

**STATE LEVEL SCIENCE, MATHEMATICS AND ENVIRONMENT
EXHIBITION FOR CHILDREN — 2016-17**

AND

**44th JAWAHARLAL NEHRU NATIONAL SCIENCE, MATHEMATICS
AND ENVIRONMENT EXHIBITION FOR CHILDREN — 2017**

GUIDELINES

**FOR THE PREPARATION OF EXHIBITS AND MODELS AND
ORGANISING EXHIBITIONS**



**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 2016-17 too. These would form the first phase of preparation for the JNNSMEE to be organised in November 2017. 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 the nation and the society. There is a need for us to continuously innovate to meet the challenges before us. The rising aspirations of human community for desire of more comfort and security has put tremendous pressure on the limited resources of the world leading to unequal access and unsustainable exploitation. This may result in unsustainable use of resources and development. Science and Mathematics act as powerful tools for investigating and understanding the world. They also play a crucial role in solving problems confronting the society and act as a major instruments for achieving goals of self reliance, socio-economic and nation building. To recognize and encourage these powerful tools so that the problems confronting the society can be overcome and a better future for the Nation can be built through science and mathematics led solutions, the theme for the State Level Science, Mathematics and Environment Exhibition (SLSMEE) for Children – 2016-17 has been chosen as **Science, Technology and Mathematics for Nation Building**.

Growth with equity has been the focus of Indian Economic Policy since 1960s. Though significant outcomes have been achieved in various areas such as poverty reduction, health and education, more remains to be done. The country today face multiple challenges.

These challenges need to be addressed appropriately to build a better future for the Nation. **The Green India, Make in India, Smart City, Beti Bachao Beti Padhao, Pradhan Mantri Jan Dhan Yojana, Saansad Adarsh Gram Yojana, Digital India, Swachh Bharat are some of the recent initiatives taken by the government of India to build a better future for the country. The theme and sub-themes identified for SLSMEE-2016-17 are directly or indirectly focusing on the above mentioned initiatives of the government.** In this context, it is envisaged that children and teachers would try to analyze all aspects of the role of science and mathematics for nation building. This will enable students and teachers to generate scientific and mathematical ideas and prepare models/exhibits for addressing various problems. Scientific and mathematical 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 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.**

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 nation.

The theme for **SLSMEE-2016-17 and JNNSMEE-2017, “Science, Technology and Mathematics for Nation Building”** aims to cover sub-themes such as-

1. Health;
2. Industry;
3. Transport and Communication;
4. Innovations in renewable resources for sustainable environment;
5. Innovations in food production and food security;
6. Mathematical solutions in everyday life

(Sub-themes listed above are suggestive. Students are free to choose any other sub-themes and develop exhibits involving Science, Technology and Mathematics for Nation Building)

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

THEME: SCIENCE, TECHNOLOGY AND MATHEMATICS FOR NATION BUILDING.

1. Health

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; to explore various scientific and technological interventions for meeting nutritional requirement of human beings and innovative ideas for better management.

The exhibits/models in this sub-

theme may pertain to:

- factors affecting the health and resulting ailments in the body;
- infectious and non-infectious diseases, relationship with causative factors and their sources;
- innovative preventive measures to control diseases at different levels/roles of various agencies;
- demonstration and use of traditional methods of medication;
- demonstration of known facts and findings, and health benefits of Yoga;
- role of biotechnology improved crops and nutrition;
- demonstration of models/ projects to show the effect of junk food items, adulterated food items on our body and its preventive measures;
- model to demonstrate importance of balanced diet and nutritional values of various food items;
- 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 Programme etc that have significant impact on health.

- 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;
- mechanisms/ways to control the spread of epidemics such as Dengue, Malaria etc.
- improved methods of sanitation and appropriate technology for waste disposal, both biodegradable and non-biodegradable;
- common prophylactic measures available and advantages of inoculation and vaccination;
- need for appropriate measures for family planning and welfare;
- ideas for developing low-cost nutritious food;
- low cost medical diagnostic and therapeutic tools;

2. Industry

The objective of this sub-theme is to help children: to understand the importance of science and mathematics in various types of industries; to think of ways and means to increase its efficiency leading to production of different kinds of goods to meet the future needs of the growing population at affordable price.

