बच्चों के लिए
राज्य स्तरीय विज्ञान, गणित एवं पर्यावरण प्रदर्शनी 2021 – 22

तथा

49वीं जवाहरलाल नेहरू राष्ट्रीय विज्ञान,
गणित एवं पर्यावरण प्रदर्शनी 2022

प्रदर्शों तथा मॉडलों को बनाने एवं प्रदर्शनी आयोजित करने हेतु

दिशानिर्देश

STATE LEVEL SCIENCE, MATHEMATICS AND ENVIRONMENT EXHIBITION FOR CHILDREN — 2021–22

AND

49TH JAWAHARLAL NEHRU NATIONAL SCIENCE, MATHEMATICS AND ENVIRONMENT EXHIBITION FOR CHILDREN — 2022

GUIDELINES

For the Preparation of Exhibits and Models and Organising Exhibition

विभिन्न स्तरों पर आयोजित होने वाली विज्ञान, गणित एवं पर्यावरण प्रदर्शनियों का उद्देश्य विज्ञान की लोकप्रियता के साथ छात्रों के बीच आविष्कारक तथा सृजनात्मक कौशल की पहचान तथा पोषण करना भी है। बच्चों को उनकी वैचारिक अभिव्यक्ति को प्रकट करने तथा वस्तुओं को उपयोग में लाने की क्षमता के विकास के लिए हर संभव प्रयास किया जाना चाहिए। वे अपनी रचनाशीलता एवं कल्पनाशीलता को व्यक्त करने के लिए पूर्ण स्वतंत्र हैं। माता–पिता, अध्यापकगण और साथी–समूहों की भूमिकाएं आर्थिक सहायता एवं परिचर्चा के रूप में हो सकती हैं। **बने–बनाए प्रदर्श/मॉडल को प्राप्त करने की प्रवृति से हर हाल में बचा जाना आवश्यक है।** बच्चों द्वारा प्रदर्शित मॉडल उनकी वैज्ञानिक सोच को अभिव्यक्त करने में समर्थ होने चाहिए, चाहे मॉडल परंपरागत हो या किसी परंपरागत मॉडल में संशोधन अथवा नवाचारी हों। प्रदर्श अथवा मॉडल की संरचना में प्रयुक्त कौशल, स्वच्छता और शिल्पकारिता को भी ध्यान में रखा जाना चाहिए।

IMPORTANT

Besides the popularisation of science, mathematics and environment issues, the objective of organisation of this exhibition at different levels is also to identify and nurture inventive and creative talent among students. Children must be encouraged to explore every resource to enable them to express and handle objects. They must be given all freedom to express their own creativity and imagination. The role of parents, teachers, and peer groups may be in the form of financial support and discussions. **The tendency of procuring the ready–made exhibits or models must be ruled out.** An exhibit must be able to bring out the scientific and mathematical ability of the children, whether the model is traditional or an improvement over the traditional model or innovation. Skills involved in constructing the exhibit or model, the degree of neatness and craftsmanship involved must also be taken into account.

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GUIDELINES

FOR THE PREPARATION OF EXHIBITS AND MODELS AND
ORGANISING EXHIBITION

विद्यया S मृतमश्नुते

एन सी ई आर टी
NCERT

राष्ट्रीय शैक्षिक अनुसंधान और प्रशिक्षण परिषद्
NATIONAL COUNCIL OF EDUCATIONAL RESEARCH AND TRAINING

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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 own activity. Children learn through interaction with people and environment around. They construct knowledge by connecting new ideas to their existing ideas.

In order to stimulate creativity, inventiveness and the attitude for innovation in science and mathematics, National Curriculum Framework (NCF-2005) emphasizes on activities, experiments, technological modules, etc. It also encourages implementation of various activities through a massive expansion of channels such as 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 Jawaharlal Nehru National Science, Mathematics and Environment Exhibition (JNNSMEE) for Children every year for popularising science, mathematics and environmental education amongst children, teachers and public in general. This exhibition is a culmination of various exhibitions organised in the previous year by the States, UTs and other organisations at 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, 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 district to state level during 2021-22 too. These would form the first phase of preparation for the JNNSMEE to be organised in November 2022. 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 lay emphasis on 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 have developed and are affected by many diverse individuals, cultures, societies and environment;
- 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, fertiliser, 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 innovate in response to a variety of problems confronting 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 human community for the desire of more comfort and security have put tremendous pressure on the limited resources of the world leading to unequal access and unsustainable exploitation. This is resulting in unsustainable use of resources.

According to United Nations 'Global Resources Outlook 2019', the 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 percent 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 of 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 for people and the planet, now and into the future, all the member states of 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.

Science and Mathematics act as powerful tools for investigating and understanding the nature and the world. They also play a crucial role in solving problems confronting the society and act as a major instrument for achieving goals of self-reliance and socio-economic development in a sustainable manner. To recognize and encourage these powerful tools so that the problems confronting the society can be overcome and a better sustainable future can be built through science and technology led solutions, the theme for the State Level Science, Mathematics and Environment Exhibition (SLSMEE) for Children during 2021-22 has been chosen as Technology and Toy.

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 Padao (Save the Girl Child, Educate the Girl Child) are some of the steps to achieve these sustainable goals.

The theme and sub-themes identified for SLSMEE 2021-22 are directly or indirectly focuses on achieving the sustainable development goals enunciated by the United Nations.

In this context, it is envisaged that children and teachers would try to analyze all aspects of the role of science and technology for 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 to students and teachers to present such ideas in the form of presentations and discussions.

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

Development of creative domain of a learner through teaching- learning process of science is an area which needs to be addressed to make experience of learning stimulating and exciting. For this, there is a need to engage learners in learning of science concepts in innovative ways which may help in all round development of a learner. Toys or games, which may be physical or virtual, are one of the learner friendly tools for learning science. Toys have been used since time immemorial for playing which, in long run, resulted in developing their cognitive, psychomotor and affective domains. Over time the form of toys and the materials used to make toys has evolved, particularly with the growth/development of technology, however, the importance of toys in learning science continues. With this in view, the theme for the **State Level Science, Mathematics and Environment Exhibition (SLSMEE) for Children– 2021–22 has been chosen as 'Technology and Toys'.**

Toys play an important role in developing different skills of an individual, such as problem solving, conflict resolution, how cause and effect work, etc., and these skills play an important role in their lives. Toys also nurture creativity and imagination and values, such as, cooperation, sharing, respect for others. Toys also play an important role in creating awareness about issues related to health, hygiene and cleanliness. The use of toys for science concepts becomes more relevant considering the declining interest of learners in learning science. On one hand, the traditional toys, which are struggling for their existence among learners in the present era, may be relooked at for use as a tool to transact science concept in an innovative manner. On the other hand, the emerging technologies may be explored to design newer toys, refining existing toys, reviving indigenous extinct toys, made of ecofriendly materials and looking for the possibilities for their use in learning science.

In this context, it is envisaged that students and teachers would try to analyze all aspects of the role of technology and toys in learning of science. This will enable students and teachers to generate ideas and prepare toys/models/exhibits for addressing various problems.

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The theme for **SLSMEE–2021-22** and **JNNSMEE–2022**, **'TECHNOLOGY AND TOYS'**, aims to cover sub–themes such as–

1. Eco Friendly Material;
2. Health and Cleanliness;
3. Software and Apps;
4. Transport;
5. Environmental and Climate Changes;
6. Mathematical Modelling

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

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. Eco-friendly Materials

The great revolution in Technological and Industrial area has boosted up the rate of environmental degradation. The beginning of environmental degradation has happened due to major use of technology in industries in the latter half of the eighteenth century. Now we look for some technologies and alternatives that will help us to overcome, reduce or reverse such impacts on the environment.

In today's world the environmental degradation and deterioration is occurring in an unmatched manner and thus making it difficult for all life forms to live a healthy life. Human population is not the only one facing different environmental issues but all the ecosystems and the life forms living in them are getting affected due to injudicious use of natural resources. All other ecosystems like air, water and soil are being degraded by the pollution from different sectors like transport, domestic, industries and agriculture. Tons of waste is being dumped in landfills, which keeps getting accumulated in the environment and pollute it. Today we are facing major environmental problems such as climate change and global warming that requires an immediate attention.

