture has made farmers less reliant on traditional farming methods and less reliant on monsoon patterns and climate change. We now have new and improved irrigation and ploughing equipment, as well as technologies that can predict weather patterns, which can help us plan and successfully harvest crops with the least amount of loss. Research and development in areas such as plant physiology, plant stress responses, and the nutritional profile of soil aid in the selection of crops appropriate for the season and the use of fewer pesticides and chemicals than would otherwise be necessary. Despite all the advantages of science and technology in agriculture, there are some drawbacks as well. For example, the use of pesticides and insecticides is a major

contributor to soil degradation and pollution, and feeding a large population with scarce resources also puts a strain on the ability to grow more food on the fertile land. Environmental concerns are not the only concern the main challenges in the agriculture sector are the ethical issues surrounding genetically modified organisms (in this case crops) and corporate businesses' control over seeds. To achieve ethically sound and equally sustainable agricultural techniques, we must strike a balance between technological innovation and ethical concern.

Goal two of the United Nations' Sustainable Development Agenda (SDG-2) is to "end hunger, achieve food security, and improve nutrition to promote sustainable agriculture." SDG Goal 2 calls for "zero hunger" in all forms by 2030 to promote sustainable development. The goal includes the challenge of providing wholesome food to everyone and everywhere so they can have healthy lives. Sustainable agriculture must be promoted and made widely known to accomplish this goal. To raise awareness and promote millet production and consumption, the United Nations has designated 2023 as the International Year of Millets.

With this sub-theme, we hope to encourage children from rural areas whose families are involved in farming to identify problems with the current situation and to find solutions using their knowledge and the assistance of teachers. The goal of this sub-theme is to assist students in finding solutions to conventional agricultural practices. We want students to identify long-term fixes for issues that farmers confront. They can see a problem and offer creative solutions by way of a model or project. Students are urged to select a problem that has local significance. There are numerous projects that students can pick from. The following is a list of several areas where students can build their projects:

- Role of biotechnology in enhancing crops' nutrient content and stress tolerance.
- Innovative approaches show how farmers can improve resource use using technologies like GPS, sensors, and data analytics.
- Creating tools or applications to gather weather data that farmers can use to schedule irrigation, harvesting, and ploughing.
- Creating tools to help with irrigation automation.
- Creating tools to gather information about the soil and topography of the area to make informed decisions before each crop season, such as if the soil is deficient in a specific nutrient needed for one crop, sowing another crop or leaving the ground unplanted to obtain the nutrition.
- Utilizing a model to illustrate the advantages of modern agricultural practices such as hydroponics and how they apply to that particular area.
- Showing off how to grow crops using new and existing genetic modification techniques for plants and crops.
- Demonstrating the breeding and selection process for agricultural types that are climatically adaptable.
- Current breed or crops that have undergone genetic engineering and their evolution throughout time. Students can give examples of modern crops in this area, compare them to earlier varieties, and discuss how technological advancements have influenced agricultural evolution.
- Build a model of the intelligent watering system.
- Create a model to demonstrate

how trap crops or the introduction of beneficial insects, such as earthworms, can be used to control pests without the need for a lot of pesticides.

- Create a smartphone application that can inform farmers about the type of soil, its chemistry, and the crops that can be grown there given the local climate and soil conditions.

- Give an example of how agricultural waste can be converted into bioenergy using techniques like anaerobic digestion.

- Create a model for using agricultural waste to create other beneficial materials, such as bio-oil, paper, compost, etc. Students should also emphasize how this can aid in sustainable energy production, trash management, and carbon footprint reduction.

- Suggest ways to combine several techniques, such as aquaponics (fish farming) or apiculture (bee farming), and explain how doing so might benefit farmers.

- Create or offer a model for novel irrigation techniques, such as drip irrigation, and their advantages over more conventional techniques.

- Create a model that tracks the health and development of crops using sensors and remote sensing methods.

- Best circumstances for fern growth and mushroom production.

- POSHAN Abhiyan, a targeted public distribution system for food grains to the underprivileged, is one example of a policy, program, or scheme that can be effectively and transparently implemented by using fair-priced stores.

- Effective methods for using biological insecticides, biological fertilizers, biological manures, biological weedicides, etc. to boost crop growth and yield.

- Innovative methods for growing fodder crops alongside the main crops to improve the nutritional value of the feed for farm animals.

- Innovative strategies for putting policies, programs, and plans into action that will improve millets' productivity and consumption in time for the International Millet Year in 2023.