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

- models showcasing improved versions of various types of machines and manufacturing plants;
- design and development of automatic devices for various

- applications in industries;
- schemes/designs to help reduce production cost and conservation of raw materials;
- roles and possibilities of the service industries like tourism, banking, Information and Communication Technology etc. for inclusive development;
- devices or methods that measure and control pollution;
- devices/methods to minimise the effects of chemical spills, solid waste, nuclear waste and radiations, etc from industries/ nuclear plants, etc;
- awareness about various aspects of environment and disposal of harmful effluents, solid waste, nuclear waste etc;
- use of innovations/improvements that may help in increasing production in various industries, such as textiles, engineering goods, machine tools, chemicals, drugs and pharmaceuticals including life-saving drugs, vaccines and devices and eco-friendly plastics, etc. to improve the quality of life;
- improved/ indigenous design/ working models of devices which may be used on small scale for production/manufacturing of utility items of daily life;
- indigenous/ innovative techniques for exploration/ conservation/ recycling/ processing of minerals and other natural resources;
- working models to demonstrate equipment/processes/devices/ technologies/ designs, which may help facilitate the domestic work.
- improved/improvised/innovative technologies associated with

weaving, pottery, metal work, dyeing, printing and other crafts practiced in cottage industry and suggestions for new designs;

3. Transport and Communication

The objectives of this sub-theme are:- to make general public and children understand different types of transport modes and communication as well as the importance of transport and communication for Nation Building; to make them aware about the issues and concerns of the present transport and communication system and to promote innovations for efficient transport and communication system. The exhibits/models in this sub-theme may pertain to:

- improvised/Indigenous models for efficient transport and fast communication especially mobile and internet for communication in rural areas;
- working models of fuel efficient/pollution-free designs of automobiles /other vehicles;
- innovative ideas for efficient management of road, rail, water and air transport systems, e.g. better safety measure, especially unmanned railway crossings checking/control of pollution, providing immediate relief to accident victims, managing traffic jams, etc;
- working models of printing technology - communication with graphics and multi-media and low-cost methods;
- working model of efficient transport system in metropolitan/urban and rural areas;
- demonstrating the principle and functioning of modern devices of communication;

- designs for making existing operation of communication more efficient;
- demonstrating the use of information technology in developing improved designs/indigenous designs/devices, which may be used on a small scale for production/manufacturing of utility items of daily use;
- developing innovative designs/models of multimedia equipments/materials and packages for the children with special needs, especially with visual and audio impairment;
- technologies of emerging web designs/effective use of ICT for knowledge retrieval & sharing;
- improvised/improved devices for effective transport and communication between various emergency services, namely medical, police, military and other administrative bodies/committees;
- use of geo-stationary satellites in providing information pertaining to vehicular movements and transportation, disaster management, etc;
- emergency mechanisms and mobilization technologies in communication and transportation systems etc;
- Innovative methods to reach online communication facility to the remote areas;
- Importance of safe and secure communication in digital world.

4. Innovations in renewable resources for sustainable environment

This area is expected to make children think of various ways and

means for making efficient use of available resources and also new techniques/methods of conservation and management of resources for sustainable environment.

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

- plans for proper management of resources and its monitoring;
- restoration of degraded areas and habitat of natural biodiversity;
- ecological studies of plants and animals;
- efficient methods of harvesting and preserving marine resources;
- schemes/designs to help reduce production cost and conservation of various raw materials;
- sustainable land use practices/ecologically sustainable farming methods;
- recycling of water, materials, solid wastes, etc;
- devices/methods that control air/water/land pollution and technologies to manage them;
- stopping depletion of essential micro nutrients in the soil;
- forest, river, mangrove, wetland conservation and management;
- desilting and renovation of ponds, tanks and reservoir;
- self regulating water harvesting system/rainwater harvesting and storage in a manner that evaporation and transportation losses are minimised;
- participatory watershed development and management;
- development of low cost technology for producing potable water;
- sea water use along the coastal area for raising mangrove and *salicornia* plantation together with

agriculture;

- innovative/improvised designs for reducing waste in extraction and processing of minerals;
- innovative methods of exploration and preserving minerals and crude oil, etc;
- cost effective heating and cooling system of buildings, etc.;
- models to control loss of natural resources due to mismanagement/disasters, etc.

5. Innovations in Food Production and Food Security

The main objectives of this sub-theme are:-to make children and teachers aware of various techniques/methods to enhance agricultural production to achieve food security; to make children and teachers think of various ways and means to enhance knowledge on food production and food security.

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

- effect of climatic change on agriculture and its mitigation and adaptive techniques/methods;
- preservative and conservative methods for prevention of soil degradation and judicious use of water;
- conventional biotechnology practices e.g., application of biotechnology, microbiology and genetic engineering to agriculture for improved yield.
- organic farming/organic fertilisers versus chemical fertilisers;
- planning and managing energy crops (*Salix*, Poplar, *Jatropha*, *Jajoba*, etc.);
- use of biotechnology for economically and ecologically

- sustainable biofuels;
- various pestcontrol and management measures;
- application of biotechnology and genetic engineering in improving animal breeds and production of animal products that are used as food;
- innovative/inexpensive/improved/indigenous technologies/methods of storage/preservation/conservation/transport of agricultural products and food materials;
- innovative/improved practices for reducing cost of cultivation;
- identification of medicinal plants and their applications;
- indigenous designs of farm machinery, agriculture implements and practices;
- impact of pollution on food and food safety and measures/methods for ensuring food safety;
- improved/improvised method of processing, preservation, storage and transport of food products;
- issues related with the animal health and food security;
- food production and demand of quality food and food security;
- nutrition education/healthy eating habits and food utilisation by body;

6. Mathematical solutions in everyday life

The main aim of this sub-theme is to make our school children and teachers aware and realise about various mathematical ideas and tools to solve problems confronting the society thereby leading to a quality life.