Using eco-friendly or environment friendly materials in daily life activities and for manufacturing or industrial processes can solve the above mentioned issues and challenges to a great extent.

For an instance, environment friendly technologies and materials can be used so that both the manufacturing process involved and the product obtained by the process are more eco-friendly. The environmental challenges that we are facing nowadays call for an attention, therefore, development of such alternatives that protects our environment from degradation is the need of the hour. One of the solutions is using eco friendly materials on major level. Eco friendly materials act like a savior to the environment as it not only cause minimum environment degradation but also reduces the negative effects on all living organisms surviving in various ecosystems. Therefore, people should be encouraged to use eco-friendly materials in different technological developments and development of toys.

Awareness about the advantages of eco-friendly materials can be generated among people by making such models. Some examples of eco-friendly materials that can be used in making the models are:

• Used papers, used books, old carton

boxes, newspapers and other waste papers can be used to make models and toys.

- Plant based materials like cotton, jute fibres and other natural fibres can be taken in use for making various models as they serve as excellent eco-friendly materials

- For making base and frames of the model various other plants based materials like bamboo, cane and wood etc.

    1. Metals can be used as an alternative of plastic or polymers used in daily life such as polyvinyl chloride (PVC), or polystyrene products such as thermocol etc although metals are non biodegradable but they better than plastics
    2. Various models can be developed to showcase the advantages of eco-friendly materials/ alternatives in different technologies and toys.

2. Health and Cleanliness

The main objectives of this sub–theme are: 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.

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

- factors affecting the health and resulting ailments in the body;
- to study as to how the cleanliness influence 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;
- the ways to dispose-off the garbage properly to maintain cleanliness;
- methods to improve rural sanitation;
- infectious and non–infectious diseases, relationship with causative factors and their sources with emphasis on Coronavirus;
- mechanisms/ways to control the spread of Coronavirus, Lung infections, Dengue, Malaria, Chikungunya, etc.;
- innovative preventive measures to control diseases at different levels/ roles of various agencies (role of 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 importance of balanced diet and 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;
- role of biotechnology to improve nutritional value of crops;
- demonstration of models/projects to show the effect of junk food items, 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;
- ways to raise awareness and sensitise people to be careful in health matters, explore the possibilities and make use of the facilities available;
- innovative ideas for effective implementation of policies/ programmes/ schemes such as Swachh Bharat Abhiyan, National Leprosy Eradication Programm etc. that have significant impact on health;
- innovative ideas for effective implementation of p o l i c i e s / programmes/ schemes such as Atmanirbhar Bharat (self-reliant India) for making India a bigger part of the global economy;
- development of knowledge–base and understanding new scientific, technological aids in bio–medical areas;
- presentation of known facts and research findings in different medical systems like Traditional, Modern, Homeopathy, Ayurvedic, etc.;
- lifestyle and its relationship with good and bad health based on known facts and researches;
- 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;
- toy/models for sustainable agriculture and health;
- toy/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;

3. Software and Apps

An interactive software is the one which allows direct communication between the user and a machine. When we are dealing with the toys, the machine refers to the toys. The main objective of this theme is to engage children and teachers in thinking of the new and innovative ways in which these type of software may be utilized in design and development of toys. Technology is providing us an edge in designing of newer type of games and toys!

On the other hand this theme may also include designing and developing Toy Programs. A toy program is a small computer program typically used for educational purposes. Toy programs are generally of little practical use, although the concepts implemented may be useful in a much more sophisticated program. Such toy programs usually ponder on specific problems, such as computing the nth term in a sequence, finding the roots of a quadratic equation and testing if a number is prime. Toy programs are also used for a developer trying out a new programming language, to test all of the language's syntax and coding methods.

The use of toys can help children learn and develop different skills such as problem solving, creativity, emotional and social development etc. It also helps in development of fine and gross

psychomotor skills. Technology has indeed changed the toys! Twenty years ago many of us were not in a position to think of the type of toys which are very commonly available today. Today, most of the beginner designers and developers still like to use their hands and the bricks at their platforms to develop new tasks. In some cases, they use prototype elements that are planned, proposed, or otherwise aren't ready yet. They occasionally use developing their thoughts with 3D printing technology (although sometimes they use good old-fashioned knives, scissors, or other tools to fashion "new" pieces out of existing ones that are similar). However master designers, use software and yes, again their own hands. Master Designers typically build models for promotional events like trade shows, tours, and so forth. Their models won't usually be made into sets that kids have to build (they'll often just be made once). Techniques like Injection Moulding are used for mass production of soft organic and McFarlane toys that we often see in restaurants, for example at McDonalds.

Most of the toy-developer programs today, are LEGO based. The word LEGO is an abbreviation of two Danish words "LEg GOdt", coined in early 1930s. It simply means play well in English. It has been the classic brick building toy of yesteryears. Nowadays, it's moved in all sorts of technological directions, including elaborate Mind storms; robotics based on programmable bricks originally conceived for educational purposes, and something approaching computer aided design (CAD).

Some specific questions that may be addressed while developing models under this sub-theme may include:
- What kind of modeling software can be used for designing prototype toys: Solid works, Catia, On Shape, Autodesk Fusion, Sketch Up, Rhino, Zbrush, Zbrush core, T- Splines; Solid Works; Pro E; Rapid Form, Geo Magic, Rhino3D, Alias etc.
- What kind of software (tools) are used by the professional designers and engineers? Or how does a professional sculptor work for designing and building LEGO models? These could be L draw (or L draw standard), traditional CAD-style system design tools, Maya for three-dimension rendering, Leo CAD, Meca Bricks, LDD (LEGO Digital Designer), inventor, mud box, or some customized software.
- What are the free tools available for designing toys: Tinker CAD (for children that can also help in developing 3D modelling programs), Fusion 360, Blender, Sketch Up Free, Mesh mixer, Tsplines Add-on on your rhino software
- Is there any software that allow us to work on a mesh and convert it to a poly surface to be exported in other standard formats?
- What are the differences between different software?
- What kind of software is used to design and publish toys' instruction manuals?
- Which software is usually used by the package designers?
- How can I work as a toy designer?
- How can the pieces may be moved in LDD software?
- What software can be used for modeling soft stuffed toys and tiny toys?
- What kind of 3D modeling software is used for developing Video Games?
- How the prototypes do are tested?
- What are the software tools used for creating Toy Stories
- What software are generally used to

make jointed toys: Sensables or Jasun?

- What are the software for measurements, mechanical analysis etc.
- What is the best software to introduce children to 3D modelling and 3D printing
- What are the designing software used in 3D printing?
- What are the software used for industrial design?
  1. What 3D modeling software would be better for game development, and why?
  2. What CAD software is the most versatile?
  3. What kind of software is used for developing 3D models from a 2D image?

4. **Transport**

Learning through play is an important part of child's development. The use of toys can help children learn many different skills they need in their life. Toys can help develop problem solving skills, helps develop their motor skills and also nurtures their creativity and imagination.

Toys have existed in India since ancient times. Traditional Indian toys were simple and could connect to the real life knowledge. Available literature shows that toys have reflected the cultures, society and have played important role in the development of the physique and mind. It has been reported that assemble of toys were found in specific parts of the Indus cities, which could be interpreted as designated play areas. One tenth of all findings in the Indus valley are play-related, which included toys as well as game pieces like Wheel cart, Rattle, dice. A lot needs to be done to recover the lost heritage.

It is essential to create a platform where young generation can showcase their innovative toys. Awareness among young generation needs to be initiated regarding the unhealthy manufacturing practices in the industry, waste control by rejecting plastic and electronic toys. Our society needs to be sensitized to the importance of organic toys. Toys can be used by children of all ages to see and recognize science embedded in their daily lives..

Students can design and develop two kinds of toys:

(a) Static and   (b) Dynamic

Static toys, such as kites, dolls, animals, birds, etc., can be made of clay, bamboo, metals, paper or any locally available materials.