4. Communication and Transport

The dream of the modern world is a reality today only because of communication and transport; these are the two pillars upon which the modern world rests. One could never imagine the world as we know it today without communication and transport; they have facilitated the exchange of ideas, goods, and culture across vast distances. The evolution of communication and transport is the basis of globalization; it has given a fast pace to development and played an important role in transforming societies, economies, and lifestyles in profound ways.

In ancient times, people used symbols for communication, which led to the discovery of language and made sharing thoughts, ideas, and learning possible. Today, the digital revolution has catapulted communication to unprecedented levels. The Internet has changed the world overnight due to new platforms like social media and messaging apps, which have shrunk the globe. Now anyone can interact with their families, friends, or complete strangers sitting in different corners of the world. Digitalization in communication has removed all geographical

barriers between individuals. This has not only democratized access to information but has also generated a global sense of unity and shared responsibility. All of this contributes to effective and transparent communication, which acts as the foundation for successful relationships, both personal and professional, helping to build international relations, prevent misunderstandings, and promote cooperation. Transport, on the other hand, is the physical movement of people, goods, and services from one place to another. In ancient times, people used to travel by road, either by walking or using an animal cart for trading; these routes were the means of exchanging goods, ideas, and culture between different civilizations. With the industrial revolution came advancements in transportation technology, which gave us railways, steam engines, and steamships, which accelerated the movement of goods and people over large distances. In the modern world, technology has further revolutionized our modes of transport; now we have air travel and a shipping network as well, which has transformed the concept of time and distance drastically. All of these advancements in modes of transport have boosted the world economy by enabling the exchange of resources and fostering interconnectivity.

Science and technology have played a dynamic role in the advancement of communication and transport; they have played an instrumental role in enhancing efficiency, connectivity, and global outreach. The inventions of telephones and radios are the basis for modern communication systems. The internet, without which we cannot imagine our world today, has become the backbone of contemporary communication. In the case of transportation, we are travelling in high-speed trains and electrical vehicles today instead of horses or bullock carts, and it was made possible only because of science and technology

advancements. We have reached the moon and have artificial satellite technologies available to us only due to the efforts of aeronautical engineers and space scientists.

Furthermore, communication and transport, along with science and technology, are different threads woven together to form the fabric of development and growth for any nation. Advances in communication have improved the management and coordination of transportation networks. Real-time tracking, monitoring, and predictive analytics have optimized the movement of goods, and enhanced traffic management has ensured the safety

of travellers. New communication technologies like artificial intelligence (AI) are contributing to making the dream of smart cities a possible reality where vehicles, infrastructure, and information are seamlessly interconnected.

While there are many benefits of science and technology in the fields of communication and transport, they also pose ethical considerations like data privacy, cybersecurity, misuse of advanced technologies, fear of job displacement by AI in automated transport systems, ethical implications of decisions made by AI-driven vehicles, etc. Hence, it is our responsibility to ensure that the benefits of these advancements are harnessed for the betterment of humanity. The objectives of this sub-theme are to make the general public and children understand different modes of communication and transport as well as the importance of communication and transport for sustainable development; to make them aware of the issues and concerns of the present communication and transport systems; and to promote innovations for efficient systems.

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

- Improvised or indigenous models for efficient transport or communication.
- Working models of fuel-efficient or pollution-free designs of automobiles, ships, boats, etc.;
- Innovative ideas for efficient management of road, rail, water, and air transport systems, e.g., better safety measures, managing traffic jams, etc.;
- Improvised or improved devices for effective transport between various emergency services, namely medical, police, military, and other administrative bodies;
- Use of geostationary satellites in providing information about vehicular movements and transportation, disaster management, etc.;
- Designs for improving existing transport and communication systems. Innovative ways of using modern modes of communication or transportation to connect people.
- Develop a mathematical model that stimulates traffic flow in a city. In this course, students can use concepts from fluid dynamics and calculus to model the movement of vehicles.
- Develop a model of how different transport technologies work, for example, how GPS uses satellite signals to determine an object's position.
- Design a model to demonstrate how electromagnetic waves propagate and how they are used in communication with the help of concepts like modulation, encoding, and signal amplification.
- Prepare a model of how optic fiber works, its uses in communication, and the future possibilities of its use.
- Explain the concepts of viral on social media. How social media networks work and how their algorithms work to trend memes, news, and articles. Students can use graphs to
- present nodes and connections to present network dynamics. Discuss the implications of social media networks on communication and social behavior.
- Develop a mathematical model to show how air routes and other parameters are designed for airplanes to optimize the shortest distance for travel. Students are encouraged to discuss the use of any new proposed technology for air traffic management and the role of communication in this regard.
- Suggest new and effective methods to optimize logistics and supply chain routes for goods transportation.
- Develop a model to show the Doppler effect and its application in radar systems. Show how changes in frequency due to motion detect the speed and direction of objects. Discuss its application.
- Develop a model to show how encryption and decryption in digital communication help with cyber security.
- Demonstrate a model of how smoke signals were used in communication and their impact on the air quality index, link it with modern-day air quality, and discuss whether modern-day communication signals are pollution-free or not.