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

- policies, programmes and schemes in mathematics that have a significant impact on human life;
- mathematical applications that have a wide ranging impact on issues such as agriculture, energy, health, environment, space, industry, communication, education, etc.;
- effective and efficient ways of communicating an experiment that revolutionize mathematical ideas;
- cost effective demonstration of known facts and research in mathematics;
- impact of mathematical ideas on other subject areas such as science, medicine, psychology, social science etc;
- contribution of mathematics for economic growth, mass literacy, eradication of poverty and malnutrition, etc.
- mathematical ideas to solve various problems of our everyday life/environment related problems;
- mathematical models to predict orbital path of comets, meteors and other minor planets;
- mathematical models to show how disease might spread in human in the event of epidemics/bioterrorism;
- mathematical models to predict the devastating effects of wars/nuclear explosions;
- mathematical models to show spread of forest fire depending on the types of tree, weather and nature of the ground surface;
- mathematical models to demonstrate the action of medicines in human system;

- using mathematical tools and computer simulation to improve cancer therapy/wound healing/tissues formation/corneal wound healing;
- mathematical tools to describe traffic flow/stock market option;
- mathematical tools to show the effect of climate change/global warming;
- mathematical tools for predicting future population and knowing the impact of population;

(The exemplar points listed so far are to trigger ideas and give directions for preparing exhibits and are not exhaustive. Further we would once again reiterate that, students and teachers are free to choose any sub-theme, even a sub-theme not listed in this guidelines. However the chosen sub-theme and the exhibits/models developed should be in the context of the theme: Science, Technology and Mathematics for Nation Building. Examples of write-ups of exhibits from the previous JNNSMEE are also given at the end of this booklet for facilitating the preparation of exhibits and models for students and teachers.)

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.

TOPIC: FOOD SECURITY

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.

Food is the first basic requirement of human. The term Food Security is often used to describe whether a country has access to enough food to meet the dietary energy requirements. As per Food and Agriculture Organisation (FAO) the term food security is defined as a situation that exists when all people, at all times, have physical, social and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life. A lot of progress has been made to ensure Food Security for all yet many people in this world still struggle to get two meals in a day.

The green revolution in India in 1960s increases the food production particularly in wheat and rice due to technological intervention such as the introduction of high yielding varieties. National Food Security Mission of India is one of the schemes of the central government to ensure Food Security in the country. Getting nutritious food is essential for the well being of the individual and society and basic enablers for the future of the nation.

The UN has declared 2016 as the International Year of Pulses (IYP-2016). The IYP-2016 aims to heighten public awareness of the nutritional benefits of pulses as part of sustainable food production aimed towards food security and nutrition. It provides an opportunity to encourage connections throughout the food chain that would better utilize

pulse-based proteins, further global production of pulses, better utilize crop rotations and address the challenges in production of pulses. It is also a unique opportunity to inspire and educate our young children, teachers and public about the role of pulses in meeting food security for all.

During the One Day Seminar we intend to create awareness among teachers, teacher educators, researchers and students about how innovations in technologies and supply chain management can promote Food Security and provide solution to many of the problems confronting the nation and the world.

Activities to be performed during this Seminar should be planned accordingly to (i) increase the public appreciation and understanding of the need to ensure Food Security; (ii) motivate people to think about various issues and challenges confronting the nation on Food Security and devise strategies for solving them; (iii) encourage out of the box thinking and lateral thinking among the children; (iv) make people aware of the role of Food Security in achieving sustainable development; and (v) make people aware about the need for collaborative and coordinated activities on national, regional and international policy makers and stakeholders.

As a part of this endeavour, to reach out to the children, teachers and public, a one day seminar may be organised in the SLSMEE for children. During this One-Day Seminar on '**Food Security**', children, teachers, parents and all concerned may be invited to generate ideas. The activities in this seminar may include:

- Making people aware of the need for Food Security to ensure development of the nation;
- Publicising the usefulness of Food Security in the development process for achieving inclusive development;
- Organising poster exhibition-cum-competitions highlighting usefulness of Food Security

especially for inclusive growth and development and in solving the problems of the society;

- Organising invited talks by experts on Food Security, particularly motivating the audience to look for its role in creating inclusive growth and development;
- Making students find solution to problems existing in their immediate environment;
- Arranging a Quiz competition in which questions may be based on Food Security;
- Arranging a group discussion among different groups, to create awareness about Food Security.