In dynamic category, moving or/ and sound, light producing toys such as, *Damaru* or drum rattle, spinning top or *lattu, Gulel,* moving vehicles, dolls, robots etc., can be made. These toys would be useful in understanding the various concepts of science. Students can design advanced science toys, or prepare science projects, based on the simple toys they have played with as children Toys can also be used as teaching aid for transacting many concepts of science. These contribute in overall development of the child.

5. **Environmental and Climate Changes**

Changes in the environment and climate are perhaps amongst the greatest threats facing the world and humanity today. There are threats related to air, water and soil pollution on the one hand, while on the other, the impacts of such environment and climate change are observed in the form of heat and cold waves, episodes of storm and smog, erratic weather patterns such as drought, flood, unpredictable rainfall, loss of crop, water stress, increase in the intensity and frequency of cyclones, melting of

glaciers, sea level rise, global warming, increase incidence of zoonotic diseases such as SARS CoV-2, collapsing ecosystem, loss of biodiversity, forest fires, social conflicts, poverty, etc. These impacts not only threaten our development and economy but they are increasing becoming a threat to our very existence. While there are natural causes to the changes in the climate, the present changes in the environment and climate that we are experiencing are due to anthropogenic/ human activities—majorly attributed to developmental activities.

Notwithstanding the impacts of changes in environment and climate, we cannot entirely give up on our developmental activities since India is still a developing country. At the same time with increase in our population there will be corresponding increase in demand for all kinds of resources—food, water, energy, habitat, transportation, etc. Making all such resources accessible to all will impact the environment and climate in some way or the other. It is, therefore, imperative to invent and innovate strategies in order to ensure that all our developmental activities are sustainable with no, or minimal, impact to the environment and climate. Towards this end, a wide range of projects may be considered by students. Some areas on 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 environment; agriculture, industries, manufacturing and transport sectors, etc.
- Reclamation of riverbanks and flood affected areas for the rehabilitation of landless people

- Solid waste management
- Water harvesting and ground water recharging
- Management coastal areas
- Reducing carbon and ecological footprint
- Green buildings
- 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 controlling them/ studies of the impact of global warming on human health (spread of epidemic like dengue, malaria, zika virus, SARS CoV-2, etc.)
- Circular economy
- Social conflicts resulting from environment and climate change and their resolution (if possible, using case studies)
- Innovative designs/ methods of waste water recycling/ reclamation/ using recycled water in industries/ homes
- Innovative technologies/ designs of sanitation/ hygiene related issues
- Innovative designs for enhancing efficiencies of existing lighting system/ automobiles/ machines/ stoves/ chulhas
- Innovative devices for various purposes—measurement of pollutants, detecting forest fires, recording weather, diseases, etc.
- Mathematical modeling to show impact of environment and climate change on biodiversity
- Mathematical modeling to show impact of increase in population one environment and climate
- Mathematical modeling to show spread of forest fire depending on the types of trees, weather and nature of the ground surface, etc.

6. Mathematical Modeling

Mathematical modeling is the process of transformation of a physical situation into mathematical analogies with appropriate conditions. Physical situations need some physical insight into the problem. Then it is solved by using various mathematical tools like percentage, area, surface area, volume, time and work, profit and loss, differential equations, probability, statistics, linear, nonlinear programming, etc. It is a multi-step process involving identifying the problem. Constructing or selecting appropriate models, fighting out what data need to be collected, deciding number of variables and predictors to be chosen for greater accuracy, testing validity of models, calculating solution and implementing the models. It may be an iterative process where we start from a crude model and gradually refine it until it is suitable for solving the problem and enables us to gain insight and understanding of the original situation. It is an art, as there can be a variety of distinct approaches to the modelling, as well as science, for being tentative in nature.

In mathematical modeling, we neither perform any practical activity nor interact with the situation directly, e.g. we do not take any sample of blood from the body to know the physiology, and still our mathematical tools reveal the actual situations. The rapid development of high speed computers with the increasing desire for the answers of everyday life problems have led to enhanced demands of modeling almost every area. The objective of this sub-theme is to help children to analyse how mathematical modeling can be used to investigate objects, events, systems and processes. It can be visualised by Fig.1.

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

- mathematical modeling to solve various problems of our everyday life/environment related problem;
- mathematical modeling and computer simulation of climate dynamics/prediction of weather phenomena based on a number of predictors;
- mathematical modeling in physical geography such as rotation and revolution of earth, precession and equinoxes etc.;
- mathematical modeling to predict orbital path of comets, meteors and other minor planets;
- mathematical modeling to show how disease might spread in human in the event of epidemics/ bioterrorism;
- mathematical modeling to predict the devastating effects of wars/ nuclear explosions;
- mathematical modeling to show spread of forest fire depending on the types of trees, weather and nature of the ground surface;
- mathematical modeling to demonstrate the action of medicines in human system;
- mathematical modeling of the working of heart, brain, lungs, kidneys, bones and endocrine system;
- computer diagnosis of human diseases;
- mathematical modeling of fluid flow in drain, spillways, rivers, etc;
- using mathematical modeling and computer simulation to improve cancer therapy/wound healing/ tissues formation/corneal wound healing;
- mathematical modeling of intracellular biochemical reactions and metabolism;

- mathematical modeling to describe traffic flow/stock market options;
- Studies of storage and retrieval techniques for computer systems;
- Data manipulation and information management techniques;
- Statistics and random number problems;
- Developing video games;
- mathematical modeling for increasing production of crops;
- mathematical modeling on balance of carbon cycle;
- mathematical modeling on social insects such as honeybees, termites, etc. to know how they use local information to generate complex and functional patterns of communication;
- mathematical modeling of maximum speed in fibre optic links;
- mathematical modeling of urban city planning;
- mathematical modeling to prevent an unwanted future/to understand various natural and unnatural phenomena;
- mathematical modeling to show the effect of climate changes/global warming;
- mathematical modeling for predicting future population and knowing the impact of population;
- mathematical modeling for increasing production of crops etc.

GUIDELINES FOR ORGANISING ONE–DAY SEMINAR

TOPIC: SCIENTIFIC ACADEMIC INSTITUTE OF INDIA

NOTE: The One–Day Seminar should preferably be organised one day before the organisation of State Level Science, Mathematics and Environment Exhibition (SLSMEE) for Children.

If we thought of life without mathematics, science and technology, then we can understand what implementations mathematics, science and technology have in our daily life. Mathematics, science and technology have affected almost every aspect of human life spanning from modern-day education, health services, communication, and transportation to the quality of life. From the morning alarm clock to the night time relaxing in the cozy beds under the fans, air conditioners or room heaters, decision to prefer baked food over fried food, checking blood sugar and blood pressure in no time, wearing masks, washing hands or maintaining social distances during the time of medical emergencies such as Covid-19 are the few examples of the implementation of scientific and mathematical knowledge for curing and improving the quality of life. For instance predicting the outbursts, preparedness and finding cure for a pandemic like Covid-19 was not possible without the knowledge of Mathematics, science and the technology. Thinking of modern education, working with large data sets, managing large financial transactions or forecasting weathers without computers or smart electronic devices is almost an impossible task without mathematics, science and technology. Mathematics, science and technology have made it possible through green revolutions to transform food starving countries into food-exporting countries. Mathematical skills along with the knowledge of science

and technology have improved agriculture manifolds by introducing agriculture machinery, improved seed varieties, eco-friendly fertilizers and pesticides. In the early beginning of the 19th-century scientists were aware of the fact that germs are spreading many common diseases. With the advancement of mathematics, science and technology over the two centuries, now we can vaccinate almost every newly born child to save him from many life-threatening diseases. Not only the mortality rate but the quality of life has also improved over the decades following advancement in mathematics, science and technology. It is not possible to imagine any corner of modern-day life which is not touched by the mathematical, scientific or technological achievements.