5. Computational Thinking

It is difficult to thrive in the technologically advanced, highly complex society we live in today. For today's generation, having the capacity to think critically, solve problems, and make wise judgments is crucial. Computational thinking is a way of problem-solving that extends beyond coding and programming to solve logical

issues. It is based on the ideas of computer science. It has made it possible for people to analyse problems, come up with effective solutions, and use these abilities across various fields.

With its cognitive abilities derived from computer science ideas, computational thinking is frequently employed to address contemporary issues. It is essentially supported by four major pillars: A) Decomposition: Dividing difficult issues into more manageable parts by concentrating on and thoroughly comprehending each component in this step, we are able to combine them to create a holistic answer. B) Pattern Recognition: In this method, the problem is examined for any discernible patterns and trends that may be compared with various scenarios to identify and implement solutions that have previously been successful for a problem of a similar nature. C) Abstraction: Reducing the issue to its core elements while omitting superfluous details. Abstractions aid in concentration and simplify solutions, making them simpler to understand and solve. D) Algorithm Design: This entails developing detailed instructions or algorithms to address a challenge. This entails rationally ordering the steps to provide efficient and successful solutions.

Numerous disciplines, including business, healthcare, the arts, and the sciences, have greatly benefited from the use of computational thinking. Computational thinking has a wide range of applications;

In business and economics, it has been used to evaluate market trends, improve supply chains, and make data-driven decisions in an effort to increase profits, lower costs, and improve efficiency. With the use of computational thinking, medical personnel can now diagnose diseases more quickly, analyse patient data, and create treatment plans. Large datasets can be analysed using computational thinking, which enables quick decision-

making in urgent situations. For artists and innovators, computational thinking has opened up an entirely new universe in a variety of emerging fields like graphic design, animation, and architecture, all of which were made possible by computational thinking alone and are now thriving. It plays a crucial part in providing educators and teachers with new resources and instructional strategies to improve learning. It has aided in developing flexible learning environments and individualised instruction for students with various requirements.

The proliferation of data and knowledge brought on by the digital revolution presents both benefits and difficulties. Computational thinking is used in many fields, like data analysis, that seems unachievable without it. For data scientists and analysts who work with massive datasets, computational thinking is crucial. The development of algorithms and models using artificial intelligence (AI) and machine learning is based on the same fundamental ideas, leading to a holistic approach to problem-solving. Computational thinking is also necessary for understanding vulnerabilities, creating secure systems, and efficiently responding to breaches in the field of cybersecurity.

We are attempting to highlight the value of computational thinking for the present and the future. In this subtheme. With this subtheme, we want students to create models or exhibits that represent the significance of computational thinking for the modern world and how it can be advantageous for society. By introducing computational thinking early in education, students can develop problem-solving skills that transcend specific subjects. And with this subtheme we want students to make models/exhibit that represents the importance of computational thinking for the modern world and how it can be beneficial for society.

The exhibits and models in this sub-theme could be related to:

- Designning a model for traffic simulation in a city and propose a way to use computational thinking in it.
- Building a model to show the use of computational thinking in managing individual and company finances to achieve their financial goals.
- Develop a model or exhibit to show an artificial ecosystem where species interact with each other based on algorithms. Here students must show the design of the algorithm by using computational thinking and can also involve the balance and adaption in the parameters for algorithm design.
- Develop a model on the use of computational thinking in different areas like healthcare, education, economy, business, entertainment, art etc. Students may choose one of these topics and explain in detail the use of computational thinking in each field.
- Develop a model to create digital stories with the help of computational thinking.
- Develop a model to show how computational thinking can be used at time of natural disasters such as floods and earthquakes by providing a solution based on comparing different scenarios and response strategies.
- Develop a model to show how computational thinking can be used to present evolution through changes in the genetic makeup of a species and calculate the rate of mutation and future of that species using computation thinking.
- Develop a model to show the use of computational thinking at the time of the pandemic and how it can provide solutions and strategies to fight such situations