India is also a major player in the world of scientific and mathematical research in the world. India is known for its contributions in the fields of mathematics, life-sciences, chemical sciences, physical sciences and agriculture in the world. India contributes significantly in the field of scientific and academic research in the world. According to NatureIndex and Worldbank reports, India is one of the top contributors to the scientific output in the world. According to NatureIndex (www.natureindex.com), India ranks 13 in the index of top-quality research producers in the world. Approximately 80 per cent of scientific research in India is carried out in the fields of Chemical and Physical sciences. To markdown and collect the further information about ongoing

research in the scientific and mathematical fields, it will be helpful to visit physically or virtually (using websites) the Indian academic and scientific research institutes contributing significantly. Some of the prominent institutes in India are

1. Indian Institute of Science (IISc)
2. Homi Bhabha National Institute (HBNI)
3. Tata Institute of Fundamental Research (TIFR)
4. Council of Scientific and Industrial Research (CSIR)
5. Indian Institute of Technology Bombay (IIT Bombay)
6. Indian Institute of Science Education and Research Kolkata (IISER Kolkata)
7. Indian Association for the Cultivation of Science (IACS)
8. Indian Institute of Science Education and Research Pune (IISER Pune)
9. Indian Institute of Technology Kanpur (IIT Kanpur)
10. Indian Institute of Technology Madras (IIT Madras)

List of some other notable institutes in India are

1. Chennai Mathematical Institute (CMI)
2. Center for Cellular and Molecular Biology (CCMB)
3. Indian Statistical Institutes Kolkata (ISI-Kolkata)
4. Hyderabad University
5. Forest Research Institute Dehradun (FRI-Dehradun)
6. National Center for Biological Sciences (NCBS)
7. Harish Chandra Research Institute (HRI)
8. Bhabha Atomic Research Centre (BARC)
9. Indian Space Research Organization (ISRO)
10. Wadia institute of Himalayan Geology (WIHG)

GUIDELINES FOR ORGANISING STATE LEVEL SCIENCE, MATHEMATICS AND ENVIRONMENT EXHIBITION FOR CHILDREN 2021–22

A. CALL FOR ENTRIES

1. The theme for SLSMEE–2021-22 for Children and for the 48th Jawaharlal Nehru National Science, Mathematics and Environment Exhibition (JNNMEE–2022) for children would be **"Technology and Toys"** pertaining to the sub–themes such as –
   1. Eco Friendly Material;
   2. Health and Cleanliness;
   3. Software and Apps;
   4. Transport;
   5. Environmental and Climate Changes;
   6. Mathematical Modeling;

(Sub–themes listed above are suggestive. Students are free to choose any other sub–themes and develop exhibits involving innovations in Technology and Toys)

7. In order to facilitate the preparation of exhibits and models for display in district to state level exhibitions during 2021–22, *Guidelines for the Preparation of Exhibits and Models* are being communicated.

8. Wide publicity should be given for inviting entries. *SLSMEE–2021–22 Guidelines for the Preparation of Exhibits and Models should be provided to all schools.* These guidelines may also be translated in local languages and be given wide publicity. This may also be given on the website(s) of the respective states/union territories and other participating organisations. It is also envisaged that guidelines be printed in local language(s), Hindi and English in the form of a booklet for their dissemination among all the schools for generating ideas and for developing exhibits and models. These guidelines can also be downloaded from NCERT website (www.ncert.nic.in).

9. Children from all schools [including government, government–aided, public and private, catholic, mission, armed–forces (Army, Air Force, Navy, Sainik, BSF, ITBP, Assam–Rifles, CRPF, Police etc.), DAV management, Maharshi Vidya Mandir, Saraswati Vidya Mandir, Navyug, Municipality, Bhartiya Vidya Bhavan, Science Clubs etc.] are eligible to participate in State Level Exhibitions. Preference may be given to students in senior classes (i.e. secondary and higher secondary stages).

Note: For State/UT Coordinator:

Following organisations conduct their own exhibitions separately:

- Kendriya Vidyalaya Sangathan;
- Navodaya Vidyalaya Samiti;
- Department of Atomic Energy Central Schools;
- Central Tibetan Schools Administration;
- CBSE affiliated Public Schools (independent schools); and
- Demonstration Multipurpose Schools of Regional Institutes of Education.

These organisations send their selected entries for consideration for participation in Jawaharlal Nehru National Science, Mathematics and Environment Exhibition (JNNSMEE) for Children to NCERT directly. Therefore, it may please be ensured that entries belonging to these organisations are not forwarded to NCERT by States/UTs.

10. Public Sector Undertakings, Industries, and other Non–government Organisations (NGOs) working in the areas (where these exhibitions are organised) may also be invited to participate as the exhibits displayed by them would be of instructional value for children and teachers

B. SCREENING, EVALUATION AND MONITORING OF ENTRIES FOR SLSMEE

1. In case Districts/Regional Level Exhibitions are not being organised by the State/UT,a Screening Committee should be set up to finalise the selection of entries from various institutions for participation in the State Level Science, Mathematics and Environment Exhibition (SLSMEE) for Children.

2. The Screening Committee may consist of representatives of SISE/SIE/SCERT and some selected representative institution(s). All records about the meeting of the committee should be maintained. The selection procedure adopted should lay more emphasis on the quality of the exhibits rather than quantity. It should be ensured that the exhibits are not crude and hazardous and have good finish and are presentable.

3. The above mentioned Screening Committee or a separate panel of judges should evaluate the exhibits according to the criteria of evaluation as mentioned for SLSMEE. Best three exhibits in each sub–theme should be selected; preferably developed by secondary and higher secondary students; by the said panel of judges. However, an outstanding exhibit developed by upper primary students and members of science clubs may also be considered if the said panel of judges feel so.

4. A list of the selected entries of the exhibits and models under each sub–theme (to be displayed in the state level exhibition) must be prepared. This must contain the name of the exhibit/model, names of the student(s) and guiding teacher(s), name of the school and a brief information about the exhibit (may be in two sentences only).

Such a list may be prepared in accordance with the NCERT's un–priced publication "List of Exhibits", displayed in the National Exhibition. It is published every year and distributed to all participating children, teachers, and visitors during the exhibition. A copy of this may be obtained from the NCERT, New Delhi. This list may also be distributed among all participating children and teachers A copy of this list should be forwarded to NCERT together with the formal report of the exhibition.

CRITERIA FOR EVALUATION OF EXHIBITS IN SLSMEE

A. CALL FOR ENTRIES

5. The theme for SLSMEE–2021–22 for Children and for the 48th Jawaharlal Nehru National Science, Mathematics and Environment Exhibition (JNNMEE–2022) for children would be "Technology and Toys" pertaining to the sub–themes such as –
   1. Eco Friendly Material;
   2. Health and Cleanliness;
   3. Software and Apps;
   4. Transport;
   5. Environmental and Climate Changes
   6. Mathematical Modeling;
   (Sub–themes listed above are suggestive. Students are free to choose any other sub–themes and develop exhibits involving innovations in Technology and Toys)

7. In order to facilitate the preparation of exhibits and models for display in district to state level exhibitions during 2021–22, *Guidelines for the Preparation of Exhibits and Models* are being communicated.

8. Wide publicity should be given for inviting entries. *SLSMEE–2021–22 Guidelines for the Preparation of*

Exhibits and Models should be provided to all schools. These guidelines may also be translated in local languages and be given wide publicity. This may also be given on the website(s) of the respective states/ union territories and other participating organisations. It is also envisaged that guidelines be printed in local language(s), Hindi and English in the form of a booklet for their dissemination among all the schools for generating ideas and for developing exhibits and models. These guidelines can also be downloaded from NCERT website (www.ncert.nic.in).

9. Children from all schools [including government, government–aided, public and private, catholic, mission, armed–forces (Army, Air Force, Navy, Sainik, BSF, ITBP, Assam–Rifles, CRPF, Police etc.), DAV management, Maharshi Vidya Mandir, Saraswati Vidya Mandir, Navyug, Municipality, Bhartiya Vidya Bhavan, Science Clubs etc.] are eligible to participate in State Level Exhibitions. Preference may be given to students in senior classes (i.e. secondary and higher secondary stages).

Note: For State/UT Coordinator:

Following organisations conduct their own exhibitions separately:

- Kendriya Vidyalaya Sangathan;
- Navodaya Vidyalaya Samiti;
- Department of Atomic Energy Central Schools;
- Central Tibetan Schools Administration;
- CBSE affiliated Public Schools (independent schools); and
- Demonstration Multipurpose Schools of Regional Institutes of Education.

These organisations send their selected entries for consideration for participation in Jawaharlal Nehru National Science, Mathematics and Environment Exhibition (JNNSMEE) for Children to NCERT directly.

Therefore, it may please be ensured that entries belonging to these organisations are not forwarded to NCERT by States/UTs.

10. Public Sector Undertakings, Industries, and other Non–government Organisations (NGOs) working in the areas (where these exhibitions are organised) may also be invited to participate as the exhibits displayed by them would be of instructional value for children and teachers

B. SCREENING, EVALUATION AND MONITORING OF ENTRIES FOR SLSMEE

1. In case Districts/Regional Level Exhibitions are not being organised by the State/UT, a Screening Committee should be set up to finalise the selection of entries from various institutions for participation in the State Level Science, Mathematics and Environment Exhibition (SLSMEE) for Children.

2. The Screening Committee may consist of representatives of SISE/SIE/SCERT and some selected representative institution(s). All records about the meeting of the committee should be maintained. The selection procedure adopted should lay more emphasis on the quality of the exhibits rather than quantity. It should be ensured that the exhibits are not crude and hazardous and have good finish and are presentable.

3. The above mentioned Screening Committee or a separate panel of judges should evaluate the exhibits according to the criteria of evaluation as mentioned for SLSMEE. Best three exhibits in each sub–theme should be selected; preferably developed by secondary and higher secondary students; by the said panel of judges. However, an outstanding exhibit developed by upper primary students and members of science clubs may also be considered if the said panel of judges feel so.

4. A list of the selected entries of the exhibits and models under each sub–theme (to be displayed in the state level exhibition) must be prepared. This must contain the name of the exhibit/model, names of the student(s) and guiding teacher(s), name of the school and a brief information about the exhibit (may be in two sentences only).

Such a list may be prepared in accordance with the NCERT's un–priced publication "List of Exhibits", displayed in the National Exhibition. It is published every year and distributed to all participating children, teachers, and visitors during the exhibition. A copy of this may be obtained from the NCERT, New Delhi. This list may also be distributed among all participating children and teachers A copy of this list should be forwarded to NCERT together with the formal report of the exhibition.

CRITERIA FOR EVALUATION OF EXHIBITS IN SLSMEE

In order to keep a uniform criteria for evaluating the exhibits in all States/UTs and on the basis of the feedback received from different agencies, the following criteria for judging the exhibits is suggested (the percentages given in bracket are suggestive weightages):

1. Involvement of children's own creativity and imagination (20 percent);
2. Originality and scientific and mathematical innovations in the exhibit/model (15 percent);
3. Scientific thought/ principle/ approach (15 percent);
4. Technical skill, workmanship and craftsmanship (15 percent);
5. Utility for Society, scalability (15 percent);
6. Economic (low cost), portability, durability, etc. (10 percent); and
7. Presentation–aspects like demonstration, explanation and display (10 percent).
   (i) 5% extra weightage may be given to exhibits from rural/backward regions.
   (ii) 3% extra weightage may be given to exhibits from semi urban regions.

On the basis of the criteria suggested above and also as mentioned in proforma VI, three entries from each sub–theme developed by students of classes IX–XII may be selected and forwarded to NCERT for consideration for participation in JNNSMEE–2022. However outstanding exhibits developed by upper primary students and members of science clubs may also be considered provided the total entries from each sub–theme does not exceed three.

In addition to this, two best exhibits developed by disabled students from any of the sub–themes may also be forwarded to NCERT. It must be kept in mind that entries submitted under this category should be displayed only by the disabled students. Further the entries forwarded should be accompanied with disability certificate from a competent authority. Disability norms followed by the government of India will be considered under this category.

(*Note: 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 model/exhibit. Organizers of exhibitions at all levels may provide opportunities to students and teachers to present such ideas in the form of presentations and discussions. SLSMEE Coordinators may forward two such innovative ideas written in a few paragraphs to NCERT ;or consideration for participation in the National Exhibition.*)

Judges are also requested to judge whether the model is traditional or an improvement over the traditional model or it is innovation as per proforma IV. Various skills involved in constructing the exhibit and model, the degree of neatness and craftsmanship may also be taken into

account. Every effort must be made to rule out the tendency of procuring the ready made exhibits/models. General layout of the exhibit, relevance, clarity of charts accompanying the exhibit and overall attractiveness to the masses and children should also be assessed. Working models should be encouraged.

C. Expenditure Norms

The 'Grant–in–Aid' provided by NCERT to respective states/UTs is a **catalytic grant** for organising State Level Exhibitions and one day Seminar . States and UTs are expected to spend the additional expenditure, if any, from the state funds. The funds given to the States/UTs are to be utilised *exclusively for meeting the travel and boarding costs of participating students and their teachers and experts.* It is suggested that the following norms of payment may be followed:

1. For Organising One–Day Seminar

(i) The seminar should be organised one day before the organisation of SLSMEE or during the days of exhibition in morning/evening hours

(ii) Honorarium to four experts/ scientists may be disbursed at the rate of ₹2500.00/– each.
Note : The expert/scientist should be preferably from a research institute/ laboratory/ university/SCERT/SIE.

(iii) Daily allowance and conveyance charges to experts/scientists may be disbursed as per state/central government rules.

(iv) Contingency grant for tea/coffee with light snacks: typing/ photocopying/ cost of transparencies/ pens/ printing of banners/ stationery etc: upto ₹20,000.00/–.

2. For Organising the SLSMEE

(i) Honorarium to **ten** judges may be disbursed at the rate of ₹2500.00/– each. **NCERT faculty members should not be provided any Honorarium from this head, if invited as a judge in the exhibition.**

(ii) Only one student and one teacher may be permitted to participate with each exhibit. Even if more than one exhibit is selected from a single school, only one teacher from that school may be allowed to participate.

(iii) Traveling allowance: actual second class sleeper rail/ bus (non–AC) fare.

(iv) Participants may be provided incidental charges maximum upto ₹400.00/– for to and fro journey by rail or bus, provided the journey time is more than 6 hours For journeys less than 6 hours no incidental charges should be paid.

(v) Boarding expenses: ₹200.00/– per head per day for each participant for a maximum of *4 days. In case the boarding facilities are not provided by the organisers, a sum of ₹300.00 per person per day may be provided.*

(vi) Local conveyance charges may be disbursed as per state/central government rules.

(vii) Contingency grant for typing/ photocopying, printing of publicity materials, exhibition material, banners, stationery etc. upto ₹50,000.00/–

D. Maintenance of Accounts

It is necessary to **maintain a separate account** for the expenditure of the grants–in–aid provided by the NCERT and the same should be forwarded to the NCERT, along with all relevant vouchers and receipts, in original **within one month of the conclusion of the exhibition** for adjustment in the NCERT account. Proforma V is given for convenience. All vouchers may be signed by the Coordinator/In–charge of the exhibition. All those vouchers/receipts that are in regional language should accompany a translated copy in English certified by the Coordinator/In–charge of

the State Level Exhibition to facilitate audit and settlement of accounts. All payments exceeding ₹5000.00/– should be supported by payee's receipt with a revenue stamp.

It may please be ensured that each Voucher/Receipt against the expenditure is duly verified for the amount and then passed for payment. The specimen of this certificate is indicated below for convenience:

*Verified and passed for payment of Rs ....
(Rupees ....
.... only.*

Signature and Seal of the Co–ordinator/Incharge. State Level Science, Mathematics and Environment Exhibition (SLSMEE) for Children – 2021–22

Note: *Only those Vouchers/Receipts against such items of expenditure, which are covered under the expenditure norms, may please be sent to this department for adjustment/settlement of accounts.*

E. Reports of SLSMEE to be sent to NCERT

A formal report of the State Level Science, Mathematics and Environment Exhibition and One–Day Seminar should reach NCERT within one month after the conclusion of the exhibition. It should include the following:

i. Dates and venue of exhibition.
ii. Proformas I – V duly filled up.
iii. List of schools participating and the number of students/teachers participating as per the proforma attached. Break–up of the male and female participants should also be given. It should also reflect on the number of rural and urban schools that participated in the exhibition.
iv. List of entries of the exhibits and models being displayed in the state level exhibition. Number of exhibits displayed under each sub–theme should also be mentioned separately.
v. Highlights of the exhibition including other activities such as lectures, film shows, book exhibition etc. and participation of other scientific/industrial organisations.
vi. Panel of judges for evaluating the exhibits/models displayed in the exhibition (in accordance with the Criteria for Evaluation of Exhibits).
vii. List of selected exhibits being sent for consideration for participation in 48th JNNSMEE–2021 bearing the name of student, teacher, school, complete write–up of exhibits, 5 minutes video presentation in CD about the exhibit by the student, etc. If the video is in regional language, it is expected to make it in Hindi/English also for wider publicity among the students and teachers. (A proforma for information about the exhibit/model is also attached for this purpose Proforma I).
viii. Number of visitors to the exhibition.

F. Criteria for Evaluation of Exhibits for Jawaharlal Nehru National Science, Mathematics and Environment Exhibition (JNNSMEE) for Children

Selected entries from all State Level Science, Mathematics and Environment Exhibition (SLSMEE) for children organised in different states, union territories and other organisations are forwarded to NCERT for consideration for participation in Jawaharlal Nehru National Science, Mathematics and Environment Exhibition (JNNSMEE) for Children. JNNSMEE is organised every year by NCERT in a state/union territory on rotation basis usually during a period which falls around the birth anniversary of Pandit Jawaharlal Nehru, that is 14th November (Children's Day). These entries are forwarded to NCERT as per

Proforma I (given in this booklet). At NCERT, these entries are screened and short–listed on the basis of their write–ups and a 5 minutes video presentation in CD by the student. For this purpose the following criteria for evaluating exhibits is adopted (the percentages given in bracket are weightages). NCERT reserves the right to alter the criteria to include adequate number of exhibits from rural/backward regions and exhibits developed by disabled students.

1. Originality and innovations in the exhibit/model (25 percent);
2. Scientific thought/ principle/ approach (20 percent);
3. Utility for Society, Scalability ; (20 percent)
4. Economic (low cost), portability, durability, etc. (15 percent); and
5. Presentation of write–up: (20 percent).

G. Suggestion on conducting Online Exhibition

In the year 2020-21, keeping in view the covid-19 situations, almost at all the places across the country the work of teaching, evaluation etc., is happening in an online mode. Though at some places, if the facilities are available or the pandemic situation is slightly better, these works have also slowly started in an offline mode.

Due to such a situation, the State officials are suggested to start the organisation of science exhibitions in an online mode beginning from block level to State level. It is suggested to encourage maximum number of students to participate in these exhibitions and display their models in an online mode wherever possible.

Wherever these exhibitions are conducted in an offline mode the SOP prepared by the Government of India must be followed. The programme may be conducted using following Guidelines:

1. **Development of a Portal:** A portal may be designed where all types of information related to science exhibition may be displayed so that everyone will have access to all the information related to the exhibition.
2. **Using an Online Platform:** To conduct the programme in online mode several available resources such as various online platforms maybe used. The meeting may be conducted for five days for a given time slot from 9:30 AM to 6:00 PM. All participating students must login to this common platform and showcase their exhibits. Participating students must remain present online for further interaction with the visiting students/persons.
3. **Interaction of Students:** There must be a scope for children/persons to visit various exhibits under various sub-themes and interact with the participating students regarding their queries about the exhibits.
4. **Uploading the Selected Videos:** All the selected exhibits may be displayed through pre-developed videos provided by participating students and teachers. There must be a scope on the portal for displaying the event as live telecast and video may remain uploaded even after the given time slot.
5. **Other Activities of the Event:** Popular lecture is one of the key features of the exhibition and may be conducted through a webinar using the live platform in the given time slot during the event.
6. **Network Issues:** In situation of network issues in Rural and interior areas, students may be allowed to send the recorded videos in form of CD/DVD to respective coordinators/in charges at the district level, from there it can be uploaded by the district coordinators on the platform if required, it is suggested that the participating students along with their teachers may participate the event from block/district level city where there is no network issue following SOP released by the government of India.
7. The catalytic grant given to state if required can be used for **website creations/technical support for conduct of exhibition**.

The Report

and

Proformas I–V

should strictly follow the above format and be forwarded

within one month

after the conclusion of the exhibition to :

Prof. T.P. Sarma

Coordinator

State Level Science, Mathematics and Environment

Exhibition (SLSMEE) for Children – 2021–22

DEPARTMENT OF EDUCATION IN SCIENCE AND MATHEMATICS

National Council of Educational Research and Training

Sri Aurobindo Marg, New Delhi 110 016

• **Phone:** 011–26962030; • **Fax:** 011–26962030

e–mail: slsmee.ncert@gmail.com • **Website:** www.ncert.nic.in

4

Proformas

49ᵗʰ Jawaharlal Nehru National Science, Mathematics and Environment Exhibition (JNNSMEE – 2022) for Children

Theme : Technology and Toys

Proforma I

Information about the Exhibit/Model

1. Title of the Exhibit/model ....
(in BLOCK letters)

2. Sub–theme:
   - 1. Eco Friendly Material ☐
   - 2. Health and Cleanliness ☐
   - 3. Software and Apps ☐
   - 4. Transport ☐
   - 5. Environmental and Climate Changes ☐
   - 6. Mathematical Modeling ☐

3. Name(s) of Contributing Student(s) ....(M/F); Class.........................

   (in BLOCK letters) ....(M/F); Class.........................

   ....(M/F); Class.........................

   ....(M/F); Class.........................

   Mobile No. ....

   Email ....

4. Name(s) of Guiding Teacher(s) .... (M/F)

   (in BLOCK letters) ....(M/F)

   Mobile No. ....

   Email ....

5. Name of school with complete postal address (in BLOCK letters) :

   ....

   ....

   ....State/UT........................... Pin ....

Phone: ....; Email ....

Mobile No. ....

6. Type of school*   Government/Local Body/ Private Aided/Private

                              Unaided/ Any other (Please Specify) ....
                              ....

7. Affiliation of the School   State Board/ICSE/CBSE, Any other (Please Specify)
                              ....

8. Location of the School   Tribal/Rural/Backward/Semi Urban/Urban
                              ....

9. Nature of the Exhibit/Model (A) Innovative/Improvised Apparatus
                              (B) Working/Static Model/Study Report
                              Any Other (Please Specify) ....

10. Whether Dark Room Space is needed for the display of Exhibit: Yes/No

11. Approximate space required for the display of Exhibit..

12. Source of inspiration/help for preparing the exhibit/model:
    (Please explain briefly about the nature and form of help received from the following):

    (i) From Teachers/School
         ....
         ....

    (ii) From Parents
         ....

    (iii) From Peer Group
         ....
         ....

    (iv) Any other
         ....
         ....

13. Brief Summary (Please explain the purpose (or aim) and the scientific principle

Government: A Government School is that which is run by the State Government or Central Government or Public Sector Undertaking or an Autonomous Organisation completely financed by the Government;

Local Body: A Local Body School is that which is run by Panchayati Raj and Local Body Institutions such as Zila Parishad, Municipal Corporation, Municipal Committee or Cantonment Board;

Private Aided: A Private Aided School is that which is run by an individual or a private organisation and receives grants from the Government or Local Body;

Private Unaided: Private Unaided School is that which is managed by an individual or a private organisation and does not receive any grant from the Government or Local Body.

    involved in the exhibit/model in not more than three lines).
    ....

....

....

....

14. Write–up of the Exhibit/Model (not more than 1,000 words) in the following format. [*Note: Proper submission of the write–up will ensure that if selected for participation in the 49 Jawaharlal Nehru National Science, Mathematics and Environment Exhibition (JNNSMEE–2022) for Children–2022, it will be considered for publication in the booklet entitled: Structure and Working of Exhibits. For convenience, examples of write–ups of exhibits are also given in this booklet.*]

I. *Introduction*
   (i) Purpose (or Rationale) behind the development or construction of the exhibit; and
   (ii) The scientific principle involved.

II. *Description*
   (i) Materials used for the construction;
   (ii) Construction and working of the exhibit/model; and
   (iii) Applications, if any.

III. *References*
   Books, journals or magazines referred for preparation of the exhibit/ model.

IV. *Illustrations*
   (i) Black and white line and labelled diagram of the model, illustrating the working of the exhibit/model.
   (ii) Close–up photographs of the exhibit/model.

15. **Five minutes video presentation in CD by the student about the exhibit containing (i) title of the exhibit (ii) sub–theme of the exhibit (iii) working of the exhibit (iv) scientific principle involved in it (v) application etc. should also be sent along with the write–up.**

Note: (i) Please do not pin or paste the photographs of the exhibits. Enclose them in a separate envelope. Description of the photograph may be written on its back.
   (ii) Please do not enclose the photographs of participating student(s) and their guide teacher(s)
   (iii) Please of not send the scanned/soft copies of write–ups instead of video presentation.

<center>CERTIFICATE OF ORIGINALITY</center>

We,..
hereby declare that the submitted exhibit/model is our original creative work / modified form of available work and to the best of our knowledge, this exhibit/model has never been developed by any other person in this form.
(Strike off, whichever is not applicable.)

(Signatures of all students and teachers)

STATE LEVEL SCIENCE, MATHEMATICS AND ENVIRONMENT EXHIBITION FOR CHILDREN–2021–22

PROFORMA II

PANEL OF JUDGES – SUB–THEME WISE*

VENUE _____

THEME : TECHNOLOGY AND TOYS

PERTAINING TO THE SUB–THEMES OF

Sub–themes : 1. Eco Friendly Material   4. Transport
(Please tick marks   2. Health and Cleanliness   5. Environmental and Climate Changes
on the area being   3. Software and Apps   6. Mathematical Modeling
evaluated)

Sl. No	Name(s) of the Judge(s)	Designation	Official Address, Phone Fax, e-mail	Residential Address Phone, Mobile
1.				
2.				
3.				
4.				

* Respective judges may have their opinions, suggestions and comments about the organisation of science, mathematics and environment exhibition. NCERT welcomes all such opinions. Kindly enclose them on separate sheets.

STATE LEVEL SCIENCE, MATHEMATICS AND ENVIRONMENT EXHIBITION FOR CHILDREN–2021–22

PROFORMA III

INFORMATION ABOUT PARTICIPATING SCHOOLS

State/Union Territory   : ....

Dates of Exhibition   : ....

Venue of Exhibition   : ....

| Type of School* | Tribal (T)/ Rural (R)/ Urban (U) | Number of Schools | Number of Exhibits/ Models | Participants from the School | | | | | | |
| | | | | Teachers | | | Students | | | |
				Male	Female	Total	Boys	Girls	Total	SC/ST
G	T									
	R									
	U									
LB	T									
	R									
	U									
PA	T									
	R									
	U									
PU	T									
	R									
	U									
Total										

* **G.** **Government:** A Government School is that which is run by the State Government or Central Government or Public Sector Undertaking or an Autonomous Organisation completely financed by the Government;
LB. **Local Body:** A Local Body School is that which is run by Panchayati Raj and Local Body Institutions such as Zila Parishad, Municipal Corporation, Municipal Committee or Cantonment Board;
PA. **Private Aided:** A Private Aided School is that which is run by an individual or a private organisation and receives grants from the Government or Local Body;
PU. **Private Unaided:** A Private Unaided School is that which is managed by an individual or a private organisation and does not receive any grant from the Government or Local Body.

State Level Science, Mathematics and Environment Exhibition for Children – 2021–22

Proforma IV

Information about Nature and Number of Exhibits Displayed

Theme : Technology and Toys

State/Union Territory: ....

Dates of Exhibition: ....

Venue of Exhibition: ....

Sub-themes	Nature and Number of Exhibits Displayed			Total No. of Exhibits
	Innovative/Improvised/Apparatus/Working Model	Static Model	Study/Survey Report	Any other (please specify)
Eco Friendly Material				
Health and Cleanliness				
Software and Apps				
Transport				
Environmental and Climate Changes				
Mathematical Modeling				

PROFORMA V

MAINTENANCE OF ACCOUNTS

State/Union Territory : ....

Dates of Exhibition : ....

Receipt				Expenditure				Signature of Coordinator
Voucher	Date	Particulars	Amount	Voucher	Date	Particulars (Head)	Amount	
		Draft No.						
		Other income, if						
						Balance Refunded to NCERT, if any,		
		Total				**Total**		

Certified that the expenditures have been made in accordance with the norms and Guidelines as given by the NCERT for organising the State Level Science and Environment Exhibition for Children. It is also certified that no other voucher is included.

Date 		Signature of the In–Charge (Controlling Officer)

State/UT _____ Duration _____

STATE LEVEL SCIENCE, MATHEMATICS AND ENVIRONMENT EXHIBITION FOR CHILDREN–2021–22

PROFORMA VI

THEME: TECHNOLOGY AND TOYS

VENUE.........................

JUDGES' PROFORMA FOR EVALUATION OF PARTICIPATING ENTRIES–SUB–THEME WISE

Sub–themes : 1. Eco Friendly Material   4. Transport

(Please tick marks 2. Health and Cleanliness   5. Environmental and Climate Changes

on the area being 3. Software and Apps   6. Mathematical Modeling

evaluated)

Sl No	Code of the Exhibit	Involvement of Children's Own Creativity and Imagination	Originality/ Innovations in the Ex- hibit/ Model	Scientific Thought/ Principle/ Approach	Technical Skills/Work- manship/ Craftsmanship	Utility for society, Scalability	Economic (low cost/ Portability/ Durability	Presentation	Total
		20%	15 %	15 %	15 %	15 %	10 %	10%	100 %
1	...	...	...	...	...	...	...	...	...
2	...	...	...	...	...	...	...	...	...
3	...	...	...	...	...	...	...	...	...
4	...	...	...	...	...	...	...	...	...
5	...							...	...

Date _____

Signature...

Name...

Designation and Affiliation...

Note: *5% and 3% extra weightage may be given to exhibits belonging to rural/backward and semi urban regions respectively.*

<div align="center">

✦ **5** ✦

EXAMPLES OF WRITE–UPS OF THE EXHIBITS

TWO EXAMPLES OF WRITE–UPS OF THE EXHIBITS DISPLAYED IN EARLIER EXHIBITION ARE GIVEN BELOW TO FACILITATE STUDENTS TO DEVELOP THE WRITE–UP OF THEIR EXHIBIT

(A) NEW PADDY THRESHER

</div>

Student : Akoijam Kheroda Devi
School : Anand Purna Schol, Thoubal District, Manipur
Teacher : Robindro Singh

INTRODUCTION

In most of the agricultural land area of Manipur, people mainly cultivate paddy. Agriculture sector contributes a major share to the total state domestic product. It provides employment to about half of the total farmers in Manipur. During harvest, farmers spend a lot of money as labour charges to thresh the paddy. In view of this, an eco–friendly machine (model) called 'New Paddy Thresher' is developed. 'New Paddy Thresher' is a manual threshing machine. It can thresh the paddy plants without cutting the straws. Such an eco–friendly machine will help the poor farmers of the country in general and farmers of Manipur in particular to improve their economy.
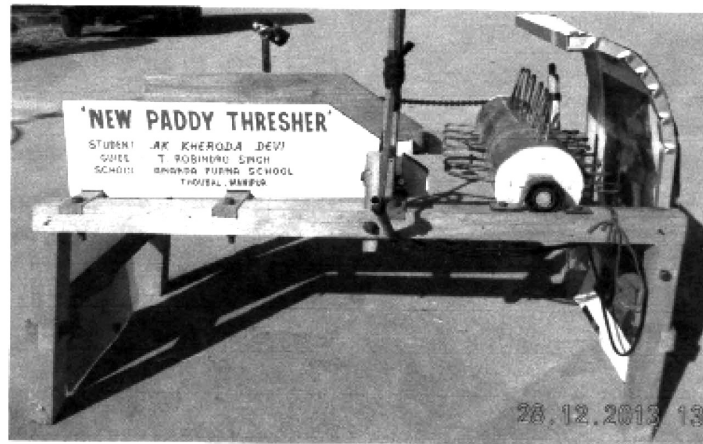
<div align="center">Figure 1: New Paddy Thresher</div>

MATERIAL REQUIRED

The material used in this exhibit are: U–shape beating rods; Bearing; Crank shaft; Iron chain; Wood; Bolts and nuts; Paddle; Paddy straw fixer.

SCIENTIFIC PRINCIPLE INVOLVED

'New Paddy Thresher' is based on the principle of pulley and Lever system.
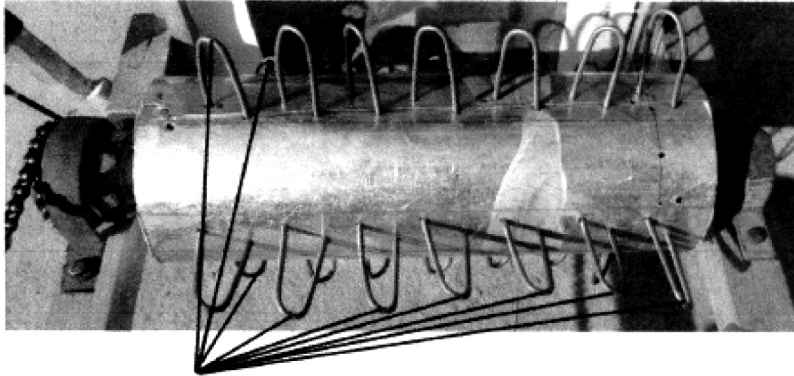
Figure 2: U–Shape Beating Rods

CONSTRUCTION AND WORKING

Four rows of U–shape beating rods are fixed on a cylinder. The two end of the beating cylinder are fixed by two bearing so as to rotate freely. A pulley is fixed on one end of the beating cylinder and joins the crank shaft with the iron chain. In one complete rotation of the crank, the beating cylinder rotates twice. An armful of paddy straw can be beaten eight times in one complete crank rotation. Three crank rotation is enough for threshing one armful of paddy.
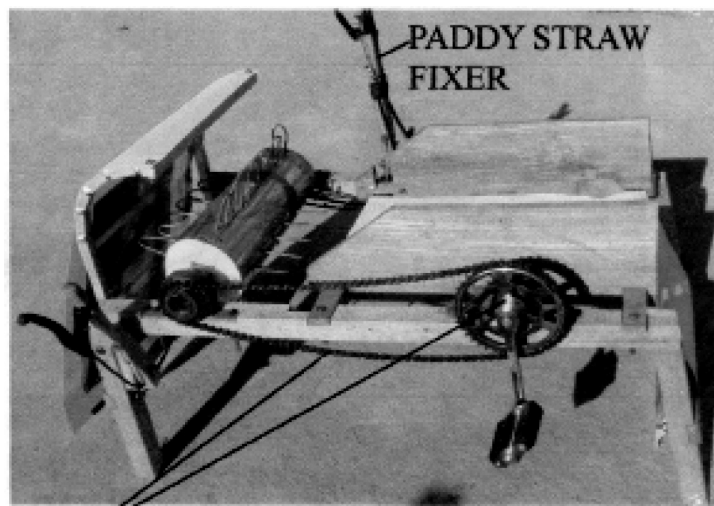
Figure 3: Crank Shaft with the Iron Chain

ADVANTAGES

  (i) It is low cost and portable.
 (ii) It is an eco–friendly machine.
(iii) A farmer can save labour and money by using this thresher.

(B) Vehicular Exhaust Filter

Student : Vaibhav Dhama, Saransh Mathur
School : Demonstration School, RIE, Ajmer, Rajasthan
Teacher : Amarendra Triphathy

INTRODUCTION

We know that many vehicles are increasing air pollution which increases global warming or the temperature of the earth. Many steps have been taken to reduce the emission level of gases coming out from the vehicle exhaust. We can see in heavy traffic areas the level of air pollution is very high. We feel uncomfortable and even feel itching in our eyes in such areas. Increasing air pollution is a danger sign for all living organisms on earth. Exhaust gases coming out from all types of automobiles contains mainly carbon mono–oxide, carbon dioxide, nitrogen dioxide, hydrocarbons, sulphur dioxide and other harmful gases. These gases are very harmful for our environment and ecological system. This project is an attempt to solve the problem of high pollution level in cities due to automobiles in heavy traffic areas. This project helps us to reduce the air pollution caused by the vehicles.

SCIENTIFIC PRINCIPLE INVOLVED

In the cooling chamber two aluminium plates which have charge on them attract dust particles. The exhaust gases pushed by the exhaust fan on the nets made of synthetic fibers and solution of sodium hydroxide (NaOH) is sprayed by the sprayer. NaOH reacts with the harmful exhaust gases and neutralizes them. This way, the level of polluted air is very low.

MATERIALS REQUIRED

Bottles of two litre capacity, T–shape water pipe joint, two exhaust fans, aluminium foil, NaOH solution, sprayer, battery, etc.

CONSTRUCTION AND WORKING

In this project the exhaust gases are collected in the cooling chamber (the shape of the cooling chamber is like a frustum) where due to the expansion of gases their temperature becomes low. In the cooling chamber there are two aluminium plates which create charge on them and attract the acidic/basic dust or harmful particles and then an exhaust fan sucks the gases and pushes the gases in NaOH treatment chamber. We can identify it in given figure 4 where the NaOH reacts with harmful gases and make them neutral. There is a machine called sprayer placed after the exhaust fan which sprays NaOH on the nets of synthetic fibers after every 2 km distance period when the vehicle is running.

In the vertical chamber the remaining dust particles are separated by exhaust fan which pushes the gases on a filter so the heavy solid harmful particles settle down. Then the remaining gases are again treated with NaOH. We can identify it in figure 5. Finally, cool and fresh air with very low air pollution comes out and spread out in the environment.
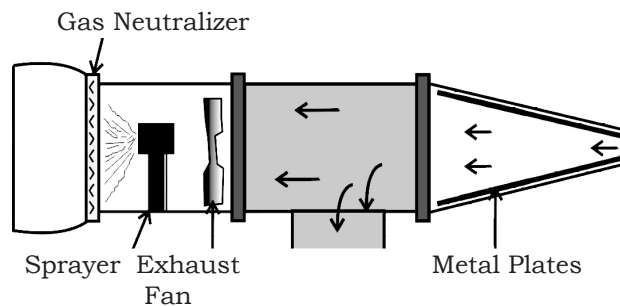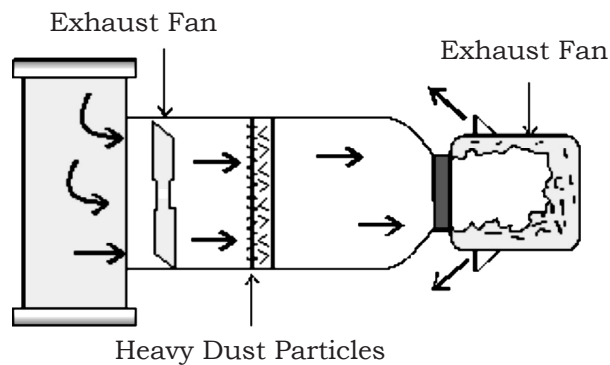

Figure 4

Figure 5

REMOVAL OF HARMFUL PARTICLES/CHEMICALS

Take out the nets of synthetic fibers and wash them in NaOH solution to remove solid sediments and harmful chemicals periodically.

RESULT

It ensures lowering of the pollution level in air due to automobiles. So we can save our earth from pollution.

राष्ट्रीय शैक्षिक अनुसंधान और प्रशिक्षण परिषद्
NATIONAL COUNCIL OF EDUCATIONAL RESEARCH AND TRAINING